Arnold Schwarzenegger
Governor

THE DEVELOPMENT OF 70-YEAR-OLD WIESLANDER VEGETATION TYPE MAPS AND AN ASSESSMENT OF LANDSCAPE CHANGE IN THE CENTRAL SIERRA NEVADA

PIER FINAL PROJECT REPORT

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Prepared By:
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Prepared By:
University of California, Davis
Department of Environmental Science and Policy
Davis, California 95616
Dr. James Thorne, Principal Investigator
T. Rodd Kelsey, Graduate Research Assistant
Jacquelyn Honig, Graduate Research Assistant
Brian Morgan, Graduate Research Assistant
Commission Contract No. 500-02-004
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Prepared For:
Public Interest Energy Research (PIER) Program
California Energy Commission

Gina Barkalow
Project Manager

Beth Chambers
Contract Manager

Kelly Birkinshaw
Program Area Lead
Energy-Related Environmental Research

Laurie ten Hope
Office Manager
Energy Systems Research

Martha Krebs
Deputy Director
ENERGY RESEARCH & DEVELOPMENT DIVISION

B.B. Blevins
Executive Director

Jackalyne Pfannenstiel
Chairman

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Preface

The Public Interest Energy Research (PIER) Program supports public interest energy research and development that will help improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.

The PIER Program, managed by the California Energy Commission (Energy Commission), conducts public interest research, development, and demonstration (RD&D) projects to benefit California.

The PIER Program strives to conduct the most promising public interest energy research by partnering with RD&D entities, including individuals, businesses, utilities, and public or private research institutions.

PIER funding efforts are focused on the following RD&D program areas:

- Buildings End-Use Energy Efficiency
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- Energy-Related Environmental Research
- Energy Systems Integration
- Environmentally Preferred Advanced Generation
- Industrial/Agricultural/Water End-Use Energy Efficiency
- Renewable Energy Technologies
- Transportation

The Development of 70-Year-Old Wieslander Vegetation Type Maps and an Assessment of Landscape Change in the Central Sierra Nevada is the final report for the Wieslander Project (contract # 500-02-004, MR-035-02) conducted by the Department of Environmental Science and Policy, University of California, Davis. The information from this project contributes to PIER's Energy-Related Environmental Research Program.

For more information about the PIER Program, please visit the Energy Commission's website at www.energy.ca.gov/pier or contact the Energy Commission at 916-654-5164.

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Abstract

Assessing dominant land cover change is critical to understanding the terrestrial consequences of climate change. This study created digital maps from a portion of a heritage vegetation survey of California, the Wieslander Vegetation Type Map survey of the 1930s. Digital maps were produced for a 30,236 km^2 area of the Sierra Nevada. These historical data were compared with CalVeg, a 1996 vegetation map produced by the US Forest Service. In addition, the extent of *Pinus ponderosa* forests on the Placerville quadrangle was compared to a historical map from 1850 as well as the 1934 map.

At low elevations, blue oak (*Quercus douglasii*) and foothill pine (*Pinus sabiniana*) areas have largely converted to grasslands. At about 1000 meters elevation, the lower edge of the "Yellow Pine Belt" (dominated by *Pinus ponderosa*) has retreated upslope about 180 meters between 1934 and 1996, and by 526 meters since 1850. Grazing, competition by nonnative grasses, and fire occurred on only 42% of the total area of change.

The authors hypothesize failure of conifer seedling establishment due to earlier Sierra snowmelts caused by warmer temperatures. The lower edge of the Sierran conifer belt appears to be sensitive to climate change, a conclusion with implications for the water-holding capacity of the mountains.

Keywords: Vegetation type map, VTM, Wieslander, GIS, digital vegetation map, dynamic vegetation model, ponderosa pine, Sierra Nevada vegetation, historical ecology, landscape assessment, 1930s

Executive Summary

Introduction

The Wieslander Vegetation Type Map (VTM) Project, conducted in the 1930s, was a United States Forest Service (USFS) effort that surveyed California's vegetation over about one third of the state. VTM survey crews mapped vegetation, recorded species inventories in 17,000 vegetation plots, took over 3000 photos, and collected over 25,000 herbarium specimens. The Wieslander data represent an excellent historical record enabling assessment of vegetation change over the last 70 years. Such information is useful to a wide variety of resource managers—and particularly to scientists developing dynamic vegetation models to predict the impacts of climate change on California. However, to be put to such uses, the map and plot data must be converted to digital format.

Only a small proportion of the Wieslander data has ever been digitized, and numerous steps are required to develop the data to a level usable in digital geographic analyses. This study digitized a portion of the vegetation maps and compared the results to modern vegetation maps to assess vegetation change over the last 70 years.

Purpose

The study's primary purpose was to establish a digital record of historical vegetation patterns in California, allowing measurement of the changes in vegetation patterns. To accomplish this, the research team developed a methodology to convert the historical VTM maps to digital VTM maps usable in a Geographic Information System (GIS). Once the historic record was digitized, the project summarized the historical extent of different vegetation types in the study region. Assessments of vegetation change over the 62 years between the historic and modern vegetation maps are presented both in total and quadrangle by quadrangle (the unit used by the VTM mappers to summarize their work). The project also digitized a historical map of the Placerville quadrangle, located just east of Sacramento in El Dorado County; this allowed a second historical analysis that measured the retreat of *Pinus ponderosa* forests in that region since 1850.

Objectives

The project's main objectives were:

1. **To create digital versions of a subset of Wieslander maps**: four 30-minute (30') quadrangles (each covering 2,400 km^2), two 15' (600 km^2) quadrangles, and eight 7.5' (150 km^2) quadrangles of the original VTM maps. The project exceeded this objective, creating digital maps for twelve 30' quadrangles, two 15' quads, and thirteen 7.5' quads covering a vegetation survey area of 30,236 km^2 in the Sierra Nevada. The mapped area extends from Yosemite National Park to Lake Tahoe and from the floor of California's Central Valley to the border with Nevada.
2. **To compare those digital VTM maps to current vegetation maps** in geographic analyses. The VTM maps contained information on the distribution of 223 species, 14

genera and physiognomic types, and 10 land cover types. (Summaries of VTM quadrangle data are provided in Appendix A, Table A-1.) The detailed, species-level distribution information in the VTM maps was converted into modern land cover classifications to enable comparison with modern vegetation maps. VTM data were thus classified (under definitions from the original data) into California Wildlife Habitat Relationship (WHR) classes developed by the California Department of Fish and Game (2004). The WHR classification identifies one or two dominant species and a physiognomic type (growth form such as forest or woodland). A total of 45 WHR classes were identified on the digital VTM maps. Once the digital VTM maps were converted to WHR types, the WHR type extents could be directly compared to the modern WHR extents as depicted on the 1996 CalVeg map produced by the US Forest Service (Schwind and Gordon 2001). The digital VTM maps covered 30,236 km^2, but only 16,978.3 km^2, or 56% of the area, was also surveyed during the 1996 CalVeg mapping effort. Change in WHR types was recorded on 41.8% of the compared area.

In addition, the project developed several ancillary products:

1. **A digitized map showing the 1850 extent of timberlands for El Dorado County**. This map, originally published by Weeks et al. in 1934, provided a measure of the timberlands lost to timber production between 1850 and 1934. The research team was thus able to assess change in the western edge of *Pinus ponderosa*–dominated forests over 146-years.
2. **A methods manual** detailing the methods used to convert the historical VTM maps to digital format.

Results

First Analysis: 1934 VTM maps compared to 1996 CalVeg map. The WHR types that lost the most range were Ponderosa Pine Forests, which decreased from a historical extent of 3,444.5 km^2 to 1,238.7 km^2, and Blue Oak–Foothill Pine Woodlands, which decreased from 1,209.1 km^2 to 559.3 km^2. The WHR types that gained the most range were Sierra Mixed Conifer, which increased from 1244 km^2 to 2951 km^2, and Montane Hardwoods, which grew from 1,123 km^2 to 2231 km^2. At the upper elevation of its range, the Ponderosa Pine Forest was replaced mostly by Douglas Fir Forest or Sierran Mixed Conifer Forest. At the lower edge of its range, Ponderosa Pine Forest was replaced mostly by Montane Hardwood Forest and Annual Grasslands. Blue Oak–Foothill Pine Woodlands were predominantly replaced by Annual Grasslands.

Second Analysis: Ponderosa Pine Forest in El Dorado County. Longer-term analysis was possible for the western edge of the Ponderosa Pine Forest in the Placerville Quadrangle, El Dorado County. Change in this edge was measured in two time steps: between 1850 and 1934, and between 1934 and 1996. In total, the western, lower extent of continuous forest moved eastwards an average of 26.4 km with an average elevational change of 526 meters. Using only the second 1934–1996 time period, the western edge moved an average of 7.1 km, accompanied by an upward shift of 193 meters. From 1850 to 1996, the overall area deforested of ponderosa pine affected by the shift was 562 km^2.

Conclusions

The loss of forest, with the range boundary moving upwards and eastwards, is the consequence of complex interactions that were not quantified as part of this project. However, the trends invite theory on what caused them. At lower elevations, the conversion of oak woodlands to grassland is part of a recognized trend in which several species of oak are not regenerating after removal (McCreary 2001). Removal of oak woodlands through a wide variety of primarily human activities has likely led to the reduction measured in the maps.

The changes in the Ponderosa Pine Forest are the most interesting. The two analyses indicate that the lower edge of this vegetation type has moved upwards considerably, and that it has been replaced by non-conifer species. The research team hypothesizes that this "trailing edge" phenomenon is partially due to climate change. Many recent studies show the Sierra Nevada is warming (e.g., Coats et al. 2006; Stewart et al. 2005; Westerling et al. 2006). This warming trend was corroborated in the study area by four long-term weather station records which indicate the monthly minimum temperatures in the middle-elevation Sierra Nevada Mountains have increased over the past 100 years by about 3˚C (5.4˚F) . This increase means that Placerville, located at the heart of the Ponderosa Pine Forest change, no longer has any months for which it is entirely frozen. Sixty years ago, December and January monthly minimums were below 0˚C. This increase in temperature is not likely responsible for the death of mature pines, which were harvested. However, the increased temperatures correspond with a longer summer drought, a condition that increases the drought stress on seedlings. Drought stress–driven mortality of seedlings following stand removal is the suspected driver of the diminishing range of the Ponderosa Pine Forest.

Mappable confounding factors that might affect seedling establishment—fire, urbanization, and areas that had converted to grassland (introduced, nonnative grasses may outcompete seedlings, or cattle on the grasslands may eat seedlings)—were removed from the analysis. Of the 562 km^2 vacated by Ponderosa Pine Forests, 328 km^2, or 58% of the area, had not been affected by these confounding factors.

Recommendations

The authors recommend a five-year landscape-scale research project to examine the mechanisms that may be driving the patterns observed in this study, and to determine whether the upslope shift of Ponderosa Pine Forests at the lower edge of their range is likely to continue in the Sierra Nevada. This range shift is of concern because forest loss potentially impacts the water retention capability of the mountains.

The historic VTM maps are a unique resource, permitting large areas of the state to be studied as they were 70 years ago. The historical measures provided by the VTM vegetation maps are useful for a variety of purposes: identifying the extent to which different habitats have already been lost, calibrating dynamic vegetation models, managing endangered species, and identifying lands potentially useful for carbon sequestration.

Consequently, it would benefit the state for the remainder of these maps, which include areas around California's major metropolitan centers, to be digitized and used for a variety of planning and management applications. Conversion of the remaining maps will be a large undertaking. Such an effort would work best if done by several university labs so that production could run in parallel, in which case the rest of the maps could be completed in a three-year period. All labs should be coordinated by one group to assure data production consistency.

In addition to the historic vegetation maps, the VTM project also surveyed over 17,000 vegetation plots in California. When the VTM plot data are digitized, they should be combined with the digital VTM maps developed for this project. A one-year study could determine the optimum methods for integrating the plot data with the vegetation maps.

Benefits to California

Californians will benefit from this project in four ways: (1) the unique VTM data are far more accessible in digital format; (2) the historical data provide a quantitative baseline from which to measure trends in dominant vegetation at the landscape scale across a broad time horizon; (3) knowledge of these trends can assist natural resource management and planning in a wide variety of fields, and is particularly relevant to climate change; and (4) the VTM data can provide a basis for modeling future species distributions under climate change by providing a historical time step that can be used in conjunction with current data to calibrate the model.

1.0 Introduction

1.1. Background and Overview

Climate projections over the next century in California suggest an increase in temperatures and the likelihood of extreme weather events, especially in winter, with particularly strong effects in the Sierra Nevada Mountains of California (Snyder et al. 2002). Changes in climate are likely to have tremendous effects on the biodiversity of California and the world (Thomas et al. 2004). Models of vegetation change predict expansion of grasslands and woody shrub habitats, loss of oak woodlands, and changes in composition of conifer forests (Field et al. 1999; Lenihan et al. 2003). Moreover, California's human population is predicted to double from its 1990 level by 2040 with attendant land-use pressures resulting, especially on oak woodlands (Landis and Reilly 2003; FRAP 2003). Fortunately, there is increasing attention from government agencies and nonprofit groups to planning and management in the face of rapid change (Groves et al. 2002; FRAP 2003). Improved understanding of how vegetation has responded to past climate and land-use change is needed to help project how it will react in the future.

In its *Climate Change Research, Development, and Demonstration Plan* (PIER 2003), the California Energy Commission's PIER Program noted that climate change may have a major impact on both electricity production and demand in California. The PIER plan identified several research questions including, "What are the potential changes in vegetation patterns in California, and how would they affect and be affected by the state's climate and hydrological cycle?" Vegetation and climate are interlinked, and the 2003 PIER plan recommended research to enhance the utility of dynamic vegetation models for California.

This project supplies baseline data and a preliminary analysis responsive to that goal. The study makes available to vegetation modelers a series of digital data never before available: a collection of historical vegetation maps, dating from the 1930s, called the Wieslander Vegetation Type Maps (VTM).

The Wieslander Vegetation Type Map (VTM) Project was a US Forest Service effort to record California's vegetation between 1928 and 1940 (Wieslander 1935a, 1935b, 1986; Griffin and Critchfield 1972). Headed by Albert Wieslander, the group took more than 3,000 photographs of vegetation, surveyed more than 17,000 vegetation plots, recorded field notes, and mapped vegetation across about 155,000 km^2, or ~35% of the state (Colwell 1977). Lands mapped were predominantly US Forest Service lands, but three national parks (Lassen, Yosemite, and Sequoia/Kings Canyon) were also mapped using the same protocols (Wieslander 1986; Griffin and Critchfield 1972). The project also collected 25,000 plant specimens, now housed at the Jepson Herbarium, University of California, Berkeley. These data collections are an important vegetation legacy, and work is underway to systematically process them for preservation and state-wide analyses (Ertter 2000; Kelly et al. 2005; http://VTM.berkeley.edu), although portions of the collection have been lost over the years.

During VTM field work, three types of maps were prepared: maps showing the location of the photographs taken, maps of the location of surveyed vegetation plots, and the vegetation

distribution (VTM) maps. Ancillary information was sometimes recorded on an additional set of maps that show stands of individual trees too small to map to polygons,[1] routes taken, boundaries of fire, and the locations of sawmills. Wieslander's original intent was that the vegetation plots and vegetation maps be used together to determine extent and composition of vegetation (Wieslander 1986; Colwell 1977). No recent work has combined the plot and vegetation map data, but a number of earlier works used parts of the information (Weeks et al. 1934, 1943; Wieslander and Jensen 1946).

The historical VTM project produced 215 vegetation quadrangles (55 7.5-minute, 88 15-minute, and 72 30-minute), although portions of some quadrangles are missing or not fully mapped. Twenty-three of the 30-minute maps were published by the University of California Press (Colwell 1977), but the detail of the species compositions on the published maps is reduced from that on the originals. Parts of the original collection have been previously studied (e.g., Walker 2000; Bouldin 1999; Allen-Diaz and Holzman 1993).

The Wieslander maps and plot data represent uniquely valuable historical data, potentially useful for a variety of purposes: for identifying the extent to which different habitats have already been lost; for calibrating dynamic vegetation models; for managing endangered species; and for identifying lands potentially useful for carbon sequestration. However, to be useful to modern researchers, the data need to be converted to a digital format compatible with geographic information systems (GIS).

This project developed methods to digitize these historic maps, making them usable in geographic analyses. The project produced digital versions of the Wieslander VTM maps for about 10% of the original VTM survey, a region of the central Sierra Nevada spanning 30,236 km^2, the size of Maryland (see Figure 1). The Wieslander plot data and landscape photos are being digitized by another group at the University of California, Berkeley, and will eventually be made public through efforts separate to those reported here. In addition to the VTM maps, this project produced a digital version of a historic map of El Dorado County showing the extent of timberlands lost between 1850 and 1934 (Weeks et al. 1934). This project's digitization effort has provided the longest time frame available for studying for regional vegetation dynamics in the historic (as opposed to prehistoric) record.

After digitizing the maps, the project team compared the Wieslander data to similar modern data on a quadrangle-by-quadrangle basis, then summarized the results across all the quads. This report presents the extents of the vegetation for each VTM quadrangle (map) that was digitized, the species listed on each map, characterizations of the polygons on each map, and the degree of change in dominant vegetation between the 1934-era maps and CalVeg, a modern vegetation map also developed by the US Forest Service, recorded in 1996.

1. A polygon is a map unit defined by a line circumscribing its outer edge. In a GIS, the area inside the boundary may have a description of the polygon's contents, which are attached to the digital map in the form of a database. Each polygon in that situation has an identifier code which permits access to the attributes of that polygon listed in the database.

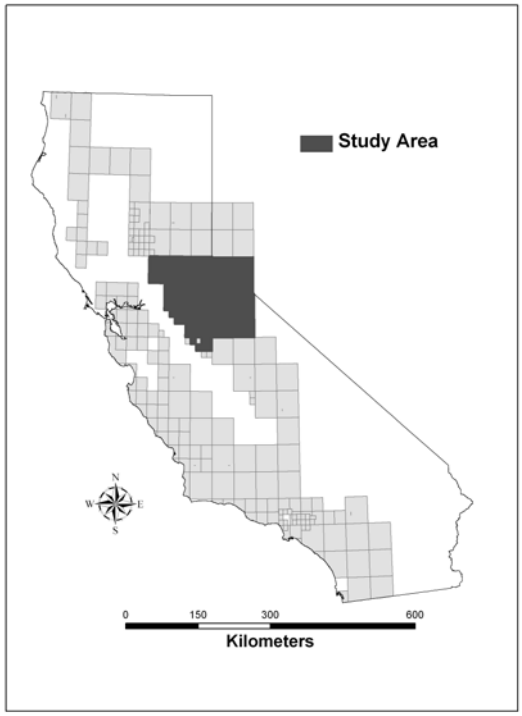


Figure 1. Study area shows which VTM maps were digitized. The light-colored quadrangles show what other parts of the state were surveyed by VTM crews.

The historical data provided through this project can be used to analyze trends in vegetation and to parameterize dynamic vegetation models under development in the PIER research program. Those models can now be run from the 1930s to the present, and the results compared to current vegetation patterns, permitting calibration of the models before running them into the future.

1.2. Project Objectives

The objectives and deliverables of the project are listed here as they were originally planned. Several changes occurred over the course of the project as noted below. The two main objectives were as follows:

1. **Digitize four 30-minute (30') and eight 7.5' Wieslander Vegetation Type Maps** from the collection of Wieslander maps, covering about 10,000 km^2. As requested, **convert the digitized VTM maps to suitable formats** for various collaborators' needs. For example, one group might need a raster-based version of the maps (a pixilated version, in which all data are represented as a continuous surface of different values) rather than a vector-based (line) format, while another might need a vector version, but of a specific sub-area of the study area.

2. **Summarize the extents of dominant vegetation on each VTM quadrangle. Analyze changes in dominant vegetation between the historical VTM maps and contemporary conditions** using CalVeg, a 1996 vegetation map produced by the US Forest Service. In addition to comparing the historical VTM maps with the modern CalVeg map, the project originally planned to use the VTM plot data as well. Changes were to be measured by looking at differences in extent of vegetation between the two time periods on a per-quadrangle basis, and by using historical and modern vegetation plots as random samples of the landscapes to look at proportional changes. However, the plot data (being digitized by a different research group in a different project) were not available in time, so only the maps were used.

Key deliverables planned for this project were:

1. Digital versions of the historic VTM maps.
2. A geo-database combining the digital VTM maps with the VTM vegetation plot data, to be used for studies of historical changes in vegetation. This deliverable was removed because digitization of the plot data (a separate project by different group) was not completed in time for use by this project.
3. A summary of historical dominant vegetation type extents on a per-quadrangle basis.
4. A comparison of historic vegetation patterns and extents to contemporary ones.

The project added the following deliverables beyond the original proposal:

1. A map that represented the western extent of Ponderosa Pine Forests found in El Dorado County in 1850 (Weeks et al. 1934). In this map, Ponderosa Pine Forest extents were based on old stump fields and remnant stands of trees, surveyed in the early 1930s.
2. A methods manual on how the VTM maps were converted to digital, georeferenced databases.

1.3. Report Organization

The rest of this report covers three main areas:

1. Two types of methods:

   A. The methods used to produce the digital VTM maps.

   B. The methods used to analyze changes in dominant vegetation patterns and extent.

2. Two types of results:

   A. A summary of all historical maps converted to digital maps and an accounting of the extent of vegetation types found in the historical VTM maps by quadrangle.

   B. Findings from two comparative analyses conducted using the digital maps. The first analysis compared the 1934 VTM maps to the 1996 CalVeg map. The second analysis focused on the extent of Ponderosa Pine Forest in El Dorado County.

3. Conclusions and recommendations.

2.0 Methods

This chapter contains two main parts: a review of the methods developed to convert the VTM maps to digital VTM maps usable in a geographic information system (GIS), and a review of the methods used to compare the resulting maps to modern digital vegetation maps.

2.1. Methods Used to Produce the Digital VTM Maps

The first task was the development of methods to render historical 1930s Wieslander vegetation maps to digital format suitable for use in a GIS. Digitizing historical maps for use in a GIS requires more than merely scanning the image. In the case of the historical VTM maps, the hand-drawn lines needed to be converted to vector-based polygons housed in a georeferenced database. Methods to accomplish this conversion depend on the historical maps being produced, which are unique because of the varying projections and geographic datum used, and the thematic content recorded. In the case of the historical VTM maps, only one previous attempt had been made (Walker 2000), and the methods used there were not suitable for this effort. Therefore, the project team developed new methods, which included the following steps: the historical VTM maps were scanned; the scans were georectified; the vegetation polygons on the maps were traced; the species codes on the maps were transcribed into a standardized digital table; and the species combinations were assigned to vegetation types according to the *Manual of California Vegetation* (Sawyer and Keeler-Wolf 1995) and the Wildlife Habitat Relationships (WHR) model developed by the California Department of Fish and Game (2004).

2.1.1. Background

The VTM survey crews were in the field for over a decade and recorded the patterns of vegetation onto US Geological Survey topographic maps (base maps). They generally worked on 30’ quadrangles, although 15', 7.5', and 6' base maps were also used. Using well-defined protocols (Wieslander, unpublished), they would delineate landscape vegetation from vantage points, color in polygons on the maps, and attribute these with species codes that represented the dominant species in each polygon. Any species recorded had to occupy at least 20% of the area delineated, and single species covered 80% of the polygons in which they were recorded. Finalized VTM maps were cut into sections, or tiles, and glued to canvas backing in groups of four, with four pieces of canvas used for each complete 30' quadrangle.

Walker’s (2000) dissertation assessed an early attempt to digitize VTM-era vegetation maps into a geographic information system (GIS). He used the VTM maps from Yosemite National Park which park scientist J. W. van Wagtendonk had digitized in the early 1980s. The digital version was produced on a digitizing table, and the exact methods used are not known. Walker compiled the digitized files that he received from the park. He determined that the early-edition topographic maps that the VTM maps were drawn on (topographic base map) had non-systematic topographic registration errors of up to 250 meters when compared to newer, digital versions of the same topography. He treated the problem by applying some 14,000 tie points to warp the historic maps to the digital topography. The spatial errors were primarily due to the way the topographic maps, on which the VTM maps were drawn, had been produced. These

topographic maps were the first-edition maps for the region, and had been surveyed on the ground, usually around 1895. The topographic maps contained errors that were carried through to the vegetation maps drawn directly on them. Subsequent to Walker's corrective actions, species lists from modern vegetation plots were in good agreement with the vegetation of the VTM polygons they were located in.

Walker's dissertation served as a warning that bringing the VTM maps into alignment with modern topography was time-intensive. The project team used a different approach, producing the VTM maps at the level of spatial accuracy at which they was originally made. Since the base topographic maps upon which the VTM was drawn were surveyed at the turn of the century, the project team reproduced the VTM maps to those standards, not adding the additional step of warping the image to get it to conform to later, improved, topographic accuracy. The project team reasoned that errors of a few hundred meters would not affect the dominant trends under investigation, which would play out over many square kilometers. Future research can apply the additional processing required to replicate Walker's approach from this product, should that level of detail be needed and funds be available.

2.1.2. Methods

Each original VTM map was originally separated into as many as 16 tiles when it was completed, and these were attached to canvas backing. This practice preserved map data which otherwise might have been lost along the creases. Therefore, the first GIS process challenge was to re-assemble the tiles in digital space. To do this, the project team acquired scanned versions of the same-edition topographic maps as the VTM maps that would be processed. Processing each VTM map to a GIS-compatible digital map was initiated by georeferencing each scanned topographic base maps into its native map projections. Scanned versions of the VTM tiles corresponding to each topographic map were then registered to the topographic base map. Once the VTM images were georeferenced, vegetation polygons were traced and plant species codes in each polygon were transcribed. At this point, the GIS version contained the same data as the original maps. Next, the VTM plant species codes were linked to modern plant scientific names, and the sequence of species in each polygon was assigned to vegetation and habitat types. The project used the *Manual of California Vegetation Types* (Sawyer and Keeler-Wolf 1995), and the California Wildlife Habitat Relationships Models (WHR) (California Department of Fish and Game 2004) for land cover classifications. Once these attributes were added to the maps, they were then error-checked and finalized.

The specific steps for digitizing each historical VTM map are detailed in the following sections.

A. Scanning the Maps

The first step in digitizing the VTM maps was to create high-resolution digital images of both the base maps and VTM tiles. Maps were scanned on a flat-bed scanner at 300 dots per inch. Two sets of maps were scanned: the VTM maps, composed of up to 16 tiles that formed a single map, and an exact edition of the United States Geological Survey topographic map used by the VTM mappers (Figures 2 and 3).

Figure 2. Scan of a historical topographic map (ca 1898) of the Placerville Quadrangle. VTM surveyors recorded the patterns of vegetation upon such a map.

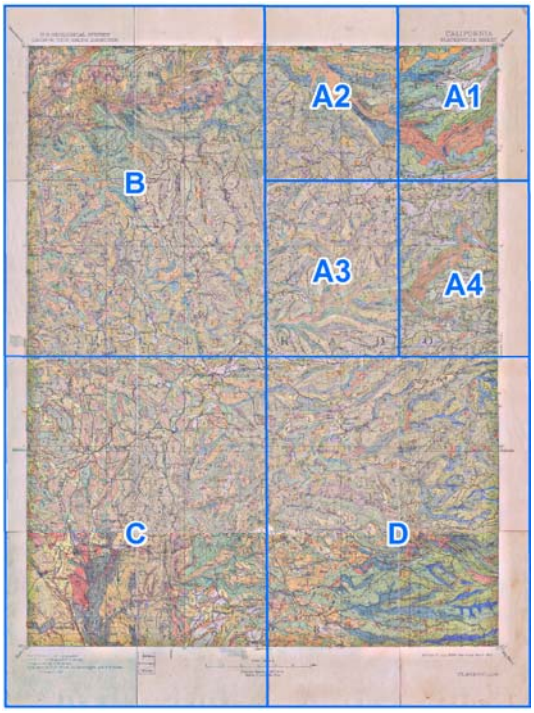


Figure 3. Mosaicked VTM map and tile naming sequence for the Placerville Quadrangle VTM map (quad code VTM56)

B. Georeferencing

Once the base topographic map and VTM tiles for a particular quadrangle were scanned, the base map was first registered into its native map projection, using ERDAS Imagine, a remote-sensing computer program, and then the VTM tiles were registered onto the base map. This process resulted in a georeferenced VTM map with a minimal amount of introduced distortion (Figure 4).

C. Digitizing the Maps

Once the VTM tiles were assigned to their native (Polyconic) map projection, the lines that delineate vegetation polygons could be digitized to create the geometry for the quadrangle. This process was completed by first digitally tracing the VTM map, then converting the traced lines to polygons and removing errors.

The vegetation polygons were digitized using a desktop pen tablet display. The display allows the user to hand-trace the lines of vegetation polygons on the screen using a stylus. Once the entire VTM map was traced, the lines were converted to polygons, verified, simplified, and checked for errors, producing a digital product as shown in Figure 5

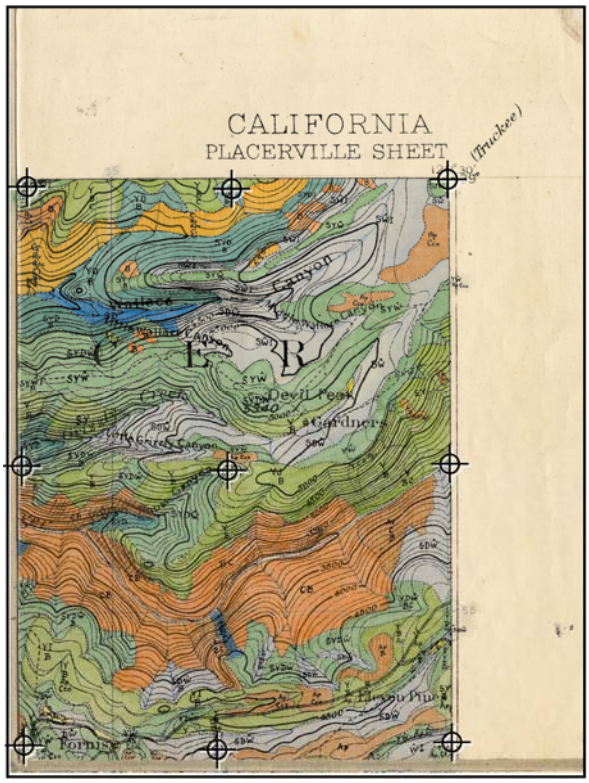


Figure 4. Example registration points used for Tile A1 of VTM56

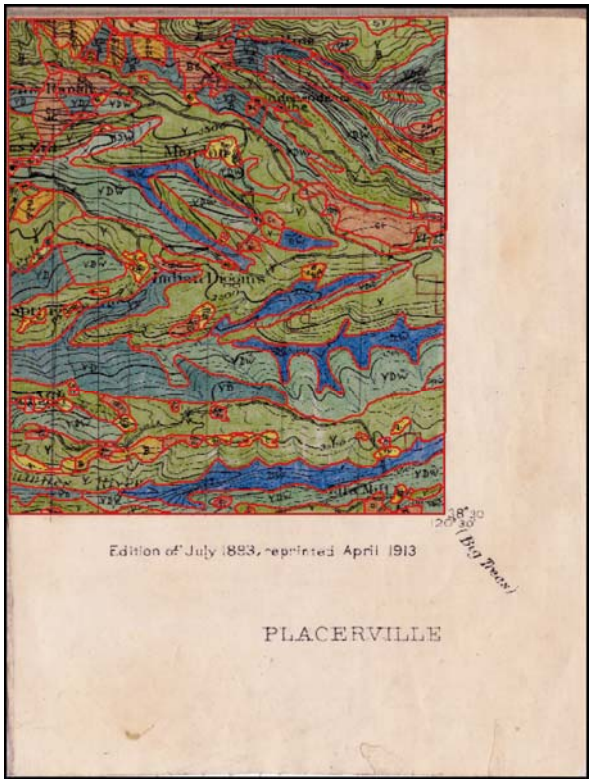


Figure 5. Completed lines for Tile D4 of VTM56

D. Attributing Species Codes to Polygons

Once the lines of the VTM maps were rendered to polygons, the species codes and other information from the original map were manually entered into the database for each quadrangle. Species codes were then associated with species names for each polygon from a lookup table (developed by the project team using Hickman 1993 as the taxonomic authority), so that both codes and names were present in the digital map (Figure 6). The database fields (Figure 7) were consistent across all maps. Figure 7 provides the full set of data fields as a guide for researchers who may eventually use the digital version of the VTM maps in their own research.

E. Crosswalking to Vegetation Types

Once the species codes, species names, and other attributes were recorded for each polygon in a quadrangle, the vegetation classifications were added to the database. The *Manual of California Vegetation* (MCV) (Sawyer and Keeler-Wolf 1995) is the classification system currently used by the majority of California vegetation ecologists. The MCV types can be related to the California Wildlife Habitat Relationships (WHR) types (California Department of Fish and Game 2004), which identify the vertebrate species associated with each habitat type in California. The project team added these vegetation classifications so that the historical maps could be compared to the modern CalVeg map, which assigns WHR classes to polygons.

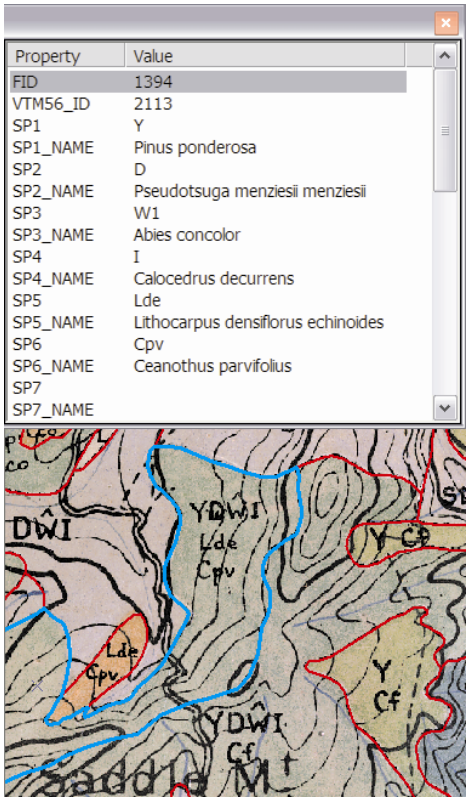


Figure 6. Example species code attributes

The VTM maps record dominant species as they occurred in each stand in order of percent cover, according to a standard set of cover thresholds specified in the VTM field methods manual (Wieslander et al. 1933 unpublished). This recording of dominant species provides "raw" floristic data that can be translated into multiple classification systems. VTM polygons labeled with a single dominant species contain a minimum cover of 80% of that species. A polygon attributed with multiple species specifies each co-dominant cover in at least 20% of the polygon. Species in VTM polygons can be grouped in one of four growth form strata: Trees, Shrubs, Herbs, and Grasses. Species from these classes can co-occur or be separated when classification to vegetation type is assigned. This project used the sequence of species recorded and information on whether the polygon had recently burned or not to assign MCV and WHR types.

Simple feature class
VTM56

Geometry *Polygon*
Contains M values *No*
Contains Z values *No*

Field name	Data type	Allow nulls	Default value	Domain	Prec-ision	Scale	Length	
OBJECTID	Object ID							
SHAPE	Geometry	Yes						
VTM56_ID	Short integer	No			4			Unique Polygon ID
SP1	String	No					5	Species Code 1
SP1_NAME	String	No					50	Species Name 1
SP2	String	No					5	Species Code 2
SP2_NAME	String	No					50	Species Name 2
SP3	String	No					5	Species Code 3
SP3_NAME	String	No					50	Species Name 3
SP4	String	No					5	Species Code 4
SP4_NAME	String	No					50	Species Name 4
SP5	String	No					5	Species Code 5
SP5_NAME	String	No					50	Species Name 5
SP6	String	No					5	Species Code 6
SP6_NAME	String	No					50	Species Name 6
SP7	String	No					5	Species Code 7
SP7_NAME	String	No					50	Species Name 7
SP8	String	No					5	Species Code 8
SP8_NAME	String	No					50	Species Name 8
SP9	String	No					5	Species Code 9
SP9_NAME	String	No					50	Species Name 9
SP10	String	No					5	Species Code 10
SP10_NAME	String	No					50	Species Name 10
SP11	String	No					5	Species Code 11
SP11_NAME	String	No					50	Species Name 11
SP12	String	No					5	Species Code 12
SP12_NAME	String	No					50	Species Name 12
MCV1	String	No					12	Manual of California Vegetation Code1
MCV1_NAME	String	No					50	Manual of California Vegetation Name1
MCV2	String	No					12	Manual of California Vegetation Code 2
MCV2_NAME	String	No					50	Manual of California Vegetation Name 2
WHR1	String	No					7	Wildlife Habitat Relationship Model Code1
WHR1_NAME	String	No					50	Wildlife Habitat Relationship Model Name 1
WHR2	String	No					7	Wildlife Habitat Relationship Model Code2
WHR2_NAME	String	No					50	Wildlife Habitat Relationship Model Name2
VTM_TYPE	String	No					50	VTM Vegetation Type
VTM_COLOR	String	No					15	VTM Polygon Color
CH_ANGLE	Short integer	No	0		4			Cross-Hatching Angle
CH_NUMBER	Short integer	No	0		4			Cross-Hatching Number
ELEVATION	Float	Yes			12	11		Average Polygon Elevation
COMMENTS	String	No					50	Notes & Comments
SHAPE_Length	Double	Yes			18	11		
SHAPE_Area	Double	Yes			18	11		

Figure 7. Example database schema for the Placerville Quadrangle (VTM56)

2.2. Methods Used to Analyze the Historic VTM Maps

The project team characterized the distribution of dominant vegetation for each VTM quadrangle, and subsequently tested for patterns of landscape change with modern vegetation maps. Methods are described for the following steps:

A. Summarize digital VTM maps.

B. Obtain modern digital vegetation maps.

C. Transform both digital maps to same projection and datum.

D. Examine dominant vegetation extents on digital VTM maps on a per-quadrangle basis, using the California Wildlife Habitat Relationships classification.

E. Compare vegetation extents between 1934 and 1996 time steps on a per-quadrangle basis.

F. Examine the change in western extent of Ponderosa Pine Forest in El Dorado County.

G. Analyze ancillary data.

A. Summarize Digital VTM Maps

Completed VTM quads were summarized in several ways. The project listed all the plant species, genera, growth types, and land cover classes used by the VTM crews. The size distribution of polygons on each quad was examined. The extent of each WHR class was summarized on a per-quad basis by exporting the attribute data to a spreadsheet and using a pivot table in Excel to derive sums of the extent of each type. The same was done for areas that were burned or had been logged. Summary data are reported in tables in Appendix A, in very similar fashion to the summary tables reported by the VTM crews themselves (Wieslander, unpublished).

B. Obtain Modern Digital Vegetation Maps

Several digital land cover maps are available for California; the most relevant to this project are the California GAP Analysis project (Davis et al. 1998) and CalVeg (US Forest Service; Schwind and Gordon 2001). The GAP Analysis map actually used the Wieslander VTM maps to help with attribution of vegetation types, causing it not to be usable for examining change on the landscape. The CalVeg map was available for only 56% of the area covered by the VTM maps digitized in this project. The project team obtained that section of CalVeg.

C. Transform Both Maps to Same Geographic Projection and Datum

The Teal Albers Equal Area projection was used in conjunction with the NAD 27 datum as the standard geographic format for all maps. The digital VTM maps were reprojected to this projection, which is the native projection for the CalVeg maps.

D. Examine Dominant Vegetation Extents on Digital VTM Maps on a Per-Quadrangle Basis, Using the WHR Classification

As described in Section 2.1.2 Step E, the project associated modern taxonomic names to the Wieslander codes. The study used the California Wildlife Habitat Relationships (WHR) classification system (California Department of Fish and Game 2004) to report on the extents of vegetation on a per-quadrangle basis. The table containing WHR types and area extent per polygon was brought into Microsoft Excel, and a pivot table was used to derive the total area sums by WHR type. These values were reported, along with the number of polygons containing the WHR type, and the area of that type that had been recently burned or logged.

E. Compare Vegetation Extents Between 1934 and 1996 Time Steps on a Per-Quadrangle Basis

The VTM maps contain more taxonomic detail than do any other set of vegetation maps in California. To compare VTM maps with modern vegetation maps, the VTM detail had to be reduced by rendering the species strings to vegetation types. The MCV classification (Sawyer and Keeler-Wolf 1995) was unsuitable for comparative purposes because it did not permit early seral chaparral types that contain resprouting oaks to be identified as chaparral. However,

assignment of WHR types (California Fish and Game 2004) from the MCV classification is well established, so the project team assigned the VTM species combinations first to MCV, and from there to WHR types. WHR types are essentially habitat classifications by physiognomy (size and general type of plants, such as grassland, scrub, savanna, woodland, and forest); the type name includes one (or rarely, two) dominant species. WHR types are listed as one of the attributes in the CalVeg map, which permitted subsequent comparison.

Vegetation classifications are generalizations of combinations of dominant plant species. The WHR classification is more general than MCV, and therefore is easier to assign correctly. The CalVeg maps use a classification of vegetation has a physiognomic, or structural, component that assigns polygons to higher physiognomic types if 10% of the polygon is in the larger size class. For example, a grassland type is termed a shrubland type when 10% or more of the polygon contains shrubs. Likewise, a shrubland is termed a hardwood woodland or forest if 10% of the shrubland is occupied by hardwood trees; and finally, a hardwood type is assigned to a conifer-dominated type if 10% or more of the area is occupied by conifers.

The VTM mappers used a 20% cutoff to include any species in a polygon's composition. This means that if a larger physiognomic type is converted to a smaller one through time (for example, a conifer type to a hardwood type), that measured change is a conservative estimate, because if even 10% conifers remained, the location would still have been assigned to conifers. These reductions in structure were the informative results in terms of assessing changes in vegetation. WHR classes of similar size that expanded are the classes in which there is the most possibility of a classification error. Note that the VTM maps provided individual species information, so it is possible that other vegetation ecologists may examine the species strings to update the classification developed by this study.

The US Geological Survey base topographic maps upon which the VTM maps were drawn have non-systematic spatial errors of up to 300 meters, particularly worse in mountainous areas, due to the early survey techniques (most topography in these editions was surveyed before 1900). Therefore, the spatial accuracy of the VTM maps is relatively low (note that the LandSat TM images used by CalVeg can themselves contain up to 80 meters spatial location error. In a worst-case scenario, where an entire VTM map was off by 300 meters and it was intersected with its corresponding CalVeg map, this would result in 35% of the map still containing spatially accurate results. However, this study did not intersect the VTM and CalVeg maps to quantify change in the total areas of different vegetation types. Instead, the project team summarized the extents of WHR types on VTM and CalVeg quads independently, then compared the extents in tabular form. This had the effect of placing more importance on the extent of vegetation, rather than determining what happened on any particular 300 meters by 300 meters on the ground. In this way the proportional changes between vegetation types are likely correctly reflected, although the exact location of those changes is not shown.

Tabular extents of WHR types for historic and current vegetation are presented on a per-quadrangle basis (Tables A-3, A-4). The project also collapsed the WHR types into seven general landcover types, to look at the most general trends. Only 56% of the region with digitized VTM maps was available on the CalVeg maps.

F. Examine the Change in Western Extent of Ponderosa Pine Forest in El Dorado County

This analysis used three maps that cover El Dorado County, representing conditions in 1850, 1934, and 1996. The analysis focused on the western extent of the conifers, which was shown as a single front on the 1850 map. To determine the edge for the 1934 and 1996 fronts, the project team divided the county into 1 km^2 cells and sampled the vegetation types from each map. If Ponderosa Pine Forest composed 75% or more of a cell, that cell was termed a matrix cell, part of the unfragmented forest. If a cell was composed of less than 75% Ponderosa Pine Forest, it was termed a fragment cell. For each time period, this approach permitted the definition of an edge of remaining contiguous forest. For the digital VTM maps, the project team used the recorded presence of *Pinus ponderosa* as the way to identify which polygons it was in. The CalVeg map was not so taxonomically precise, so the team used WHR types known to contain ponderosa (Ponderosa Pine Forest, Douglas Fir Forest, Sierran Mixed Conifer).

Once the cells representing the westernmost extent of contiguous Ponderosa Pine Forest were identified, three metrics were developed: distance between fronts, elevation change between fronts, and area between fronts. Two additional processing steps were needed to produce these numbers. First, the polygons from each map were used to sample a digital elevation model and derive the average elevation of each polygon. The elevation values for the polygons at the forest front were then averaged for each date.

Second, east- west transects were created every 250 meters, progressing from the southern edge of the county to the northern edge, for a total of 225 transects. These transects were used to identify the latitude/longitude position of westernmost matrix polygons containing Ponderosa Pine Forest. This effectively returned three locations on each of 225 transects, representing the westernmost location of the forest in 1850, 1934, and 1996. The distances between each point were calculated and the average distance calculated.

Finally, the front from each time period was digitized to a vector line. This permitted the creation of polygons representing zones of conversion between 1850–1934, 1934–1996, and 1850–1996. The areas and composition of dominant vegetation types inside these zones were then assessed. Dominant vegetation types that might represent confounding factors to the influence of climate change—grasslands, urban areas, and places that had burned within the zone vacated by Ponderosa Pine Forest—were removed from the spatial extents. These types were hypothesized to affect the recruitment of ponderosa seedlings in the following ways: in grasslands, either cattle feeding or competition from nonnative grasses may affect ponderosa pine seedlings; urban settings may prohibit their establishment; and fire may also destroy seedlings.

G. Ancillary Data Analysis

Four weather stations were identified that form an elevational transect up the western side of the Sierra Nevada Mountains. The temperature and precipitation data for these stations were obtained from the Western Regional Climate Center and the National Climate Data Center (Karl et al. 1990). The stations are Sacramento (5 meters, 118 years), Placerville (610 meters, 50 years), Yosemite Valley (1220 meters, 98 years), and Tahoe (1900 meters, 95 years). The analysis used

monthly averages derived from minimum daily temperature to examine temperature trends in the study area. Minimum monthly temperatures per site were converted to a 10-year mean of minimum monthly temperature for each month, to reduce some of the variability. For example, the project team took the average of the first 10 years of the January values from a site, and assigned that value to the last date of the 10; then advanced one year and repeated the process. Minimum monthly temperature values were regressed against year, using a bivariate fit model.

3.0 Project Results

This section contains four parts:

3.1 Report on Deliverables

3.2 General Findings from the Digitized VTM Quadrangles

3.3 Historical Changes in Landcover

3.4 Data Availability

3.1. Report on Deliverables

Project deliverables are listed here along with the outcomes associated with each.

Deliverable 1. GIS-compatible versions of a subset of VTM maps from the collection of Wieslander maps.

The project digitized more quadrangles than originally planned. The original objective called for converting four 30' and eight 7.5' maps, covering about 10,000 km^2. The project actually converted twelve 30', two 15', and thirteen 7.5' historical VTM maps in the central Sierra Nevada (Figure 8). The old maps cover 32,250 km^2 and the surveys on those maps cover 30,236 km^2. Figure 9 provides a key to identify the VTM quadrangle identification codes used to reference vegetation results presented in this report.

In addition to the VTM maps in Figure 8, the project digitized a 1934 map (Weeks et al. 1934) of the estimated loss of timberlands between 1850 and 1934 for El Dorado County (Figures 10a and 10b).

The data are available in GIS format by quadrangle (by request from researchers), and a tabular summary of the 1934 data is in Appendix A. The data can also be converted to other formats (e.g., raster) upon request.

Deliverable 2. A Geo-database that combines the digital VTM maps with the VTM vegetation plot data.

Digitization of the VTM plot data (a separate project by a different research group) was not completed in time for use by this project, hence the project team did not conduct a plot-based analysis. The project was thus confined to map-base analyses.

Deliverable 3. A summary of the historical extents of dominant vegetation types on a per-quadrangle basis.

The dominant vegetation extents are reported by quadrangle (Appendix A, Table A-3).

Deliverable 4. A comparison of historic vegetation patterns and extents to contemporary ones.

The project conducted two different analyses. First, the project team analyzed regional change in dominant vegetation extents between the 1934 VTM maps and the 1996 CalVeg vegetation map The analysis focused on a 16,978 km^2 section of the study area because the modern CalVeg

map used for comparison did not cover the entire area that the VTM maps cover. A summary of these changes is reported on a per-quadrangle basis in Appendix A, Table A-4.

The second analysis measured the shifts in the western extent of coniferous forest dominated by *Pinus ponderosa* in El Dorado County, by comparing the 1850 El Dorado map (Weeks et al. 1934), the 1934 Wieslander map, and the corresponding section of the 1996 CalVeg map.

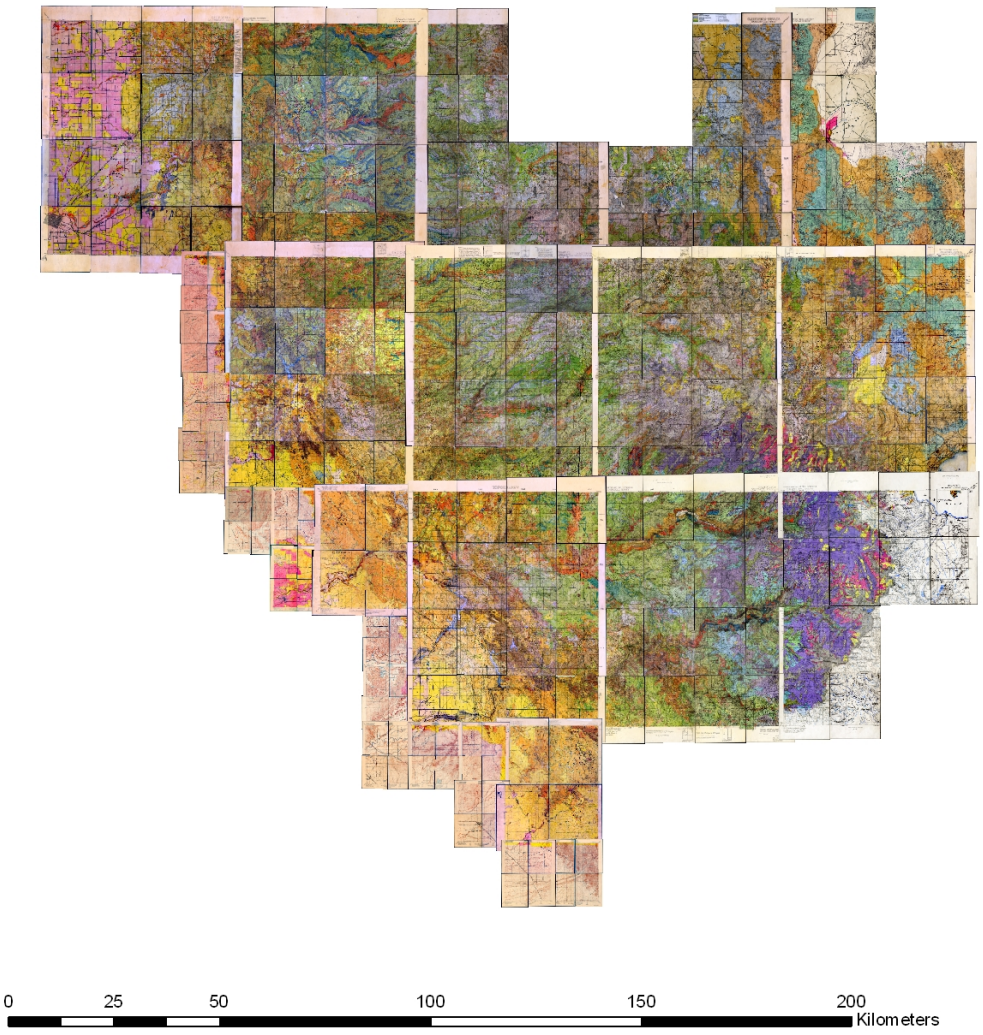


Figure 8. This map shows the original scanned maps for the region converted to GIS. Note that the color scheme on all the maps is consistent, allowing for observation of distribution of vegetation types even on the old maps.

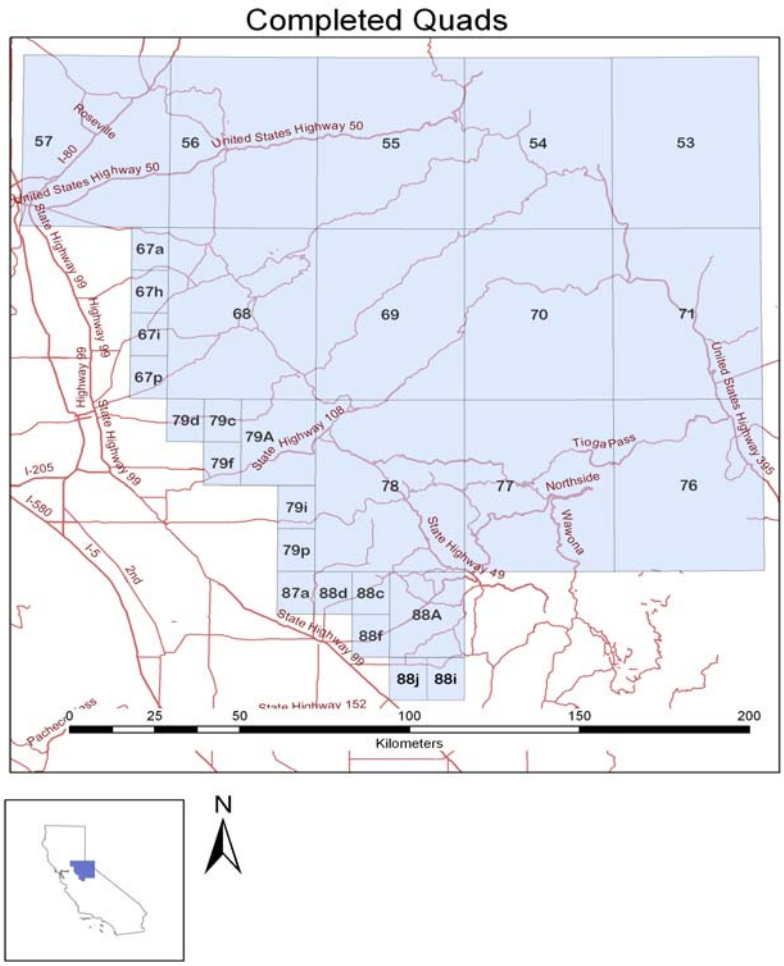
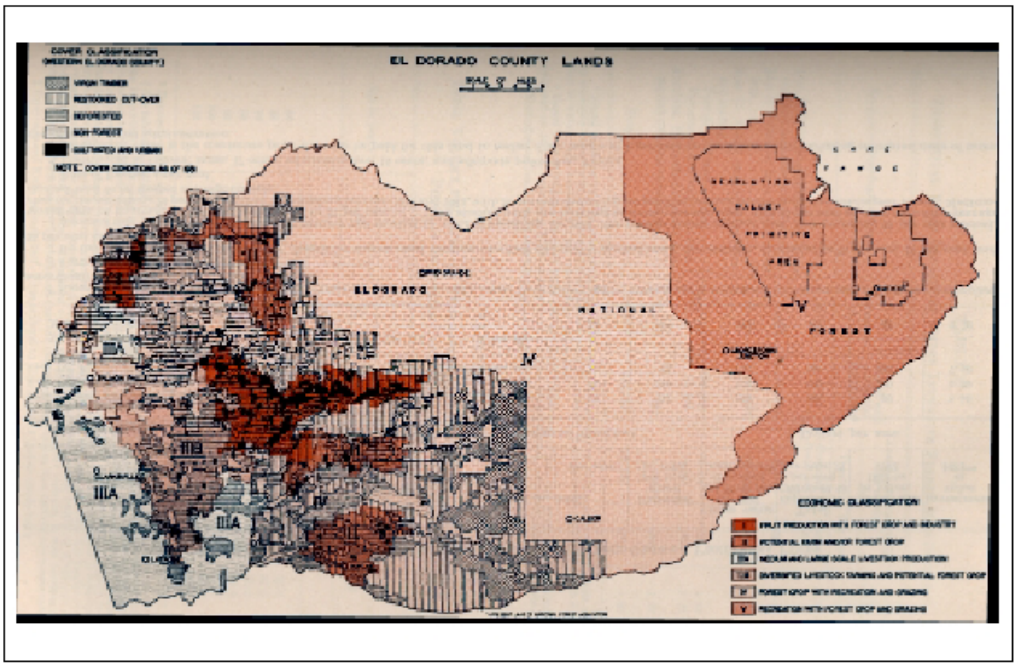


Figure 9. This map shows all the VTM quadrangles reported in the study with their associated codes. The codes listed can be used to look up the table documenting extent and change for that quadrangle. The code convention to identify the size of a quad is as follows: VTM50 (a number alone) indicates a 30' quadrangle, VTM79A (a number followed by a capital letter) indicates a 15' quadrangle, and VTM79f (a number followed by a lowercase letter) indicates a 7.5' quadrangle.

A



B

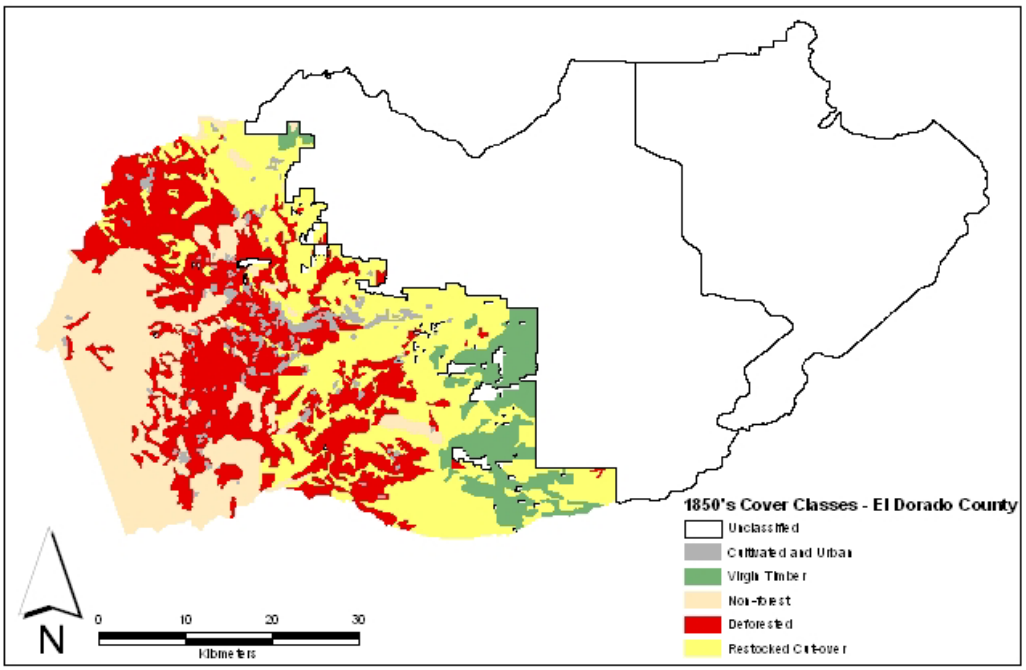


Figure 10a. A copy of the historic map showing lost timberlands (Weeks et al. 1934).

Figure 10b. The red in this map of El Dorado County represents the area (144,943 acres) of Ponderosa Pine Forest which was lost between 1850 and 1934. Yellow represents areas which had been logged, which contained second-growth ponderosa pine (155,277 acres) at that same time. Green areas (38,520 acres) represent virgin timber below 6,000 feet elevation (numbers from Weeks et al. 1934). The map was made by the director of the Wieslander VTM project in 1934, and used old stump fields and remnant stands of pine as the basis for map boundaries.

3.2. General Findings from the Digitized VTM Quadrangles

The project processed historical VTM map surveys covering 30,236 km^2 of the central Sierra Nevada. The VTM crews had recorded a total of 223 species in the region, as well as 14 genera or physiognomic types, 10 land cover types, and 8 species codes which remained unidentified (Table 1). These were converted to MCV and WHR classifications, but the original species are presented here for verification purposes. Distributions of these species were mapped across 46,377 polygons (Figure 11) with an average size of 1.44 km^2, a median of 0.44 km^2, and standard deviation of 4.5 km^2 Table 2 shows polygon statistics for each quadrangle.

The size of polygons is a useful metric for assessing what types of analyses the maps can be used for. Figure 12 shows the distribution of polygon sizes. Details of the species composition and polygon size distribution of each individual quadrangle are found in Appendix A, Tables A-1, A-2, and A-3.

The project categorized 6,476 unique combinations of species recorded in the VTM maps into two commonly used California vegetation (or land cover) classifications, the *Manual of California Vegetation* types (Sawyer and Keeler-Wolf 1996) and the California Wildlife Habitat Relationships models (California Department of Fish and Game 2004). These land cover types were compared on a per-quadrangle basis. The project identified 45 WHR types on the 30,236.5-km^2 VTM study area. WHR classes are presented in Table 3, which shows the full extent of each WHR type as well as the extent of that type that had recently been burned or logged (early seral condition). Ponderosa Pine Forest was the most widespread, covering 3,618 km^2, followed by Annual Grasslands, covering 2,785 km^2 (Table 3). The third-largest category, Unknown, indicates parts of each quad that were not mapped in the original surveys. Summaries of land cover extent by quad are found in Appendix A, Table A-3.

Table 1. Species, genera, and physiognomic and land cover types as recorded by VTM crews in the 1930s on the quadrangles digitized for this report

Species		
Abies concolor	Chrysothamnus nauseosus gnaphalodes	Philadelphus lewisii
Abies magnifica	Chrysothamnus sp.	Phlox cespitosa
Acer glabrum	Chrysothamnus viscidiflorus	Phyllodoce breweri
Acer macrophyllum	Chrysothamnus viscidiflorus puberulus	Phyllodoce empetriformis
Achyronychia cooperi	Cornus sericea sericea	Pinus albicaulis
Adenostoma fasciculatum	Corylus cornuta californica	Pinus attenuata
Aesculus californica	Cupressus lawsoniana	Pinus contorta murrayana
Aira caryophyllea	Cupressus macnabiana	Pinus coulteri
Alnus rhombifolia	Dendromecon rigida	Pinus flexilis
Alnus rubra	Dicentra chrysantha	Pinus jeffreyi
Alnus tenuifolia	Dirca occidentalis	Pinus lambertiana
Arbutus menziesii	Distichlis spicata	Pinus monophylla
Arctostaphylos canescens	Echinocereus engelmannii	Pinus monticola
Arctostaphylos manzanita	Ellisia chrysanthemifolia	Pinus ponderosa
Arctostaphylos mariposa	Encelia actoni	Pinus sabiniana
Arctostaphylos mewukka mewukka	Ephedra nevadensis	Pogogyne douglasii
Arctostaphylos myrtifolia	Ephedra viridis	Populus balsamifera trichocarpa

Species, cont.		
Arctostaphylos nevadensis	Ericameria arborescens	Populus fremontii fremontii
Arctostaphylos nissenana	Ericameria bloomeri	Populus tremuloides
Arctostaphylos otayensis	Ericameria discoidea	Prunus andersonii
Arctostaphylos patula	Ericameria greenei	Prunus emarginata
Arctostaphylos tomentosa	Ericameria parishii parishii	Prunus subcordata
Arctostaphylos viscida	Ericameria suffruticosa	Pseudotsuga menziesii menziesii
Arctostaphylos viscida mariposa	Eriodictyon californicum	Psorothamnus polydenius
Artemisia tridentata	Eriogonum heermannii	Pteridium aquilinum pubescens
Artemisia arbuscula	Eriogonum parvifolium	Purshia tridentata
Artemisia californica	Eriogonum roseum	Quercus agrifolia
Artemisia cana bolanderi	Eriogonum umbellatum	Quercus berberidifolia
Artemisia nova	Eriogonum wrightii	Quercus chrysolepis
Artemisia rothrockii	Eriophyllum confertiflorum	Quercus chrysolepis nana
Artemisia spinescens	Erodium cicutarium	Quercus douglasii
Artemisia tridentata	Festuca rubra	Quercus durata
Artemisia trifida	Forestiera pubescens	Quercus engelmannii
Aster chilensis	Fraxinus dipetala	Quercus garryana
Astragalus bolanderi	Fremontodendron californicum	Quercus garryana breweri
Astragalus mojavensis	Garrya fremontii	Quercus kelloggii
Atriplex canescens	Grayia spinosa	Quercus lobata
Atriplex confertifolia	Helianthemum scoparium	Quercus sadleriana
Atriplex lentiformis torreyi	Heteromeles arbutifolia	Quercus vaccinifolia
Atriplex parryi	Holodiscus discolor	Quercus wislizeni
Atriplex polycarpa	Holodiscus microphyllus glabrescens	Quercus wislizeni frutescens
Avena barbata	Hymenoclea salsola	Rhamnus californica
Avena fatua	Hypericum perforatum	Rhamnus crocea
Baccharis douglasii	Iris missouriensis	Rhamnus ilicifolia
Baccharis pilularis	Juniperus californica	Rhamnus tomentella tomentella
Berberis aquifolium repens	Juniperus communis	Ribes aureum
Brickellia californica	Juniperus occidentalis	Ribes californicum
Bromus carinatus carinatus	Juniperus osteosperma	Ribes cereum
Bromus diandrus	Keckiella breviflora	Ribes roezlii
Bromus hordeaceus	Keckiella cordifolia	Ribes velutinum
Bromus madritensis rubens	Kochia americana	Salsola tragus
Bromus tectorum	Krascheninnikovia lanata	Salvia dorrii incana
Calocedrus decurrens	Lasthenia californica	Salvia sonomensis
Carnegiea gigantea	Lathyrus polyphyllus	Sarcobatus vermiculatus
Ceanothus cordulatus	Ledum glandulosum	Senecio flaccidus douglasii
Ceanothus cuneatus	Lepechinia calycina	Sequoiadendron giganteum
Ceanothus diversifolius	Leptodactylon pungens	Styrax officinalis redivivus
Ceanothus fresnensis	Leymus condensatus	Symphoricarpos mollis
Ceanothus integerrimus	Ligusticum grayi	Symphoricarpos rotundifolius
Ceanothus leucodermis	Lithocarpus densiflorus	Taxus brevifolia
Ceanothus oliganthus	Lithocarpus densiflorus echinoides	Tetradymia canescens
Ceanothus oliganthus sorediatus	Lotus scoparius	Tetradymia comosa
Ceanothus parvifolius	Lupinus albifrons	Tetradymia glabrata
Ceanothus spinosus	Lupinus bicolor	Toxicodendron diversilobum
Ceanothus tomentosus	Lupinus excubitus	Trifolium variegatum
Ceanothus velutinus	Lupinus lepidus lobbii	Tsuga heterophylla
Cercidium floridum floridum	Lupinus succulentus	Tsuga mertensiana
Cercocarpus betuloides	Malacothamnus fasciculatus	Umbellularia californica
Cercocarpus ledifolius	Malus fusca	Veratrum californicum californicum
Chaenactis carphoclinia	Medicago polymorpha	Vulpia myuros hirsuta
Chamaebatia foliolosa	Mirabilis californica	Wyethia mollis

Species, cont.		
Chrysolepis chrysophylla	Monardella odoratissima	Xylococcus bicolor
Chrysolepis sempervirens	Palafoxia arida	Xylorhiza tortifolia tortifolia
Chrysothamnus nauseosus	Pellaea mucronata	Yucca whipplei
Chrysothamnus nauseosus consimilis		
14 Genera and Physiognomic Types	**10 Land Cover Types**	**8 Unidentified Codes**
Annuals	Airport	CAG
Astragalus sp.	Barren	Aro
Chrysothamnus sp.	Burn	Epn
Eucalyptus	Cemetery	Far2
Grass	Cultivated	H'
Herbs	Glacier	Md2
Juncus sp.	Mill	Tar2
Lupinus sp.	Residence	Tm2
Meadow	Rock	
Navarretia sp.	Water	
Ribes sp.		
Salix sp.		
Tule		
Wild hay		

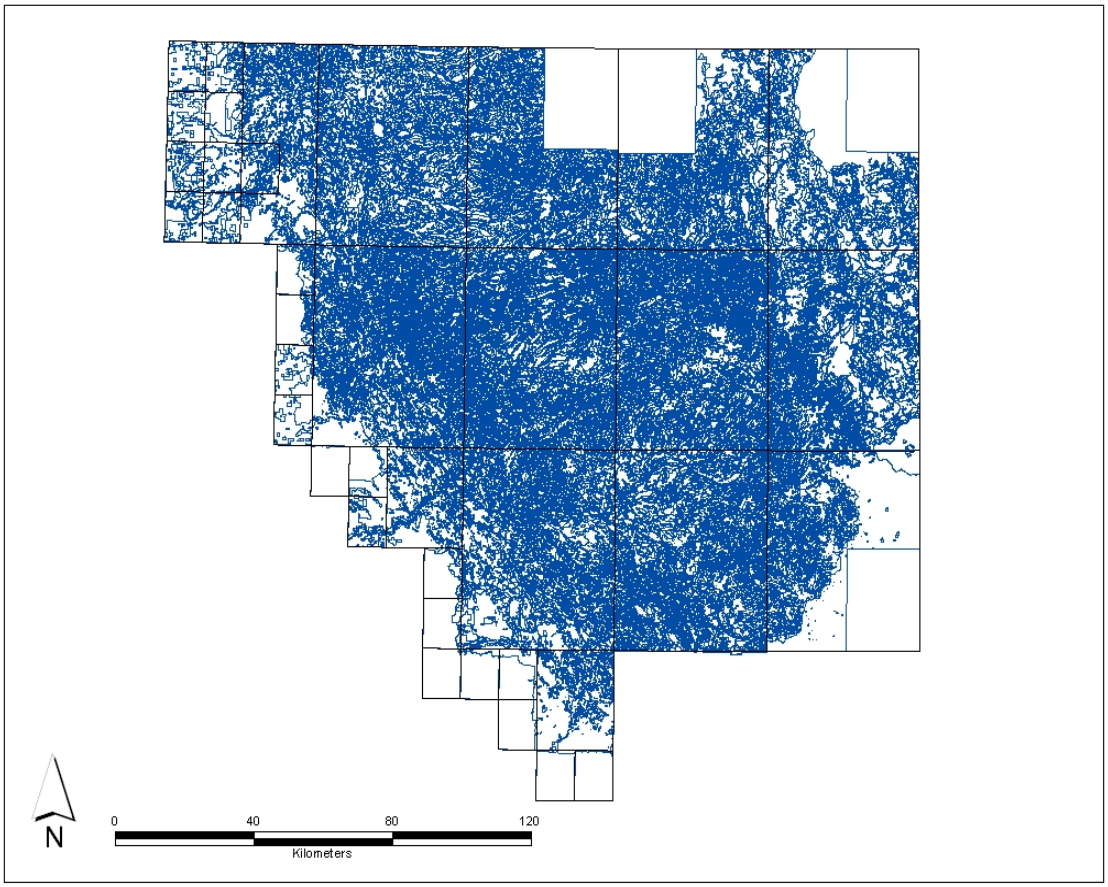


Figure 11. A view of the digitized lines, traced from the historic VTM maps

Table 2. Polygons on VTM quadrangles (hectares; 1 ha = 0.01 km^2)

VTM Quad ID	Number of Polygons	Mean (ha)	Median (ha)	Standard Deviation (ha)	Minimum (ha)	Maximum (ha)
VTM53	908	150.6	41.4	423.2	0.2	5,170.0
VTM54	2931	59.3	18.1	233.4	0.1	7,832.6
VTM55	2870	63.2	22.8	139.4	0.3	3,178.7
VTM56	3422	75.6	18.9	275.2	0.1	10,850.8
VTM67a	156	42.9	10.3	239.3	0.2	2,992.3
VTM67i	42	213.4	12.5	1113.4	1.2	7,333.1
VTM67p	19	801.5	63.1	2217.8	3.8	9,622.0
VTM68	6060	40.1	13.7	197.5	0.3	11,336.9
VTM69	5659	42.9	15.9	133.8	0.4	3,439.9
VTM70	6216	39.1	15.5	115.3	0.3	4,408.2
VTM71	4178	56.6	12.5	300.8	0.0	10,443.3
VTM76	2351	44.0	12.6	241.7	0.1	7,184.7
VTM77	5609	43.8	16.5	119.4	0.6	3,112.8
VTM78	4403	55.5	18.3	373.2	0.1	16,406.4
VTM79A	648	94.2	12.1	707.9	0.4	11,761.9
VTM79c	13	562.2	68.4	1310.7	0.9	4,940.8
VTM79d	3	40.1	36.8	6.8	33.9	49.6
VTM79f	87	170.5	11.2	782.6	0.2	6,366.4
VTM79i	46	80.8	7.1	213.2	0.5	1,280.6
VTM79p	15	132.2	61.9	210.4	0.6	811.3
VTM87a	5	17.6	11.3	20.4	1.3	57.4
VTM88A	676	90.9	6.8	1274.7	0.3	32,036.0
VTM88c	19	225.9	7.0	887.7	0.3	3,989.9
VTM88d	27	49.8	4.5	192.3	1.3	1,027.8
VTM88f	7	144.4	38.8	219.1	3.7	657.1
VTM88i	2	435.1	435.1	234.8	51.5	383.6
VTM88j	5	120.2	90.7	155.6	3.6	386.1

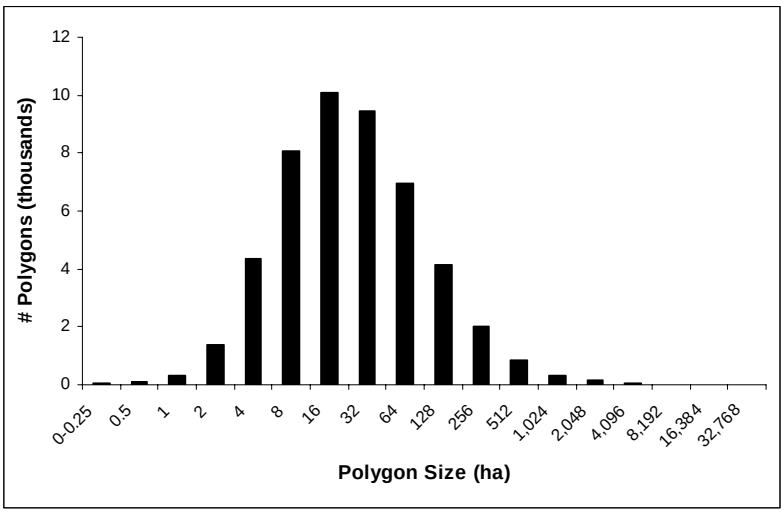


Figure 12. Distribution of polygon sizes for the VTM maps in the study area

Table 3. Land cover on VTM maps (area in hectares)

WHR Type	Total Area (ha)	Early Seral Due to Logging (ha)	Early Seral Due to Burns (ha)	Not Logged or Burned (ha)
Ponderosa Pine (PPN)	361,784.6	2,408.3	169.7	331,992.8
Annual Grassland (AGS)	278,457.7	4,251.7		274,206.0
Unknown (UKW)	269,973.2	17.5	0.0	269,955.7
Sagebrush (SGB)	216,196.5	5,839.3		210,357.2
Agriculture (AGR)	156,652.5	1.9	5.7	156,644.9
Pinyon-Juniper (PJN)	146,729.7	1,874.1		144,855.6
Montane Hardwood (MHW)	137,438.1	3,983.4	5,911.4	127,543.3
Sierran Mixed Conifer (SMC)	129,908.3	2,298.6		127,609.6
Lodgepole Pine (LPN)	128,038.3	24,755.6		103,282.8
Blue Oak–Foothill Pine (BOP)	124,926.9	4,346.7	22,818.7	97,761.5
Blue Oak Woodland (BOW)	118,464.7	190.7	287.2	117,986.9
Jeffrey Pine (JPN)	116,823.5	31,737.0		85,086.5
Barren (BAR)	102,778.5	201.2		102,577.2
Montane Chaparral (MCP)	94,446.0	23,280.6	18,657.3	52,508.1
Subalpine Conifer (SCN)	94,189.9	23,856.2		70,333.7
Red Fir (RFR)	85,068.3	8,232.1		76,836.2
Chamise-Redshank Chaparral (CRC)	82,555.1	205.0	1,299.1	81,051.0
White Fir (WFR)	70,884.1	622.4		70,261.7
Mixed Chaparral (MCH)	69,965.7	15,934.2	41,452.9	12,405.1
Douglas Fir (DFR)	34,157.6	251.8	587.1	30,993.3
Wet Meadow (WTM)	33,860.1	2,610.4		31,249.7
Montane Hardwood–Conifer (MHC)	33,189.8	31.6	1,133.5	32,024.7
Eastside Pine (EPN)	31,790.2	11,839.0	0.0	19,951.2
Lacustrine (LAC)	26,543.2			26,543.2
Desert Scrub (DSC)	15,277.1	1,147.6		14,129.4
Juniper (JUN)	15,255.9	2,297.3	0.0	12,958.6
Aspen (ASP)	12,395.6	48.5	391.5	11,442.6
Valley Oak Woodland (VOW)	9,552.8	163.8	115.3	9,273.8
Montane Riparian (MRI)	7,745.0	588.2	22.5	7,134.3
Low Sage (LSG)	5,934.7	404.0		5,530.7
Urban (URB)	4,480.3			4,480.3
Bitterbrush (BBR)	2,748.0	505.8	10.4	2,089.5
Closed-Cone Pine–Cypress (CPC)	1,898.0			1,898.0
Valley Foothill Riparian (VRI)	1,312.2	389.8		922.4
Perennial Grassland (PGS)	1,186.2			1,186.2
Weed Field (WEE)	240.7	9.3		231.4
Saline Emergent Wetland (SEW)	209.4			209.4
Eucalyptus (EUC)	143.7	44.5		99.2
Alkali Desert Scrub (ASC)	134.3			134.3
Fresh Emergent Wetland (FEW)	131.8	1.0		130.8
Glacier (GLA)	83.2			83.2
Dryland Grain Crops (DGR)	78.3			78.3
Alpine Dwarf–Shrub (ADS)	11.1	1.0		10.1

WHR Type, cont.	Total Area (ha)	Early Seral Due to Logging (ha)	Early Seral Due to Burns (ha)	Not Logged or Burned (ha)
Desert Succulent Scrub (DSS)	4.0			4.0
Fern	2.8			2.8
Grand Total	**3,023,647.2**	**174,369.9**	**92,862.2**	**2,726,047.0**

3.3. Historical Changes in Landcover

3.3.1. Regional Assessment of Change in Extents of WHR Classes between 1934 and 1996

Observation of changes over the study area was possible for only a subset of the digital VTM maps that were produced, because CalVeg, the modern map used for comparison, did not cover the same extent as the VTM maps. Thus, each set of maps was clipped so that the area compared per quad was the region that contained both 1930s and 1996 data (Figure 13). The results, summarized across all comparable areas, are presented in Table 4. Out of the 16,978.3 km^2 for which change in dominant vegetation types could be examined, 41.8%, or 7106.3 km^2, was assessed to have changed over 65 years. Table 4 presents the compiled summations. The summary of change by quadrangle is in Appendix A, Table A-4.

Regionally, the most extensive historic vegetation type, Ponderosa Pine Forest, occupied 20% of the area for which change was measured. Ponderosa Pine Forests decreased in extent by 64% from a historical 3,444.5 km^2 to a contemporary 1,238.7 km^2, or 5.9% of the study area. Blue Oak–Foothill Pine Woodlands decreased by 53.7%, from 1,209.1 to 559.3 km^2. WHR types that gained the most were Sierra Mixed Conifer, which went from 1244 km^2 to 2951 km^2; Montane Hardwoods, which grew from 1,123 km^2 to 2231 km^2; and Annual Grasslands, which increased by 1077 km^2 (Table 4). Chaparral decreased by 636 km^2 in the region. At upper elevations, combining all upper-elevation conifer types into one category, conifers lost 1,569 km^2 and upper-elevation hardwoods gained 1,758 km^2. Riparian zones decreased by over 50%, as did Aspen stands.

At the upper elevation of its range, Ponderosa Pine Forest was replaced mostly by Douglas Fir Forest or Sierran Mixed Conifer Forest. The authors hypothesize that this change is likely due to effective fire suppression in the mixed conifer zone of the Sierra Nevada. Fire suppression at this elevation favors the recruitment of white fir (*Abies concolor*), a species not found in pure ponderosa stands, but characteristic of mixed conifer stands. At the lower edge of its range, Ponderosa Pine Forest was replaced mostly by Montane Hardwood Forest and Annual Grasslands. Blue Oak–Foothill Pine Woodlands were predominantly replaced by Annual Grasslands.

The high number of species and WHR types present on the VTM maps are an indication of its superior taxonomic resolution to the modern vegetation maps. The project was not able to analyze change for some historical mapped vegetation extents because the modern maps do not

capture the same taxonomic detail. By contrast, the modern CalVeg map had a finer spatial resolution, so increases in types that form patches on the landscape, such as Valley Oak Woodlands, may show an increase because smaller stands missed by the VTM maps were picked up by the modern mapping technique. The report presents all changes, but provides an interpretation for only the largest.

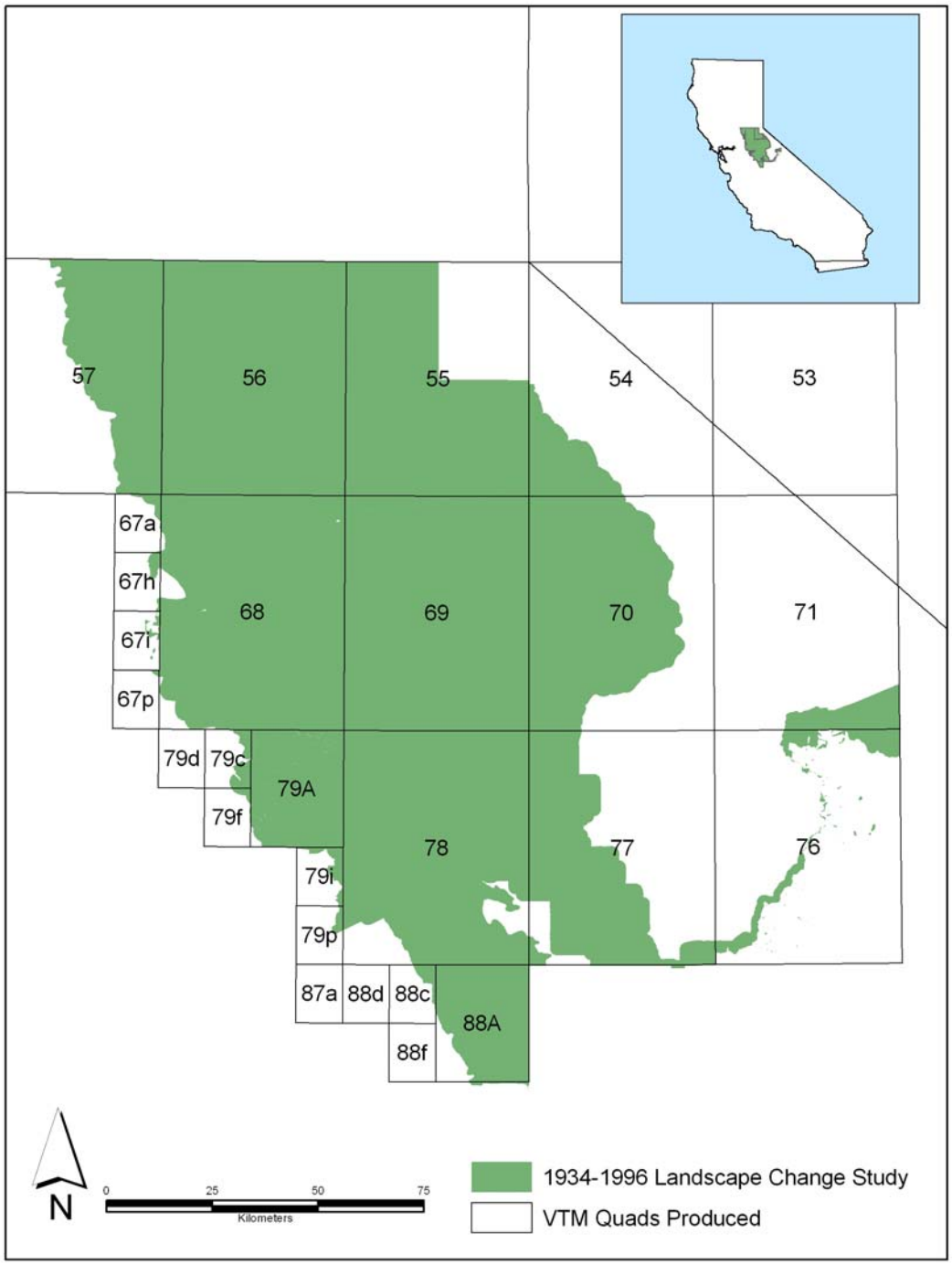


Figure 13. The 16,978 km^2 area containing both 1934 VTM maps and 1996 CalVeg map is outlined in green, with a backdrop of the entire VTM map quads in the study area.

Table 4. Change on the landscape as measured by WHR classes between 1934 and 1996. The lower section of the table represents compiled classes. Working landscapes in the lower section is a class dominated by ranching and agriculture.

WHR Classes	VTM (ha)	CalVeg (ha)	Area Gained or Lost (ha)
Sierran Mixed Conifer (SMC)	124,422.7	295,167.1	170,744.4
Montane Hardwood (MHW)	112,335.8	223,118.9	110,783.1
Annual Grassland (AGS)	180,202.2	287,919.8	107,717.6
Montane Hardwood-Conifer (MHC)	31,962.4	97,056.9	65,094.6
Barren (BAR)	42,430.4	86,000.5	43,570.0
Blue Oak Woodland (BOW)	121,302.3	152,867.0	31,564.7
Red Fir (RFR)	47,177.3	76,546.1	29,368.8
Lacustrine (LAC)	21,357.9	38,575.5	17,217.7
Urban (URB)	1,983.6	17,082.5	15,098.9
Mixed Chaparral (MCH)	66,241.1	77,280.2	11,039.1
Douglas Fir (DFR)	32,121.7	42,046.1	9,924.4
Alpine Dwarf-Shrub (ADS)	11.1	2,454.5	2,443.4
Montane Hardwood Conifer (MHC)	259.7	1,553.8	1,294.1
Valley Oak Woodland (VOW)	2,263.8	3,171.3	907.5
Pinyon-Juniper (PJN)	45.6	145.9	100.3
Unknown (XXX)	162.8	211.4	48.6
Coastal Oak Woodland (COW)		5.5	5.5
Fern	2.8		-2.8
Desert Succulent Scrub (DSS)	4.0		-4.0
Fresh Emergent Wetland (FEW)	81.6		-81.6
Eucalyptus (EUC)	110.2	16.9	-93.3
Saline Emergent Wetland (SEW)	96.8		-96.8
Weed Field (WEE)	227.1		-227.1
Unknown (UKW)	366.0		-366.0
Valley Foothill Riparian (VRI)	594.2		-594.2
Desert Scrub (DSC)	685.6		-685.6
Low Sage (LSG)	907.0		-907.0
Perennial Grassland (PGS)	1,186.2		-1,186.2
Closed-Cone Pine-Cypress (CPC)	1,700.2	476.8	-1,223.4
Montane Riparian (MRI)	2,667.7	1,357.7	-1,309.9
Aspen (ASP)	1,981.4	532.0	-1,449.4
Bitterbrush (BBR)	1,828.2		-1,828.2
Juniper (JUN)	3,063.7		-3,063.7
Sagebrush (SGB)	12,957.9	6,786.3	-6,171.6
Eastside Pine (EPN)	6,412.4		-6,412.4
Wet Meadow (WTM)	11,448.1	3,647.9	-7,800.1
Subalpine Conifer (SCN)	33,331.5	14,011.6	-19,319.9
Lodgepole Pine (LPN)	54,301.0	31,916.1	-22,384.9
Montane Chaparral (MCP)	71,990.4	41,404.0	-30,586.4
Agriculture (AGR)	42,474.3	9,508.5	-32,965.8
White Fir (WFR)	54,506.5	12,278.4	-42,228.1
Chamise-Redshank Chaparral (CRC)	77,387.0	33,242.9	-44,144.1
Jeffrey Pine (JPN)	67,935.9	11,924.9	-56,011.0

WHR Classes cont.	VTM (ha)	CalVeg (ha)	Area Gained or Lost (ha)
Blue Oak–Foothill Pine (BOP)	120,905.6	5,592.7	-115,312.9
Ponderosa Pine (PPN)	344,449.7	123,874.6	-220,575.1
Combined WHR Types	**VTM (ha)**	**CalVeg (ha)**	**Area Gained or Lost (ha)**
Upper Elevation Hardwoods (MHW, MHC)	144,298.2	320,175.8	175,877.7
Working Landscapes (AGS, CRP)	222,676.5	297,428.3	74,751.8
Urban (URB)	1,983.6	17,082.5	15,098.9
Riparian (WTM, VRI, MRI)	14,709.9	5,005.6	-9,704.3
Chaparral (MCP, MCH, CRC, CPC)	215,618.6	151,927.1	-63,691.4
Lower Elevation Hardwoods (VOW, BOW, BOP)	244,471.7	161,631.0	-82,840.7
Conifer (SMC, RFR, DFR, SCN, LPN, WFR, JPN, PPN)	764,658.8	607,764.9	-156,893.9

3.3.2. Changes in the Western Extent of Ponderosa Pine Forest from 1850 to Present

The second analysis examined the western edge of the coniferous forest in El Dorado County. The three historical maps of this area permitted measurement of the shift of the western edge in two steps: between 1850 and 1934, and between 1934 and 1996. In total, the western, lower extent of continuous Ponderosa Pine Forest moved eastwards an average of 26.4 km with an average elevational change of 526 meters (Figure 14). The 1850s map was the least certain of the data; however, the trend was also evident using only the 1934–1996 time period, during which time the western edge moved an average of 7.1 km (+/- 300 m, the potential horizontal spatial registration error when intersecting the 1934 map with the 1996 map); accompanied by an average upward shift of 193 m. The overall area affected by the shift from 1850 to 1996 was 562 km^2.

Potentially confounding dominant vegetation and land cover types—fire zones, urban areas, and grasslands—occupied 42% of the 562 km^2 zone of Ponderosa Pine Forests retreat. The remaining 58% is the portion of change that could not be discounted by confounding factors available in the digital maps.

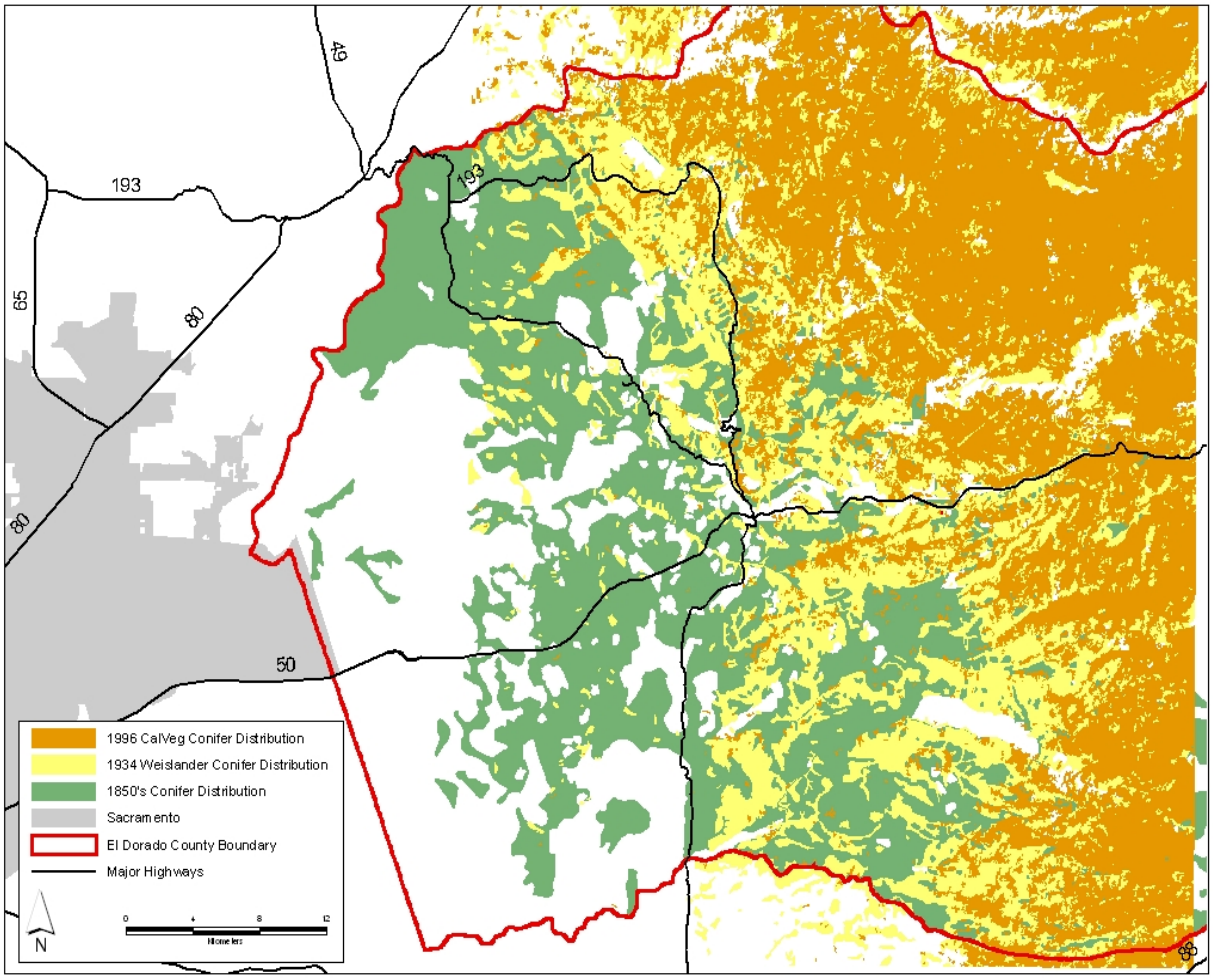


Figure 14. Upwards shift of the coniferous belt from 1850 to 1996. The shift in elevation from yellow to brown represents an upslope movement of 180 meters on average.

3.4. Data Availability

A full collection of the GIS layers developed for this project requires 75 gigabytes of storage. The quadrangles are available upon request to Dr. James Thorne, Dept. Environmental Science and Policy, 1 Shields Ave., University of California, Davis, Calif. 95616, jhthorne@ucdavis.edu. In addition, the maps will be made viewable on a browser hosted by the lab of Dr. James Quinn, UC Davis. There are plans to submit the maps to the Alexandria Digital Library, UC Santa Barbara, to be used in a digital catalog that will be maintained by the US Library of Congress. The methods manual is also available from the author upon request.

4.0 Conclusions and Recommendations

4.1. Conclusions

The findings from this study prove conclusively that the lower edge of the ponderosa pine belt has shifted upslope. The results also suggest a possible reason for this shift: increasing length Sierra Nevada summer droughts is causing high mortality among recruiting ponderosa pine seedlings. Further research is needed in this area to determine whether this is the case and how sharp the gradient for tree seedling mortality may be.

The results presented here suggest that methods for timber harvest at the lower edge of the ponderosa pine belt should be considered. It is expected that the same processes described here will continue to drive the conifer belt upslope, given disturbances that completely remove forest canopy such as clear-cut logging. Maintaining some degree of canopy closure will likely be necessary for these forests to successfully reestablish as coniferous forests after logging. Not cutting at the lower edge would be the preferred option given the results of this study, as it would help "hold the line" of the forest. There is good reason to try to maintain these systems as coniferous forests, since their structure contributes to holding snows longer, and the well-being of humans in California is directly associated to the snow pack of the Sierra Nevada. Maintaining these lower-edge forests would also contribute to efforts to fix carbon, and provide habitat for endangered species. The importance of forests to water availability was already well understood in 1890, when Sequoia National Park was founded in part due to the arguments of Central Valley farmers who wanted to preserve the forests to assure their water supply.

The authors hypothesize that the shift in the retreating edge of Ponderosa Pine Forest is due at least in part to climate change. Adult ponderosa pine in the region are known to have been heavily logged. Therefore, the disappearance of the adult trees is due to human perturbation. However, the lack of forest regeneration, as quantified by little measurable regeneration of ponderosa pine in the deforested zone on the 1996 map, means there has been no successful recruitment of seedlings. This component is potentially tied to climate change. With the warming trend reported below, summer drought periods begin sooner, leading to a longer dry period and greater drought stress. In red fir (*Abies magnifica*) forests upslope from the ponderosa pine, late snows are correlated with more tree growth, while increased exposure to solar radiation associated with earlier snowmelt leads to drier soils, which in turn makes seedling establishment more difficult (Barbour et al. 1998). The same physical processes are at work in the ponderosa pine belt described here. This trailing-edge process occurs at the lower end of the elevational distribution a species. The upper- or leading-edge dynamic is new establishment at higher elevations, which has been reported for other species of Sierra Nevadan conifers by Millar et al. (2004).

Minimum monthly temperatures from Sierra Nevadan weather stations in the study area increased for all months of the year at all sites, and indicated an average warming in the region of approximately 3°C (5.4°F)over the past 100 years. The monthly trends are reported in Appendix A, Table A-5. The yearly trends are presented here. Sacramento, below the ponderosa shift zone, had the lowest rate of warming, at 0.012°C/yr^{-1} (R^2= 0.56 for 10-year smoothed data).

The station at Placerville, in the center of the shift zone for Ponderosa Pine Forest, is experiencing minimum monthly temperature increases at the rate of 0.055°C/yr^{-1} since 1942 (N = 57 years, R^2= 0.83, 10-year smoothed data). The Placerville station went from having two months a year which were frozen every night (December and January) to none. Yosemite Valley's minimum monthly temperatures are warming at the rate of 0.041°C/yr^{-1} (R^2= 0.88, 10-year smoothed data), and the Tahoe station is recording a rate of 0.044°C/yr^{-1} (R^2= 0.84, 10-year smoothed data).

These results are consistent with other observations that the Sierra Nevada is warming: Lake Tahoe, a 500 km^2 integrator of surrounding conditions, is warming (Coats et al. 2006); western North America is experiencing earlier snowmelt (Stewart et al. 2005); and fires in the western US are occurring more frequently (Westerling et al. 2006).

Digitization of the Wieslander VTM maps under funding from the California Energy Commission has led to a resource that can be used by many groups interested in natural resource management and research in the Sierra Nevada. The historical data were collected as part of the foundational effort to record forest condition in California. As such they can prove useful by comparing them with modern assessments to determine the changes in dominant vegetation types. This trend analysis permits quantitative assessment of landscape-level changes over a greater region and time period than has ever been available for California before.

4.2. Recommendations

Three recommendations arise from this study. The first deals with questions raised by the study's results. The other two deal with further development of the VTM data as a foundational data set for terrestrial research and management.

1. **Conduct spatially detailed study to inform forest management practices.** Project results about the upslope movement of the lower edge of the ponderosa pine belt, which seems to be occurring after stand-replacing disturbances, raise questions about the necessary management practices for successful conifer establishment. Because the process of conversion of ponderosa pine to other vegetation has been happening for over 150 years, and since this process has potential impacts on the well-being of Californians through the potential change in water availability associated with loss of coniferous forests, the authors recommend a more spatially detailed study that combines three components: (1) planting experiments along an altitudinal gradient, (2) detailed climatic data development and modeling to better identify dynamics along this gradient, and (3) detailed geographic analyses to identify slopes and aspects on the mountain range that are likely to experience change in land cover.

   The authors recommend a five-year study, which would allow time to assess the success of seedlings in response to various establishment conditions. The climate and geographic work would be mostly conducted over three years, although instrumentation established should continue to be monitored over the length of the

study (and preferably become part of the long-term network of climate records, at sites selected for relevance to climate change studies). The geographic analysis would be conducted over the first two to three years of the study, and would provide hypotheses that the field and climate components would help to resolve, such as which slopes are most likely to fail to establish conifer seedlings. This study would include development of geographic habitat suitability models in the first year; installation of plantings and climate monitoring stations in the second year; and monitoring, maintenance, and analysis of sites and data in subsequent years.

Start-up costs would include $40,000 for 200 Hobo pendant data loggers and five weather stations, $20,000 for seed acquisition and planting supplies, and $15,000 for computer equipment. First-year costs would be $275,000; subsequent years would be $160,000, for a total budget of $915,000 over five years.

2. **Digitize the rest of the Wieslander maps.** The utility of the heritage VTM dataset is evident. It provides a definitive measure of conditions 70 years ago which can inform both management and research for a wide variety of terrestrial research questions, including the effects of climate change. Further, there is no other source for this information than the old maps, which represent an irreplaceable resource for the state. The rest of the VTM vegetation maps should be rendered to digital format for use throughout the state.

   This recommendation is for a multi-year study using methods established during the current funding phase. This project produced 27 quadrangles; another 198 quads remain. The methods for production are now well established, and methods of analysis and distribution have been identified. In this effort, production of the quads and their subsequent analysis went beyond the $70,000 granted in the PIER project. Full digital conversion of the original maps costs about $6,000/quad, leading to an estimated cost of $1.18 million. However, efficiencies of scale are possible.

   A three-year project funded at $630,000 per year could develop the remainder of the data. The authors propose that a capacity to produce the maps be developed at two additional university labs, so that the map digitization can occur in parallel, with management of the entire project to run through one lab/campus. Map production for the state would finish approximately two and a half years into the project, and the final six months would be used in preparing the data for general use, regional analyses, manuscript preparation, and distribution of products to other PIER efforts that can use the data in their research and management efforts.

3. **Analyze the VTM plot data.** The final recommendation addresses the VTM plot data, which were not rendered to digital format in time for use on this project. The UC Berkeley group that has been developing those data is now nearing the end of its efforts, and the plots should become available to researchers within the next year.

The authors recommend a two-year study, funded at $140,000, which would explore the technical challenges of joining the VTM plot data to the VTM maps. This joining is a nontrivial exercise due to the spatial imprecision in the old plot locations. However, the payoff for comprehensively solving this problem is that the VTM vegetation polygons, such as those presented in this report, would gain much more detail, permitting community species composition and stand structure to be added to the spatial extents given in the VTM vegetation maps. These additional details would make modeling of plant species' response to climate change much more robust. If this effort is conducted in parallel to a larger map development project, the plot data could be added to the final deliverables for that project. This parallel work would combine the plots to all the new VTM maps produced.

4.3. Benefits to California

The state of California benefits from this project in a number of ways. First, many resource agency personnel are interested in using these maps for resource management purposes. The historical perspective provided by VTM data permits more informed planning and decision making with regards to natural resources and endangered species in the state, because it provides a window onto how things have already changed.

Second, the conversion of the historical VTM maps to digital VTM maps permits much wider access to the information, which until recently had been kept in a lab at the University of California, Berkeley. The only way to access the data was to travel to the University and copy whatever components were of interest. The digital versions can be shared much more easily. The state will also gain recognition for sponsoring a project whose map results are of interest to the US Library of Congress, which has requested that these data be made available for its effort to store digital imagery.

Third, the maps will be particularly useful for analyzing trends at coarse spatial scales. The state benefits from this work because it identifies the dynamics of dominant vegetation across large regions and a long time horizon. The capability to identify ongoing, long-term trends is something that is possible only with reliable historic data. Focusing on these measured trends, such as the retreat of conifers upslope, in future research will permit better understanding of the role that climate change may be playing in landscape-level ecological processes. Because the VTM data are comprehensive for the areas they cover, they will permit investigations of the relative contributions and interactions of various processes such as fire, human disturbance, and climate change. The interactions of those processes may have a much larger effect on land cover than any one process alone.

Fourth, the data will be usable by scientists who model the ranges of species, such as those performing dynamic vegetation modeling. These groups will be able to use the VTM data as input and as validation of modeled species ranges under a historical extent. This permits the modelers to have two sets of training and test data—the VTM data and modern species distribution records. Having two sets of data permits better calibration of the model techniques, which in turn will lend more credence to model predictions that project into the future.

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6.0 Glossary

CalVeg. A vegetation map produced by the US Forest Service in 1996 (Schwind and Gordon 2001). CalVeg uses the WHR model to categorize landscapes.

Datum. A term that in geography indicates a reference surface (of the globe) which mapmakers use to create maps in a manner such that one may be compared to another, and that distances, elevations, and areas may be standardized.

GAP — Gap Analysis Project. An effort in the 1990s to map the dominant vegetation of California and rank the mapped types according to their rarity and level of representation on lands managed for conservation (Davis et al. 1998).

GIS — Geographic Information System. A computer program that permits the development, portrayal, and analysis of electronic maps.

Geo-database. A database with spatial references that can be used in GIS analyses.

km^2 — square kilometer, the area described by a square with edges of 1000 meters.

m — meter.

MCV — *Manual of California Vegetation.* A book by Sawyer and Keeler-Wolf (1995) that describes dominant vegetation types for California.

Montane Coniferous Zone. An elevational band of conifer species in found in many mountain ranges. In the area of the VTM study, the Montane Coniferous Zone starts at about 1000 m and extends up to treeline.

Polygon. A map unit defined by a line circumscribing its outer edge. In a GIS, the area inside the boundary may have a description of the polygon's contents, which are attached to the digital map in the form of a database. Each polygon in that situation has an identifier code which permits access to the attributes of that polygon listed in the database.

Projection. A mathematical means of transferring spatial information from the three dimensions of the earth's surface to the two dimensions of a map or GIS.

Seral Condition. The stage of a site's vegetative progression. When burned or otherwise disturbed, montane sites in California often will progress through several types of vegetation over a period of some 10 to 20 years. A typical progression might consist of annual plants, which are over-topped by shrubs, which are over-topped by hardwoods, which eventually give way to conifers. Early seral refers to plants in the early phases of this succession.

USFS — United States Forest Service.

VTM — Vegetation Type Map. Vegetation maps produced by the US Forest Service during the 1930s were created under a program called the Wieslander Vegetation Type Map program.

WHR — California Wildlife Habitat Relationships model. Developed by the California Department of Fish and Game, the model assigns dominant vegetation into a classification that is widely used because it identifies habitat suitability for the vertebrate species of the state. The classification identifies the structure of the vegetation, such as forest, woodland, chaparral, etc., and it provides one dominant species name. For example, a Blue Oak Woodland (BOW) is an open-canopy vegetation type found in the foothills around the Central Valley of California that has a grassy understory, is dominated by blue oak, and is suitable habitat for a wide range of species, including various reptiles, birds, and mammals. WHR classes were used in the landscape change analyses of this report because the simple classification helped to minimize classification error—a VTM polygon that lists three shrub species might be assigned to the wrong chaparral type, but it would still receive a shrub type WHR class. The WHR classification also permitted the input of information about the seral condition of vegetation in a polygon after fire, something that the MCV classification in its current published version is not capable of identifying. This was important for identifying shrub types that had oaks as a component of the species in the polygon. The MCV classification would assign those types to an oak class, but in reality the site was a chaparral field that contained sprouting oaks.

Appendix A

Data Tables

Table A-1. Species per quadrangle found by the Wieslander survey. The codes refer to the quadrangles, using the reference system of the old surveyors. These codes can be tracked for location on Figure 9.

Species VTM 53	
Artemesia tridentata	*Holodiscus discolor*
Artemisia arbuscula	*Holodiscus microphyllus glabrescens*
Artemisia cana bolanderi	*Hymenoclea salsola*
Artemisia nova	*Juniperus osteosperma*
Artemisia spinescens	*Keckiella breviflora*
Artemisia tridentata	*Kochia americana*
Atriplex canescens	*Krascheninnikovia lanata*
Atriplex confertifolia	*Pinus albicaulis*
Atriplex lentiformis torreyi	*Pinus monophylla*
Ceanothus velutinus	*Populus fremontii fremontii*
Cercocarpus ledifolius	*Populus tremuloides*
Chrysothamnus nauseosus	*Prunus andersonii*
Chrysothamnus nauseosus consimilis	*Psorothamnus polydenius*
Chrysothamnus nauseosus gnaphalodes	*Purshia tridentata*
Chrysothamnus viscidiflorus	*Ribes velutinum*
Chrysothamnus viscidiflorus puberulus	*Salsola tragus*
Ephedra nevadensis	*Salvia dorrii incana*
Ephedra viridis	*Sarcobatus vermiculatus*
Eriogonum heermannii	*Symphoricarpos rotundifolius*
Eriogonum umbellatum	*Tetradymia glabrata*
Grayia spinosa	**Land Cover Types**
Genera and Physiognomic Types	Barren
Annuals	Burn
Grass	Cultivated
Salix sp.	Water
Meadow	
Unidentified Code	
CAG	

Species VTM 54	
Abies concolor	*Juniperus osteosperma*
Abies magnifica	*Leptodactylon pungens*
Acer macrophyllum	*Lupinus bicolor*
Adenostoma fasciculatum	*Pinus albicaulis*
Arctostaphylos nevadensis	*Pinus contorta murrayana*
Arctostaphylos otayensis	*Pinus jeffreyi*
Arctostaphylos patula	*Pinus lambertiana*
Artemisia arbuscula	*Pinus monophylla*
Artemisia nova	*Pinus monticola*
Artemisia tridentata	*Pogogyne douglasii*
Artemisia trifida	*Populus balsamifera trichocarpa*

Species VTM 54, cont.	
Atriplex canescens	*Populus fremontii fremontii*
Bromus tectorum	*Populus tremuloides*
Calocedrus decurrens	*Prunus andersonii*
Carnegiea gigantea	*Prunus emarginata*
Ceanothus cordulatus	*Purshia tridentata*
Ceanothus cuneatus	*Quercus chrysolepis*
Ceanothus velutinus	*Quercus kelloggii*
Cercocarpus ledifolius	*Quercus vacciniifolia*
Chamaebatia foliolosa	*Quercus wislizeni*
Chrysothamnus nauseosus	*Salsola tragus*
Chrysothamnus sp.	*Sarcobatus vermiculatus*
Eriogonum umbellatum	*Symphoricarpos rotundifolius*
Garrya fremontii	*Tetradymia canescens*
Grayia spinosa	*Tsuga mertensiana*
Holodiscus discolor	*Wyethia mollis*
Juniperus occidentalis	
Genera and Physiognomic Types	**Land Cover Types**
Annuals	Barren
Grass	Cultivated
Meadow	Residence
Ribes sp.	Water
Salix sp.	
Wild hay	
Unidentified Code	
Epn	

Species VTM 55	
Abies concolor	*Juniperus occidentalis*
Abies magnifica	*Leptodactylon pungens*
Arbutus menziesii	*Lithocarpus densiflorus echinoides*
Arctostaphylos canescens	*Monardella odoratissima*
Arctostaphylos mewukka mewukka	*Palafoxia arida*
Arctostaphylos nevadensis	*Phyllodoce empetriformis*
Arctostaphylos patula	*Pinus albicaulis*
Arctostphylos viscida	*Pinus contorta murrayana*
Artemisia arbuscula	*Pinus jeffreyi*
Artemisia tridentata	*Pinus lambertiana*
Brickellia californica	*Pinus monticola*
Calocedrus decurrens	*Pinus ponderosa*
Ceanothus cordulatus	*Populus tremuloides*
Ceanothus cuneatus	*Prunus emarginata*
Ceanothus integerrimus	*Pseudotsuga menziesii menziesii*
Ceanothus oliganthus	*Purshia tridentata*
Ceanothus parvifolius	*Quercus chrysolepis*
Cercocarpus ledifolius	*Quercus kelloggii*
Chamaebatia foliolosa	*Quercus vacciniifolia*
Chrysolepis sempervirens	*Quercus wislizeni*

Species VTM 55, cont.	
Cornus sericea sericea	*Tsuga heterophylla*
Corylus cornuta californica	*Tsuga mertensiana*
Garrya fremontii	*Veratrum californicum californicum*
Heteromeles arbutifolia	*Vulpia myuros hirsuta*
Holodiscus discolor	*Wyethia mollis*
Genera and Physiognomic Types	**Land Cover Types**
Annuals	Barren
Chrysothamnus sp.	Cultivated
Eucalyptus	Mill
Grass	Water
Lupinus sp.	
Meadow	
Salix sp.	

Species VTM 56	
Abies concolor	*Erodium cicutarium*
Acer macrophyllum	*Heteromeles arbutifolia*
Adenostoma fasciculatum	*Hypericum perforatum*
Aesculus californica	*Lithocarpus densiflorus*
Aira caryophyllea	*Lithocarpus densiflorus echinoides*
Alnus rubra	*Pellaea mucronata*
Arctostaphylos manzanita	*Pinus attenuata*
Arctostaphylos mewukka mewukka	*Pinus contorta murrayana*
Arctostaphylos nissenana	*Pinus jeffreyi*
Arctostaphylos patula	*Pinus lambertiana*
Arctostaphylos viscida	*Pinus monophylla*
Arctostphylos viscida	*Pinus ponderosa*
Avena barbata	*Pinus sabiniana*
Avena fatua	*Prunus emarginata*
Bromus carinatus carinatus	*Pseudotsuga menziesii menziesii*
Bromus diandrus	*Pteridium aquilinum pubescens*
Bromus hordeaceus	*Quercus berberidifolia*
Calocedrus decurrens	*Quercus chrysolepis*
Ceanothus cordulatus	*Quercus chrysolepis nana*
Ceanothus cuneatus	*Quercus douglasii*
Ceanothus integerrimus	*Quercus durata*
Ceanothus leucodermis	*Quercus kelloggii*
Ceanothus parvifolius	*Quercus lobata*
Ceanothus spinosus	*Quercus wislizeni*
Ceanothus tomentosus	*Quercus wislizeni frutescens*
Cercocarpus betuloides	*Toxicodendron diversilobum*
Cercocarpus ledifolius	*Trifolium variegatum*
Chamaebatia foliolosa	*Umbellularia californica*
Cupressus macnabiana	*Vulpia myuros hirsuta*
Eriodictyon californicum	**Land Cover Types**
Genera and Physiognomic Types	Barren
Grass	Cultivated

Meadow	Residence
Salix sp.	Rock
	Water

Species VTM 57	
Adenostoma fasciculatum	*Pinus coulteri*
Alnus rhombifolia	*Pinus lambertiana*
Arctostaphylos manzanita	*Pinus monophylla*
Arctostaphylos otayensis	*Pinus monticola*
Arctostphylos viscida	*Pinus ponderosa*
Avena barbata	*Pinus sabiniana*
Avena fatua	*Populus fremontii fremontii*
Bromus carinatus carinatus	*Pseudotsuga menziesii menziesii*
Bromus diandrus	*Quercus agrifolia*
Bromus hordeaceus	*Quercus berberidifolia*
Bromus madritensis rubens	*Quercus chrysolepis*
Ceanothus cuneatus	*Quercus douglasii*
Ceanothus integerrimus	*Quercus kelloggii*
Chrysolepis chrysophylla	*Quercus lobata*
Ellisia chrysanthemifolia	*Quercus wislizeni*
Erodium cicutarium	*Quercus wislizeni frutescens*
Festuca rubra	*Rhamnus tomentella tomentella*
Forestiera pubescens	*Taxus brevifolia*
Heteromeles arbutifolia	*Toxicodendron diversilobum*
Medicago polymorpha	*Trifolium variegatum*
Pellaea mucronata	*Tsuga heterophylla*
Pinus contorta murrayana	*Vulpia myuros hirsuta*
Genera and Physiognomic Types	**Land Cover Types**
Eucalyptus	Airport
Grass	Barren
Navarretia sp.	Cultivated
Salix sp.	Residence
Tule	Water
Unidentified Code	
H'	
Tm2	
Tar2	
Far2	

Species VTM 67 a	
Adenostoma fasciculatum	*Populus fremontii fremontii*
Arctostaphylos manzanita	*Pseudotsuga menziesii menziesii*
Arctostaphylos myrtifolia	*Quercus douglasii*
Arctostphylos viscida	*Quercus lobata*
Eriodictyon californicum	*Quercus wislizeni*
Heteromeles arbutifolia	*Quercus wislizeni frutescens*
Pinus sabiniana	**Land Cover Types**
Genera and Physiognomic Types	Cultivated

Grass	Water
Meadow	
Salix sp.	

Species VTM 76 h	
Adenostoma fasciculatum	*Populus fremontii fremontii*
Aesculus californica	*Quercus douglasii*
Eriodictyon californicum	*Quercus lobata*
Eriogonum parvifolium	*Quercus wislizeni*
Pinus sabiniana	**Land Cover Types**
Genera and Physiognomic Types	Cultivated
Grass	

Species VTM 67 i	
Aesculus californica	*Quercus lobata*
Populus fremontii fremontii	*Quercus wislizeni*
Quercus douglasii	**Land Cover Types**
Genera and Physiognomic Types	Cultivated
Salix sp.	

Species VTM 67 p	
Genera and Physiognomic Types	**Land Cover Types**
Grass	Cultivated

Species VTM 68	
Abies concolor	*Pinus contorta murrayana*
Adenostoma fasciculatum	*Pinus coulteri*
Aesculus californica	*Pinus lambertiana*
Alnus rhombifolia	*Pinus monophylla*
Arbutus menziesii	*Pinus ponderosa*
Arctostaphylos manzanita	*Pinus sabiniana*
Arctostaphylos mewukka mewukka	*Populus fremontii fremontii*
Arctostaphylos myrtifolia	*Pseudotsuga menziesii menziesii*
Arctostaphylos patula	*Pteridium aquilinum pubescens*
Arctostaphylos viscida mariposa	*Quercus agrifolia*
Arctostphylos viscida	*Quercus chrysolepis*
Baccharis pilularis	*Quercus douglasii*
Brickellia californica	*Quercus engelmannii*
Calocedrus decurrens	*Quercus garryana*
Ceanothus cuneatus	*Quercus garryana breweri*
Ceanothus fresnensis	*Quercus kelloggii*
Ceanothus integerrimus	*Quercus lobata*
Chamaebatia foliolosa	*Quercus wislizeni*
Chrysolepis chrysophylla	*Quercus wislizeni frutescens*
Corylus cornuta californica	*Rhamnus californica*
Dicentra chrysantha	*Rhamnus ilicifolia*
Dirca occidentalis	*Rhamnus tomentella tomentella*

Species VTM 68, cont.	
Ericameria arborescens	*Ribes aureum*
Eriodictyon californicum	*Salvia sonomensis*
Eriogonum roseum	*Styrax officinalis redivivus*
Helianthemum scoparium	*Toxicodendron diversilobum*
Heteromeles arbutifolia	*Tsuga heterophylla*
Keckiella cordifolia	*Xylococcus bicolor*
Lepechinia calycina	*Yucca whipplei*
Lotus scoparius	**Land Cover Types**
Malacothamnus fasciculatus	Barren
Genera and Physiognomic Types	Cultivated
Grass	Residence
Salix sp.	
Unidentified Code	
Md2	

Species VTM 69	
Abies concolor	*Monardella odoratissima*
Abies magnifica	*Pinus contorta murrayana*
Acer glabrum	*Pinus jeffreyi*
Adenostoma fasciculatum	*Pinus lambertiana*
Aesculus californica	*Pinus monophylla*
Arctostaphylos manzanita	*Pinus monticola*
Arctostaphylos mewukka mewukka	*Pinus ponderosa*
Arctostaphylos nevadensis	*Pinus sabiniana*
Arctostaphylos patula	*Populus balsamifera trichocarpa*
Arctostaphylos viscida mariposa	*Populus tremuloides*
Arctostphylos viscida	*Prunus emarginata*
Artemisia tridentata	*Prunus subcordata*
Calocedrus decurrens	*Pseudotsuga menziesii menziesii*
Ceanothus cordulatus	*Pteridium aquilinum pubescens*
Ceanothus cuneatus	*Quercus chrysolepis*
Ceanothus fresnensis	*Quercus douglasii*
Ceanothus integerrimus	*Quercus garryana breweri*
Ceanothus velutinus	*Quercus kelloggii*
Cercocarpus betuloides	*Quercus lobata*
Cercocarpus ledifolius	*Quercus vacciniifolia*
Chamaebatia foliolosa	*Quercus wislizeni*
Chrysolepis sempervirens	*Quercus wislizeni frutescens*
Ericameria arborescens	*Rhamnus tomentella tomentella*
Ericameria bloomeri	*Ribes cereum*
Eriodictyon californicum	*Ribes roezlii*
Eriogonum roseum	*Sarcobatus vermiculatus*
Eriogonum wrightii	*Symphoricarpos mollis*
Fraxinus dipetala	*Symphoricarpos rotundifolius*
Garrya fremontii	*Toxicodendron diversilobum*
Heteromeles arbutifolia	*Tsuga mertensiana*
Holodiscus discolor	*Veratrum californicum californicum*

Species VTM 69, cont.	
Hypericum perforatum	*Wyethia mollis*
Juniperus occidentalis	*Xylococcus bicolor*
Ledum glandulosum	**Land Cover Types**
Genera and Physiognomic Types	Barren
Annuals	Burn
Astragalus sp.	Cultivated
Eucalyptus	Mill
Grass	Residence
Herbs	Water
Lupinus sp.	
Meadow	
Salix sp.	

Species VTM 70	
Abies concolor	*Eriogonum umbellatum*
Abies magnifica	*Eriogonum wrightii*
Acer glabrum	*Heteromeles arbutifolia*
Alnus incana tenuifolia	*Holodiscus discolor*
Alnus rhombifolia	*Juniperus communis*
Arctostaphylos nevadensis	*Juniperus occidentalis*
Arctostaphylos patula	*Leptodactylon pungens*
Arctostaphylos viscida mariposa	*Ligusticum grayi*
Arctostphylos viscida	*Lupinus albifrons*
Artemisia arbuscula	*Monardella odoratissima*
Artemisia cana bolanderi	*Pinus albicaulis*
Artemisia rothrockii	*Pinus contorta murrayana*
Artemisia tridentata	*Pinus jeffreyi*
Astragalus bolanderi	*Pinus lambertiana*
Berberis aquifolium repens	*Pinus monophylla*
Calocedrus decurrens	*Pinus monticola*
Ceanothus cordulatus	*Pinus ponderosa*
Ceanothus cuneatus	*Populus balsamifera trichocarpa*
Ceanothus fresnensis	*Populus tremuloides*
Ceanothus integerrimus	*Prunus emarginata*
Ceanothus oliganthus sorediatus	*Pseudotsuga menziesii menziesii*
Ceanothus velutinus	*Purshia tridentata*
Cercidium floridum floridum	*Quercus agrifolia*
Cercocarpus ledifolius	*Quercus chrysolepis*
Chamaebatia foliolosa	*Quercus kelloggii*
Chrysolepis sempervirens	*Quercus vacciniifolia*
Chrysothamnus nauseosus	*Quercus wislizeni*
Echinocereus engelmannii	*Sequoia sempervirens*
Ericameria bloomeri	*Symphoricarpos rotundifolius*
Ericameria discoidea	*Tsuga mertensiana*
Ericameria greenei	*Veratrum californicum californicum*
Ericameria suffruticosa	*Wyethia mollis*

Genera and Physiognomic Types	Land Cover Types
Annuals	Barren
Astragalus sp.	Cultivated
Chrysothamnus sp.	Water
Eucalyptus	
Grass	
Herbs	
Lupinus sp.	
Meadow	
Salix sp.	

Species VTM 71	
Abies concolor	*Leptodactylon pungens*
Abies magnifica	*Leymus condensatus*
Alnus rhombifolia	*Lupinus succulentus*
Arctostaphylos manzanita	*Mirabilis californica*
Arctostaphylos nevadensis	*Philadelphus lewisii*
Artemisia cana bolanderi	*Phlox cespitosa*
Artemisia nova	*Pinus albicaulis*
Artemisia tridentata	*Pinus contorta murrayana*
Aster chilensis	*Pinus flexilis*
Atriplex confertifolia	*Pinus jeffreyi*
Atriplex polycarpa	*Pinus monophylla*
Bromus tectorum	*Pinus monticola*
Ceanothus velutinus	*Populus balsamifera trichocarpa*
Cercocarpus ledifolius	*Populus tremuloides*
Chaenactis carphoclinia	*Prunus andersonii*
Chrysolepis sempervirens	*Prunus emarginata*
Chrysothamnus nauseosus	*Purshia tridentata*
Chrysothamnus nauseosus consimilis	*Quercus agrifolia*
Chrysothamnus viscidiflorus	*Quercus chrysolepis*
Corylus cornuta californica	*Quercus vaccinifolia*
Distichlis spicata	*Quercus vacciniifolia*
Ephedra viridis	*Quercus wislizeni*
Ericameria bloomeri	*Ribes californicum*
Ericameria parishii parishii	*Ribes cereum*
Ericameria suffruticosa	*Ribes velutinum*
Eriogonum umbellatum	*Salsola tragus*
Eriophyllum confertiflorum	*Sarcobatus vermiculatus*
Grayia spinosa	*Symphoricarpos rotundifolius*
Holodiscus discolor	*Tetradymia canescens*
Iris missouriensis	*Tetradymia comosa*
Juniperus communis	*Tetradymia glabrata*
Juniperus occidentalis	*Tsuga mertensiana*
Juniperus osteosperma	*Wyethia mollis*
Keckiella cordifolia	*Xylococcus bicolor*
Lathyrus polyphyllus	

Species VTM 71, cont.	
Genera and Physiognomic Types	**Land Cover Types**
Grass	Barren
Herbs	Cemetery
Lupinus sp.	Cultivated
Meadow	Glacier
Salix sp.	Residence
	Water

Species VTM 76	
Abies concolor	*Holodiscus discolor*
Abies magnifica	*Juniperus occidentalis*
Arbutus menziesii	*Lupinus lepidus lobbii*
Arctostaphylos manzanita	*Phyllodoce breweri*
Arctostaphylos nevadensis	*Pinus albicaulis*
Arctostaphylos patula	*Pinus contorta murrayana*
Arctostaphylos tomentosa	*Pinus jeffreyi*
Arctostaphylos viscida mariposa	*Pinus lambertiana*
Artemisia arbuscula	*Pinus monophylla*
Artemisia californica	*Pinus monticola*
Artemisia nova	*Pinus ponderosa*
Artemisia rothrockii	*Populus tremuloides*
Artemisia tridentata	*Prunus emarginata*
Atriplex confertifolia	*Pseudotsuga menziesii menziesii*
Atriplex parryi	*Quercus chrysolepis*
Calocedrus decurrens	*Quercus sadleriana*
Ceanothus cordulatus	*Quercus vacciniifolia*
Ceanothus cuneatus	*Quercus wislizeni*
Cercocarpus ledifolius	*Sarcobatus vermiculatus*
Chrysolepis chrysophylla	*Tsuga heterophylla*
Chrysolepis sempervirens	*Tsuga mertensiana*
Grayia spinosa	*Xylorhiza tortifolia tortifolia*
Heteromeles arbutifolia	**Land Cover Types**
Genera and Physiognomic Types	Barren
Grass	Water
Herbs	
Juncus sp.	
Meadow	
Salix sp.	

Species VTM 77	
Abies concolor	*Heteromeles arbutifolia*
Abies magnifica	*Holodiscus discolor*
Acer glabrum	*Hypericum perforatum*
Acer macrophyllum	*Juniperus occidentalis*
Achyronychia cooperi	*Lasthenia californica*
Adenostoma fasciculatum	*Lupinus excubitus*
Aesculus californica	*Malus fusca*
Alnus rhombifolia	*Pinus albicaulis*

Species VTM 77 cont.	
Alnus tenuifolia	*Pinus attenuata*
Arctostaphylos mariposa	*Pinus contorta murrayana*
Arctostaphylos mewukka mewukka	*Pinus jeffreyi*
Arctostaphylos nevadensis	*Pinus lambertiana*
Arctostaphylos patula	*Pinus monticola*
Arctostaphylos viscida mariposa	*Pinus ponderosa*
Arctostphylos viscida	*Pinus sabiniana*
Artemisia nova	*Populus fremontii fremontii*
Artemisia rothrockii	*Populus tremuloides*
Artemisia tridentata	*Prunus emarginata*
Astragalus bolanderi	*Pseudotsuga menziesii menziesii*
Astragalus mojavensis	*Pteridium aquilinum pubescens*
Avena barbata	*Quercus agrifolia*
Brickellia californica	*Quercus chrysolepis*
Calocedrus decurrens	*Quercus douglasii*
Ceanothus cordulatus	*Quercus garryana*
Ceanothus cuneatus	*Quercus garryana breweri*
Ceanothus diversifolius	*Quercus kellogii*
Ceanothus integerrimus	*Quercus lobata*
Ceanothus leucodermis	*Quercus vacciniifolia*
Ceanothus oliganthus	*Quercus wislizeni*
Ceanothus parvifolius	*Quercus wislizeni frutescens*
Ceanothus tomentosus	*Rhamnus crocea*
Cercocarpus betuloides	*Sequoia sempervirens*
Cercocarpus ledifolius	*Toxicodendron diversilobum*
Chamaebatia foliolosa	*Tsuga heterophylla*
Chrysolepis sempervirens	*Tsuga mertensiana*
Cupressus lawsoniana	*Umbellularia californica*
Dendromecon rigida	*Wyethia mollis*
Ericameria arborescens	*Xylococcus bicolor*
Eriodictyon californicum	**Land Cover Types**
Garrya fremontii	Barren
Genera and Physiognomic Types	Burn
Grass	Cultivated
Herbs	Residence
Lupinus sp.	Water
Meadow	
Salix sp.	
Unidentified Code	
Aro	

Species VTM 78	
Abies concolor	*Juniperus californica*
Adenostoma fasciculatum	*Lepechinia calycina*
Aesculus californica	*Lotus scoparius*
Alnus rhombifolia	*Pinus attenuata*
Arctostaphylos manzanita	*Pinus jeffreyi*

Species VTM 78, cont.	
Arctostaphylos mewukka mewukka	*Pinus lambertiana*
Arctostaphylos patula	*Pinus ponderosa*
Arctostaphylos viscida mariposa	*Pinus sabiniana*
Arctostphylos viscida	*Populus fremontii fremontii*
Baccharis douglasii	*Pseudotsuga menziesii menziesii*
Brickellia californica	*Pteridium aquilinum pubescens*
Calocedrus decurrens	*Quercus berberidifolia*
Ceanothus cordulatus	*Quercus chrysolepis*
Ceanothus cuneatus	*Quercus douglasii*
Ceanothus integerrimus	*Quercus garryana breweri*
Ceanothus tomentosus	*Quercus kelloggii*
Cercocarpus betuloides	*Quercus lobata*
Chamaebatia foliolosa	*Quercus wislizeni*
Dendromecon rigida	*Quercus wislizeni frutescens*
Encelia actoni	*Rhamnus tomentella tomentella*
Ericameria arborescens	*Senecio flaccidus douglasii*
Eriodictyon californicum	*Toxicodendron diversilobum*
Fraxinus dipetala	*Umbellularia californica*
Heteromeles arbutifolia	**Land Cover Types**
Genera and Physiognomic Types	Barren
Annuals	Burn
Eucalyptus	Cultivated
Grass	Mill
Meadow	Residence
Salix sp.	Water

Species VTM 79 A	
Adenostoma fasciculatum	*Pseudotsuga menziesii menziesii*
Aesculus californica	*Quercus douglasii*
Arctostaphylos manzanita	*Quercus kelloggii*
Ceanothus cuneatus	*Quercus lobata*
Eriodictyon californicum	*Quercus wislizeni*
Heteromeles arbutifolia	*Rhamnus crocea*
Pinus sabiniana	*Rhamnus tomentella tomentella*
Populus fremontii fremontii	*Toxicodendron diversilobum*
Genera and Physiognomic Types	**Land Cover Types**
Grass	Cultivated
Salix sp.	Residence
	Water

Species VTM 79 c	
Quercus douglasii	
Genera and Physiognomic Types	**Land Cover Types**
Grass	Cultivated

Species VTM 79 d	
Genera and Physiognomic Types	**Land Cover Types**
Grass	Cultivated

Species VTM 79 f	
Populus fremontii fremontii	*Quercus lobata*
Quercus douglasii	*Quercus wislizeni*
Genera and Physiognomic Types	**Land Cover Types**
Grass	Cultivated
Meadow	Water
Salix sp.	

Species VTM 79 i	
Populus fremontii fremontii	*Quercus lobata*
Quercus douglasii	
Genera and Physiognomic Types	**Land Cover Types**
Annuals	Barren
Grass	Cultivated
Salix sp.	Water

Species VTM 79 p	
Quercus douglasii	
Genera and Physiognomic Types	**Land Cover Types**
Grass	Cultivated
Salix sp.	

Species VTM 87 a	
Quercus lobata	
Genera and Physiognomic Types	**Land Cover Types**
Grass	Cultivated
Salix sp.	Water

Species VTM 88 A	
Adenostoma fasciculatum	*Heteromeles arbutifolia*
Aesculus californica	*Pinus sabiniana*
Arctostphylos viscida	*Populus fremontii fremontii*
Ceanothus cuneatus	*Pseudotsuga menziesii menziesii*
Ceanothus leucodermis	*Quercus chrysolepis*
Dendromecon rigida	*Quercus douglasii*
Eriodictyon californicum	*Quercus kelloggi*
Fraxinus dipetala	*Quercus wislizeni*
Fremontodendron californicum	*Toxicodendron diversilobum*
Genera and Physiognomic Types	**Land Cover Types**
Grass	Cultivated
Salix sp.	Water

Species VTM 88 c	
Quercus douglasii	*Quercus wislizeni*

Species VTM 88 c, cont.	
Genera and Physiognomic Types	**Land Cover Types**
Grass	
Salix sp.	

Species VTM 88 d	
Alnus rhombifolia	*Quercus lobata*
Populus fremontii fremontii	
Genera and Physiognomic Types	**Land Cover Types**
Grass	Cultivated
Salix sp.	Water

Species VTM 88 f	
Populus fremontii fremontii	
Genera and Physiognomic Types	**Land Cover Types**
Grass	Cultivated
Salix sp.	

Table A-2. Polygon size distribution by quadrangle

Polygon Size (ha)	Number of Polygons VTM 53	VTM 54	VTM 55	VTM 56	VTM 67 a	VTM 67 p	VTM 68	VTM 69	VTM 70	VTM 71	VTM 76	VTM 77
0-0.25	1	1	0	1	1	0	0	0	0	29	17	0
0.5	0	2	2	0	1	0	3	1	7	6	67	0
1	2	12	10	4	4	0	13	8	29	66	73	19
2	6	77	59	94	10	3	115	105	136	249	126	88
4	27	254	195	376	20	7	550	428	572	496	239	396
8	51	420	369	522	35	7	1239	971	1060	706	380	933
16	131	592	496	558	29	7	1436	1330	1357	828	432	1304
32	157	612	543	577	20	3	1224	1190	1260	720	418	1248
64	202	432	511	470	18	5	805	837	940	520	288	815
128	153	277	337	388	13	6	408	469	509	292	185	465
256	84	143	209	236	4	2	151	200	239	132	79	202
512	38	68	99	119	0	1	64	80	77	68	34	83
1,024	29	28	33	46	0	0	32	22	21	32	5	39
2,048	14	7	4	25	0	0	15	11	5	22	3	14
4,096	12	4	3	4	1	0	3	7	3	7	3	3
8,192	1	2	0	1	0	1	1	0	1	4	2	0
16,384	0	0	0	1	0	0	1	0	0	1	0	0
32,768	0	0	0	0	0	0	0	0	0	0	0	0
Total Polygons	**908**	**2,931**	**2,870**	**3,422**	**156**	**42**	**6,060**	**5,659**	**6,216**	**4,178**	**2,351**	**5,609**
Mean (ha)	150.6	59.3	63.2	75.6	42.9	213.4	40.1	42.9	39.1	56.6	44.0	43.8
Median (ha)	41.4	18.1	22.8	18.9	10.3	12.5	13.7	15.9	15.5	12.5	12.6	16.5
Standard Deviation (ha)	423.2	233.4	139.4	275.2	239.3	1113.4	197.5	133.8	115.3	300.8	241.7	119.4
Minimum (ha)	0.2	0.1	0.3	0.1	0.2	1.2	0.3	0.4	0.3	0.0	0.1	0.6
Maximum (ha)	5,170.0	7,832.6	3,178.7	10,850.8	2,992.3	7,333.1	11,336.9	3,439.9	4,408.2	10,443.3	7,184.7	3,112.8

Polygon Size (ha)	Number of Polygons VTM 78	VTM 79 A	VTM 79 c	VTM 79 d	VTM 79 f	VTM 79 i	VTM 79 p	VTM 88 A	VTM 88 c	VTM 88 d	VTM 88 f	VTM 88 i	VTM 88 j	Total
0-0.25	2	0	0	0	1	0	0	0	0	0	0	0	0	53
0.5	3	1	0	0	2	0	0	3	1	0	0	0	0	99
1	19	4	1	0	2	2	2	26	2	0	0	0	0	298
2	89	23	4	0	4	5	0	79	0	4	0	0	0	1276
4	328	83	1	0	10	4	2	130	1	6	1	0	1	4126
8	646	134	0	0	17	13	1	140	8	4	2	0	0	7658
16	946	141	0	0	18	5	1	113	3	6	0	0	1	9733
32	920	107	0	0	14	3	1	77	1	3	0	0	0	9098
64	739	75	0	3	5	1	1	52	1	3	1	1	0	6724
128	419	41	2	0	4	6	2	26	0	0	1	0	2	4003
256	184	21	2	0	4	4	3	15	1	0	1	0	0	1916
512	69	8	0	0	3	1	1	5	0	0	0	1	1	818
1,024	24	4	1	0	0	1	1	5	0	0	1	0	0	324
2,048	8	1	1	0	0	1	0	2	0	1	0	0	0	134
4,096	2	0	0	0	2	0	0	1	1	0	0	0	0	56
8,192	2	2	1	0	1	0	0	1	0	0	0	0	0	20
16,384	2	3	0	0	0	0	0	0	0	0	0	0	0	8
32,768	1	0	0	0	0	0	0	1	0	0	0	0	0	2
Total Polygons	**4,403**	**648**	**13**	**3**	**87**	**46**	**15**	**676**	**19**	**27**	**7**	**2**	**5**	**46346**
Mean (ha)	55.5	94.2	562.2	40.1	170.5	80.8	132.2	90.9	225.9	49.8	144.4	144.4	144.4	
Median (ha)	18.3	12.1	68.4	36.8	11.2	7.1	61.9	6.8	7	4.5	38.8	38.8	38.8	
Standard Deviation (ha)	373.2	707.9	1310.7	6.8	782.6	213.2	210.4	1274.7	887.7	192.3	219.1	219.1	219.1	
Minimum (ha)	0.1	0.4	0.9	33.9	0.2	0.5	0.6	0.3	0.3	1.3	3.7	3.7	3.7	
Maximum (ha)	16406.4	11761.9	4940.8	49.6	6366.4	1280.6	811.3	32036.0	3989.9	1027.8	657.1	657.1	657.1	

Table A-3. VTM WHR distribution by quadrangle

VTM 53								
WHR Type	Number of Polygons	Area (ha)	Percent of Total Area	Early Seral Due to Logging (ha)	Restocked Logged (ha)	Early Seral Due to Burns (ha)	Restocked Burned (ha)	No Disturbance Measured (ha)
AGR	9.0	4,132.1	2.3%					32.7
Annual Grassland (AGS)	9.0	192.8	0.1%					4,132.1
Aspen (ASP)	4.0	30.3	0.0%					192.8
Barren (BAR)	2.0	70.2	0.0%					30.3
Bitterbrush (BBR)	9.0	496.0	0.3%					70.2
Desert Scrub (DSC)	104.0	12,372.3	6.8%					496.0
Juniper (JUN)	2.0	32.7	0.0%	79.2				12,372.3
Lacustrine (LAC)	4.0	20.2	0.0%					20.2
Low Sage (LSG)	21.0	1,239.8	0.7%					1,239.8
Montane Chaparral (MCP)	57.0	1,540.5	0.8%					1,540.5
Montane Riparian (MRI)	8.0	318.3	0.2%					318.3
Pinyon-Juniper (PJN)	300.0	65,878.4	36.1%	620.9				65,878.4
Subalpine Conifer (SCN)	3.0	185.4	0.1%					185.4
Sagebrush (SGB)	325.0	48,196.8	26.4%	42.5				48,196.8
(UKW)	21.0	46,285.1	25.4%					46,285.1
Valey Foothill Riparian (VRI)	3.0	25.9	0.0%					25.9
Wet Meadow (WTM)	28.0	1,297.9	0.7%					1,297.9
Total	909.0	182,314.9	100.0%	742.6		0.0		182,314.9
VTM 54								
WHR Type	Number of Polygons	Area (ha)	Percent of Total Area	Early Seral Due to Logging (ha)	Restocked Logged (ha)	Early Seral Due to Burns (ha)	Restocked Burned (ha)	No Disturbance Measured (ha)

AGR	13.0	1,178.0	0.7%					1,178.0
VTM 54								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Annual Grassland (AGS)	24.0	1,734.7	1.0%	73.7				1,661.0
Alkali Desert Scrub (ASC)	1.0	125.2	0.1%					125.2
Aspen (ASP)	195.0	2,185.6	1.2%	10.9				2,174.7
Barren (BAR)	102.0	2,236.3	1.3%	27.7				2,208.6
Bitterbrush (BBR)	6.0	207.1	0.1%	100.6				106.5
Dryland Grain Crops (DGR)	3.0	78.3	0.0%					78.3
Desert Scrub (DSC)	5.0	265.1	0.2%					265.1
Eastside Pine (EPN)	257.0	12,012.8	6.8%	1366.6				10,646.2
Jeffrey Pine (JPN)	325.0	17,609.1	10.0%	3571.3				14,037.8
Juniper (JUN)	77.0	5,295.2	3.0%	126.6				5,168.6
Lacustrine (LAC)	6.0	1,046.4	0.6%					1,046.4
Lodgepole Pine (LPN)	159.0	9,635.9	5.5%	1531.1				8,104.9
Low Sage (LSG)	54.0	3,089.3	1.8%	254.7				2,834.6
Montane Chaparral (MCP)	220.0	4,954.7	2.8%	959.3				3,995.3
Montane Hardwood-Conifer (MHC)	1.0	7.3	0.0%					7.3
Montane Hardwood (MHW)	37.0	625.7	0.4%	15.9				609.8
Montane Riparian (MRI)	23.0	465.8	0.3%	7.5				458.3
Pinyon-Juniper (PJN)	417.0	40,974.6	23.3%	543.7				40,431.0
Red Fir (RFR)	178.0	9,613.5	5.5%	957.6				8,655.9
Subalpine Conifer (SCN)	172.0	12,080.9	6.9%	1048.9				11,032.0
Sagebrush (SGB)	433.0	43,227.7	24.6%	1206.7				42,020.9
Sierran Mixed Conifer (SMC)	1.0	12.7	0.0%					12.7

Unknown (UKW)	23.0	2,309.2	1.3%	12.9				2,296.3
Urban (URB)	4.0	36.5	0.0%					36.5
Valey Foothill Riparian (VRI)	1.0	29.1	0.0%					29.1
White Fir (WFR)	114.0	3,191.8	1.8%	134.8				3,057.0
Wet Meadow (WTM)	81.0	1,781.1	1.0%	33.9				1,747.2
Total	2932.0	176,009.6	100.0%	11984.5		0.0		164,025.2
VTM 55								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
AGR	1.0	1.7	0.0%					1.7
Annual Grassland (AGS)	61.0	431.3	0.2%	118.2				
Aspen (ASP)	23.0	513.0	0.3%					
Barren (BAR)	137.0	2,820.2	1.6%					1.7
Bitterbrush (BBR)	3.0	142.3	0.1%					313.1
Douglas Fir (DFR)	34.0	2,325.4	1.3%					513.0
Desert Scrub (DSC)	1.0	7.2	0.0%					2,820.2
Eastside Pine (EPN)	32.0	2,838.7	1.6%	2246.9				142.3
Jeffrey Pine (JPN)	418.0	19,273.3	10.6%	9124.5				2,325.4
(JUL)	1.0	27.9	0.0%	27.9				7.2
Juniper (JUN)	15.0	717.3	0.4%	267.1				591.7
Lacustrine (LAC)	46.0	661.7	0.4%					10,148.8
Lodgepole Pine (LPN)	157.0	15,096.1	8.3%	4437.3				661.7
Low Sage (LSG)	6.0	79.4	0.0%					10,658.8
Mixed Chaparral (MCH)	19.0	458.1	0.3%	140.1		144.5		79.4
Montane Chaparral (MCP)	427.0	11,273.6	6.2%	4797.6		291.2		173.5
Montane Hardwood-Conifer (MHC)	1.0	259.7	0.1%					6,184.8
Montane Hardwood (MHW)	77.0	1,666.9	0.9%	461.7				259.7
Montane Riparian	7.0	84.8	0.0%					1,205.3

(MRI)								
VTM 55								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Ponderosa Pine (PPN)	301.0	29,090.9	16.0%	1877.1				84.8
Red Fir (RFR)	128.0	13,667.1	7.5%	5522.1				27,213.8
Subalpine Conifer (SCN)	106.0	7,609.9	4.2%	4812.4				8,145.0
(SEP)	3.0	352.4	0.2%	352.4				2,797.6
Sagebrush (SGB)	31.0	2,060.4	1.1%	965.6				1,094.8
Sierran Mixed Conifer (SMC)	652.0	63,201.8	34.9%	2293.6				60,908.2
Unknown (UKW)	4.0	9.4	0.0%					9.4
Urban (URB)	1.0	17.1	0.0%					17.1
White Fir (WFR)	70.0	4,837.4	2.7%					4,837.4
Wet Meadow (WTM)	108.0	1,744.3	1.0%	298.0				1,446.3
Total	2870.0	181,269.5	100.0%	37742.6		435.7		142,642.7
VTM 56								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
WHR Type	**Polygons**	**Area (ha)**	**Total Area**	**to Logging (ha)**	**Logged (ha)**	**to Burns (ha)**	**Burned (ha)**	**Measured (ha)**
AGR	380.0	6,105.5	2.5%			1.9		6,103.6
Annual Grassland (AGS)	595.0	12,403.8	5.1%	11.4		8.3		12,384.0
Barren (BAR)	8.0	70.5	0.0%					70.5
Blue Oak–Foothill Pine (BOP)	144.0	12,338.0	5.1%			3907.5		8,430.5
Blue Oak Woodland (BOW)	45.0	7,342.1	3.0%			139.3		7,202.8
Closed-Cone Pine-Cypress (CPC)	35.0	665.7	0.3%					665.7

VTM 56								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Chamise-Redshank Chaparral (CRC)	200.0	10,462.4	4.3%			115.6		10,346.7
Douglas Fir (DFR)	95.0	9,797.3	4.1%			4.2		9,793.2
Fern	1.0	2.8	0.0%					2.8
Lacustrine (LAC)	18.0	1,242.8	0.5%					1,242.8
Lodgepole Pine (LPN)	1.0	4.2	0.0%					4.2
Mixed Chaparral (MCH)	180.0	16,476.1	6.8%	30.3		14521.7		1,924.0
Montane Chaparral (MCP)	267.0	11,840.3	4.9%			9613.9		2,226.4
Montane Hardwood-Conifer (MHC)	53.0	5,531.1	2.3%					5,531.1
Montane Hardwood (MHW)	439.0	25,795.8	10.7%	1722.0		163.0		23,910.8
Montane Riparian (MRI)	5.0	112.8	0.0%					112.8
Perennial Grassland (PGS)	28.0	1,186.2	0.5%					1,186.2
Ponderosa Pine (PPN)	610.0	81,779.0	33.9%	225.3				81,553.7
Sierran Mixed Conifer (SMC)	282.0	36,947.9	15.3%					36,947.9
Urban (URB)	1.0	8.9	0.0%					8.9
Valley Oak Woodland (VOW)	8.0	240.3	0.1%			24.4		215.8
(WEE)	20.0	227.1	0.1%					227.1
White Fir (WFR)	3.0	278.1	0.1%					278.1
Wet Meadow (WTM)	4.0	22.4	0.0%					22.4
Total	3422.0	240,881.1	100.0%	1989.1		28499.9		210,392.2

VTM 57								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
AGR	339.0	98,498.0	40.8%					98,498.0
Annual Grassland (AGS)	566.0	75,465.3	31.3%		263.6			75,201.7
Barren (BAR)	27.0	1,904.2	0.8%					1,904.2
Blue Oak–Foothill Pine (BOP)	82.0	8,574.7	3.6%		94.8	770.6		7,709.3
Blue Oak Woodland (BOW)	127.0	7,315.1	3.0%	9.6	16.2			7,289.3
Chamise-Redshank Chaparral (CRC)	66.0	3,889.7	1.6%					3,889.7
Douglas Fir (DFR)	106.0	7,489.5	3.1%					7,489.5
Eucalyptus (EUC)	4.0	33.5	0.0%					33.5
Fresh Emergent Wetland (FEW)	2.0	28.0	0.0%					28.0
Lacustrine (LAC)	15.0	931.0	0.4%					931.0
Mixed Chaparral (MCH)	42.0	1,432.2	0.6%			703.4		728.8
Montane Chaparral (MCP)	16.0	668.9	0.3%			526.4		142.6
Montane Hardwood-Conifer (MHC)	161.0	11,250.2	4.7%			91.7		11,158.5
Montane Hardwood (MHW)	259.0	16,440.7	6.8%		187.8			16,252.9
Montane Riparian (MRI)	59.0	2,202.7	0.9%		664.1			1,538.6
Ponderosa Pine (PPN)	111.0	2,067.0	0.9%					2,067.0
Subalpine Conifer (SCN)	2.0	38.6	0.0%					38.6
Sierran Mixed Conifer (SMC)	2.0	203.7	0.1%					203.7

Unknown (UKW)	2.0	36.8	0.0%					36.8
VTM 57								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Urban (URB)	6.0	2,317.4	1.0%					2,317.4
Valley Oak Woodland (VOW)	10.0	96.6	0.0%					96.6
Valley Foothill Riparian (VRI)	20.0	330.5	0.1%		76.1			254.4
Total	2024.0	241,214.1	100.0%	9.6		2092.1		237,810.0
VTM 67 a								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
AGR	12.0	110.0	0.7%					110.0
Annual Grassland (AGS)	26.0	3,497.8	23.1%					3,497.8
Blue Oak–Foothill Pine (BOP)	24.0	675.7	4.5%			6.6		669.1
Blue Oak Woodland (BOW)	38.0	1,119.9	7.4%					1,119.9
Chamise-Redshank Chaparral (CRC)	14.0	411.1	2.7%			61.3		349.8
Lacustrine (LAC)	2.0	44.4	0.3%					44.4
Mixed Chaparral (MCH)	6.0	59.1	0.4%			47.2		11.9
Montane Chaparral (MCP)	8.0	155.3	1.0%			21.4		133.9
Montane Hardwood-Conifer (MHC)	6.0	306.2	2.0%			161.4		144.9
Montane Hardwood (MHW)	12.0	250.2	1.7%				10.1	250.2
Montane Riparian (MRI)	5.0	24.6	0.2%	17.7				6.9

Unknown (UKW)	3.0	8,457.1	55.8%					8,457.1
VTM 67 a								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Valley Oak Woodland (VOW)	1.0	15.2	0.1%					15.2
Valley Foothill Riparian (VRI)	1.0	18.0	0.1%	18.0				0.0
Wet Meadow (WTM)	1.0	4.5	0.0%					4.5
Total	159.0	15,149.1	100.0%	35.7		297.8		14,815.6
VTM 67 h								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
AGR	4.0	46.5	0.3%					46.5
Annual Grassland (AGS)	23.0	1,412.3	9.3%					1,412.3
Blue Oak–Foothill Pine (BOP)	6.0	184.8	1.2%					184.8
Blue Oak Woodland (BOW)	27.0	1,942.6	12.8%					1,942.6
Chamise-Redshank Chaparral (CRC)	15.0	231.5	1.5%					231.5
Montane Hardwood (MHW)	3.0	93.6	0.6%					93.6
Unknown (UKW)	1.0	11,139.1	73.4%					11,139.1
Valley Oak Woodland (VOW)	2.0	111.2	0.7%					111.2
Valley Foothill Riparian (VRI)	1.0	10.4	0.1%					10.4
Total	82.0	15,172.0	100.0%	0.0		0.0		15,172.0

VTM 67 i								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
AGR	4.0	7,494.3	49.3%					7,494.3
Blue Oak Woodland (BOW)	13.0	142.2	0.9%					142.2
Montane Hardwood (MHW)	2.0	27.7	0.2%					27.7
Unknown (UKW)	24.0	7,512.6	49.5%					7,512.6
Valley Foothill Riparian (VRI)	1.0	9.9	0.1%	9.9				0.0
Total	44.0	15,186.7	100.0%	9.9		0.0		15,176.8
VTM 67 p								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
AGR	3.0	9,634.0	63.3%					9,634.0
Annual Grassland (AGS)	16.0	5,594.3	36.7%					5,594.3
Total	19.0	15,228.3	100.0%	0.0		0.0		15,228.3
VTM 68								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
AGR	394.0	8,855.4	3.6%					8,855.4
Annual Grassland (AGS)	999.0	46,190.0	19.0%	18.9				46,171.1
Barren (BAR)	11.0	110.4	0.0%					110.4
Bitterbrush (BBR)	1.0	10.4	0.0%			10.4		0.0
Blue Oak–Foothill Pine (BOP)	440.0	37,068.0	15.3%	39.9		1864.3	11.6	35,152.2

Blue Oak Woodland (BOW)	472.0	35,348.0	14.6%	87.5		20.4		35,240.1
VTM 68								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Chamise-Redshank Chaparral (CRC)	691.0	22,095.1	9.1%			606.4		21,488.7
Douglas Fir (DFR)	50.0	1,726.7	0.7%			6.3		1,720.4
Lacustrine (LAC)	12.0	739.2	0.3%					739.2
Mixed Chaparral (MCH)	461.0	10,571.2	4.4%	4.3		8869.2	51.3	1,646.4
Montane Chaparral (MCP)	499.0	10,723.5	4.4%			6073.1		4,650.4
Montane Hardwood-Conifer (MHC)	197.0	6,181.2	2.5%			275.3	11.2	5,894.7
Montane Hardwood (MHW)	848.0	23,763.5	9.8%	45.5		393.7	585.2	22,739.1
Montane Riparian (MRI)	16.0	448.1	0.2%	346.4				101.7
Ponderosa Pine (PPN)	818.0	33,887.4	14.0%			142.0		33,745.4
Sierran Mixed Conifer (SMC)	54.0	2,456.1	1.0%					2,456.1
Unknown (UKW)	3.0	21.9	0.0%					21.9
Urban (URB)	29.0	1,144.8	0.5%					1,144.8
Valley Oak Woodland (VOW)	51.0	879.5	0.4%			14.2		865.3
Valley Foothill Riparian (VRI)	13.0	551.7	0.2%	270.3				281.4
Wet Meadow (WTM)	1.0	2.1	0.0%					2.1
Total	6060.0	242,774.3	100.0%	812.9		18275.3		223,026.9

VTM 69								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
AGR	126.0	1,247.3	0.5%					1,247.3
Annual Grassland (AGS)	414.0	5,807.6	2.4%	569.5				5,238.2
Aspen (ASP)	48.0	478.6	0.2%			35.9		442.7
Barren (BAR)	73.0	1,006.8	0.4%					1,006.8
Bitterbrush (BBR)	2.0	15.5	0.0%					15.5
Blue Oak–Foothill Pine (BOP)	251.0	9,114.5	3.8%	1.9		3893.7	77.4	5,141.5
Blue Oak Woodland (BOW)	40.0	1,003.7	0.4%					1,003.7
Chamise-Redshank Chaparral (CRC)	273.0	5,708.4	2.3%	60.8		112.6		5,535.0
Douglas Fir (DFR)	111.0	4,920.6	2.0%	7.1		26.6		4,886.9
Desert Scrub (DSC)	1.0	9.7	0.0%					9.7
Eastside Pine (EPN)	30.0	595.8	0.2%	235.7				360.2
Eucalyptus (EUC)	7.0	71.8	0.0%	27.4				44.4
Jeffrey Pine (JPN)	580.0	17,090.1	7.0%	2622.2				14,467.9
Juniper (JUN)	1.0	17.2	0.0%					17.2
Lacustrine (LAC)	15.0	414.5	0.2%					414.5
Lodgepole Pine (LPN)	47.0	1,899.5	0.8%	123.0				1,776.5
Mixed Chaparral (MCH)	375.0	8,527.6	3.5%	756.1		5720.9		2,050.5
Montane Chaparral (MCP)	525.0	10,476.9	4.3%	531.4		3959.1		5,986.3
Montane Hardwood-Conifer (MHC)	79.0	2,272.1	0.9%	11.6		197.3		2,063.2
Montane Hardwood (MHW)	470.0	14,029.8	5.8%	1457.9		652.3	135.5	11,784.1
Montane Riparian (MRI)	7.0	54.0	0.0%			12.2		41.8

Ponderosa Pine (PPN)	1336.0	104,963.5	43.2%	72.2		9.9		104,881.5
Red Fir (RFR)	111.0	10,928.4	4.5%	8.7				10,919.6
Subalpine Conifer (SCN)	13.0	274.2	0.1%	9.8				264.4
Sagebrush (SGB)	2.0	8.2	0.0%	3.6				4.6
Sierran Mixed Conifer (SMC)	178.0	9,871.6	4.1%	5.0				9,866.6
Unknown (UKW)	4.0	103.1	0.0%					103.1
Urban (URB)	13.0	205.6	0.1%					205.6
Valley Oak Woodland (VOW)	14.0	230.2	0.1%			87.1		143.1
Valley Foothill Riparian (VRI)	4.0	45.7	0.0%					45.7
White Fir (WFR)	404.0	30,030.3	12.4%	25.9				30,004.4
Wet Meadow (WTM)	105.0	1,578.3	0.6%	77.3				1,501.0
Total	5659.0	243,001.2	100.0%	6607.3		14707.5		221,686.4
VTM 70								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Annual Grassland (AGS)	44.0	1,370.4	0.6%	1014.9				355.5
Aspen (ASP)	155.0	2,195.2	0.9%	13.9		121.6	208.8	1,850.9
Barren (BAR)	724.0	40,060.3	16.5%	5.1				40,055.1
Bitterbrush (BBR)	28.0	977.5	0.4%	405.2				572.3
Douglas Fir (DFR)	1.0	149.2	0.1%					149.2
Desert Succulent Scrub (DSS)	1.0	4.0	0.0%					4.0
Eastside Pine (EPN)	163.0	7,786.6	3.2%	4777.4				3,009.2
Eucalyptus (EUC)	3.0	29.8	0.0%	17.0				12.8
Jeffrey Pine (JPN)	745.0	32,360.3	13.3%	10478.8				21,881.5
Juniper (JUN)	134.0	3,681.4	1.5%	1196.8				2,484.6
Lacustrine (LAC)	180.0	1,595.1	0.7%					1,595.1
Lodgepole Pine (LPN)	825.0	43,625.2	17.9%	16298.3				27,326.8

Low Sage (LSG)	50.0	1,526.2	0.6%	149.3				1,377.0
VTM 70								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Mixed Chaparral (MCH)	4.0	72.6	0.0%			63.4		9.2
Montane Chaparral (MCP)	472.0	15,984.5	6.6%	6496.7		129.2		9,358.6
Montane Hardwood-Conifer (MHC)	3.0	182.7	0.1%	3.3				179.4
Montane Hardwood (MHW)	34.0	564.0	0.2%	206.0		97.5	5.7	254.9
Montane Riparian (MRI)	158.0	1,608.4	0.7%	100.9		10.3		1,497.2
Pinyon-Juniper (PJN)	9.0	189.7	0.1%					189.7
Ponderosa Pine (PPN)	62.0	4,514.5	1.9%	90.5				4,423.9
Red Fir (RFR)	383.0	17,536.0	7.2%	1230.3				16,305.7
Subalpine Conifer (SCN)	998.0	31,663.7	13.0%	12227.6				19,436.1
Sagebrush (SGB)	310.0	12,877.3	5.3%	2427.2			9.0	10,441.0
Sierran Mixed Conifer (SMC)	12.0	1,077.1	0.4%					1,077.1
Unknown (UKW)	6.0	37.9	0.0%	4.6				33.3
Valley Foothill Riparian (VRI)	2.0	7.7	0.0%					7.7
White Fir (WFR)	164.0	12,895.6	5.3%	243.5				12,652.1
Wet Meadow (WTM)	546.0	8,619.3	3.5%	1140.1				7,479.2
Total	6216.0	243,192.0	100.0%	58527.4		422.0		184,242.6

VTM 71								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	10.0	134.8	0.1%					134.8
Annual Grassland (AGS)	18.0	205.8	0.1%					205.8
Alkali Desert Scrub (ASC)	1.0	9.2	0.0%					9.2
Aspen (ASP)	456.0	6,270.9	2.6%	22.6		186.0	121.4	5,940.9
Barren (BAR)	245.0	19,692.4	8.1%	134.1				19,558.3
Bitterbrush (BBR)	15.0	887.4	0.4%					887.4
Desert Scrub (DSC)	42.0	2,439.5	1.0%	1067.5				1,372.1
Eastside Pine (EPN)	94.0	4,158.9	1.7%	47.3				4,111.6
(GLA)	6.0	83.2	0.0%					83.2
Jeffrey Pine (JPN)	95.0	3,373.8	1.4%	54.0				3,319.9
Juniper (JUN)	107.0	3,084.8	1.3%	79.4				3,005.4
Lacustrine (LAC)	42.0	7,139.6	2.9%					7,139.6
Lodgepole Pine (LPN)	286.0	8,763.7	3.6%	349.4				8,414.3
Mixed Chaparral (MCH)	2.0	3.4	0.0%					3.4
Montane Chaparral (MCP)	450.0	7,384.4	3.0%	361.5				7,022.9
Montane Hardwood (MHW)	2.0	25.7	0.0%					25.7
Montane Riparian (MRI)	115.0	1,002.0	0.4%	24.0				978.0
Pinyon-Juniper (PJN)	281.0	39,652.9	16.3%	709.6				38,943.4
Red Fir (RFR)	1.0	2.8	0.0%					2.8
Subalpine Conifer (SCN)	664.0	17,231.4	7.1%	3754.1				13,477.3
Saline Emergent Wetland (SEW)	5.0	209.4	0.1%		95.2			114.1
Sagebrush (SGB)	813.0	109,460.6	45.0%	1192.6				108,268.0
Unknown (UKW)	7.0	1,334.8	0.5%					1,334.8

Urban (URB)	3.0	61.6	0.0%					61.6
VTM 71								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Valley Foothill Riparian (VRI)	1.0	11.0	0.0%					11.0
White Fir (WFR)	18.0	327.2	0.1%					327.2
Wet Meadow (WTM)	400.0	10,137.0	4.2%	948.9	77.3			9,110.7
Total	4179.0	243,088.3	100.0%	8744.9		186.0		234,157.4
VTM 76								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Alpine Dwarf-Shrub (ADS)	1.0	11.1	0.0%	11.1				0.0
Annual Grassland (AGS)	1.0	4.4	0.0%					4.4
Aspen (ASP)	27.0	224.1	0.1%	12.1			23.0	212.0
Barren (BAR)	374.0	26,326.4	14.3%	31.1				26,295.3
Douglas Fir (DFR)	1.0	22.9	0.0%					22.9
Desert Scrub (DSC)	3.0	183.3	0.1%	7.5				175.7
Eastside Pine (EPN)	13.0	737.0	0.4%	651.6				85.5
Fresh Emergent Wetland (FEW)	2.0	103.8	0.1%	99.8				4.0
Jeffrey Pine (JPN)	79.0	3,550.5	1.9%	754.1				2,796.4
Juniper (JUN)	51.0	1,694.9	0.9%	1015.7				679.3
Lacustrine (LAC)	368.0	7,462.0	4.0%					7,462.0
Lodgepole Pine (LPN)	432.0	34,714.0	18.8%	8627.8				26,086.2
Montane Chaparral (MCP)	64.0	1,202.0	0.7%	356.8				845.2
Montane Hardwood (MHW)	3.0	133.5	0.1%					133.5
Montane Riparian (MRI)	49.0	394.7	0.2%	10.4				384.3

Pinyon-Juniper (PJN)	2.0	34.0	0.0%					34.0
VTM 76								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Ponderosa Pine (PPN)	1.0	1.2	0.0%					1.2
Red Fir (RFR)	81.0	4,991.9	2.7%	524.4				4,467.5
Subalpine Conifer (SCN)	443.0	19,820.7	10.7%	9588.8				10,231.9
Sagebrush (SGB)	17.0	332.8	0.2%	26.9				305.9
Sierran Mixed Conifer (SMC)	1.0	30.8	0.0%					30.8
Unknown (UKW)	1.0	75,228.4	40.8%					75,228.4
White Fir (WFR)	12.0	298.8	0.2%	77.8				221.0
Wet Meadow (WTM)	327.0	6,967.7	3.8%	1856.6				5,111.0
Total	2353.0	184,470.9	100.0%	23652.5		0.0		160,818.4
VTM 77								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	16.0	176.9	0.1%					176.9
Annual Grassland (AGS)	159.0	2,839.5	1.2%	42.9				2,796.6
Aspen (ASP)	44.0	497.8	0.2%			48.0		449.9
Barren (BAR)	289.0	7,564.3	3.1%	29.3				7,535.0
(BOP)	115.0	4,200.9	1.7%	230.7		2713.3		1,256.9
(BOW)	14.0	208.4	0.1%			124.6		83.8
(CPC)	46.0	548.2	0.2%					548.2
(CRC)	270.0	8,727.6	3.5%	20.7				8,706.9
(DFR)	120.0	4,363.8	1.8%	237.7		511.4		3,614.6
Eastside Pine (EPN)	49.0	3,307.9	1.3%	2807.7				500.2
Jeffrey Pine (JPN)	670.0	23,562.0	9.6%	5870.2				17,691.9
Juniper (JUN)	14.0	352.1	0.1%	228.2				123.9
Lacustrine (LAC)	40.0	1,270.8	0.5%					1,270.8

Lodgepole Pine (LPN)	292.0	14,299.8	5.8%	1871.4				12,428.3
VTM 77								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Mixed Chaparral (MCH)	294.0	9,460.1	3.8%	39.9		6866.5		2,553.8
Montane Chaparral (MCP)	407.0	8,817.7	3.6%	416.7		1611.2		6,789.8
(MHC)	36.0	804.0	0.3%	12.2		106.2		685.6
Montane Hardwood (MHW)	802.0	19,942.2	8.1%	1486.7		4170.4		14,285.1
Montane Riparian (MRI)	7.0	42.7	0.0%					42.7
(PPN)	827.0	66,959.3	27.2%	368.5		1.7		66,589.2
Red Fir (RFR)	317.0	28,309.8	11.5%	481.5				27,828.3
Subalpine Conifer (SCN)	171.0	5,273.6	2.1%	1791.0				3,482.6
Sagebrush (SGB)	5.0	32.6	0.0%					32.6
(SMC)	137.0	14,162.2	5.8%					14,162.2
Unknown (UKW)	13.0	110.1	0.0%					110.1
Urban (URB)	1.0	7.1	0.0%					7.1
(VOW)	9.0	215.6	0.1%					215.6
(WEE)	3.0	13.6	0.0%	9.3				4.3
White Fir (WFR)	278.0	18,504.2	7.5%	216.2				18,288.0
Wet Meadow (WTM)	164.0	1,363.0	0.6%	61.2				1,301.8
Total	5609.0	245,937.9	100.0%	16222.1		16153.3		213,562.5
VTM 78								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	236.0	6,904.9	2.8%			5.7		6,899.2
Annual Grassland (AGS)	697.0	40,724.2	16.7%	689.9				40,034.3
Barren (BAR)	20.0	891.0	0.4%					891.0

Bitterbrush (BBR)	1.0	11.8	0.0%					11.8
VTM 78								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(BOP)	510.0	35,964.3	14.7%	124.4		13125.2		22,714.7
(BOW)	219.0	31,411.0	12.8%	11.4		105.0		31,294.6
(CPC)	24.0	684.1	0.3%					684.1
(CRC)	566.0	29,173.9	11.9%	7.8		457.6		28,708.5
(DFR)	35.0	2,280.6	0.9%			36.3		2,244.3
(EUC)	1.0	8.6	0.0%					8.6
Jeffrey Pine (JPN)	1.0	4.3	0.0%					4.3
Lacustrine (LAC)	10.0	2,548.9	1.0%					2,548.9
Mixed Chaparral (MCH)	585.0	20,881.7	8.5%	41.6		17986.2		2,853.9
Montane Chaparral (MCP)	313.0	8,659.5	3.5%			5886.9		2,772.6
(MHC)	156.0	6,012.6	2.5%	3.3		190.9		5,818.4
Montane Hardwood (MHW)	477.0	17,052.0	7.0%	53.6		584.3		16,414.1
Montane Riparian (MRI)	23.0	436.5	0.2%	89.7				346.8
(PPN)	446.0	37,688.5	15.4%			16.1		37,672.4
(SMC)	9.0	1,098.4	0.4%					1,098.4
Unknown (UKW)	4.0	54.7	0.0%					54.7
Urban (URB)	18.0	645.0	0.3%					645.0
(VOW)	21.0	346.7	0.1%			14.0		332.7
Valley Foothill Riparian (VRI)	10.0	179.1	0.1%	73.6				105.5
White Fir (WFR)	8.0	520.6	0.2%					520.6
Wet Meadow (WTM)	13.0	322.0	0.1%					322.0
Total	4403.0	244,504.9	100.0%	1095.3		38408.2		205,001.4

VTM 79 A								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	40.0	1,769.4	2.9%					1,769.4
Annual Grassland (AGS)	219.0	19,978.3	32.7%	1715.4				18,262.9
(BOP)	91.0	10,174.6	16.7%	29.5		438.4		9,706.8
(BOW)	84.0	23,003.1	37.7%	82.2		37.2		22,883.7
(CRC)	43.0	1,021.1	1.7%					1,021.1
(DFR)	8.0	389.1	0.6%	2.8		6.5		379.8
Lacustrine (LAC)	3.0	637.1	1.0%					637.1
Mixed Chaparral (MCH)	39.0	1,262.6	2.1%	8.4		1051.6		202.6
Montane Chaparral (MCP)	14.0	168.4	0.3%			158.8		9.6
(MHC)	11.0	325.8	0.5%	1.2		110.7		213.9
Montane Hardwood (MHW)	82.0	2,030.1	3.3%	90.1		13.2		1,926.8
Montane Riparian (MRI)	8.0	208.4	0.3%					208.4
Unknown (UKW)	1.0	1.8	0.0%					1.8
Urban (URB)	3.0	36.3	0.1%					36.3
(VOW)	1.0	14.7	0.0%					14.7
Valley Foothill Riparian (VRI)	1.0	19.9	0.0%					19.9
Total	648.0	61,040.6	100.0%	1929.5		1816.4		57,294.7
VTM 79 d								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	1.0	33.9	28.2%					33.9
Annual Grassland (AGS)	2.0	86.4	71.8%					86.4

Total	3.0	120.3	100.0%	0.0		0.0		120.3
VTM 79 c								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	5.0	531.7	3.5%					531.7
Annual Grassland (AGS)	2.0	5,484.5	36.0%					5,484.5
(BOW)	6.0	1,292.0	8.5%					1,292.0
Unknown (UKW)	1.0	7,942.9	52.1%					7,942.9
Total	14.0	15,251.1	100.0%	0.0		0.0		15,251.1
VTM 79 f								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	16.0	6,612.8	43.3%					6,612.8
Annual Grassland (AGS)	43.0	7,802.3	51.1%					7,802.3
(BOW)	5.0	65.2	0.4%					65.2
Lacustrine (LAC)	1.0	444.6	2.9%					444.6
Montane Hardwood (MHW)	11.0	103.4	0.7%					103.4
Montane Riparian (MRI)	9.0	197.1	1.3%					197.1
Unknown (UKW)	1.0	6.8	0.0%					6.8
(VOW)	1.0	21.8	0.1%					21.8
Wet Meadow (WTM)	1.0	20.5	0.1%					20.5
Total	88.0	15,274.4	100.0%	0.0		0.0		15,274.4

VTM 79 i								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	5.0	391.4	2.6%					391.4
Annual Grassland (AGS)	15.0	2,283.4	14.9%					2,283.4
Barren (BAR)	1.0	25.5	0.2%					25.5
(BOW)	21.0	991.7	6.5%					991.7
Lacustrine (LAC)	1.0	9.1	0.1%					9.1
Montane Riparian (MRI)	1.0	5.6	0.0%					5.6
Unknown (UKW)	1.0	11,585.7	75.7%					11,585.7
Valley Foothill Riparian (VRI)	2.0	10.4	0.1%					10.4
Total	47.0	15,302.7	100.0%	0.0		0.0		15,302.7
VTM 79 p								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	4.0	1,359.0	8.9%					1,359.0
Annual Grassland (AGS)	8.0	619.0	4.0%					619.0
(BOW)	1.0	3.7	0.0%					3.7
Montane Riparian (MRI)	2.0	1.5	0.0%					1.5
Unknown (UKW)	1.0	13,330.5	87.0%					13,330.5
Total	16.0	15,313.7	100.0%	0.0		0.0		15,313.7

VTM 87 a								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	2.0	24.4	0.2%					24.4
Annual Grassland (AGS)	1.0	57.4	0.4%					57.4
Lacustrine (LAC)	1.0	1.3	0.0%					1.3
Montane Riparian (MRI)	1.0	4.7	0.0%					4.7
Unknown (UKW)	1.0	15,257.6	99.4%					15,257.6
Total	6.0	15,345.4	100.0%	0.0		0.0		15,345.4
VTM 88 A								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	45.0	1,091.4	1.8%					1,091.4
Annual Grassland (AGS)	232.0	36,214.6	58.9%					36,214.6
(BOP)	67.0	6,458.0	10.5%					6,458.0
(BOW)	172.0	14,349.9	23.4%					14,349.9
(CRC)	22.0	832.6	1.4%					832.6
(DFR)	47.0	672.6	1.1%					672.6
Lacustrine (LAC)	1.0	2.0	0.0%					2.0
Mixed Chaparral (MCH)	14.0	212.0	0.3%					212.0
Montane Chaparral (MCP)	2.0	58.1	0.1%					58.1
(MHC)	4.0	56.7	0.1%					56.7
Montane Hardwood (MHW)	49.0	1,360.1	2.2%					1,360.1
Montane Riparian (MRI)	14.0	89.1	0.1%					89.1

Valley Foothill Riparian (VRI)	7.0	50.2	0.1%					50.2
Total	676.0	61,447.4	100.0%	0.0		0.0		61,447.4
VTM 88 c								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Annual Grassland (AGS)	2.0	3,997.0	26.1%					3,997.0
(BOP)	2.0	48.1	0.3%					48.1
(BOW)	10.0	216.9	1.4%					216.9
Montane Hardwood (MHW)	3.0	20.1	0.1%					20.1
Montane Riparian (MRI)	2.0	10.8	0.1%					10.8
Unknown (UKW)	1.0	11,048.5	72.0%					11,048.5
Total	20.0	15,341.4	100.0%	0.0		0.0		15,341.4
VTM 88 d								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	9.0	164.5	1.1%					164.5
Annual Grassland (AGS)	7.0	1,102.8	7.2%					1,102.8
Lacustrine (LAC)	2.0	5.3	0.0%					5.3
Montane Hardwood (MHW)	1.0	3.7	0.0%					3.7
Montane Riparian (MRI)	3.0	21.4	0.1%					21.4
Unknown (UKW)	1.0	13,995.7	91.2%					13,995.7
(VOW)	4.0	38.9	0.3%					38.9
Valley Foothill Riparian (VRI)	1.0	8.9	0.1%					8.9
Total	28.0	15,341.2	100.0%	0.0		0.0		15,341.2

VTM 88 f								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	2.0	46.7	0.3%					46.7
Annual Grassland (AGS)	3.0	953.5	6.2%					953.5
Montane Riparian (MRI)	2.0	11.0	0.1%					11.0
Unknown (UKW)	1.0	14,359.1	93.4%					14,359.1
Total	8.0	15,370.2	100.0%	0.0		0.0		15,370.2
VTM 88 i								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
Annual Grassland (AGS)	1.0	383.6	2.5%					383.6
(BOW)	1.0	51.5	0.3%					51.5
Unknown (UKW)	1.0	14,974.4	97.2%					14,974.4
Total	3.0	15,409.6	100.0%	0.0		0.0		15,409.6
VTM 88 j								
WHR Type	**Number of Polygons**	**Area (ha)**	**Percent of Total Area**	**Early Seral Due to Logging (ha)**	**Restocked Logged (ha)**	**Early Seral Due to Burns (ha)**	**Restocked Burned (ha)**	**No Disturbance Measured (ha)**
(AGR)	1.0	107.7	0.7%					107.7
Annual Grassland (AGS)	3.0	489.9	3.2%					489.9
Unknown (UKW)	1.0	14,831.2	96.1%					14,831.2
Valley Foothill Riparian (VRI)	1.0	3.6	0.0%					3.6
Total	6.0	15,432.3	100.0%	0.0		0.0		15,432.3

Table A-4. Change by quadrangle between the 1934 VTM maps and 1996 CalVeg map

VTM 54 WHR Type	VTM Area (ha)	VTM Percent of Total Area	CalVeg Area (ha)	CalVeg Percent of Total Area	Area Gained or (Lost) (ha)	Percent of Type Gained or (Lost)	Percent of Map Gained or (Lost)	Total Turnover
Alpine Dwarf-Shrub (ADS)		0.0%	86.9	0.3%	86.9	0.0%	0.3%	86.9
Annual Grassland (AGS)	129.4	0.4%	448.4	1.5%	318.9	246.5%	1.1%	318.9
Aspen (ASP)	9.5	0.0%	4.0	0.0%	-5.5	-58.2%	0.0%	5.5
Barren (BAR)	934.4	3.1%	6,139.4	20.5%	5,205.0	557.1%	17.4%	5,205.0
Bitterbrush (BBR)	95.3	0.3%		0.0%	-95.3	-100.0%	-0.3%	95.3
Eastside Pine (EPN)	285.2	1.0%		0.0%	-285.2	-100.0%	-1.0%	285.2
Jeffrey Pine (JPN)	3,191.3	10.7%	1,235.5	4.1%	-1,955.8	-61.3%	-6.5%	1,955.8
Juniper (JUN)	585.5	2.0%		0.0%	-585.5	-100.0%	-2.0%	585.5
Lacustrine (LAC)	196.4	0.7%		0.0%	-196.4	-100.0%	-0.7%	196.4
Lodgepole Pine (LPN)	7,475.4	25.0%	3,536.9	11.8%	-3,938.5	-52.7%	-13.2%	3,938.5
Low Sage (LSG)	510.0	1.7%		0.0%	-510.0	-100.0%	-1.7%	510.0
Montane Chaparral (MCP)	814.7	2.7%	2,190.5	7.3%	1,375.8	168.9%	4.6%	1,375.8
Montane Hardwood-Conifer (MHC)		0.0%	26.0	0.1%	26.0	0.0%	0.1%	26.0
Montane Riparian (MRI)	354.4	1.2%	7.1	0.0%	-347.3	-98.0%	-1.2%	347.3
Red Fir (RFR)	6,208.4	20.7%	12,346.8	41.3%	6,138.4	98.9%	20.5%	6,138.4
Subalpine Conifer (SCN)	7,475.3	25.0%	1,962.9	6.6%	-5,512.4	-73.7%	-18.4%	5,512.4
Sagebrush (SGB)	1,221.9	4.1%	42.4	0.1%	-1,179.5	-96.5%	-3.9%	1,179.5
Sierran Mixed Conifer (SMC)		0.0%	809.2	2.7%	809.2	0.0%	2.7%	809.2
Unknown (XXX) (UKW)	22.7	0.1%		0.0%	-22.7	-100.0%	-0.1%	22.7
Water (WAT)		0.0%	499.9	1.7%	499.9	0.0%	1.7%	499.9
White Fir (WFR)	44.1	0.1%	45.4	0.2%	1.2	2.8%	0.0%	1.2
Wet Meadow (WTM)	373.7	1.2%	544.4	1.8%	170.7	45.7%	0.6%	170.7
Total	**29,927.6**	**100.0%**	**29,925.5**	**100.0%**				**14,633.1**

VTM55 WHR Type	VTM Area (ha)	VTM Percent of Total Area	CalVeg Area (ha)	CalVeg Percent of Total Area	Area Gained or (Lost) (ha)	Percent of Type Gained or (Lost)	Percent of Map Gained or (Lost)	Area Turnover
Alpine Dwarf-Shrub (ADS)		0.0%	32.1	0.0%	32.1	0.0%	0.0%	32.1
Agriculture (AGR)	1.7	0.0%		0.0%	-1.7	-100.0%	0.0%	1.7
Annual Grassland (AGS)	431.3	0.2%	785.5	0.4%	354.2	82.1%	0.2%	354.2
Aspen (ASP)	513.0	0.3%	7.4	0.0%	-505.7	-98.6%	-0.3%	505.7
Barren (BAR)	2,819.9	1.6%	10,520.7	5.8%	7,700.8	273.1%	4.2%	7,700.8
Bitterbrush (BBR)	142.3	0.1%		0.0%	-142.3	-100.0%	-0.1%	142.3
Douglas Fir (DFR)	2,325.4	1.3%	1,888.3	1.0%	-437.1	-18.8%	-0.2%	437.1
Desert Scrub (DSC)	7.2	0.0%		0.0%	-7.2	-100.0%	0.0%	7.2
Eastside Pine (EPN)	2,838.7	1.6%		0.0%	-2,838.7	-100.0%	-1.6%	2,838.7
Jeffrey Pine (JPN)	19,272.5	10.6%	754.5	0.4%	-18,517.9	-96.1%	-10.2%	18,517.9
Juniper (JUN)	1,097.6	0.6%		0.0%	-1,097.6	-100.0%	-0.6%	1,097.6
Lacustrine (LAC)	661.7	0.4%		0.0%	-661.7	-100.0%	-0.4%	661.7
Lodgepole Pine (LPN)	15,096.1	8.3%	4,537.1	2.5%	-10,559.0	-69.9%	-5.8%	10,559.0
Low Sage (LSG)	79.4	0.0%		0.0%	-79.4	-100.0%	0.0%	79.4
Mixed Chaparral (MCH)	458.1	0.3%	371.4	0.2%	-86.7	-18.9%	0.0%	86.7
Montane Chaparral (MCP)	11,273.4	6.2%	13,751.9	7.6%	2,478.5	22.0%	1.4%	2,478.5
Montane Hardwood Conifer (MHC)	259.7	0.1%	1,553.8	0.9%	1,294.1	498.2%	0.7%	1,294.1
Montane Hardwood (MHW)	1,666.3	0.9%	1,998.8	1.1%	332.5	20.0%	0.2%	332.5
Montane Riparian (MRI)	84.8	0.0%	59.5	0.0%	-25.2	-29.8%	0.0%	25.2
Ponderosa Pine (PPN)	29,090.4	16.0%	12,492.3	6.9%	-16,598.1	-57.1%	-9.2%	16,598.1
Red Fir (RFR)	13,667.1	7.5%	29,972.8	16.5%	16,305.7	119.3%	9.0%	16,305.7
Subalpine Conifer (SCN)	7,609.9	4.2%	1,666.7	0.9%	-5,943.2	-78.1%	-3.3%	5,943.2
Sagebrush (SGB)	2,060.4	1.1%	37.3	0.0%	-2,023.1	-98.2%	-1.1%	2,023.1
Sierran Mixed Conifer (SMC)	63,201.8	34.9%	84,640.9	46.7%	21,439.1	33.9%	11.8%	21,439.1
Unknown (XXX) (UKW)	9.4	0.0%		0.0%	-9.4	-100.0%	0.0%	9.4
Urban (URB)	17.1	0.0%	64.7	0.0%	47.6	278.2%	0.0%	47.6
Water (WAT)		0.0%	2,648.0	1.5%	2,648.0	0.0%	1.5%	2,648.0
White Fir (WFR)	4,837.4	2.7%	12,009.0	6.6%	7,171.6	148.3%	4.0%	7,171.6
Wet Meadow (WTM)	1,744.3	1.0%	1,473.9	0.8%	-270.4	-15.5%	-0.1%	270.4
Total	**181,267.0**	100.0%	**181,266.7**	100.0%				**59,804.3**

VTM 56 WHR Type	VTM Area (ha)	VTM Percent of Total Area	CalVeg Area (ha)	CalVeg Percent of Total Area	Area Gained or (Lost) (ha)	Percent of Type Gained or (Lost)	Percent of Map Gained or (Lost)	Total Turnover
(Agriculture (AGR)	6,105.5	2.5%		0.0%	-6,105.5	-100.0%	-2.5%	6,105.5
Annual Grassland (AGS)	12,403.8	5.1%	24,550.6	10.2%	12,146.8	97.9%	5.0%	12,146.8
Barren (BAR)	70.5	0.0%	961.5	0.4%	891.0	1263.8%	0.4%	891.0
Blue Oak–Foothill Pine (BOP)	12,338.0	5.1%	1,312.4	0.5%	-11,025.6	-89.4%	-4.6%	11,025.6
Blue Oak Woodland (BOW)	7,342.1	3.0%	13,211.6	5.5%	5,869.5	79.9%	2.4%	5,869.5
Coastal Oak Woodland (COW)		0.0%	5.5	0.0%	5.5	0.0%	0.0%	5.5
Closed-Cone Pine-Cypress (CPC)	665.7	0.3%	194.9	0.1%	-470.7	-70.7%	-0.2%	470.7
Chamise-Redshank Chaparral (CRC)	10,462.4	4.3%	1,260.2	0.5%	-9,202.2	-88.0%	-3.8%	9,202.2
Cropland (CRP)		0.0%	3,553.8	1.5%	3,553.8	0.0%	1.5%	3,553.8
Douglas Fir (DFR)	9,797.3	4.1%	27,606.4	11.5%	17,809.1	181.8%	7.4%	17,809.1
Eucalyptus (EUC)		0.0%	15.4	0.0%	15.4	0.0%	0.0%	15.4
Fern	2.8	0.0%		0.0%	-2.8	-100.0%	0.0%	2.8
Lacustrine (LAC)	1,242.8	0.5%		0.0%	-1,242.8	-100.0%	-0.5%	1,242.8
Lodgepole Pine (LPN)	4.2	0.0%		0.0%	-4.2	-100.0%	0.0%	4.2
Mixed Chaparral (MCH)	16,476.1	6.8%	11,719.7	4.9%	-4,756.4	-28.9%	-2.0%	4,756.4
Montane Chaparral (MCP)	11,840.3	4.9%	498.4	0.2%	-11,341.9	-95.8%	-4.7%	11,341.9
Montane Hardwood-Conifer (MHC)	5,531.1	2.3%	19,839.2	8.2%	14,308.1	258.7%	5.9%	14,308.1
Montane Hardwood (MHW)	25,795.7	10.7%	69,478.3	28.8%	43,682.5	169.3%	18.1%	43,682.5
Montane Riparian (MRI)	112.8	0.0%	250.8	0.1%	137.9	122.2%	0.1%	137.9
Perennial Grassland (PGS)	1,186.2	0.5%		0.0%	-1,186.2	-100.0%	-0.5%	1,186.2
Ponderosa Pine (PPN)	81,779.0	33.9%	31,838.8	13.2%	-49,940.2	-61.1%	-20.7%	49,940.2
Sierran Mixed Conifer (SMC)	36,947.9	15.3%	27,725.8	11.5%	-9,222.1	-25.0%	-3.8%	9,222.1
Urban (URB)	8.9	0.0%	4,297.9	1.8%	4,289.0	48375.7%	1.8%	4,289.0
Valley Oak Woodland (VOW)	240.3	0.1%	1,338.1	0.6%	1,097.8	456.9%	0.5%	1,097.8
Water (WAT)		0.0%	1,185.1	0.5%	1,185.1	0.0%	0.5%	1,185.1
Weed Field (WEE)	227.1	0.1%		0.0%	-227.1	-100.0%	-0.1%	227.1

VTM 56	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
White Fir (WFR)	278.1	0.1%		0.0%	-278.1	-100.0%	-0.1%	278.1
Wet Meadow (WTM)	22.4	0.0%	35.4	0.0%	13.0	57.8%	0.0%	13.0
Total	**240,881.0**	100.0%	**240,879.7**	100.0%				**105,005.2**
VTM 57	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Agriculture (AGR)	19,235.9	19.1%		0.0%	-19,235.9	-100.0%	-19.1%	19,235.9
Annual Grassland (AGS)	25,989.7	25.8%	34,270.5	34.0%	8,280.8	31.9%	8.2%	8,280.8
Barren (BAR)	25.1	0.0%	1,033.8	1.0%	1,008.7	4017.6%	1.0%	1,008.7
Blue Oak–Foothill Pine (BOP)	8,104.3	8.0%	984.6	1.0%	-7,119.7	-87.9%	-7.1%	7,119.7
Blue Oak Woodland (BOW)	6,635.3	6.6%	24,239.0	24.0%	17,603.7	265.3%	17.4%	17,603.7
Chamise-Redshank Chaparral (CRC)	3,889.3	3.9%	380.3	0.4%	-3,509.1	-90.2%	-3.5%	3,509.1
Cropland (CRP)		0.0%	1,497.7	1.5%	1,497.7	0.0%	1.5%	1,497.7
Douglas Fir (DFR)	7,499.3	7.4%	152.7	0.2%	-7,346.5	-98.0%	-7.3%	7,346.5
Eucalyptus (EUC)		0.0%	1.5	0.0%	1.5	0.0%	0.0%	1.5
Lacustrine (LAC)	522.3	0.5%	606.9	0.6%	84.6	16.2%	0.1%	84.6
Mixed Chaparral (MCH)	1,420.4	1.4%	3,178.5	3.1%	1,758.1	123.8%	1.7%	1,758.1
Montane Chaparral (MCP)	710.1	0.7%		0.0%	-710.1	-100.0%	-0.7%	710.1
Montane Hardwood-Conifer (MHC)	10,944.4	10.8%	3,124.0	3.1%	-7,820.4	-71.5%	-7.7%	7,820.4
Montane Hardwood (MHW)	12,713.2	12.6%	15,272.2	15.1%	2,558.9	20.1%	2.5%	2,558.9
Montane Riparian (MRI)	279.5	0.3%	520.3	0.5%	240.8	86.1%	0.2%	240.8
Ponderosa Pine (PPN)	2,095.1	2.1%	267.8	0.3%	-1,827.3	-87.2%	-1.8%	1,827.3
Sierran Mixed Conifer (SMC)	203.7	0.2%		0.0%	-203.7	-100.0%	-0.2%	203.7
Unknown (XXX) (UKW)	29.7	0.0%		0.0%	-29.7	-100.0%	0.0%	29.7
Urban (URB)	19.0	0.0%	10,200.7	10.1%	10,181.7	53514.7%	10.1%	10,181.7
Valley Oak Woodland (VOW)	594.8	0.6%	1,163.2	1.2%	568.5	95.6%	0.6%	568.5

VTM 57	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	Area (ha)	of Total Area	Area (ha)	of Total Area	or (Lost) (ha)	Gained or (Lost)	Gained or (Lost)	Turnover
Valley Foothill Riparian (VRI)	11.5	0.0%		0.0%	-11.5	-100.0%	0.0%	11.5
Water (WAT)		0.0%	3,901.1	3.9%	3,901.1	0.0%	3.9%	3,901.1
Wet Meadow (WTM)		0.0%	127.4	0.1%	127.4	0.0%	0.1%	127.4
Total	**100,922.6**	100.0%	**100,922.1**	100.0%				**47,813.6**
VTM 67 a	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Agriculture (AGR)	2.1	0.1%		0.0%	-2.1	-100.0%	-0.1%	2.1
Annual Grassland (AGS)	473.4	26.7%	793.6	44.7%	320.3	67.7%	18.1%	320.3
Barren (BAR)		0.0%	0.2	0.0%	0.2	0.0%	0.0%	0.2
Blue Oak–Foothill Pine (BOP)	564.5	31.8%	43.1	2.4%	-521.5	-92.4%	-29.4%	521.5
Blue Oak Woodland (BOW)	201.6	11.4%	345.8	19.5%	144.2	71.5%	8.1%	144.2
Chamise-Redshank Chaparral (CRC)	252.0	14.2%	54.1	3.0%	-197.9	-78.5%	-11.2%	197.9
Cropland (CRP)		0.0%	11.6	0.7%	11.6	0.0%	0.7%	11.6
Lacustrine (LAC)	9.7	0.5%	9.5	0.5%	-0.2	-2.4%	0.0%	0.2
Mixed Chaparral (MCH)	4.5	0.3%	253.1	14.3%	248.6	5510.1%	14.0%	248.6
Montane Chaparral (MCP)	78.1	4.4%		0.0%	-78.1	-100.0%	-4.4%	78.1
Montane Hardwood-Conifer (MHC)	68.3	3.8%	49.0	2.8%	-19.3	-28.2%	-1.1%	19.3
Montane Hardwood (MHW)	80.4	4.5%	176.9	10.0%	96.5	120.1%	5.4%	96.5
Montane Riparian (MRI)	21.1	1.2%	8.6	0.5%	-12.5	-59.0%	-0.7%	12.5
Urban (URB)		0.0%	24.7	1.4%	24.7	0.0%	1.4%	24.7
Valley Foothill Riparian (VRI)	18.0	1.0%		0.0%	-18.0	-100.0%	-1.0%	18.0
Water (WAT)		0.0%	3.4	0.2%	3.4	0.0%	0.2%	3.4
Total	**1,773.6**	100.0%	**1,773.6**	100.0%				**849.5**

VTM 67 h	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Annual Grassland (AGS)	392.8	23.4%	1,246.8	74.3%	854.0	217.4%	50.9%	854.0
Barren (BAR)		0.0%	14.2	0.8%	14.2	0.0%	0.8%	14.2
Blue Oak–Foothill Pine (BOP)	150.1	8.9%	16.4	1.0%	-133.7	-89.1%	-8.0%	133.7
Blue Oak Woodland (BOW)	894.5	53.3%	345.1	20.6%	-549.4	-61.4%	-32.7%	549.4
Chamise-Redshank Chaparral (CRC)	158.2	9.4%	6.8	0.4%	-151.4	-95.7%	-9.0%	151.4
Cropland (CRP)		0.0%	7.8	0.5%	7.8	0.0%	0.5%	7.8
Mixed Chaparral (MCH)		0.0%	6.0	0.4%	6.0	0.0%	0.4%	6.0
Montane Hardwood-Conifer (MHC)		0.0%	6.0	0.4%	6.0	0.0%	0.4%	6.0
Montane Hardwood (MHW)	83.1	5.0%		0.0%	-83.1	-100.0%	-5.0%	83.1
Water (WAT)		0.0%	29.5	1.8%	29.5	0.0%	1.8%	29.5
Total	**1,678.7**	100.0%	**1,678.7**	100.0%				**917.6**
VTM 67 i	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Agriculture (AGR)	595.8	64.3%		0.0%	-595.8	-100.0%	-64.3%	595.8
Annual Grassland (AGS)		0.0%	612.1	66.0%	612.1	0.0%	66.0%	612.1
Barren (BAR)		0.0%	30.0	3.2%	30.0	0.0%	3.2%	30.0
Blue Oak Woodland (BOW)	133.5	14.4%	28.7	3.1%	-104.8	-78.5%	-11.3%	104.8
Montane Hardwood-Conifer (MHC)		0.0%	2.0	0.2%	2.0	0.0%	0.2%	2.0
Montane Hardwood (MHW)	11.0	1.2%	20.4	2.2%	9.4	85.1%	1.0%	9.4
Unknown (XXX) (UKW)	176.7	19.1%		0.0%	-176.7	-100.0%	-19.1%	176.7
Valley Foothill Riparian (VRI)	9.9	1.1%		0.0%	-9.9	-100.0%	-1.1%	9.9
Water (WAT)		0.0%	233.8	25.2%	233.8	0.0%	25.2%	233.8
Total	**927.0**	100.0%	**927.0**	100.0%				**887.3**

VTM 67 p	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Annual Grassland (AGS)	189.1	100.0%	186.0	98.3%	-3.1	-1.7%	-1.7%	3.1
Barren (BAR)		0.0%	2.0	1.0%	2.0	0.0%	1.0%	2.0
Blue Oak Woodland (BOW)		0.0%	1.2	0.6%	1.2	0.0%	0.6%	1.2
Total	**189.1**	100.0%	**189.1**	100.0%				**3.1**
VTM 68	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Agriculture (AGR)	7,872.1	3.3%		0.0%	-7,872.1	-100.0%	-3.3%	7,872.1
Annual Grassland (AGS)	42,018.4	17.8%	77,385.1	32.8%	35,366.7	84.2%	15.0%	35,366.7
Barren (BAR)	110.4	0.0%	1,718.5	0.7%	1,608.1	1456.0%	0.7%	1,608.1
Bitterbrush (BBR)	10.4	0.0%		0.0%	-10.4	-100.0%	0.0%	10.4
Blue Oak–Foothill Pine (BOP)	36,798.0	15.6%	1,140.0	0.5%	-35,658.0	-96.9%	-15.1%	35,658.0
Blue Oak Woodland (BOW)	34,170.4	14.5%	37,193.6	15.8%	3,023.2	8.8%	1.3%	3,023.2
Closed-Cone Pine-Cypress (CPC)		0.0%	38.2	0.0%	38.2	0.0%	0.0%	38.2
Chamise-Redshank Chaparral (CRC)	22,042.8	9.3%	8,485.7	3.6%	-13,557.1	-61.5%	-5.7%	13,557.1
Cropland (CRP)		0.0%	2,885.8	1.2%	2,885.8	0.0%	1.2%	2,885.8
Coastal Scrub (CSC)		0.0%		0.0%	0.0	0.0%	0.0%	0.0
Douglas Fir (DFR)	1,724.5	0.7%	2,847.5	1.2%	1,122.9	65.1%	0.5%	1,122.9
Eastside Pine (EPN)		0.0%		0.0%	0.0	0.0%	0.0%	0.0
Eucalyptus (EUC)		0.0%		0.0%	0.0	0.0%	0.0%	0.0
Foothill Pine (FHP)		0.0%		0.0%	0.0	0.0%	0.0%	0.0
Lacustrine (LAC)	716.9	0.3%		0.0%	-716.9	-100.0%	-0.3%	716.9
Lodgepole Pine (LPN)		0.0%		0.0%	0.0	0.0%	0.0%	0.0
Mixed Chaparral (MCH)	10,571.1	4.5%	13,037.3	5.5%	2,466.2	23.3%	1.0%	2,466.2
Montane Chaparral (MCP)	10,710.4	4.5%	181.5	0.1%	-10,528.8	-98.3%	-4.5%	10,528.8
Montane Hardwood-Conifer (MHC)	6,165.7	2.6%	25,056.6	10.6%	18,890.8	306.4%	8.0%	18,890.8
Montane Hardwood (MHW)	23,697.4	10.0%	44,653.1	18.9%	20,955.7	88.4%	8.9%	20,955.7
Montane Riparian (MRI)	444.9	0.2%	153.9	0.1%	-291.1	-65.4%	-0.1%	291.1

VTM 68	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	Area (ha)	of Total Area	Area (ha)	of Total Area	or (Lost) (ha)	Gained or (Lost)	Gained or (Lost)	Turnover
Ponderosa Pine (PPN)	33,870.1	14.4%	12,916.9	5.5%	-20,953.2	-61.9%	-8.9%	20,953.2
Sierran Mixed Conifer (SMC)	2,456.1	1.0%	673.5	0.3%	-1,782.6	-72.6%	-0.8%	1,782.6
Unknown (XXX)	21.9	0.0%		0.0%	-21.9	-100.0%	0.0%	21.9
Urban (URB)	1,144.8	0.5%	1,973.0	0.8%	828.2	72.3%	0.4%	828.2
Valley Oak Woodland (VOW)	870.6	0.4%	586.6	0.2%	-284.1	-32.6%	-0.1%	284.1
Valley Foothill Riparian (VRI)	441.0	0.2%		0.0%	-441.0	-100.0%	-0.2%	441.0
Water (WAT)		0.0%	4,926.8	2.1%	4,926.8	0.0%	2.1%	4,926.8
White Fir (WFR)		0.0%		0.0%	0.0	0.0%	0.0%	0.0
Wet Meadow (WTM)	2.1	0.0%	6.3	0.0%	4.2	195.5%	0.0%	4.2
Total	**235,860.4**	100.0%	**235,860.0**	100.0%				92,117.0
VTM 69	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Agriculture (AGR)	1,247.3	0.5%		0.0%	-1,247.3	-100.0%	-0.5%	1,247.3
Annual Grassland (AGS)	5,807.6	2.4%	7,374.8	3.0%	1,567.2	27.0%	0.6%	1,567.2
Aspen (ASP)	478.6	0.2%	2.5	0.0%	-476.1	-99.5%	-0.2%	476.1
Barren (BAR)	1,006.1	0.4%	2,643.5	1.1%	1,637.4	162.8%	0.7%	1,637.4
Bitterbrush (BBR)	15.5	0.0%		0.0%	-15.5	-100.0%	0.0%	15.5
Blue Oak–Foothill Pine (BOP)	9,114.3	3.8%	120.9	0.0%	-8,993.4	-98.7%	-3.7%	8,993.4
Blue Oak Woodland (BOW)	1,003.7	0.4%	2,131.9	0.9%	1,128.2	112.4%	0.5%	1,128.2
Chamise-Redshank Chaparral (CRC)	5,708.4	2.3%	3,142.0	1.3%	-2,566.4	-45.0%	-1.1%	2,566.4
Cropland (CRP)		0.0%	86.9	0.0%	86.9	0.0%	0.0%	86.9
Douglas Fir (DFR)	4,920.6	2.0%	5,832.2	2.4%	911.6	18.5%	0.4%	911.6
Desert Scrub (DSC)	9.7	0.0%		0.0%	-9.7	-100.0%	0.0%	9.7
Eastside Pine (EPN)	595.8	0.2%		0.0%	-595.8	-100.0%	-0.2%	595.8
Eucalyptus (EUC)	71.8	0.0%		0.0%	-71.8	-100.0%	0.0%	71.8
Jeffrey Pine (JPN)	17,089.6	7.0%	2,142.3	0.9%	-14,947.2	-87.5%	-6.2%	14,947.2

VTM 69	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Juniper (JUN)	17.2	0.0%		0.0%	-17.2	-100.0%	0.0%	17.2
Lacustrine (LAC)	414.0	0.2%		0.0%	-414.0	-100.0%	-0.2%	414.0
Lodgepole Pine (LPN)	1,899.5	0.8%	4,418.8	1.8%	2,519.3	132.6%	1.0%	2,519.3
Mixed Chaparral (MCH)	8,525.4	3.5%	14,799.1	6.1%	6,273.7	73.6%	2.6%	6,273.7
Montane Chaparral (MCP)	10,476.5	4.3%	8,188.9	3.4%	-2,287.6	-21.8%	-0.9%	2,287.6
Montane Hardwood-Conifer (MHC)	2,272.1	0.9%	22,598.5	9.3%	20,326.4	894.6%	8.4%	20,326.4
Montane Hardwood (MHW)	14,027.3	5.8%	34,394.1	14.2%	20,366.8	145.2%	8.4%	20,366.8
Montane Riparian (MRI)	54.0	0.0%	7.4	0.0%	-46.6	-86.3%	0.0%	46.6
Ponderosa Pine (PPN)	104,955.0	43.2%	26,667.9	11.0%	-78,287.0	-74.6%	-32.2%	78,287.0
Red Fir (RFR)	10,928.4	4.5%	4,849.9	2.0%	-6,078.4	-55.6%	-2.5%	6,078.4
Subalpine Conifer (SCN)	274.2	0.1%		0.0%	-274.2	-100.0%	-0.1%	274.2
Sagebrush (SGB)	8.2	0.0%		0.0%	-8.2	-100.0%	0.0%	8.2
Sierran Mixed Conifer (SMC)	9,871.6	4.1%	101,385.2	41.7%	91,513.6	927.0%	37.7%	91,513.6
Unknown (XXX) (UKW)	103.1	0.0%		0.0%	-103.1	-100.0%	0.0%	103.1
Urban (URB)	205.6	0.1%	5.2	0.0%	-200.4	-97.5%	-0.1%	200.4
Valley Oak Woodland (VOW)	230.2	0.1%		0.0%	-230.2	-100.0%	-0.1%	230.2
Valley Foothill Riparian (VRI)	45.7	0.0%		0.0%	-45.7	-100.0%	0.0%	45.7
Water (WAT)		0.0%	1,767.5	0.7%	1,767.5	0.0%	0.7%	1,767.5
White Fir (WFR)	30,030.3	12.4%	29.7	0.0%	-30,000.6	-99.9%	-12.3%	30,000.6
Wet Meadow (WTM)	1,578.3	0.6%	396.0	0.2%	-1,182.4	-74.9%	-0.5%	1,182.4
Total	**242,985.6**	100.0%	**242,985.2**	100.0%				**148,098.7**
VTM 70	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Annual Grassland (AGS)	1,328.2	0.8%	1,390.5	0.9%	62.3	4.7%	0.0%	62.3
Aspen (ASP)	628.9	0.4%	60.1	0.0%	-568.8	-90.4%	-0.4%	568.8
Barren (BAR)	27,269.1	16.9%	49,200.1	30.6%	21,931.1	80.4%	13.6%	21,931.1
Bitterbrush (BBR)	932.8	0.6%		0.0%	-932.8	-100.0%	-0.6%	932.8

VTM 70 WHR Type	VTM Area (ha)	VTM Percent of Total Area	CalVeg Area (ha)	CalVeg Percent of Total Area	Area Gained or (Lost) (ha)	Percent of Type Gained or (Lost)	Percent of Map Gained or (Lost)	Total Turnover
Douglas Fir (DFR)	149.2	0.1%		0.0%	-149.2	-100.0%	-0.1%	149.2
Desert Succulent Scrub (DSS)	4.0	0.0%		0.0%	-4.0	-100.0%	0.0%	4.0
Eastside Pine (EPN)	2,585.7	1.6%		0.0%	-2,585.7	-100.0%	-1.6%	2,585.7
Eucalyptus (EUC)	29.8	0.0%		0.0%	-29.8	-100.0%	0.0%	29.8
Jeffrey Pine (JPN)	26,950.5	16.7%	7,601.6	4.7%	-19,349.0	-71.8%	-12.0%	19,349.0
Juniper (JUN)	1,030.2	0.6%		0.0%	-1,030.2	-100.0%	-0.6%	1,030.2
Lacustrine (LAC)	1,049.3	0.7%		0.0%	-1,049.3	-100.0%	-0.7%	1,049.3
Lodgepole Pine (LPN)	27,233.9	16.9%	19,206.1	11.9%	-8,027.9	-29.5%	-5.0%	8,027.9
Low Sage (LSG)	317.6	0.2%		0.0%	-317.6	-100.0%	-0.2%	317.6
Mixed Chaparral (MCH)	72.6	0.0%	10.2	0.0%	-62.4	-86.0%	0.0%	62.4
Montane Chaparral (MCP)	12,121.0	7.5%	13,022.3	8.1%	901.3	7.4%	0.6%	901.3
Montane Hardwood-Conifer (MHC)	182.7	0.1%	561.3	0.3%	378.6	207.2%	0.2%	378.6
Montane Hardwood (MHW)	449.0	0.3%	795.9	0.5%	346.8	77.2%	0.2%	346.8
Montane Riparian (MRI)	884.1	0.5%	86.3	0.1%	-797.7	-90.2%	-0.5%	797.7
Ponderosa Pine (PPN)	4,259.9	2.6%	1,554.2	1.0%	-2,705.7	-63.5%	-1.7%	2,705.7
Red Fir (RFR)	13,931.9	8.7%	25,703.3	16.0%	11,771.4	84.5%	7.3%	11,771.4
Subalpine Conifer (SCN)	15,372.5	9.5%	8,445.2	5.2%	-6,927.3	-45.1%	-4.3%	6,927.3
Sagebrush (SGB)	5,043.4	3.1%	969.4	0.6%	-4,074.0	-80.8%	-2.5%	4,074.0
Sierran Mixed Conifer (SMC)	1,077.1	0.7%	29,275.1	18.2%	28,198.0	2618.0%	17.5%	28,198.0
Unknown (XXX) (UKW)	13.2	0.0%		0.0%	-13.2	-100.0%	0.0%	13.2
Valley Foothill Riparian (VRI)	7.7	0.0%		0.0%	-7.7	-100.0%	0.0%	7.7
Water (WAT)		0.0%	2,669.3	1.7%	2,669.3	0.0%	1.7%	2,669.3
White Fir (WFR)	12,470.1	7.7%	194.2	0.1%	-12,275.8	-98.4%	-7.6%	12,275.8
Wet Meadow (WTM)	5,644.8	3.5%	293.9	0.2%	-5,350.9	-94.8%	-3.3%	5,350.9
Total	**161,039.2**	100.0%	**161,038.9**	100.0%				**66,258.9**

VTM 71	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	Area (ha)	of Total Area	Area (ha)	of Total Area	or (Lost) (ha)	Gained or (Lost)	Gained or (Lost)	Turnover
Alpine Dwarf-Shrub (ADS)		0.0%	1,030.9	6.0%	1,030.9	0.0%	6.0%	1,030.9
Agriculture (AGR)	7.3	0.0%		0.0%	-7.3	-100.0%	0.0%	
Aspen (ASP)	351.5	2.1%	374.2	2.2%	22.7	6.5%	0.1%	22.7
Barren (BAR)	2,120.1	12.4%	5,104.7	29.9%	2,984.6	140.8%	17.5%	2,984.6
Bitterbrush (BBR)	620.1	3.6%		0.0%	-620.1	-100.0%	-3.6%	
Desert Scrub (DSC)	485.5	2.8%		0.0%	-485.5	-100.0%	-2.8%	485.5
Eastside Pine (EPN)	106.9	0.6%		0.0%	-106.9	-100.0%	-0.6%	106.9
Jeffrey Pine (JPN)	8.3	0.0%	163.1	1.0%	154.8	1867.0%	0.9%	154.8
Juniper (JUN)	333.1	2.0%		0.0%	-333.1	-100.0%	-2.0%	333.1
Lacustrine (LAC)	6,534.2	38.3%		0.0%	-6,534.2	-100.0%	-38.3%	6,534.2
Lodgepole Pine (LPN)	194.0	1.1%	93.2	0.5%	-100.9	-52.0%	-0.6%	100.9
Montane Chaparral (MCP)	266.7	1.6%		0.0%	-266.7	-100.0%	-1.6%	266.7
Montane Riparian (MRI)	70.7	0.4%	8.9	0.1%	-61.8	-87.4%	-0.4%	61.8
Pinyon-Juniper (PJN)	11.6	0.1%	127.1	0.7%	115.5	999.8%	0.7%	115.5
Red Fir (RFR)		0.0%	133.1	0.8%	133.1	0.0%	0.8%	133.1
Subalpine Conifer (SCN)	1,155.0	6.8%	203.2	1.2%	-951.8	-82.4%	-5.6%	951.8
Saline Emergent Wetland (SEW)	96.8	0.6%		0.0%	-96.8	-100.0%	-0.6%	96.8
Sagebrush (SGB)	4,381.0	25.7%	5,177.5	30.3%	796.6	18.2%	4.7%	796.6
Sierran Mixed Conifer (SMC)		0.0%	505.1	3.0%	505.1	0.0%	3.0%	505.1
Unknown (XXX) (UKW)	11.2	0.1%		0.0%	-11.2	-100.0%	-0.1%	11.2
Water (WAT)		0.0%	3,835.2	22.5%	3,835.2	0.0%	22.5%	3,835.2
Wet Meadow (WTM)	325.0	1.9%	322.7	1.9%	-2.2	-0.7%	0.0%	2.2
Total	**17,078.8**	100.0%	**17,078.8**	100.0%				**9,264.8**
VTM 76	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Alpine Dwarf-Shrub (ADS)	11.1	0.1%	1,304.6	7.0%	1,293.5	11684.1%	6.9%	1,293.5
Annual Grassland (AGS)		0.0%	7.0	0.0%	7.0	0.0%	0.0%	7.0
Aspen (ASP)		0.0%	83.8	0.4%	83.8	0.0%	0.4%	83.8
Barren (BAR)	5,553.5	29.6%	6,891.3	36.7%	1,337.8	24.1%	7.1%	1,337.8

VTM 76	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Desert Scrub (DSC)	183.3	1.0%		0.0%	-183.3	-100.0%	-1.0%	183.3
Fresh Emergent Wetland (FEW)	81.6	0.4%		0.0%	-81.6	-100.0%	-0.4%	81.6
Jeffrey Pine (JPN)	216.7	1.2%	27.9	0.1%	-188.8	-87.1%	-1.0%	188.8
Lacustrine (LAC)	6,627.5	35.3%		0.0%	-6,627.5	-100.0%	-35.3%	6,627.5
Lodgepole Pine (LPN)	2,343.6	12.5%	124.1	0.7%	-2,219.5	-94.7%	-11.8%	2,219.5
Montane Chaparral (MCP)	69.6	0.4%	177.6	0.9%	108.0	155.1%	0.6%	108.0
Montane Hardwood-Conifer (MHC)		0.0%	35.8	0.2%	35.8	0.0%	0.2%	35.8
Montane Hardwood (MHW)	9.1	0.0%	3.2	0.0%	-5.8	-64.3%	0.0%	5.8
Montane Riparian (MRI)	25.2	0.1%		0.0%	-25.2	-100.0%	-0.1%	25.2
Pinyon-Juniper (PJN)	34.0	0.2%	18.8	0.1%	-15.2	-44.6%	-0.1%	15.2
Red Fir (RFR)	1,036.4	5.5%	1,869.0	10.0%	832.6	80.3%	4.4%	832.6
Subalpine Conifer (SCN)	1,281.9	6.8%	1,718.7	9.2%	436.8	34.1%	2.3%	436.8
Sagebrush (SGB)	243.0	1.3%	559.7	3.0%	316.7	130.3%	1.7%	316.7
Sierran Mixed Conifer (SMC)		0.0%	211.4	1.1%	211.4	0.0%	1.1%	211.4
Unknown (XXX)	0.0	0.0%		0.0%	0.0	-100.0%	0.0%	0.0
Water (WAT)		0.0%	5,585.9	29.8%	5,585.9	0.0%	29.8%	5,585.9
Wet Meadow (WTM)	1,049.2	5.6%	146.8	0.8%	-902.3	-86.0%	-4.8%	902.3
Total	**18,765.8**	100.0%	**18,765.8**	100.0%				**10,249.2**
VTM 77	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Agricultural (AGR)	139.9	0.1%		0.0%	-139.9	-100.0%	-0.1%	139.9
Annual Grassland (AGS)	2,231.0	2.0%	3,463.8	3.1%	1,232.8	55.3%	1.1%	1,232.8
Barren (BAR)	1,955.6	1.7%	612.9	0.5%	-1,342.7	-68.7%	-1.2%	1,342.7
Blue Oak–Foothill Pine (BOP)	2,758.6	2.4%	181.2	0.2%	-2,577.4	-93.4%	-2.3%	2,577.4
Blue Oak Woodland (BOW)	54.0	0.0%	1,525.1	1.3%	1,471.0	2722.5%	1.3%	1,471.0
Closed-Cone Pine-Cypress (CPC)	475.9	0.4%	191.4	0.2%	-284.5	-59.8%	-0.3%	284.5

VTM 77	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Chamise-Redshank Chaparral (CRC)	7,016.8	6.2%	1,373.4	1.2%	-5,643.4	-80.4%	-5.0%	5,643.4
Cropland (CRP)		0.0%	5.1	0.0%	5.1	0.0%	0.0%	5.1
Douglas Fir (DFR)	2,363.0	2.1%	748.6	0.7%	-1,614.4	-68.3%	-1.4%	1,614.4
Jeffrey Pine (JPN)	1,202.7	1.1%		0.0%	-1,202.7	-100.0%	-1.1%	1,202.7
Lacustrine (LAC)	206.8	0.2%		0.0%	-206.8	-100.0%	-0.2%	206.8
Lodgepole Pine (LPN)	54.3	0.0%		0.0%	-54.3	-100.0%	0.0%	54.3
Mixed Chaparral (MCH)	6,785.7	6.0%	10,171.4	9.0%	3,385.8	49.9%	3.0%	3,385.8
Montane Chaparral (MCP)	5,011.6	4.4%	3,110.7	2.7%	-1,900.9	-37.9%	-1.7%	1,900.9
Montane Hardwood-Conifer (MHC)	473.6	0.4%	10,575.8	9.3%	10,102.2	2133.1%	8.9%	10,102.2
Montane Hardwood (MHW)	13,736.8	12.1%	23,411.8	20.7%	9,675.0	70.4%	8.5%	9,675.0
Montane Riparian (MRI)		0.0%	1.3	0.0%	1.3	0.0%	0.0%	1.3
Ponderosa Pine (PPN)	50,759.9	44.8%	18,677.6	16.5%	-32,082.4	-63.2%	-28.3%	32,082.4
Red Fir (RFR)	1,405.1	1.2%	1,671.1	1.5%	266.0	18.9%	0.2%	266.0
Subalpine Conifer (SCN)	162.7	0.1%	14.9	0.0%	-147.8	-90.8%	-0.1%	147.8
Sierran Mixed Conifer (SMC)	9,566.2	8.4%	36,600.7	32.3%	27,034.6	282.6%	23.9%	27,034.6
Unknown (XXX)	88.8	0.1%		0.0%	-88.8	-100.0%	-0.1%	88.8
Urban (URB)		0.0%	22.8	0.0%	22.8	0.0%	0.0%	22.8
Valley Oak Woodland (VOW)	66.8	0.1%		0.0%	-66.8	-100.0%	-0.1%	66.8
Water (WAT)		0.0%	539.6	0.5%	539.6	0.0%	0.5%	539.6
White Fir (WFR)	6,325.9	5.6%		0.0%	-6,325.9	-100.0%	-5.6%	6,325.9
Wet Meadow (WTM)	386.2	0.3%	297.4	0.3%	-88.9	-23.0%	-0.1%	88.9
Total	**113,228.1**	100.0%	**113,196.6**	100.0%				**53,681.9**
VTM 78	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Agricultural (AGR)	3,843.0	1.7%		0.0%	-3,843.0	-100.0%	-1.7%	3,843.0
Annual Grassland (AGS)	30,763.9	13.7%	55,772.4	24.9%	25,008.5	81.3%	11.2%	25,008.5
Barren (BAR)	492.2	0.2%	827.8	0.4%	335.6	68.2%	0.1%	335.6

VTM 78	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	Area (ha)	of Total Area	Area (ha)	of Total Area	or (Lost) (ha)	Gained or (Lost)	Gained or (Lost)	Turnover
Bitterbrush (BBR)	11.8	0.0%		0.0%	-11.8	-100.0%	0.0%	11.8
Blue Oak–Foothill Pine (BOP)	34,228.2	15.3%	1,516.5	0.7%	-32,711.7	-95.6%	-14.6%	32,711.7
Blue Oak Woodland (BOW)	31,204.4	13.9%	37,085.9	16.6%	5,881.5	18.8%	2.6%	5,881.5
Closed-Cone Pine-Cypress (CPC)	558.6	0.2%	52.2	0.0%	-506.3	-90.7%	-0.2%	506.3
Chamise-Redshank Chaparral (CRC)	26,003.3	11.6%	17,081.4	7.6%	-8,922.0	-34.3%	-4.0%	8,922.0
Cropland (CRP)		0.0%	479.4	0.2%	479.4	0.0%	0.2%	479.4
Douglas Fir (DFR)	2,280.6	1.0%	2,970.5	1.3%	689.9	30.3%	0.3%	689.9
Eucalyptus (EUC)	8.6	0.0%		0.0%	-8.6	0.0%	0.0%	8.6
Jeffrey Pine (JPN)	4.3	0.0%		0.0%	-4.3	-100.0%	0.0%	4.3
Lacustrine (LAC)	2,527.9	1.1%		0.0%	-2,527.9	-100.0%	-1.1%	2,527.9
Mixed Chaparral (MCH)	20,458.8	9.1%	23,008.9	10.3%	2,550.1	12.5%	1.1%	2,550.1
Montane Chaparral (MCP)	8,391.5	3.7%	282.1	0.1%	-8,109.4	-96.6%	-3.6%	8,109.4
Montane Hardwood-Conifer (MHC)	5,941.9	2.7%	14,689.7	6.6%	8,747.8	147.2%	3.9%	8,747.8
Montane Hardwood (MHW)	16,699.2	7.5%	28,951.6	12.9%	12,252.4	73.4%	5.5%	12,252.4
Montane Riparian (MRI)	75.8	0.0%	42.2	0.0%	-33.6	-44.3%	0.0%	33.6
Ponderosa Pine (PPN)	37,640.3	16.8%	19,459.2	8.7%	-18,181.2	-48.3%	-8.1%	18,181.2
Sierran Mixed Conifer (SMC)	1,098.4	0.5%	13,340.3	6.0%	12,241.9	1114.5%	5.5%	12,241.9
Unknown (XXX)	50.2	0.0%	211.4	0.1%	161.2	321.4%	0.1%	161.2
Urban (URB)	551.9	0.2%	290.6	0.1%	-261.3	-47.4%	-0.1%	261.3
Valley Oak Woodland (VOW)	246.4	0.1%	71.4	0.0%	-175.0	-71.0%	-0.1%	175.0
Valley Foothill Riparian (VRI)	5.1	0.0%		0.0%	-5.1	-100.0%	0.0%	5.1
Water (WAT)		0.0%	7,795.0	3.5%	7,795.0	0.0%	3.5%	7,795.0
White Fir (WFR)	520.6	0.2%		0.0%	-520.6	-100.0%	-0.2%	520.6
Wet Meadow (WTM)	322.0	0.1%		0.0%	-322.0	-100.0%	-0.1%	322.0
Total	**223,928.9**	100.0%	**223,928.5**	100.0%				**76,143.5**

VTM 79 A	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Agricultural (AGR)	1,548.1	2.6%		0.0%	-1,548.1	-100.0%	-2.6%	1,548.1
Annual Grassland (AGS)	19,515.4	32.3%	33,529.1	55.6%	14,013.8	71.8%	23.2%	14,013.8
Barren (BAR)		0.0%	260.2	0.4%	260.2	0.0%	0.4%	260.2
Blue Oak–Foothill Pine (BOP)	10,174.6	16.9%	44.6	0.1%	-10,130.1	-99.6%	-16.8%	10,130.1
Blue Oak Woodland (BOW)	22,990.1	38.1%	20,330.9	33.7%	-2,659.2	-11.6%	-4.4%	2,659.2
Chamise-Redshank Chaparral (CRC)	1,021.1	1.7%	698.7	1.2%	-322.5	-31.6%	-0.5%	322.5
Cropland (CRP)		0.0%	797.1	1.3%	797.1	0.0%	1.3%	797.1
Douglas Fir (DFR)	389.1	0.6%		0.0%	-389.1	-100.0%	-0.6%	389.1
Lacustrine (LAC)	637.1	1.1%		0.0%	-637.1	-100.0%	-1.1%	637.1
Mixed Chaparral (MCH)	1,262.6	2.1%	696.8	1.2%	-565.8	-44.8%	-0.9%	565.8
Montane Chaparral (MCP)	168.4	0.3%		0.0%	-168.4	-100.0%	-0.3%	168.4
Montane Hardwood-Conifer (MHC)	325.8	0.5%	317.3	0.5%	-8.5	-2.6%	0.0%	8.5
Montane Hardwood (MHW)	2,030.1	3.4%	1,009.8	1.7%	-1,020.3	-50.3%	-1.7%	1,020.3
Montane Riparian (MRI)	208.4	0.3%	50.1	0.1%	-158.2	-76.0%	-0.3%	158.2
Unknown (XXX)	1.8	0.0%		0.0%	-1.8	-100.0%	0.0%	1.8
Urban (URB)	36.3	0.1%	197.9	0.3%	161.6	445.5%	0.3%	161.6
Valley Oak Woodland (VOW)	14.7	0.0%	12.0	0.0%	-2.6	-17.9%	0.0%	2.6
Valley Foothill Riparian (VRI)	10.7	0.0%		0.0%	-10.7	-100.0%	0.0%	10.7
Water (WAT)		0.0%	2,314.3	3.8%	2,314.3	0.0%	3.8%	2,314.3
Wet Meadow (WTM)		0.0%	3.7	0.0%	3.7	0.0%	0.0%	3.7
Total	**60,334.1**	100.0%	**60,262.4**	100.0%				**17,586.5**
VTM 79 c	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Agricultural (AGR)	26.3	0.6%		0.0%	-26.3	-100.0%	-0.6%	26.3
Annual Grassland (AGS)	3,137.4	70.4%	3,589.4	80.6%	452.0	14.4%	10.1%	452.0
Blue Oak Woodland (BOW)	1,292.0	29.0%	836.8	18.8%	-455.2	-35.2%	-10.2%	455.2

VTM 79 c	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	Area (ha)	of Total Area	Area (ha)	of Total Area	or (Lost) (ha)	Gained or (Lost)	Gained or (Lost)	Turnover
Cropland (CRP)		0.0%	13.9	0.3%	13.9	0.0%	0.3%	13.9
Mixed Chaparral (MCH)		0.0%	10.4	0.2%	10.4	0.0%	0.2%	10.4
Montane Hardwood (MHW)		0.0%	5.3	0.1%	5.3	0.0%	0.1%	5.3
Unknown (XXX)	0.0	0.0%		0.0%	0.0	-100.0%	0.0%	0.0
Total	**4,455.8**	100.0%	**4,455.8**	100.0%			0.0%	**481.6**
VTM 79 d	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Annual Grassland (AGS)	15.5	100.0%	15.5	100.0%	0.0	0.0%	0.0%	0.0
Total	**15.5**	**12.0%**	**15.5**	**100.0%**				**0.0**
VTM 79 f	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Agricultural (AGR)	79.9	9.3%		0.0%	-79.9	-100.0%	-9.3%	79.9
Annual Grassland (AGS)	779.5	90.7%	734.2	85.4%	-45.3	-5.8%	-5.3%	45.3
Blue Oak Woodland (BOW)		0.0%	3.7	0.4%	3.7	0.0%	0.4%	3.7
Cropland (CRP)		0.0%	102.6	11.9%	102.6	0.0%	11.9%	102.6
Mixed Chaparral (MCH)		0.0%	9.1	1.1%	9.1	0.0%	1.1%	9.1
Montane Hardwood (MHW)		0.0%	9.8	1.1%	9.8	0.0%	1.1%	9.8
Total	**859.4**	100.0%	**859.4**	100.0%				**125.2**
VTM 79 i	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Agricultural (AGR)	391.4	10.5%		0.0%	-391.4	-100.0%	-10.5%	391.4
Annual Grassland (AGS)	2,283.4	61.4%	3,422.9	92.1%	1,139.5	49.9%	30.7%	1,139.5
Barren (BAR)	25.5	0.7%	4.0	0.1%	-21.5	-84.4%	-0.6%	21.5
Blue Oak Woodland (BOW)	991.7	26.7%	188.5	5.1%	-803.3	-81.0%	-21.6%	803.3
Cropland (CRP)		0.0%	46.1	1.2%	46.1	0.0%	1.2%	46.1
Lacustrine (LAC)	9.1	0.2%		0.0%	-9.1	-100.0%	-0.2%	9.1
Mixed Chaparral (MCH)		0.0%	1.1	0.0%	1.1	0.0%	0.0%	1.1
Montane Hardwood-Conifer (MHC)		0.0%	11.5	0.3%	11.5	0.0%	0.3%	11.5

VTM 79 i	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Montane Hardwood (MHW)		0.0%	43.1	1.2%	43.1	0.0%	1.2%	43.1
Montane Riparian (MRI)	5.6	0.2%		0.0%	-5.6	-100.0%	-0.2%	5.6
Unknown (XXX)	0.0	0.0%		0.0%	0.0	-100.0%	0.0%	0.0
Valley Foothill Riparian (VRI)	10.4	0.3%		0.0%	-10.4	-100.0%	-0.3%	10.4
Total	**3,717.1**	100.0%	**3,717.1**	100.0%				**1,241.2**
VTM 79 p	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Agricultural (AGR)	855.4	77.7%		0.0%	-855.4	-100.0%	-77.7%	855.4
Annual Grassland (AGS)	241.7	22.0%	1,070.1	97.2%	828.5	342.8%	75.3%	828.5
Blue Oak Woodland (BOW)	3.7	0.3%	4.9	0.4%	1.2	30.8%	0.1%	1.2
Cropland (CRP)		0.0%	18.0	1.6%	18.0	0.0%	1.6%	18.0
Mixed Chaparral (MCH)		0.0%	6.3	0.6%	6.3	0.0%	0.6%	6.3
Montane Hardwood (MHW)		0.0%	1.4	0.1%	1.4	0.0%	0.1%	1.4
Unknown (XXX)	0.0	0.0%		0.0%	0.0	-100.0%	0.0%	0.0
Total	**1,100.8**	100.0%	**1,100.8**	100.0%				**855.4**
VTM 88 A	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Agricultural (AGR)	522.4	1.0%		0.0%	-522.4	-100.0%	-1.0%	522.4
Annual Grassland (AGS)	29,433.9	54.5%	34,361.9	63.7%	4,928.0	16.7%	9.1%	4,928.0
Barren (BAR)		0.0%	34.4	0.1%	34.4	0.0%	0.1%	34.4
Blue Oak–Foothill Pine (BOP)	6,458.0	12.0%	233.0	0.4%	-6,225.1	-96.4%	-11.5%	6,225.1
Blue Oak Woodland (BOW)	14,325.8	26.5%	15,338.7	28.4%	1,012.9	7.1%	1.9%	1,012.9
Chamise-Redshank Chaparral (CRC)	832.6	1.5%	760.3	1.4%	-72.3	-8.7%	-0.1%	72.3
Cropland (CRP)		0.0%	2.6	0.0%	2.6	0.0%	0.0%	2.6
Douglas Fir (DFR)	672.6	1.2%		0.0%	-672.6	-100.0%	-1.2%	672.6
Lacustrine (LAC)	2.0	0.0%		0.0%	-2.0	-100.0%	0.0%	
Mixed Chaparral (MCH)	205.9	0.4%	1.0	0.0%	-204.9	-99.5%	-0.4%	204.9

VTM 88 A	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Montane Chaparral (MCP)	58.1	0.1%		0.0%	-58.1	-100.0%	-0.1%	58.1
Montane Hardwood-Conifer (MHC)	56.7	0.1%	164.3	0.3%	107.6	189.8%	0.2%	107.6
Montane Hardwood (MHW)	1,331.9	2.5%	2,893.3	5.4%	1,561.4	117.2%	2.9%	1,561.4
Montane Riparian (MRI)	46.4	0.1%	161.3	0.3%	114.9	247.4%	0.2%	114.9
Urban (URB)		0.0%	5.1	0.0%	5.1	0.0%	0.0%	5.1
Valley Foothill Riparian (VRI)	34.3	0.1%		0.0%	-34.3	-100.0%	-0.1%	34.3
Water (WAT)		0.0%	24.7	0.0%	24.7	0.0%	0.0%	24.7
Total	**53,980.5**	100.0%	**53,980.5**	100.0%				**7,790.6**
VTM 88 c	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Annual Grassland (AGS)	2,030.4	87.9%	2,255.9	97.7%	225.5	11.1%	9.8%	225.5
Barren (BAR)	48.1	2.1%	1.3	0.1%	-46.7	-97.2%	-2.0%	46.7
Blue Oak–Foothill Pine (BOP)	216.9	9.4%		0.0%	-216.9	-100.0%	-9.4%	216.9
Blue Oak Woodland (BOW)	7.9	0.3%	51.5	2.2%	43.7	554.3%	1.9%	43.7
Montane Hardwood (MHW)	5.5	0.2%		0.0%	-5.5	-100.0%	-0.2%	5.5
Montane Riparian (MRI)	0.0	0.0%		0.0%	0.0	-100.0%	0.0%	0.0
Unknown (XXX)		0.0%	0.0	0.0%	0.0	0.0%	0.0%	0.0
Total	**2,308.8**	100.0%	**2,308.8**	100.0%				**269.1**
VTM 88 i	**VTM**	**VTM Percent**	**CalVeg**	**CalVeg Percent**	**Area Gained**	**Percent of Type**	**Percent of Map**	**Total**
WHR Type	**Area (ha)**	**of Total Area**	**Area (ha)**	**of Total Area**	**or (Lost) (ha)**	**Gained or (Lost)**	**Gained or (Lost)**	**Turnover**
Annual Grassland (AGS)	383.6	88.2%	431.0	99.0%	47.3	12.3%	10.9%	47.3
Blue Oak Woodland (BOW)	51.5	11.8%	4.2	1.0%	-47.3	-91.9%	-10.9%	47.3
Unknown (XXX)	0.0	0.0%		0.0%	0.0	-100.0%	0.0%	0.0
Total	**435.1**	100.0%	**435.1**	100.0%				**47.3**

VTM 88 j	VTM	VTM Percent	CalVeg	CalVeg Percent	Area Gained	Percent of Type	Percent of Map	Total
WHR Type	Area (ha)	of Total Area	Area (ha)	of Total Area	or (Lost) (ha)	Gained or (Lost)	Gained or (Lost)	Turnover
Annual Grassland (AGS)	222.7	100.0%	222.7	100.0%	0.0	0.0%	0.0%	0.0
Unknown (XXX)	0.0	0.0%		0.0%	0.0	-100.0%	0.0%	0.0
Total	**222.7**		**222.7**					**0.0**

Table A-5. Minimum monthly temperature regressions for the four stations used in the study

Tahoe	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Rate	0.052	0.044	0.045	0.034	0.036	0.056	0.053	0.059	0.045	0.039	0.038	0.032	0.044
RSquare	0.821	0.870	0.765	0.731	0.819	0.907	0.947	0.872	0.954	0.908	0.913	0.598	0.962
RSquare Adj	0.819	0.869	0.763	0.728	0.817	0.906	0.947	0.871	0.954	0.907	0.912	0.594	0.962
Root Mean Square Error	0.611	0.422	0.621	0.519	0.423	0.450	0.316	0.569	0.248	0.311	0.295	0.666	0.220
Mean of Response	-8.271	-7.456	-6.188	-3.984	-0.739	1.907	4.990	4.646	2.541	-1.140	-4.496	-6.993	-2.098
Observations (or Sum Wgts)	86.000	86.000	86.000	86.000	86.000	86.000	86.000	86.000	86.000	86.000	86.000	86.000	86.000

Yosemite Valley	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Rate	0.034	0.025	0.043	0.037	0.043	0.053	0.051	0.063	0.062	0.050	0.029	0.023	0.041
RSquare	0.729	0.600	0.852	0.701	0.828	0.823	0.864	0.837	0.904	0.886	0.639	0.339	0.882
RSquare Adj	0.726	0.596	0.850	0.698	0.826	0.821	0.862	0.836	0.903	0.885	0.635	0.332	0.881
Root Mean Square Error	0.593	0.583	0.522	0.693	0.566	0.705	0.586	0.783	0.584	0.521	0.640	0.920	0.436
Mean of Response	-3.167	-1.696	-0.822	1.812	5.024	8.544	11.733	10.744	7.777	3.529	-0.709	-2.824	3.312
Observations (or Sum Wgts)	99.000	98.000	99.000	99.000	99.000	99.000	99.000	97.000	99.000	99.000	99.000	99.000	99.000

Placerville web	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Rate	0.056	0.067	0.080	0.063	0.098	0.125	0.109	0.142	0.125	0.109	0.058	0.041	0.107
RSquare	0.650	0.849	0.900	0.645	0.813	0.706	0.617	0.671	0.644	0.744	0.714	0.674	0.833
RSquare Adj	0.644	0.846	0.898	0.639	0.810	0.701	0.610	0.665	0.637	0.739	0.709	0.668	0.830
Root Mean Square Error	0.687	0.474	0.447	0.788	0.784	1.353	1.442	1.667	1.561	1.070	0.614	0.481	0.805
Mean of Response	-0.067	1.303	2.595	4.178	7.023	9.829	11.888	11.801	9.707	6.206	2.538	0.274	5.575
Observations (or Sum Wgts)	57.000	57.000	57.000	57.000	57.000	57.000	57.000	57.000	57.000	57.000	57.000	57.000	57.000

Sacramento	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Rate	0.012	0.011	0.006	0.007	0.015	0.016	0.019	0.021	0.021	0.020	0.016	0.007	0.013
RSquare	0.302	0.318	0.080	0.186	0.454	0.627	0.757	0.669	0.785	0.795	0.560	0.159	0.563
RSquare Adj	0.296	0.313	0.072	0.179	0.449	0.623	0.755	0.666	0.784	0.794	0.556	0.152	0.563
Root Mean Square Error	0.632	0.557	0.656	0.468	0.547	0.426	0.373	0.503	0.377	0.342	0.474	0.530	0.382
Mean of Response	4.184	6.172	7.532	9.066	11.278	13.689	14.988	14.692	13.847	10.953	6.959	4.365	9.785
Observations (or Sum Wgts)	118	117	118	118	118	118	118	116	118	118	118	118	118