Meeting Date: 02/25/25
Staff: D. Schwab
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Staff Report 58 (Informational)

SUMMARY

California is experiencing increased wildfire risk and frequency due to climate change. The State's forested lands and the communities near them are highly vulnerable to wildfires. The California State Lands Commission manages approximately 458,843 acres of school lands for the benefit of the California State Teacher's Retirement System (CalSTRS). Approximately 55,000 acres of these school lands are forested, although the exact forested acreage is undetermined. In alignment with the State's prioritization to manage forested lands to improve wildfire resiliency and forest health, the Commission has invested in building staff capacity and funding to assess the Commission's forested parcels and initiate responsible forest management strategies.

As part of this effort, staff have developed the School Lands Forest Information System (SLFIS), a web-based tool that uses publicly available data to provide information about forest attributes of school lands parcels to better inform forest management decisions. The development of this tool represents Phase 1 of a larger process to build a forest inventory and establish desired future conditions for forested school lands. The SLFIS provides a platform to collect, store, and query information about school lands parcels and enables staff to conduct an initial assessment of forest composition, health, and wildlife habitat; identify areas for rehabilitation, fuels treatment, and timber production; and prioritize parcels for site visits to collect data about field conditions and characteristics.

This report highlights five important ways the SLFIS can be applied to inform staff's forest management decisions:

- Property-wide assessments
- Evaluating sets of parcels or management units
- Identifying potential agency partnerships
- Assessing priority areas for fuel reduction
- Developing a neighbor contact database

This report concludes with recommendations to guide resource prioritization as the Commission continues its forest management efforts and implements strategies to improve the resilience and health of its forested parcels. These recommendations describe the next steps for Phase 2 data collection and forest inventory development, prioritization and parcel management, and improved coordination and resource management.

EXHIBIT:

A. The School Lands Forest Information System: Phase 1 Report and Recommendations

Exhibit A

THE SCHOOL LANDS FOREST INFORMATION SYSTEM

PHASE 1 REPORT AND RECOMMENDATIONS

Prepared: February 2025

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Executive Summary

As California experiences increased wildfire risk and frequency due to climate change, the State's forested lands and nearby communities are highly vulnerable. The California State Lands Commission (Commission) manages approximately 458,843 acres of fee-owned school lands for the benefit of the California State Teacher's Retirement System (CalSTRS). Approximately 55,000 acres of these school lands are forested, although the exact forested acreage is undetermined. In alignment with the State's prioritization to manage forested lands to improve wildfire resiliency and forest health, the Commission has invested in building staff capacity and funding to assess the Commission's forested parcels and initiate responsible forest management strategies.

As part of this effort, Commission staff have developed the School Lands Forest Information System (SLFIS), a web-based tool that uses publicly available data to provide information about forest attributes of school lands parcels to better inform forest management decisions. The development of this tool represents Phase 1 of a larger process to build a Forest Inventory and establish desired future conditions for forested school lands. The SLFIS provides a platform to collect, store, and query information about school lands parcels and enables staff to conduct an initial assessment of forest composition, health, and wildlife habitat; identify areas for rehabilitation, fuels treatment, and timber production; and prioritize parcels for site visits to collect data about field conditions and characteristics.

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This report concludes with recommendations to guide prioritization of resources as the Commission continues to develop its forest management efforts and implement strategies to improve the resilience and health of its forested parcels. These staff recommendations include the next steps for phase 2 data collection and forest inventory development, prioritization and parcel management, and for improved coordination and resource management.

1.0 Introduction

1.1 Purpose

The purpose of this report is to describe the development of the School Lands Forest Information System (SLFIS), highlight its uses and applications, and provide recommendations for the next steps. The SLFIS is a web-based Geographic Information System (GIS) application that uses publicly available data to provide information regarding various forest attributes of School lands parcels. The SLFIS can be used to look up information regarding forested school lands and can inform forest management decisions. The most important dataset included in the SLFIS is the TreeMap dataset, published by the U.S. Department of Agriculture (USDA) Forest Service.

The SLFIS establishes a benchmark for assessing the condition of school lands' forests and is the first step (phase 1) in collecting, storing, and querying information about forested school lands parcels. Potential uses of the SLFIS include assessing wildlife habitat; identifying areas for rehabilitation, fuels treatment, or timber production; and prioritizing parcels for a forest inventory. A forest inventory involves the collection of information about a forested area's characteristics and conditions that can inform effective management actions. Developing the SLFIS marks the completion of phase 1 in the effort to build an inventory of the Commission's forested school lands. Another purpose of this report is to identify next steps and make recommendations for further refining the SLFIS and implementing phase 2 of the school lands forest inventory.

1.2 Background

The Commission manages approximately 458,843 acres of fee-owned school lands for the benefit of CalSTRS. The United States granted school lands to California in 1853 to benefit public education. Generally, they included the 16th and 36th sections of every township. Approximately 55,000 acres of school lands are forested, although the exact forested acreage is undetermined.

The Commission traditionally had a forestry program, but by the late 1990s most of the forestry staff at the Commission had retired and their positions were eliminated due to budget cuts. In 2018, the Commission participated in the Forest Climate Action Team and in the development of the California Forest Carbon Plan. The Forest Carbon Plan determined that forests are an important carbon sink and should be managed to promote carbon sequestration, and that forests needed to become more resilient to mitigate the effects of climate change. The Forest Carbon Plan recommended that agencies identify and fund staff or contractors to support implementation of the plan and support its collaborative efforts. In alignment with this recommendation and to revitalize

active management of forested school lands, the Commission created and recruited for a forester position. The position was filled in September 2022.

The SLFIS was developed to help the Commission advance the goals in the Forest Carbon Plan, adhere to the requirements of the Public Resources Code, and support the Commission's 2021-2025 Strategic Plan. The Forest Carbon Plan provides strategies for California's forests to become healthier, more resilient, and more reliable long-term greenhouse gas sinks, rather than greenhouse gas emission sources. Public Resources Code sections 8700 through 8723 require school lands to be proactively managed to provide an economic base in support of public schools and to ensure that school lands are a permanent and productive resource base. The Commission's Strategic Plan identifies the rising frequency and intensity of wildfires as a threat to the state's forested school lands and directs staff to identify and evaluate opportunities for carbon sequestration and implement strategies on Public Trust lands and school lands to enhance resilience to climate change impacts and protect wildlife habitat. Given the absence of any forestry staff employed by the Commission for at least 20 years, there is a need to assess the current status of forested school lands.

2.0 Methodology

Three important criteria were considered when developing the SLFIS, including: 1) the software for the SLFIS must support spatial data, such as data used in a GIS; 2) the SLFIS must be assembled without additional funding or staff augmentation; and 3) the datasets included in the SLFIS must be available for Commission staff to use, with no restrictions.

The Commission uses ESRI GIS software to display and analyze spatial data across Commission-managed lands. Due to the Commission's in-house expertise and familiarity with the software, this ESRI GIS was used to develop the SLFIS. The SLFIS was created on the Commission's internal web-based GIS platform, known as Atlas, by the Commission's GIS team. Atlas allows staff to quickly understand spatial relationships and perform analyses without the need for specialized desktop software and extensive training.

For a better and more efficient user experience, the SLFIS integrates several tools from the ESRI platform: the Experience Builder, the Web AppBuilder, and Survey123. These tools allow a user to conduct specific queries and analyses, while also enabling them to generate reports and create visualizations of the data.

The data inputs for the SLFIS come from federal and state agencies that publish GIS data about forested lands that are free of charge and available for public use without restrictions. Agencies such as CAL FIRE, the California Department of Fish and Wildlife, and the U.S. Department of Agriculture (USDA) Forest Service

provide data about vegetation types, quantifiable forest metrics, wildlife habitat, roads systems, watercourses, and fire perimeters. The full list of datasets and their sources is included in the Appendix.

An important dataset included in the SLFIS is the USDA Forest Service's 2016 TreeMap. The TreeMap dataset was developed to help assess wildfire risks and forest carbon dynamics, but it is also useful for other forest management purposes. The TreeMap dataset provides quantitative forest attributes for forest vegetation types across the United States at a 30-meter by 30-meter resolution. Data such as live and dead trees per acre, basal area per acre, board foot volume per acre, and carbon tons per acre are included in TreeMap (a description of these data types is provided in the Glossary at the end of this report).

The TreeMap 2016 dataset was created using a technique known as imputation. The imputation for TreeMap 2016 involves taking a dataset of 30-meter by 30-meter resolution created using remote sensing that is available across the continental United States (known as the LANDIFRE dataset), in combination with forest inventory data collected in the field at specific points throughout the U.S. (as part of the USDA Forest Service's Forest Inventory & Analysis Program), to predict forest attributes in similarly sized plots (30-meter by 30-meter) in forested areas anywhere in the continental United States. The imputation technique is advantageous in areas where field data are lacking.

3.0 Functionality

The SLFIS provides a variety of interactive elements and tools that help the user explore data and produce reports. Summaries of the underlying data can be interactively explored on an overview page, with more in-depth querying and reporting available on a screening page.

The overview page of the SLFIS provides the user with the ability to select school lands parcels through a map or list interface. Once the user selects the parcels they are interested in viewing, they can review the top forest types and their acreages across the selected parcels. The SLFIS also produces parcel-wide statistics on forest stand structure, including mean basal area per acre, mean live trees per acre, mean volume (live sawlog board feet per acre), mean live aboveground carbon per acre, mean standing dead carbon per acre, and mean down dead carbon per acre (see the Glossary for definitions). Users can generate customizable reports as needed. These data can be used to answer forest management questions and establish desired future conditions. The Results and Analysis section of this report highlights examples of the SLFIS application in forest management planning.

In addition to conducting forest health and management analyses, the SLFIS can be used to identify communities and their distance from selected parcels. ESRI's Survey123 also enables Commission staff to gather information from and store communications with adjacent property owners. These tools help provide critical information that can assess accessibility to parcels and evaluate community wildfire risk.

4.0 Results and Analysis

The SLFIS has many forest management applications. The SLFIS can provide general overview statistics of all forested school lands, groups of parcels, or specific parcels. At these different scales, potential uses include assessing areas for timber production, fuel reduction, carbon sequestration, and wildlife habitat. The SLFIS can also evaluate parcels that have been identified by other agencies, such as CAL FIRE, as priorities for fuels treatment and assist in identifying priority parcels for a field inventory.

This section evaluates five main applications of the SLFIS:

- Property-wide assessments
- Evaluating sets of parcels or management units
- Identifying potential agency partnerships
- Assessing priority areas for fuel reduction
- Developing a neighbor contact database

This section concludes with a discussion of the limitations of the SLFIS.

4.1 Property-wide assessments

Per the 2016 TreeMap data, 429 school lands parcels contain 34,313 acres of forest. After removing 133 parcels that contained less than 10 acres of forested land (and are therefore considered only partially forested), a total of 33,962 acres of forest are estimated across 296 school lands parcels. This means that most Commission-managed forested school lands occur on 296 parcels.[1]

[1] It is possible that the 133 parcels that were excluded from this initial assessment due to having fewer than 10 forested acres are contiguous with forested lands not managed by the Commission. These smaller forested parcels might require further assessment in the future to determine potential management needs and whether coordination with adjacent landowners is necessary.

The five most common forest vegetation types on school lands parcels are California Mixed Conifer (7,808 acres), Canyon Live Oak (5,456 acres), California Black Oak (2,850 acres), Blue Oak (2,128 acres), and Pinyon / Juniper Woodland (2,708 acres) (**Figure 1**). Of those vegetation types, the California Mixed Conifer vegetation type has been the one traditionally managed for timber production from a forestry perspective. The "Other" category includes 13,012 acres of 62 various forest vegetation types as classified by TreeMap.

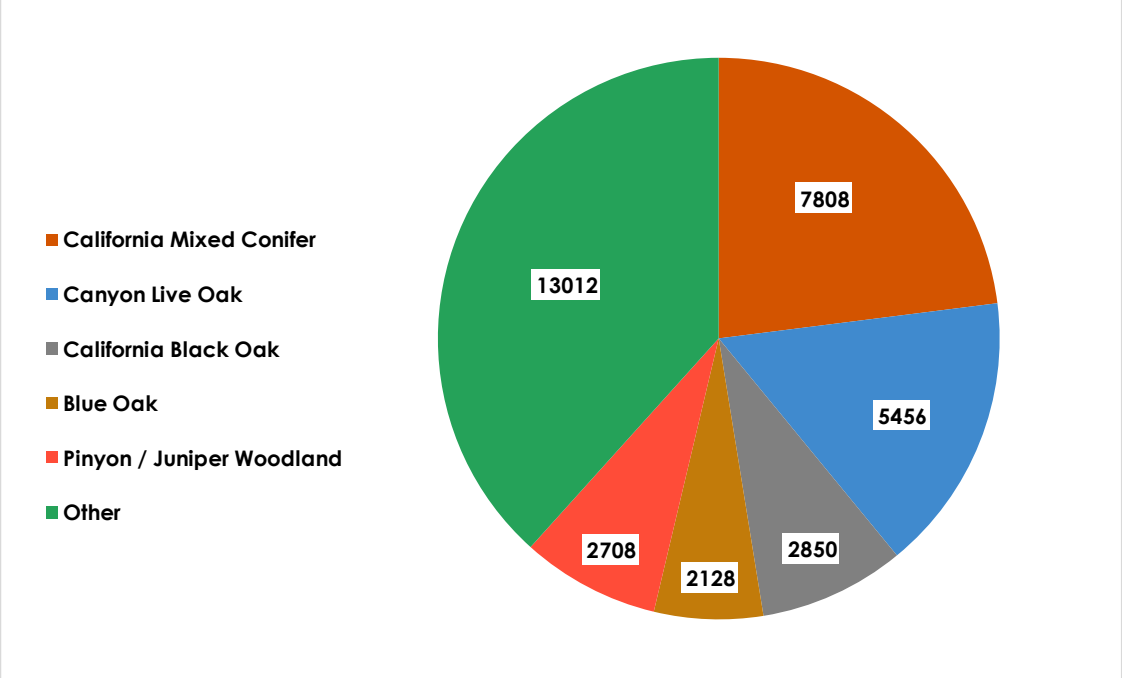


Figure 1: Acreage totals for the five most-common forest vegetation types on school lands (California Mixed Conifer, Canyon Live Oak, California Black Oak, Pinyon/Juniper Woodland, and Blue Oak) and an "Other" category that includes 62 less-common vegetation types.

Estimates of carbon contained in living, standing dead, and downed forest material are included with the TreeMap data and can be summed to estimate the total carbon per acre, and therefore total carbon sequestered across all forested school lands parcels. Tracking total carbon sequestered across all school lands can provide insight into how forested school lands are mitigating for the effects of climate change and can identify average rates of emission or sequestration on school lands over time. The 2016 TreeMap data estimates that school lands parcels contained 1,462,915 tons of carbon in forest vegetation types. This is likely an underestimate, since the TreeMap carbon data were incomplete in some areas, and areas with incomplete data were assumed to have zero carbon per acre.

If the TreeMap data is evaluated in areas where fires burned on school lands parcels between 2017 and 2024, an estimate can be made of the potential amount of carbon released from school lands during these fires. If it is assumed that fires completely consumed the forest vegetation on the parcel, it is estimated that a maximum of 178,054 tons of carbon may have been released due to fires on school lands since 2016.

The TreeMap data can also help determine the extent and location of wildlife habitat on school lands parcels, such as for the Northern Spotted Owl (NSO)[2]. The SLFIS indicates that up to 8,277 acres of NSO nesting/roosting habitat existed on school lands parcels in 2016. The TreeMap data helps provide initial insight into specific habitat characteristics across parcels, and staff may be able to incorporate more recent and detailed public data sets to further refine our understanding and prioritization.

4.2 Evaluating sets of parcels or management units

The SLFIS can be used to assess a group or aggregation of school lands parcels that are in geographic proximity to each other and indicate whether there is a potential for timber management based on past records. It is common in forestry to manage parcels in close proximity to each other as a management unit.

For example, a review of previous forest management files indicates that a forest management plan was written for an area known as the "High Peak Management Unit" in Mendocino County in the early 1980s. The High Peak Management Unit included multiple school lands parcels that were located near or adjacent to each other to form one management "Unit" (**Figure 2**). An overview of areas such as the High Peak Management Unit can be quickly created using the Report and Export function of the SLFIS.

When evaluating areas for potential timber management, forest metrics such as trees per acre, board-foot volume per acre, basal area per acre, and quadratic mean diameter are important characteristics to consider. These terms are

[2] Northern Spotted Owl (NSO) nesting/roosting habitat in the interior of its range is defined as a forest stand with 1) a basal area of at least 150 square feet per acre, 2) a Quadratic Mean Diameter (QMD) of at least 15 inches, 3) at least 8 trees per acre (TPA) that are at least 26 inches in diameter, and 4) a canopy closure of at least 60 percent.

defined in the glossary. These metrics provide information on the density and size of the trees making up the forest.

The boundaries of the High Peak Management Unit have changed since the 1980s due to land exchanges. The 34 parcels that currently make up the High Peak Management Unit average 19,827 board feet per acre and a basal area of 156 ft^2/acre, indicating that this area could have merchantable timber growing on it and be suitable for timber management. The High Peak Management Unit contains 1,133 acres of California Mixed Conifer forest and 357 acres of Douglas fir forest, forest types that are important timber producers in California. Given these characteristics, the High Peak Management Unit could provide a potential source of timber production and income for CalSTRS.

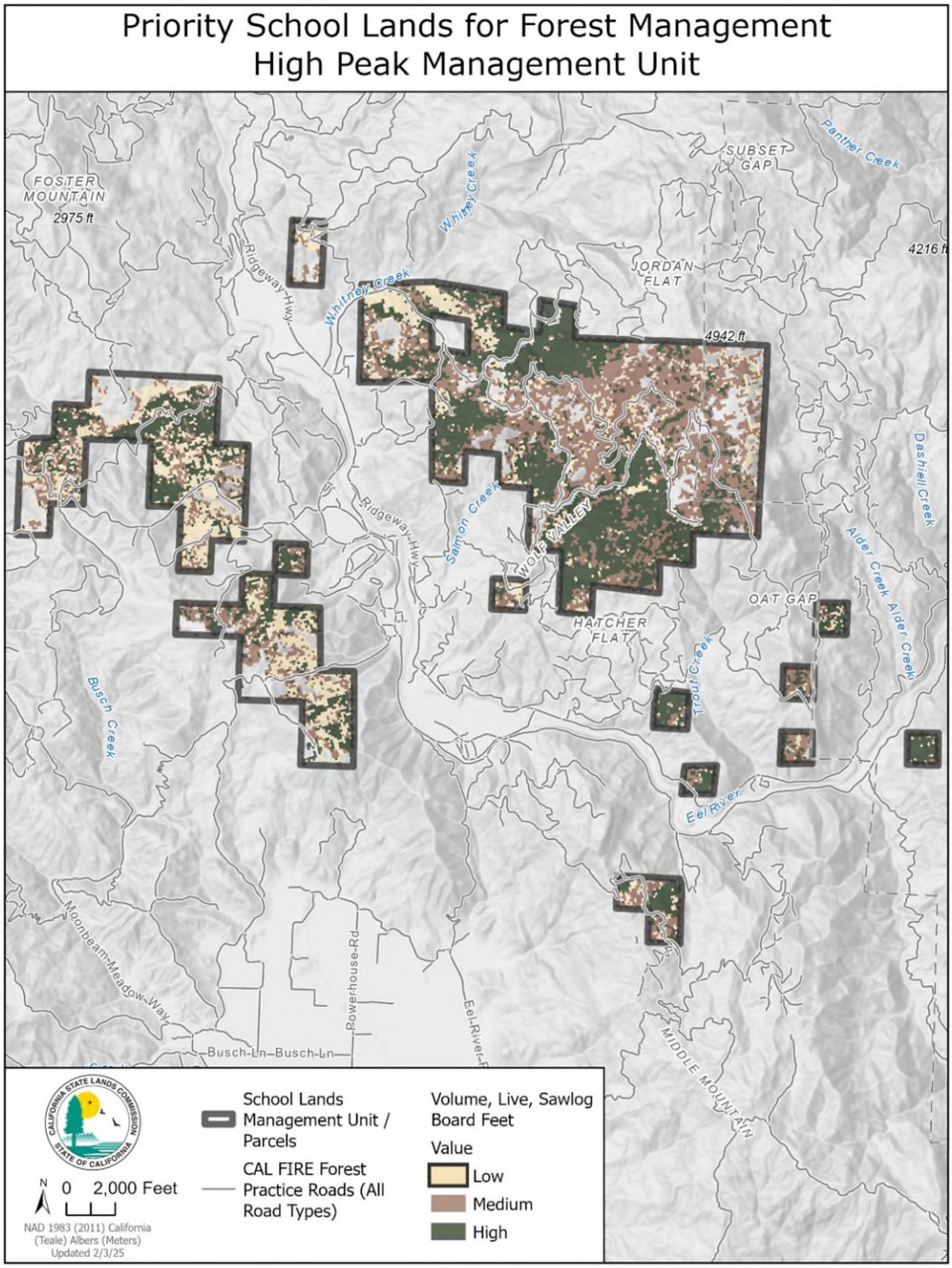


Figure 2: The High Peak Management Unit includes 34 parcels that currently average 19,827 board feet per acre and a basal area of 156 ft^2/acre.

There are other school lands parcels that are contiguous or near each other that could also be managed as units. Managing groups of parcels as units is practical logistically and from a landscape perspective, as parcels near each other could be accessed by the same road system and typically have similar ecological characteristics. Once management units have been established, forest characteristics taken from TreeMap can be evaluated at the management unit level to determine which management unit(s) should be prioritized for field data collection.

Staff conducted an analysis in ArcGIS Pro using geoprocessing tools to aggregate parcels within one mile of each other into two cohesive units. Staff then evaluated the TreeMap data at the management unit level. Considering that the Commission may wish to manage school lands forests for multiple objectives, TreeMap data that were evaluated in the management units included forested acreage, board-foot volume per acre, basal area per acre, and total live above-ground and down-dead carbon. Proximity to a community (as a measure of potential risk and vulnerability to communities from forest fires) and presence of roads (as a measure of accessibility) were also included as criteria in the prioritization. Based on these prioritization criteria, staff determined the top five forest management units to prioritize for a forest inventory and further evaluation (**Error! Reference source not found.**; **Table 1**; **Table 2**).

The proposed top five management units for prioritization are High Peak (**Figure 2**), Poonkinny (**Figure 4**), Salt Creek (**Figure 5**), Ham Pass (**Figure 6**), and Mineral (**Figure 7**) – each map of the management units reflects the estimated board-foot volume per acre derived from TreeMap. There are three volume classes: Low (0 – 4862 bd. Ft. /acre), Medium (4863 – 17464 bd. Ft. /acre), and High (>17464 bd ft. /acre). All five management units have high board foot per acre values distributed across them, which may indicate high timber production value. Each of these five management units (**Table 1**) had management plans prepared for them in the 1980s, indicating that forest management was planned in these areas in the past.

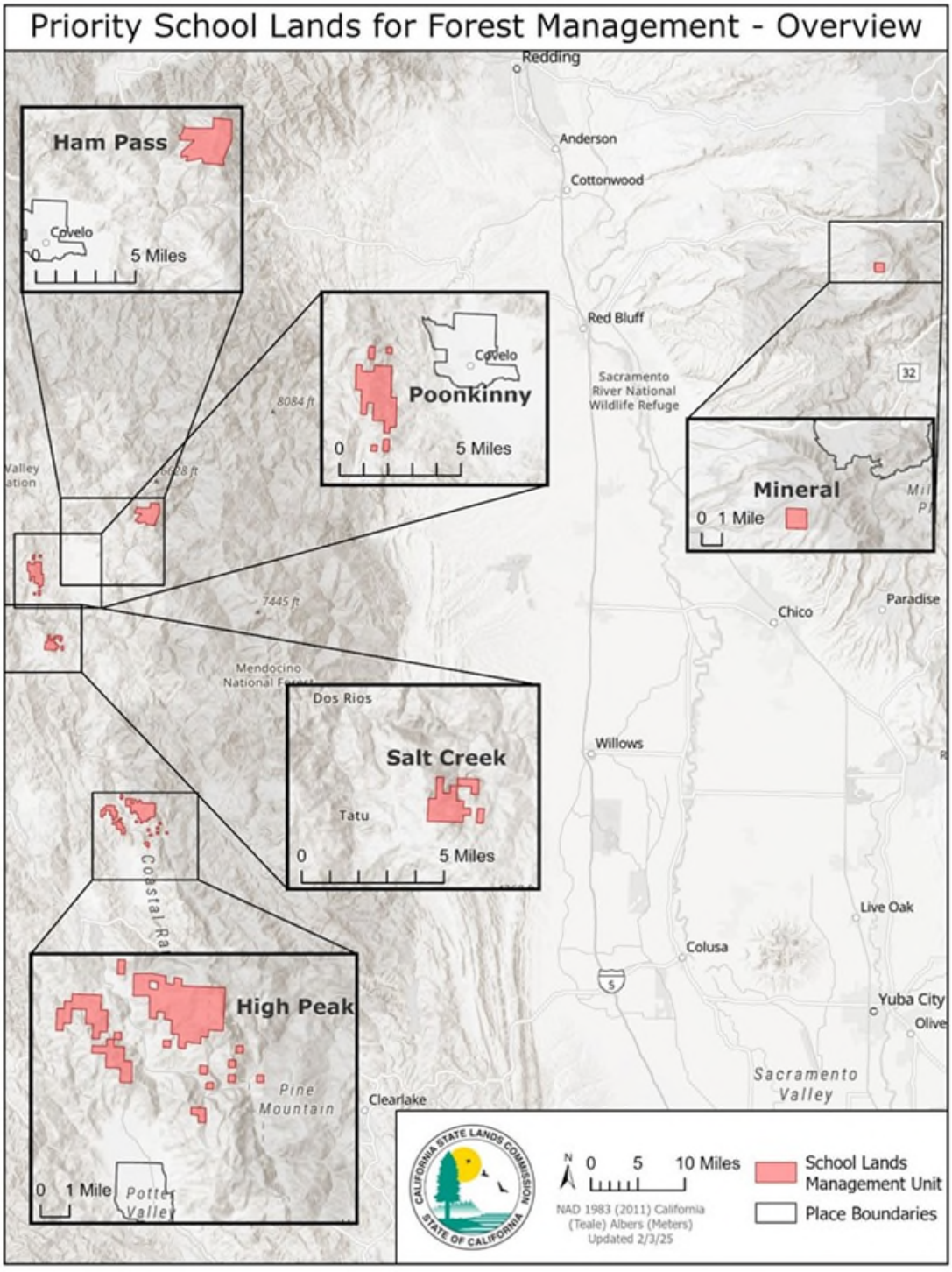


Figure 3: Locations of the top five management units proposed for prioritization

Table 1: The top five Forest Management Units to prioritize for a forest inventory and evaluation.

Management Unit	Number of School Land Parcels in Management Unit	Management Unit Acres	Acres of Forested Land	Volume (bd. Ft. / acre)	Basal Area (sq. ft. / acre)	Total Live Aboveground Carbon and Down Dead Carbon (tons)	Distance to Community (miles)
High Peak	34	5,052	4,359	19,827	156	237,965	1.89
Poonkinny	12	2,205	1,975	25,982	153	112,079	1.59
Salt Creek	7	1,146	1,057	31,699	173	73,045	7.09
Ham Pass	8	2,692	634	28,420	167	37,559	6.10
Mineral	1	623	622	38,118	227	40,202	2.43

Table 2: Road mileage for five Management Units

Management Unit	Permanent	Seasonal	Temporary	Total
High Peak	0.14	5.57	14.86	20.57
Ham Pass	2.87	3.21	3.66	9.75
Poonkinny	0.00	1.38	2.23	3.60
Salt Creek	0.00	2.51	1.08	3.59
Mineral	1.30	0.00	0.00	1.30

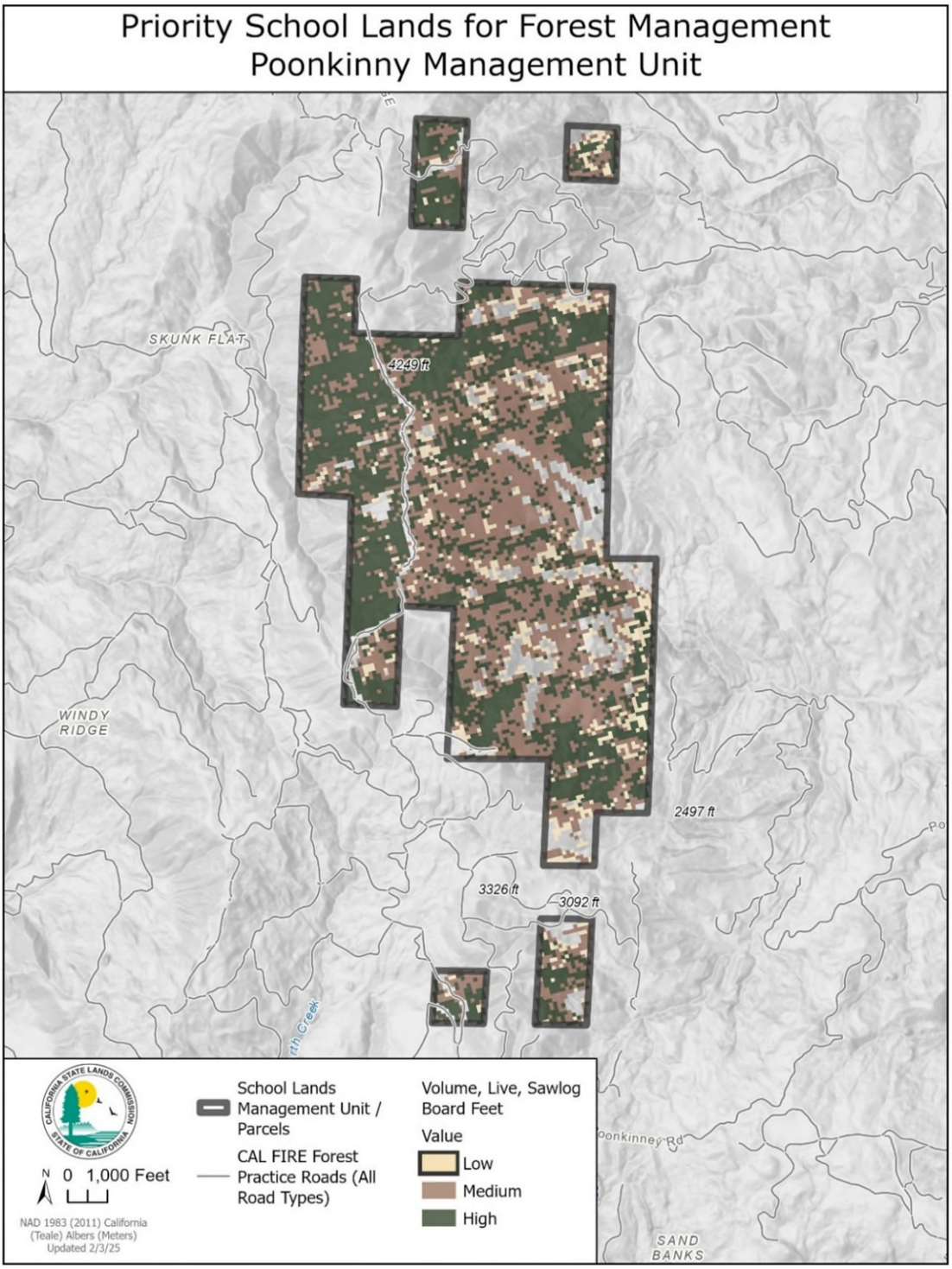


Figure 4: Poonkinny Management Unit

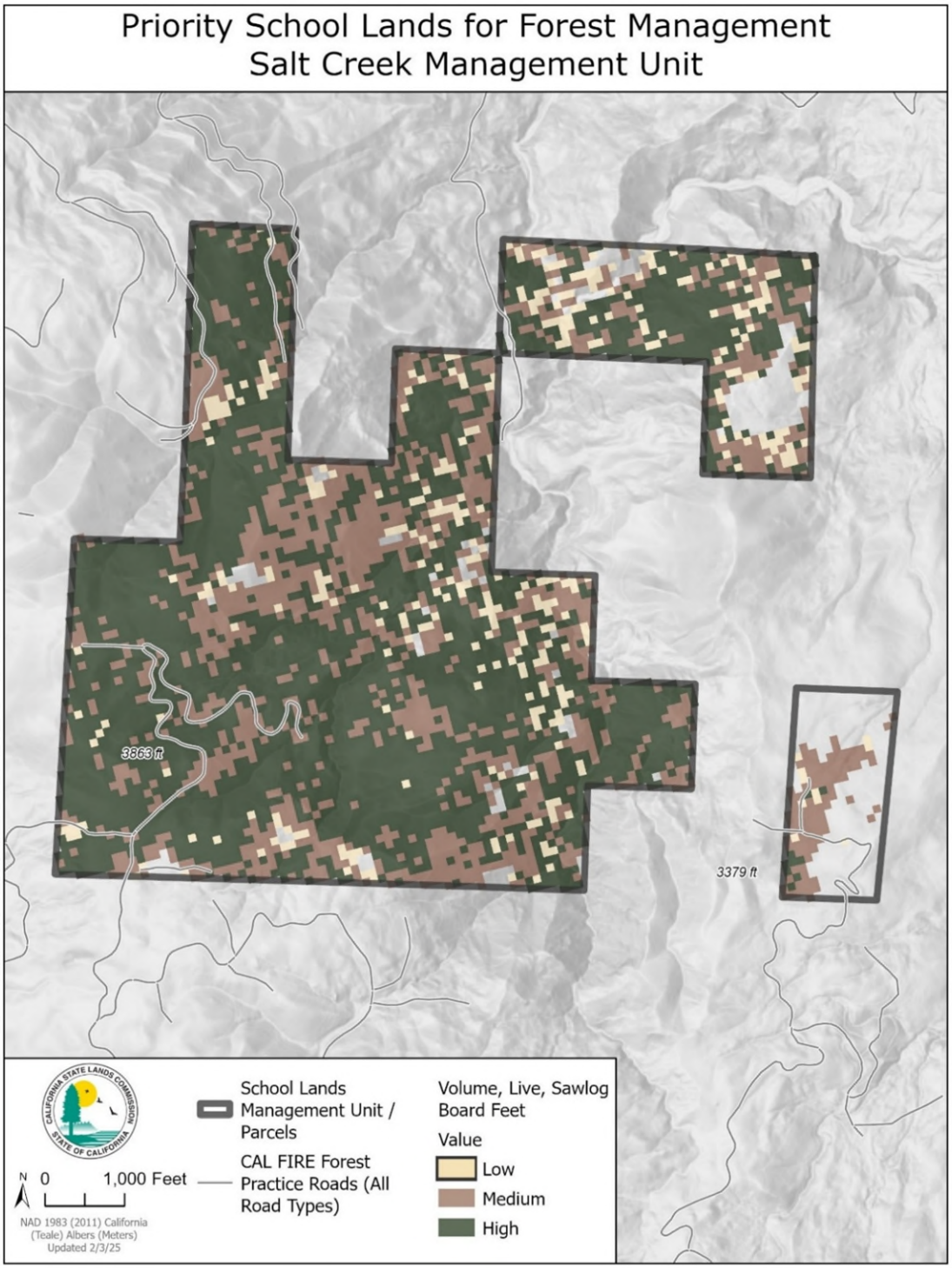


Figure 5: Salt Creek Management Unit

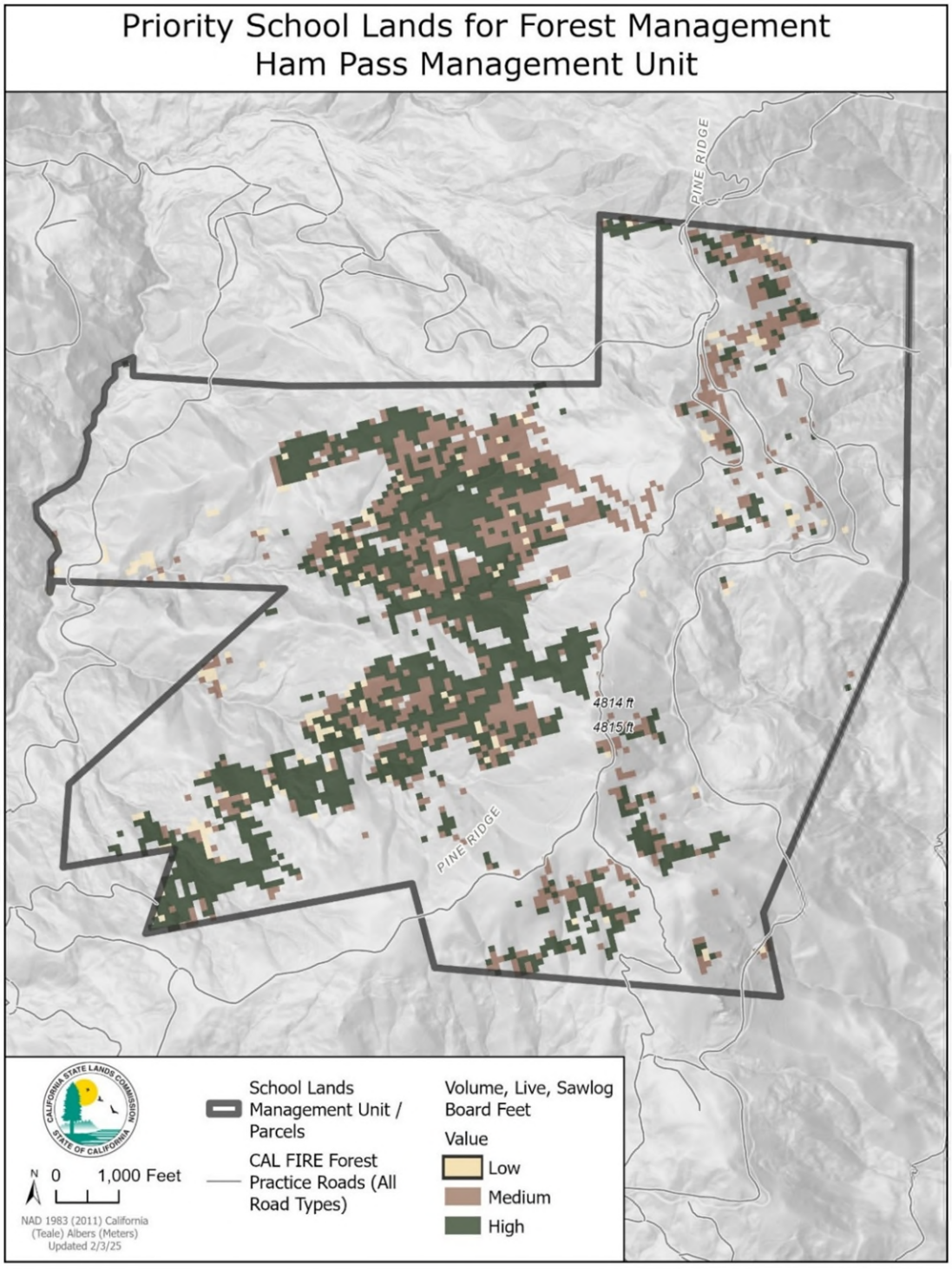


Figure 6: Ham Pass Management Unit

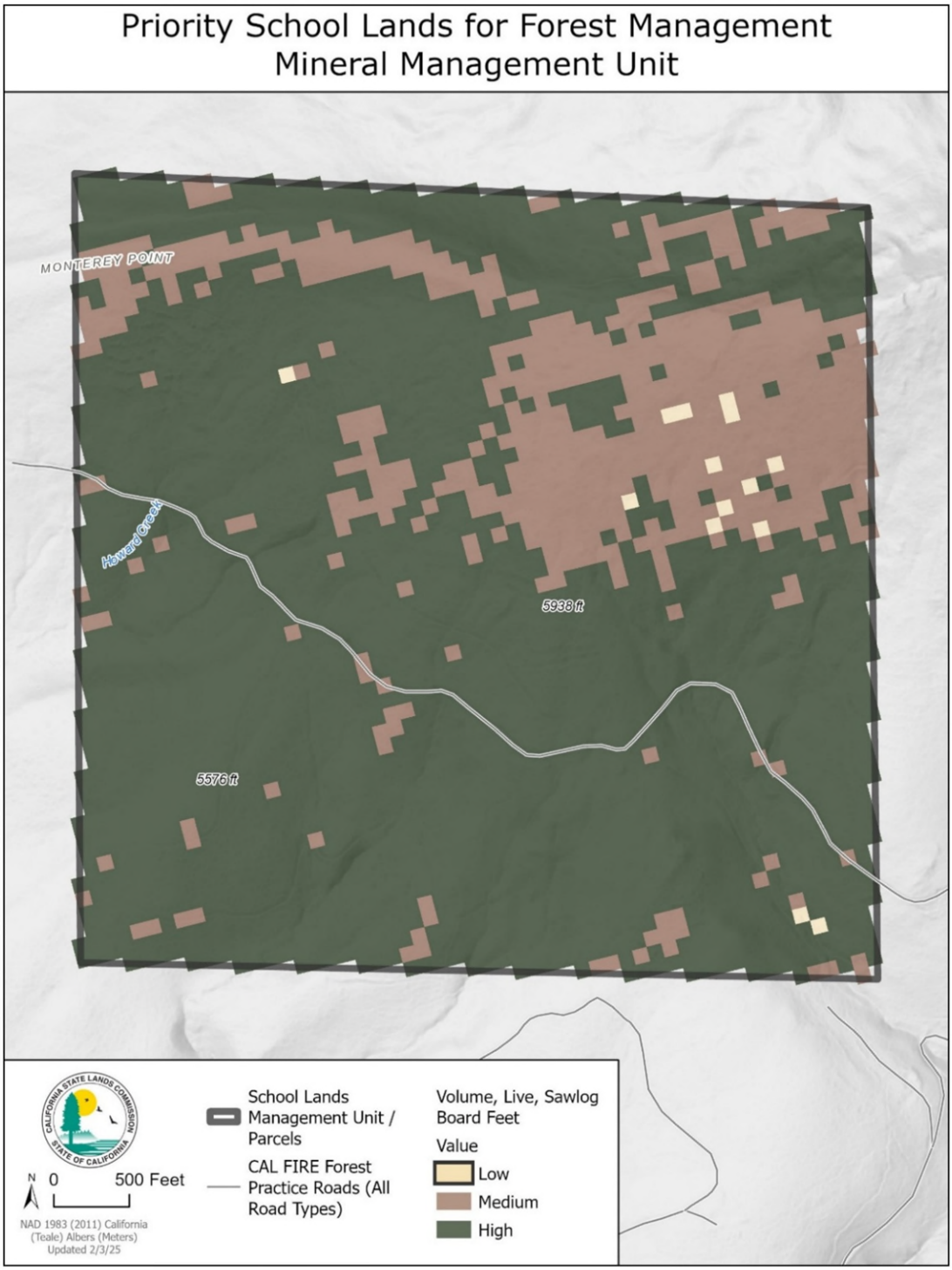


Figure 7: Mineral Management Unit

4.3 Evaluating Individual Parcels

The SLFIS can evaluate specific parcels. For example, staff used the SLFIS to determine that school lands Parcel 072-001 in Tehama County contains 622 forested acres, the most of any school lands parcel. The forested acres include Mixed Conifer (274 acres), White Fir (238 acres), Red Fir (48 acres), Grand Fir (31 acres), and Lodgepole Pine (23 acres) (**Figure 8**). The forested areas on Parcel 072-001 average a timber volume of 38,118 board feet per acre and a basal area of 227 square feet per acre, indicating that there may be a well-stocked timber stand present. Based on historical records in the Commission's forestry files, this parcel was known as the "Mineral" parcel and had a management plan written for it in the mid-1980s; the parcel is now referred to as the Mineral Management Unit. Parcel 072-001 has not been impacted by recent fires and appears to be a good parcel to target for timber management and production.

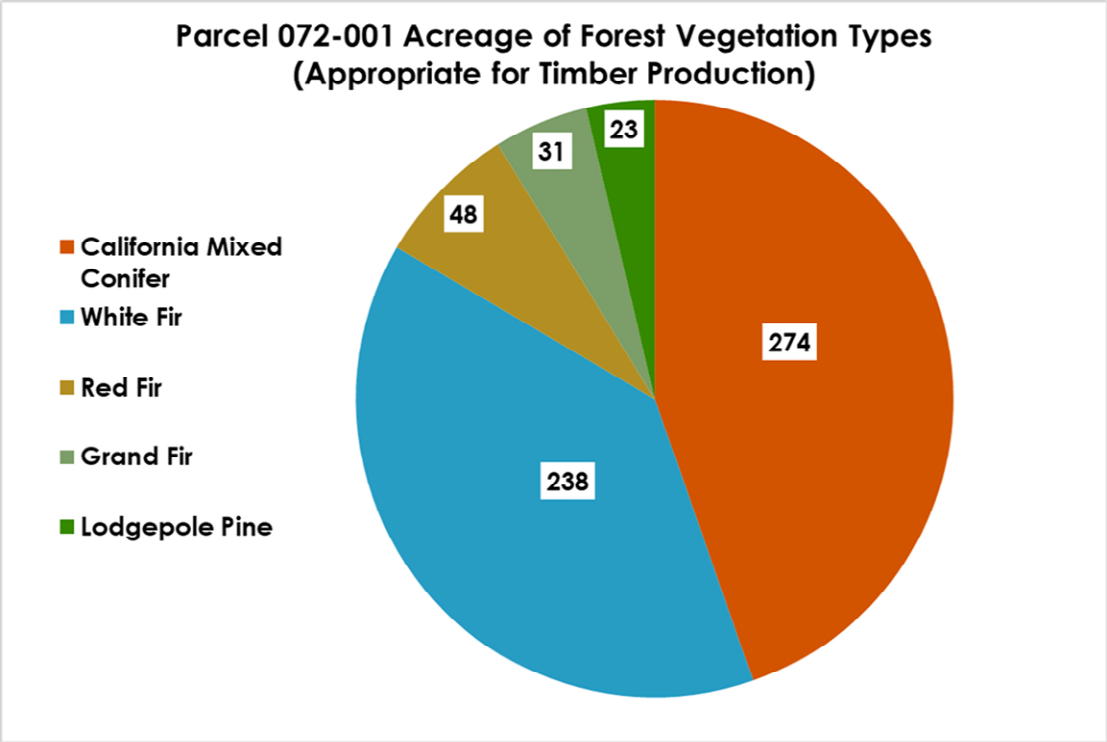


Figure 8: Estimated acreage totals across major vegetation types present in school lands Parcel 072-001

In comparison, the SLFIS indicates that Parcel 107-003 in Lake County has 558 acres of forested acres. The major vegetation types are Oregon White Oak (151 acres), California Black Oak (105 acres), Blue Oak (79 acres), Canyon Live Oak (69 acres), and California Laurel (41 acres) (**Figure 9**). Oaks provide an important source of food for wildlife through a phenomenon called Acorn masting, which occurs when an unusually large quantity of acorns drop to the forest floor. Oaks

also provide habitat for many species of wildlife and are a culturally important food source to many Native American tribes in the region. Parcel 107-003 could be important to manage for wildlife habitat and oak woodland conservation.

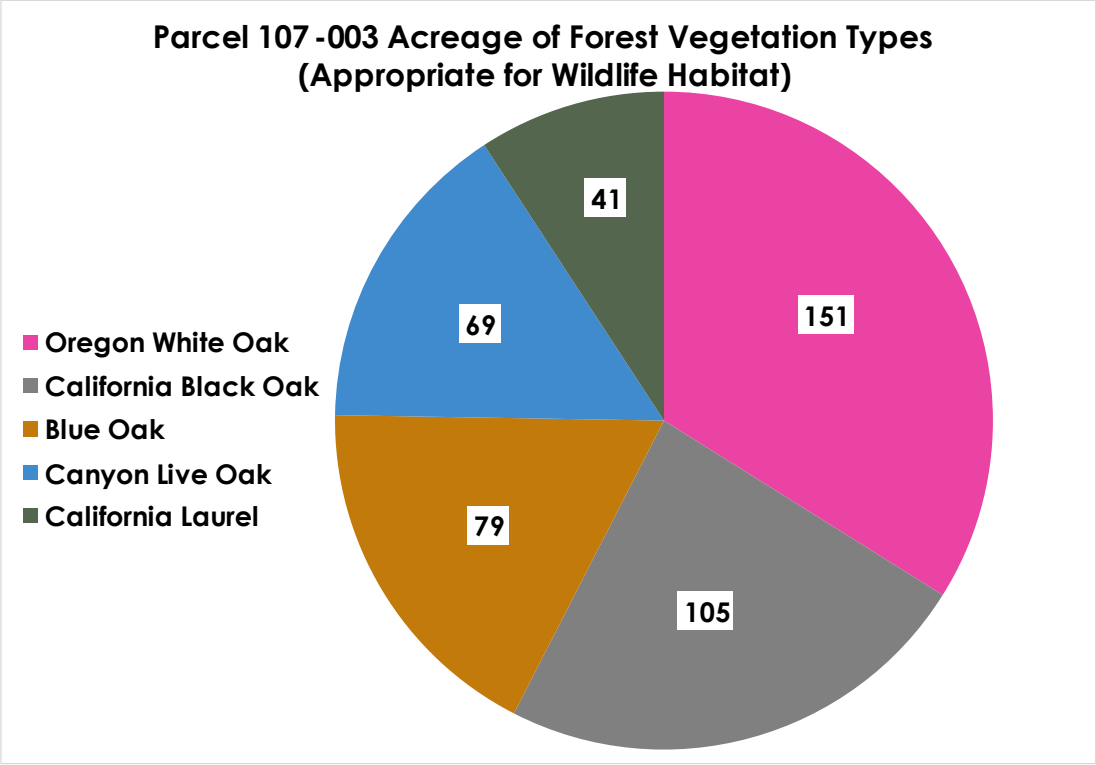


Figure 9: Estimated acreage totals across major vegetation types present in school lands Parcel 107-003.

The SLFIS includes datasets of past and current-year fire perimeters and can be used to assess which forested parcels may have been affected by wildfires. Parcels128-003, 128-001, and 127-001 in Shasta County, and Parcel 069-002 in Plumas County all appear to have had productive timber stands when the TreeMap data was created in 2016 but are within the footprints of fires that occurred after the TreeMap data was produced. Remotely sensed imagery appears to show burned timber on these parcels. A field assessment of these parcels should be conducted to determine the extent of damage caused by fires and to determine next steps for rehabilitation (such as reforestation) and future management.

4.4 Investigating Potential Agency Partnerships

The SLFIS can support interagency discussions about the condition of forest vegetation and the need for fuel reduction projects. For example, the Truckee Fire Protection District recommends thinning school lands Parcel 062-002 near the community of Truckee to reduce the potential risk for a future fire spreading

through the parcel. TreeMap indicates that Parcel 062-002 contains approximately 81 acres of Ponderosa Pine Forest, with a live tree density of 256 trees per acre, indicating that trees are spaced roughly 13 feet apart on average (**Figure 10**). Although this is a rough estimate, and more data needs to be collected, this data suggests that a forest thinning to reduce the stand density may be appropriate. A forest thinning under these circumstances could improve forest growth and tree health by creating more growing space and improving the availability of limited resources such as water, light, and soil nutrients. A thinning could also reduce the intensity of potential forest fires on the parcel by increasing the spacing between tree crowns that could carry a fire.

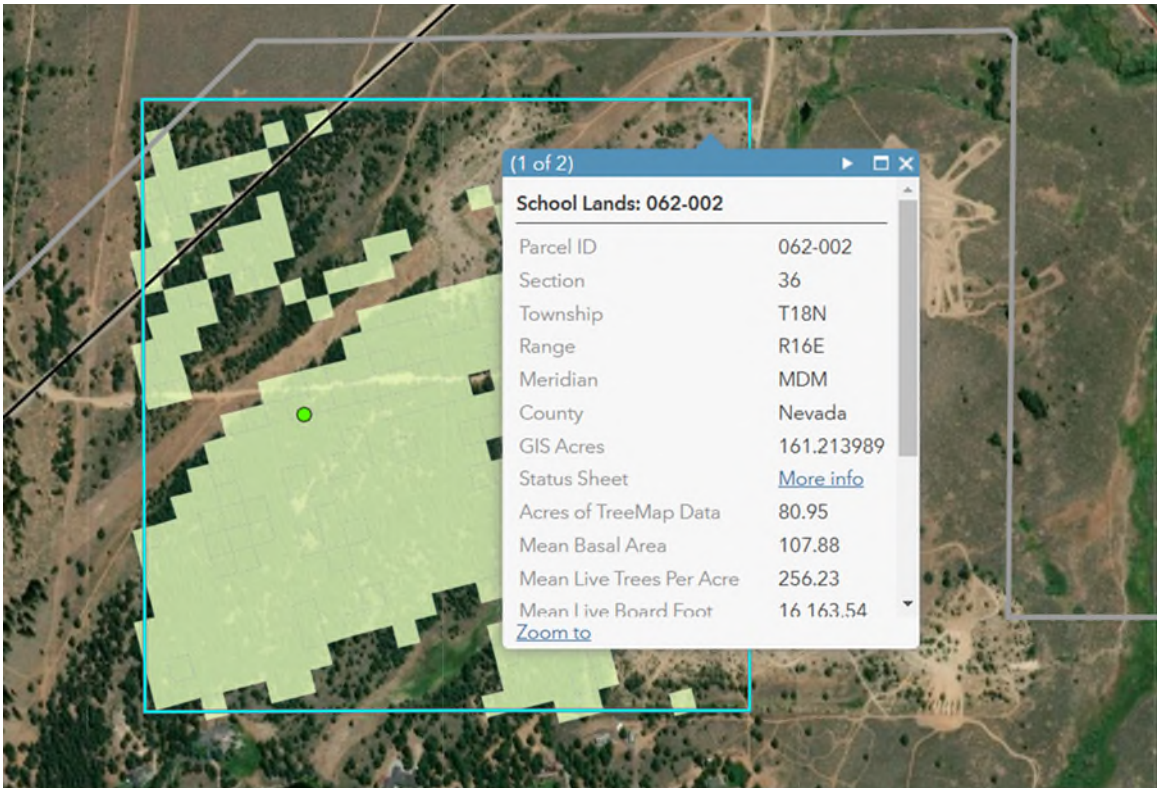


Figure 10: A summary of information pulled from the SLFIS for Parcel 062-002.

4.5 Assessing priority areas for fuel reduction

When assessing a school lands parcel for fuels reduction treatments, proximity of the parcel to communities is an important consideration. The SLFIS allows the user to identify a school lands parcel and query the data for the presence of communities within a certain distance of the parcel. For instance, the Trinity County Resource Conservation District identified school lands Parcel 125-004 as important for fuel reduction treatment. The SLFIS shows that Parcel 125-004 is within 5 miles of the communities of Weaverville, Douglas City, and Lewiston (**Figure 11**).

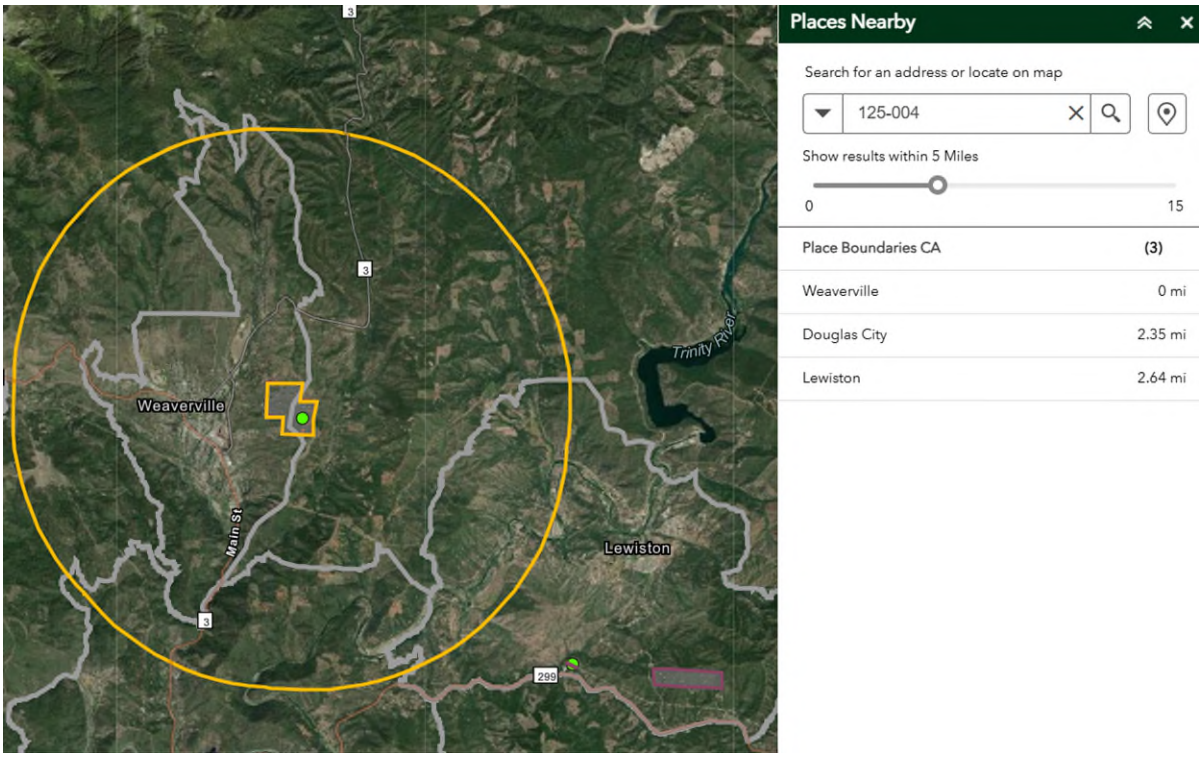


Figure 11: The SLFIS shows the proximity of communities to parcel 125-004

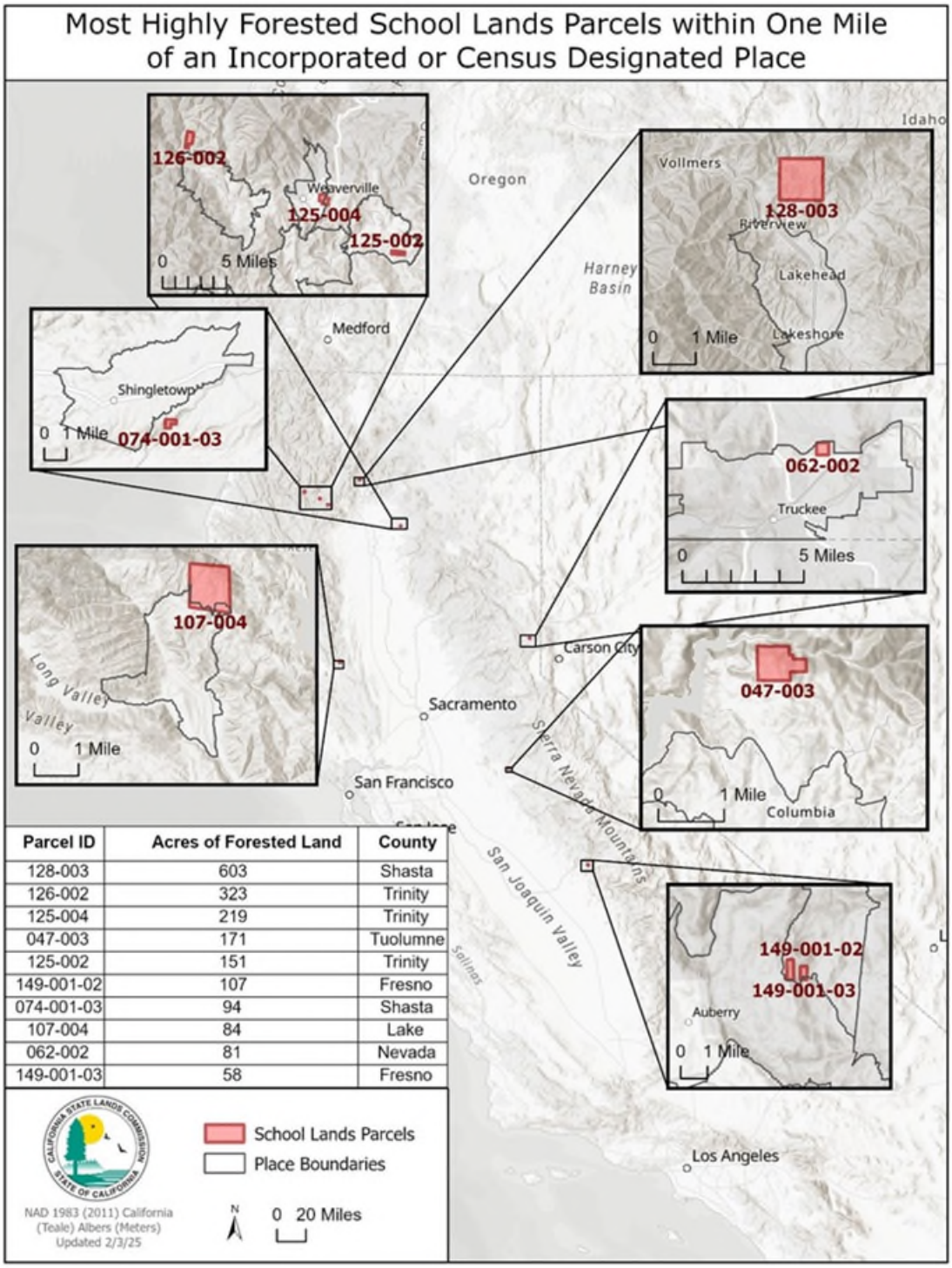
Additional analysis in ArcGIS Pro software with the TreeMap data can assess community proximity to all school lands parcels. For this analysis, 2023 Census data that includes both incorporated places and Census Designated Places (CDPs) was used for community boundaries. CDPs are a statistical geography representing closely settled, unincorporated communities that are locally recognized and identified by name. This analysis determined that 29 parcels occur within one mile of a community, and 66 parcels occur within two miles of a community (**Table 3***: **The number of forested school lands parcels within certain distances (miles) to a community***). All school lands parcels with forest vegetation types occur within 45 miles of a community.

Table 3: The number of forested school lands parcels within certain distances (miles) to a community

Distance from a Community (miles)	**Number of Parcels**
1	29
2	66
5	196

Distance from a Community (miles)	Number of Parcels
10	341
15	364
20	393
25	399
30	407
35	419
40	427
45	429

To inform prioritization efforts, staff assessed the 10 school lands parcels with the greatest acreage of forest vegetation that are within one mile of a community (**Figure 12**). Of the 29 parcels within one mile of community (*Table 3*), the largest parcel is Parcel 128-003 in Shasta County, with a size of 603 acres.



Parcel ID	Acres of Forested Land	County
128-003	603	Shasta
126-002	323	Trinity
125-004	219	Trinity
047-003	171	Tuolumne
125-002	151	Trinity
149-001-02	107	Fresno
074-001-03	94	Shasta
107-004	84	Lake
062-002	81	Nevada
149-001-03	58	Fresno

Figure 12: The 10 most forested school lands parcels (acres) within one mile of a community.

Further prioritization can occur when considering other attributes related to forest fuels, such as dry biomass per acre or standing dead trees per acre, which are indicators for the amount of potential fuel and can be assessed to determine wildfire risk (see Glossary).While these data are present in TreeMap, the dataset is not complete, with many missing values for these attributes. At this point, the TreeMap dataset, and therefore the SLFIS, cannot provide a complete picture of fuel loading (the amount of fuel in an area) on forested school lands. But the SLFIS provides a preliminary assessment of which parcels may need fuels treatment. These areas can be further analyzed with other local, state, and federal agency programs, such as Planscape, a publicly available online fuel reduction project planning tool, and by conducting site visits.

5.0 Other Uses: Contacts / Neighbor Database

Most forested school lands parcels have multiple adjacent landowners and coordination with these landowners will be important. The SLFIS includes a Neighbor Notification and Contacts Database to store information provided by adjacent landowners. When staff discuss a concern with an adjacent landowner, the landowner's contact information, date of conversation, and topic/concern are entered into the database. This information has a spatial component and can be tied to an Assessor's Parcel Number and queried at any time. Valuable information can be gained from this database, including the local history of a parcel, safety concerns, and accessibility (roadways) to the parcel. Understanding adjacent ownership and management authorities surrounding forested school lands will help staff identify where there may be opportunities to coordinate with neighbors to access the parcel, collaborate on treatment activities, or share information. For example, staff are coordinating with CAL FIRE to implement a Vegetation Management Plan on school lands Parcel 117-002. The Neighbor Notification and Contacts Database contains notes regarding discussions about the proposed project on that parcel.

6.0 Limitations of the School Lands Forest Information System

The SLFIS has many benefits, but its limitations also need to be considered. The main advantage is that all the data are publicly available at no cost to the user. The SLFIS user interface is also easy to learn without prior GIS experience, providing a convenient and quick way to look up information and generate a report. It also does not require the Commission to pay for each user to obtain a license to use ArcGIS Pro software. Datasets can be easily added, including web-based data, and the Neighbor Notification Database provides an efficient way to look up communications.

Some limitations of the SLFIS are that the 2016 TreeMap data are almost 10 years old and likely do not represent current conditions where the forest has continued to grow, or in areas where fires have burned. Additionally, the data

from TreeMap have been imputed from other areas throughout the United States and are not directly from school lands parcels. Also, there are errors of omission (i.e., data were not included that should have been) throughout the dataset where areas that are forested were not included in the data, and errors of commission (i.e., including data that should have been excluded) where other vegetation types besides forest were included in the data and classified as forest. Some of the data are incomplete or absent, such as the Quadratic Mean Diameter and standing dead carbon. Lastly, the SLFIS does not include all the functionality of a desktop GIS application, and more complex analyses will require the use of ArcGIS Pro.

7.0 Recommendations and Next Steps

Staff developed the SLFIS as an initial step to create an inventory of forested school lands that will help inform and support effective and meaningful resource management, help the Commission advance the goals identified in its Strategic Plan and the Forest Carbon Plan, and support efforts to improve the health and resiliency of forested school lands. The SLFIS is an important tool for Commission staff to collect, store, and query information about forested School lands parcels. Staff has begun using the SLFIS for data analysis to assess parcel conditions and make informed decisions about prioritizing parcels for resource management.

The next step is to inventory forested school lands. A forest inventory involves collecting information such as the forest's tree species composition, size of trees, tree density and spacing, number and types of seedlings, and tree health. Information on timber growth rates, tree mortality, site quality, forest canopy, fire history, pollution problems, insect and disease infestations/infections, and forest fuel loading can also be collected in an inventory. Data collection occurs at specific points in a forest, known as inventory plots, and can then be used to calculate other forest attributes such as wood volume per acre, carbon per acre, wildlife habitat attributes, and to determine fire risk. A hypothetical distribution of forest inventory plots on the High Peak Management Unit is shown in **Figure 13**, demonstrating how a forest inventory would be implemented.

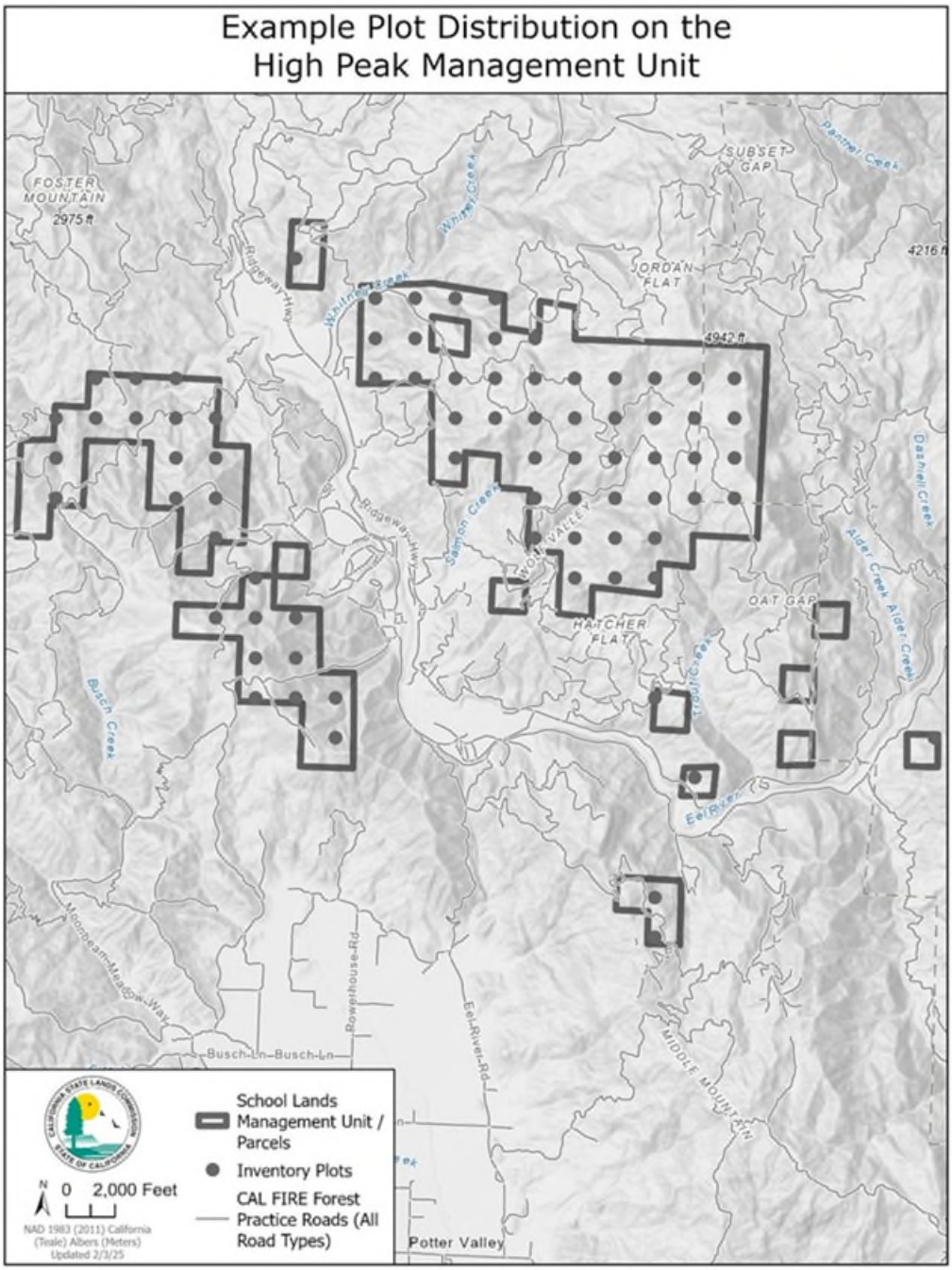


Figure 13: Hypothetical Forest Inventory Plot Distribution on the High Peak Management Unit

Staff recommend taking the following steps to implement phase 2 of preparing a forest inventory, including refining data collection and management for the SLFIS, identifying resource management priorities to inform forest inventory

development, and enhancing coordination with partner agencies in support of implementing management strategies that help California's forests to become healthier and more resilient in the face of climate change.

7.1 Recommendations for data collection and forest inventory development

The SLFIS provides an initial assessment of forested school lands using publicly available data and the TreeMap imputation technique. To refine the SLFIS and develop a more accurate assessment based on emerging needs and priorities, it is important to continue to update the SLFIS with new and relevant publicly available data as it becomes available and to conduct site visits to collect relevant field data. Next steps include:

1. Update the SLFIS with relevant publicly available data based on the program's needs and priorities.

Federal, state, and regional partners are continuing to develop data resources in response to emerging needs to efficiently manage forested lands to promote health and resilience to wildfire, climate change impacts, pests, and other concerns. Staff are monitoring and researching these efforts to identify relevant data that can be integrated into the SLFIS to inform a forest inventory.

2. Identify and refine the land and resource needs and priorities to inform the development and use of a forest inventory.

When designing a forest inventory, management objectives should be considered. These objectives could include growing and harvesting timber for commercial forest products, maintaining or improving wildlife habitat, invasive species management, sequestering carbon, contributing to the state's natural working lands and nature-based solutions targets, maintaining or improving forest health, or reducing or mitigating wildfire risk. Staff will assess management objectives and identify priorities to achieve efficient management outcomes, despite limited staff capacity and funding.

3. Conduct field assessments on priority parcels to collect data for a forest inventory.

Most of the publicly available data used to develop the SLFIS are based on large-scale remote sensing techniques and imputed data. To develop a relevant and accurate forest inventory, field assessments are necessary to ground truth assumed or estimated data and to gather relevant site-specific data to better inform staff's management of its forested parcels. Information about the forest and habitat attributes, such as the forest vegetation type, size of the trees, tree density, species composition, and the number and types of

seedlings are data typically collected in field assessments. These data are then used to calculate other forest attributes such as wood volume per acre, carbon per acre, and fuel loading per acre. Together, these data can help provide information on timber growth rates, mortality, site quality, forest canopy coverage, fire history, pollution problems, insect and disease infestations/infections, and fuel loading.

4. Classify vegetation on forested school lands using the California Wildlife Habitat Relationships classification method.

CAL FIRE recommends that the California Wildlife Habitat Relationships vegetation classification system be used on the Commission's school lands. Creating a map of vegetation types using high resolution remotely sensed imagery with field verification will improve vegetation type mapping and reduce errors present in the TreeMap vegetation classification (which was imputed without field verification). This will lead to a better understanding of the vegetation types present on School lands, help staff target forest vegetation types to inventory, and reduce the variance in the estimates of forest metrics.

5. Engage in discussions with subject matter experts and agency partners to determine how to best balance the need to collect reliable field data with agency resource limitations.

Staff should continue to consult with the Commission's GIS service provider ESRI to determine which technologies could improve efficiencies in sampling and create cost-savings. The field inventory needs to balance the benefits of obtaining reliable site-specific data with the costs of conducting the inventory.

6. Revisit sampled areas periodically to detect changes in forest conditions and determine trends.

Collected over time, forest inventory data may help identify important trends and can be used in growth models to estimate future forest conditions. These data can also be used in fire behavior models to determine fire behavior and fire risk and identify priority areas for fuels treatment. Using a GIS application, staff can assess spatial trends associated with the forest inventory data, providing further insight into the broader forest ecosystem health and sustainability.

7.2 Recommendations for determining prioritization and parcel management

1. Categorize and assess groups of parcels that belong to cohesive forest management units.

Given the scattered nature of the school lands parcels and the Commission's limited financial and human resources available for forest management, parcels should be prioritized for a forest inventory / forest management data collection effort. As stated in the Results and Analysis section of this report, forested parcels that are contiguous or near each other are typically managed as units within the forestry profession. Managing groups of parcels as units is practical logistically and from a landscape perspective because parcels near each other typically have similar ecological characteristics. Once management units have been established, forest characteristics taken from TreeMap can be evaluated at the management unit level to determine which management unit(s) should be prioritized for field data collection.

2. The top five parcels should be prioritized for a field inventory (**Table 1**). The High Peak Management Unit should be the highest priority.

Staff recommends that the top five forest management units ("High Peak", "Poonkinny", "Salt Creek", "Ham Pass", and "Mineral") be prioritized for field inventory to ensure relevant and accurate information is available for informed decision-making.

The High Peak Management Unit should be the highest priority because it consists of 34 school lands parcels and has the most acreage of forested land of any management unit.

3. Assess potential opportunities for revenue generating activities that may apply to forested parcels.

Traditional revenue generating activities on forested parcels involve timber harvesting, but there may be additional activities that could be implemented for revenue generation or leased for fees. Staff can use a forest inventory to evaluate revenue generating opportunities for parcels, such as carbon sequestration and storage efforts and native plant rearing.

7.3 Recommendations for coordination and resource management

1. Assess and categorize land ownership surrounding and adjacent to forested school lands parcels.

Gaining access to the Commission's forested school lands parcels may require coordination or agreements with private landowners or federal, state, or local land managers. Staff recommend conducting an assessment to identify land ownership and jurisdiction over lands surrounding and adjacent to priority school lands parcels. This will allow staff to engage with landowners and managers to coordinate efforts to visit, evaluate, and manage the Commission's forested lands.

2. Identify and engage with federal, state, local, tribal governments, agencies, and community members.

Forested school land parcels are scattered throughout the state and are often part of contiguous forests managed by other entities. It is important to coordinate with other land managers because there may be opportunities to share or combine resources and capacity to achieve shared management objectives, collaborate to address shared challenges, and meaningfully meet regional or community needs. Increased coordination with neighbors can also help address accessibility issues to remote or hard to reach parcels where roads may be in disrepair or access may require passage through private or secured locations.

3. Identify potential funding sources or opportunities to support land and resource management activities.

State and federal investments in forest health and wildfire resilience may offer opportunities for the Commission to apply for grant funding to support management activities. In addition, the Commission can partner with tribal governments to explore opportunities for co-management that implement traditional land management practices, such as cultural burning and ecosystem restoration. These opportunities may also help to advance multi-beneficial efforts related to co-management and climate resilience.

Glossary

This glossary includes definitions for technical terms, measurements, and other characteristics that are common in forestry management. For this report and for the benefit of the readership, some terms have been adapted by staff to be more easily understood by a wide range of audiences.

Basal area per acre: The total cross-sectional area of the tree trunks measured from 4.5 feet off the ground of all trees on an acre, expressed in square feet. When averaged across a forest, mean basal area per acre is used to express the density of trees in a forest.

Board foot: A unit of measure of wood volume in a tree or group of trees. One board foot is one-foot wide by one-foot long by one-inch thick. The sum of the wood volume of all trees on an acre is termed the board feet per acre, and when summed across a forest, provides an estimate of how much wood a forest has accumulated.

Quadratic Mean Diameter (QMD): A measure to assess average tree size in an area. It is the diameter of a theoretical tree containing average basal area per tree in a forest.

Mean Standing Dead Carbon per Acre: The average amount of carbon sequestered in dead vegetation which is still standing vertically, like standing dead trees.

Mean Down Dead Carbon per Acre: Fallen dead trees and other dead vegetation lying on the forest floor greater than 3 inches diameter (measured in tons per acre); estimated by the USDA Forest Service's Forest Inventory and Analysis Program based on forest type, geographic area, and live tree carbon density.

Mean Live trees per acre: An average of the number of living trees per acre within an area.

Permanent Road: A Logging Road that is part of the Permanent Road Network and is designed for year-round use. These roads have a surface that is suitable for maintaining a stable operating surface throughout the year.

Seasonal Road: A Logging Road that is part of the Permanent Road Network that is not designed for year-round use. These roads have a surface that is suitable for maintaining a stable operating surface during the seasonal period of use.

Temporary Road: A Logging Road that is to be used only during Timber Operations and that will be deactivated or abandoned upon completion of use.

Table 4: Datasets Used in the School Lands Forest Information System

Dataset	Source	URL or Notes
CAL FIRE Forest Practice Hydrology	CAL FIRE	https://services1.arcgis.com/jUJYIo9tSA7EHvfZ/arcgis/rest/services/CAL_FIRE_Forest_Practice_Hydrology_TA83/FeatureServer
CAL FIRE Forest Practicie Roads	CAL FIRE	https://services1.arcgis.com/jUJYIo9tSA7EHvfZ/arcgis/rest/services/CAL_FIRE_Forest_Practice_Roads_TA83/FeatureServer
California State Lands Commission Leases	California State Lands Commission	https://data-cslc.opendata.arcgis.com/datasets/ca-state-lands-commission-leases/explore
CalVeg Existing Vegetation	US Forest Service	Downloaded existing vegetation datasets by zone.
Counties	CAL FIRE	https://services1.arcgis.com/jUJYIo9tSA7EHvfZ/arcgis/rest/services/California_County_Boundaries/FeatureServer
Current Timber Harvesting Plans	CAL FIRE	https://services1.arcgis.com/jUJYIo9tSA7EHvfZ/arcgis/rest/services/CAL_FIRE_Timber_Harvesting_Plans_All_TA83/FeatureServer/0
CWHR Vegetation Types	CAL FIRE	Downloaded from CAL FIRE (FVEG)
Federal Lands	Multiple	Service on Esri's Living Atlas. It includes data from the Bureau of Land Management, Bureau of Reclamation, Department of Defense, National Park Service, US Fish and Wildlife Service, and US Forest Service.
Hexagon Imagery	Hexagon	Paid Service

Dataset	Source	URL or Notes
Historical Timber Harvesting Plans	CAL FIRE	https://services1.arcgis.com/jUJYIo9tSA7EHvfZ/arcgis/rest/services/CAL_FIRE_Timber_Harvesting_Plans_All_TA83/FeatureServer/1
Place Boundaries	U.S. Census Bureau	Downloaded
Public Land Survey System (PLSS)	Bureau of Land Management	Downloaded
School Lands	California State Lands Commission	https://data-cslc.opendata.arcgis.com/datasets/school-lands/explore
School Lands with TreeMap Stats	California State Lands Commission	Modified version of staff version that includes TreeMap statistics prepared in ArcGIS Pro.
State Park Boundaries	California State Parks	https://services2.arcgis.com/AhxrK3F6WM8ECvDi/arcgis/rest/services/ParkBoundaries/FeatureServer/0
TreeMap 2016 Polygons	U.S. Forest Service	Downloaded 2016 Version
California Wildfire Perimeters (Historical Data)	CAL FIRE	https://services1.arcgis.com/jUJYIo9tSA7EHvfZ/ArcGIS/rest/services/California_Fire_Perimeters/FeatureServer/0
NIFC Wildfire Perimeters (Current Data)	National Interagency Fire Center	https://services3.arcgis.com/T4QMspbfLg3qTGWY/arcgis/rest/services/WFIGS_Interagency_Perimeters_YearToDate/FeatureServer/0