Boggs Mountain
Demonstration State Forest
Management Plan

California Department of Forestry and Fire Protection
The Resources Agency
State of California

March 2018

CERTIFICATION by REGISTERED PROFESSIONAL FORESTER

pursuant to California Code of Regulations
Title 14, § 1602.1

I, Peter C. Leuzinger, am responsible for the preparation of this Forest Management Plan for Boggs Mountain Demonstration State Forest.

_____
Peter C. Leuzinger, RPF #2904

_____
Date

APPROVAL of FOREST MANAGEMENT PLAN
for
BOGGS MOUNTAIN DEMONSTRATION STATE FOREST

Approved by vote of the Board of Forestry and Fire Protection

_____
Matt Dias, Executive Officer

_____
Date

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1. Introduction

The Demonstration State Forest system of the California Department of Forestry and Fire Protection (Department or CAL FIRE) was established in the mid-1940's to meet local, regional, and statewide needs for research, demonstration, and education related to forest management. Currently, the State Forest system encompasses over 71,000 acres of land in the form of eight state forests. Demonstration State Forests are healthy, living forests which demonstrate conservation and protection of wildlife, fisheries, vegetation, soil, and watershed resources as well as sustained-yield forest management activities.

Boggs Mountain Demonstration State Forest (BMDSF or Forest) is a 3,493-acre mixed conifer forest located in Lake County between Clear Lake and Calistoga.

This Management Plan (Plan) replaces the Management Plan approved by the Board of Forestry and Fire Protection (the Board) in November 2008. It provides information on the current conditions on the Forest and serves (1) as a guide for the integrated use and protection of the Forest's resources, (2) to meet requirements of legislation and Board policy, and (3) to address local, regional, and statewide issues. The Plan and the projects undertaken will be evaluated by the Board every five years (Board Policy 0351.10).

Statutes and Board Policy

BMDSF was acquired under the authority of the State Forest Purchase Act and from funds made available to implement this act provided by the 1947 Legislature. The legislative authority for the State Forest system is contained in Public Resources Code (PRC) §§ 4631-4659 and §§ 4701-4703. The PRC specifically states the management of State Forests shall conform with forest management practices designed to achieve maximum sustained production of high-quality forest products while giving consideration to values relating to recreation, watershed, wildlife, range and forage, fisheries, and aesthetic enjoyment.

Management of BMDSF is a cooperative effort between the Department and the Board. PRC § 4645 specifies that the Department, in accordance with plans approved by the Board, shall manage State Forests. PRC § 4646 states that the Director of the Department shall administer all the statutory requirements relating to State Forests in accordance with policies adopted by the Board.

Board policy describes Boggs Mountain and three other Demonstration State Forests as "commercial timberland areas managed by professional foresters who conduct programs in timber management, recreation, demonstration, and investigation in conformance with detailed management plans," (Board Policy 0351.1). Board policy specifically states that the primary purpose of BMDSF is to conduct innovative demonstrations, experiments, and education in forest management; and that timber production will be the primary land use on BMDSF with recreation recognized as a secondary but compatible land use (Board Policy 0351.2). Guiding BMDSF management are additional Board policies that encourage Demonstration State Forest managers to:

- Conduct research and demonstration projects including those focused on silviculture, mensuration, logging methods, economics, hydrology, protection, and recreation.

Research and demonstration projects will be directed to the needs of the general public, small forest landowners, timber operators, and the timber industry.

- Conduct periodic field tours to exhibit State Forest activities and accomplishments to forest industry, small forest landowners, relevant public agencies and the general public, and disseminate information to these audiences.

- Consult with and solicit the cooperation of the State universities and colleges, the USDA Forest Service, and other public and private agencies in conducting studies requiring special knowledge.

History of Boggs

BMDSF was within the territory of one or more of the following Native American groups: Eastern Pomo, Southeastern Pomo, Lake Miwok, Clear Lake Wappo, and Patwin. Since the crest of Boggs Mountain divides the Putah and Kelsey Creek watersheds and since California Native Americans often used watershed divides as territory boundaries, it is likely that more than one group controlled the area. Evidence shows that Boggs Mountain enjoyed some prehistoric use year-round with populations rising during the summer and fall months.

Artifacts collected on BMDSF support the theory that the primary pre-historic activity on Boggs Mountain was hunting. No known milling equipment has been found within the forest boundary. Archaeological research in the State Forest has revealed temporary camps, collecting stations, lithic workshops, and chipping stations. Also, a high projectile point to debitage ratio is found throughout the forest. Neither informal flaked stone tools nor any nonflaked expedient tools are present in the BMDSF collection.

The majority of prehistoric archaeological sites and artifacts discovered on BMDSF belong to the Late Prehistoric Period (A.D. 500-1579) which appears to be the largest population density of indigenous people. This large population continued through the Proto-historic period, until the time of initial contact between the California Native Americans and the Europeans.

During the Mexican period of the early 1830's, trappers including Jedediah Smith and Ewing Young explored Clear Lake or its tributaries. These visits were of little consequence on the Clear Lake Basin until Mariano Vallejo was granted 44,280 acres in June 1834. The first Mexican military penetration into Clear Lake country, and what is now BMDSF, occurred during fights with the Wappo in 1835. When the Californios Cavalry killed over 200 attackers, Governor Figueroa forced a peace. The following April, in 1836, a second attack by 20 Californios and 100 Suisun Indians against the Wappo resulted in a peace treaty under which 7 local chiefs agreed to live in peace. As a result of this treaty, Mariano's brother, Salvador Vallejo received a 71,000-acre land grant including BMDSF area.

With statehood in 1850, California became the 31st state in the Union and Napa became one of the original 27 California counties. Lilburn W. Boggs, ex-Governor of Missouri, and a successful merchant in Sonoma, farmed the Napa Valley. Sometime before 1860 he purchased land in what is now Lake County. Boggs' son Henry C. bought a steam-powered sawmill in 1866 and later combined sawmill, gristmill, and planer. Located on the eastern margin of what is now BMDSF, Boggs' Mill and Boggs' Lake operated until 1880. In 1878 Henry C. Boggs bought a small lot near the head of Malo Creek, moving his sawmill there two years later. By 1884 Henry Boggs bought almost all the timberland within the present State Forest boundaries. His son

Lilburn H. Boggs served as manager in addition to his duties as Lake County Sheriff. The major road between Middletown and Clear Lake, now Highway 175, was called Boggs' Road in the early 1880's. Logging took place on most of what is now the Forest, with the heaviest cutting between 1882 and 1887. By 1898, the year of Henry C. Boggs death, the Farmers Savings Bank under its president James W. Boggs, had acquired just about all the acreage presently incorporated by the Forest.

The property was subsequently owned by Hugh Davey then Jim McCauley. McCauley established a resort near the head of Kelsey Creek renaming it Camp Calso. Jim McCauley died in 1941 and his heirs sold the timber rights to Setzer Forest Products. Most of the land use after Boggs was for cattle-grazing until 1947 when the then present owner, Calso Company, sold the timber rights on 2,700 acres to the Setzer Forest Products Company.

The funds to purchase lands for State Forests were made available by the 1947 legislature to implement the State Forest Purchase Act (PRC 4631). In December 1949, after Setzer had clearcut 2,800+ acres, the State of California bought the timberland for $38,700 with the intention of creating a demonstration forest. The research concern at BMDSF was the study of forest recovery from a completely cut over area. 3,432 acres of land and timber were acquired from the Calso Company for $20,600. The remaining $18,100 went to Setzer Forest Products Company. Setzer owned the merchantable timber on 2,731 acres of the tract. Setzer sold all the timber between 16 and 23 inches in diameter at breast height (DBH) (an estimated 6,100,000 board feet of timber) and one million board feet of thrifty seed trees between 23 and 29 inches DBH to the State under terms of a precutting agreement. All other commercial timber was harvested in 1949 and 1950.

Setzer completed logging their timber holdings in 1950. In 1954, Glenco Forest Products Company, successor in interest to Setzer Forest Products, quitclaimed its rights, title, and interest in the property to the State in accordance with the terms of the cutting agreement. The status of the Forest at the time of purchase by the State was that of a recently cut-over forest from which all merchantable timber had been harvested except for scattered seed trees and patches of old-growth trees considered inaccessible at the time of purchase. Early state occupancy of the Forest property was mainly for protective and custodial purposes. The Service Forester assigned to the Region I Office in Santa Rosa did inventory and mapping, to a limited extent, during this period.

In 1965, Cliff Fago, became the first permanent forest manager assigned to BMDSF. He completed the forest inventory, began experimental and demonstrational activity, and conducted the first timber sale in 1966. The timber harvesting was directed toward removal of the remaining old growth. The residual old growth was essentially removed from the Forest by 1976, and between then and 2015, cutting methods were used that resulted in a regulated, all-age forest. An active experimental and demonstrational program was developed during this period involving growth determination, disease control, better utilization methods, fertilization studies, and reforestation.

Geothermal activity, particularly in the Cobb Mountain area, a few miles west of Boggs Mountain, caused an increase in the surrounding population in the 1980's. Exploratory drilling occurred in the surrounding areas, including BMDSF, where Geothermal Kinetics, Inc. drilling to a depth of approximately 4,400 feet in July 1981. Drilling was abandoned when geologic conditions indicated that a geothermal source would not be found at a depth that would make utilization feasible. Subsequently, this portion of the Forest area became a popular shooting range.

No timber was harvested on the Forest from the completion of logging in 1950 until 1966 when 3,085,000 board feet of old growth was cut. A Forest-wide inventory was completed the same year which estimated the total gross timber volume after the 1967 harvest at 31,465,000 board feet on 3,433 acres, 6,000,000 or more of which was old growth. The acquisition estimate apparently considerably under estimated the merchantable volume on the Forest. Most of the residual old growth was harvested from the Forest by 1976.

Two land purchases have added to the forest land base since the original acquisition. Thirty-one acres were added to the Forest in 1972, when the Division of Forestry acquired Lot 3, Sec. 6, T11N, R7W from the State Lands Commission for $5,600. A 40+-acre parcel in the NW1/2SE 1/4, Sec. 35, T11N, R8W was purchased from the Voss family by the State of California in 1991. A portion of the Forest, 9.8 acres in SE1/, SE1/4 Sec. 3, T11N, R8W, was sold to the Middletown Unified School District in 1981 for $41,160, as a result of Assembly Bill 476. The current total area of BMDSF is 3,493 acres.

On September 12, 2015, a wildfire caused by faulty hot tub wiring started in Lake County. Known as the Valley Fire, it burned thousands of acres within a couple hours and by the time it was extinguished it had scorched 76,067 acres. Having killed four people and destroyed nearly 2,000 buildings, it is classified as the fourth most destructive fire in California. Over 90% of the trees within BMDSF were killed directly by the fire and many of the remaining trees were killed post-fire due to bark beetle infestation aggravated by the fire and prolonged drought.

CAL FIRE closed BMDSF indefinitely due to hazardous conditions caused by the Valley Fire. The closure was necessary to ensure public health and safety and was done in accordance with Title 14 § 1439. The process of rehabilitating the Forest has been initiated and salvage logging of the dead trees has begun to reduce the fuel loads and to allow replanting of the burned areas.

Management Objectives

Commented [DM1]: Consider adding a management objective that focused upon assisting the state in achieve goals of GHG storage and sequestration through active forest management.

It is estimated that 90% of the trees on the property have died because of the Valley Fire and subsequent bark beetle and drought mortality. Current management objectives at BMDSF revolve around the successful establishment of a future crop of trees via plantation. Other important management goals include rebuilding the recreation potential of the Forest, keeping fire off the property, and promoting research. The property was previously managed as a working forest, which facilitated research and demonstrated diverse timber management practices to private timberland owners and the public at large. Current emphasis will be on restocking the Forest so that it may be utilized for these purposes again. The long-term objective will be to establish a dynamic mosaic of diverse forest structures and a high productive capacity. This management approach will produce a sustainable harvest of high quality timber products, support biological diversity, and ensure opportunities for future forestry-related research. Detailed objectives follow in no particular order of importance:

- Continue to harvest dead, dying, and diseased trees with hazard reduction as a goal. Maintain safe conditions for employees, visitors, and neighbors by identifying hazardous situations and eliminating them where possible. The forest will remain closed to the public until such a time as it can be made safe for the public to enter.

- Manage newly established plantations to maximize resilience to perturbations in moisture, temperature, pests, and storm events.

- Reconstruct and maintain the forest road system through development of the Road Management Plan. Continued upgrading of the road network is essential for long-term resource management, administrative access, fire control, and recreational purposes. Establish a road system that is hydrologically disconnected, where feasible, and largely self-maintaining and/or requiring low levels of maintenance.

- Maintain a law enforcement presence on the Forest to preserve the peace and prevent trespassing and the vandalism of roads and facilities.

- Continue an aggressive pest management program to prevent the spread of insects and disease with a goal of minimizing mortality. Harvest salvage material where feasible.

- Restore the multiple-use recreational experience previously provided by the Forest by reestablishing a trail system and rebuilding recreational facilities that were damaged in the fire.

- Prevent site degradation by using erosion controls and soil conservation practices in all restoration and management activities.

- Encourage research on post-fire ecosystems and the impacts and results of different management techniques. Continue to provide access to BMDSF as an outdoor laboratory where researchers from CAL FIRE, universities, other agencies and research institutions can conduct targeted and long term research projects that address important questions about forests and forest management.

- Maintain or replace the existing infrastructure and barracks, including bunks and kitchen facilities, at BMDSF headquarters. Housing available at BMDSF is instrumental in facilitating projects by visiting researchers. By providing onsite storage for equipment and housing for personnel the Forest is a more attractive option for partnering institutions from outside of the area. A Minor Capital Outlay Budget Change Proposal is in development to replace BMDSF's aging office building.

- Continue fire prevention and hazard reduction programs, including a prescribed burn program, to reduce the fire hazard and maintain fuel breaks in critical areas to keep potential damage from future wildfires to a minimum. Increase the resiliency of the plantation to catastrophic wildfires.

- Investigate and conduct timber stand improvement practices and young growth stand management to produce the best quality of forest products on a sustained basis. Explore the production and utilization of hardwoods and small "unmerchantable" biomass material from thinning operations.

- Seek opportunities to maintain or increase functional wildlife habitat within the planning watersheds.

- Focus forest inventory efforts over the next few years on completing a high intensity temporary plot system to assess the areas that have residual green timber and to get an initial estimate of the stocking and species composition of the young plantations. Re-establish the grid of Continuous Forest Inventory plots to track changes on the Forest, including the development of the post-fire plantations.

Commented [DM2]: Seems like a separate management objective.

Commented [DM3]: This seems like you intend to burn the plantations. I would suspect not until at least 25 years of age.

Commented [DM4]: Within the planning watershed or within the Forest.

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This Management Plan provides information on the whole program associated with management of BMDSF, and, as such, many of the activities addressed under the Management Plan are subject to further California Environmental Quality Act (CEQA) evaluation on a project-by-project basis prior to implementation. As such, many of the projects discussed or proposed in this Management Plan have not been subject to CEQA evaluation. Further CEQA evaluation on these projects will occur at the appropriate project-level prior to implementation. These project-level will be conducted in conformance with regulatory framework of the CEQA Guidelines.

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2. Current Management Situation

General Features

Location

Boggs Mountain Demonstration State Forest (BMDSF) lies approximately 50 miles inland from the Pacific shoreline and 75 air miles north of San Francisco, on the summit separating the Clear Lake drainage to the north from Putah Creek drainage to the east (Figure 1). It is located six miles south of the southeast end of Clear Lake. The community of Cobb is adjacent to BMDSF, Middletown is eight miles to the southeast, and Lakeport, the county seat of Lake County, is located 30 miles to the northwest.

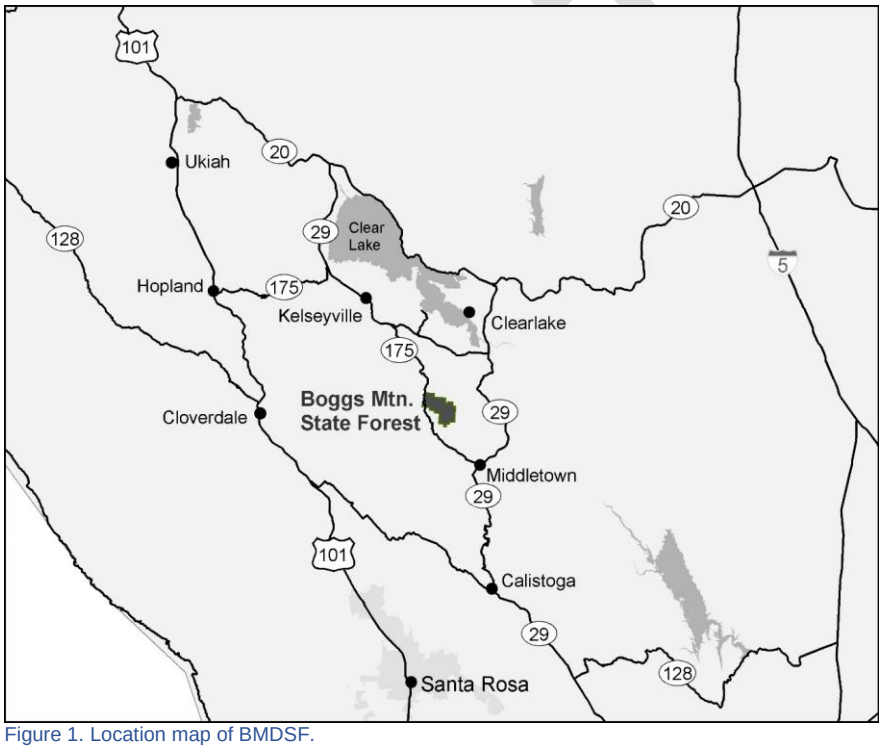

Figure 1. Location map of BMDSF.

Boundaries

BMDSF is a contiguous ownership located in southern Lake County within Townships 11 and 12 North, Ranges 7 and 8 West on the Mount Diablo Base and Meridian. Legal subdivision lines form the boundaries. The boundary generally follows the edges of the natural occurrence of timber on the south and east sides of the Forest. All boundaries of the Forest were surveyed and established by licensed surveyors following the Valley Fire in 2015. The surveys are recorded and on file at the Lake County Courthouse. The property lines have been established in the field with the posting of signs, flagging and tree marking.

Topography

Boggs Mountain is a large lava cap about one mile wide by 3-1/2 miles long, forming a gently rolling summit with the sides breaking down into moderate to steep slopes, with limited rock outcroppings. Elevations within BMDSF range from 2,360 feet to 3,750 feet above sea level. At the 3,000 feet elevation, the topography flattens out so that the top of the mountain resembles a plateau, dissected by several gulches. To the east and northeast, the mountaintop breaks very sharply to Big Canyon Creek, resulting in rather steep terrain in Section 6 and in the northeast portions of Sections 1 and 7. To the west, the topography slopes gently into a valley drained by the headwaters of Kelsey Creek at an elevation of about 2,500 feet. To the northeast, the Forest extends almost into the pass through which State Highway 175 crosses the Boggs Mountain range at an elevation of 3,000 feet. Generally, the ground is smooth with little or no rock outcrops except on the steep slopes. There are four main watercourses located on the Forest, which originate near the mountaintop. Mill Creek and Spikenard Creek flow down the north side, Houghton Creek flows down the west side, and Malo Creek flows down the east side.

Climate

As with much of California, the climate in the BMDSF is dominated by a Mediterranean weather pattern characterized by hot, dry summers and cool, wet winters. The average annual rainfall is approximately 65 inches, with extreme annual precipitation ranges from 22 inches to 130 inches. Some light snowfall typically occurs every winter, however occasional winter storms can bring as much as 2 to 3 feet of snow which can remain on the ground for a month or more.

Annual temperature ranges are considerably greater than those within the immediate areas of coastal influence with the average maximum summer temperature of 90°F and the average minimum winter temperature of 31°F. Temperature extremes can range from a minimum of 15°F in winter to a maximum of 105°F in summer.

Area, Ownership Pattern, and Adjacent Ownerships

BMDSF is comprised of 3,493 acres, as described in recorded surveys. There are no private ownerships located within the Forest boundaries. The Forest has common boundaries with eight subdivisions and some 70 private landowners. Most of the adjacent ownerships on the west side of the Forest have been developed for residential subdivisions. Because of the large numbers and the frequent turnover of owners, current ownership information is periodically updated from the Lake County Assessor's records. Larger, less developed parcels, are found adjacent to the northern and eastern boundaries of the forest. The undeveloped parcels range from brush-dominated land to very extensively managed timberlands, all of which burned in the Valley Fire in 2015.

Zoning

But for a 40-acre property acquired and incorporated in 1991, BMDSF is zoned by Lake County as Timber Production Zone (TPZ), devoted to and used for growing and harvesting timber and compatible uses. “Compatible use” is defined in the Timberland Productivity Act (Gov. Code 51104) as any use which does not significantly detract from the use of the property for, or inhibit, growing and harvesting timber and shall include, but not be limited to the following, unless in a specific instance such use would be contrary to the preceding definition of compatible use:

- Management for watershed.
- Management for fish and wildlife habitat or hunting and fishing.
- A use integrally related to the growing, harvesting, and processing of forest products, including but not limited to roads, log landings, and log storage areas.
- The erection, construction, alteration, or maintenance of gas, electric, water, or communication transmission facilities.
- Grazing.
- A residence or other structure necessary for the management of lands zoned as timberland production.

Forest Description

Forest Structure

Prior to the Valley Fire, the average age of the second growth timber stands on BMDSF was approximately 65 years, however most of the timber stands were dominated by two distinct age classes. The predominant age of younger timber was 55 years, resulting from natural regeneration after the intensive harvesting that took place in 1949-50. The majority of the older trees were in the 90-95-year range; these trees were considered not merchantable during the 1949-50 harvest, and thus escaped harvest.

Commented [DM5]: Should this say in the mid-late 1960’s. Seems like the earlier history discussed relatively extensive harvesting in 1966-67. Timber regenerated from1950 would currently be 68 years old.

The 2015 Valley Fire had a dramatic impact on forest structure as the fire burned through 99% of the property, killing over 90% of the mature trees and 95% of the regeneration. This resulted in a dense forest of standing dead timber with isolated green and partially burned stands, the largest of which is 80 acres.

This structure was further altered by the salvage harvesting done under three separate emergency notices (1-15EM-027 LAK, 1-15EM-028 LAK, and 1-16EM-023 LAK) in 2015/16, that together covered BMDSF entirely. As of 2018, the Forest has been partially salvaged logged under a salvage timber sale and focused on recovering the commercial value of the remaining timber. There is still a large volume of standing dead trees, primarily hardwoods and unmerchantable conifers. A second salvage entry is planned and will focus on creating space for planting of seedlings and continued fire hazard mitigation.

Commented [DM6]: I made revision here, but wanted to make sure that this was all accurate. Emergency Notice harvesting and salvage harvesting are seemingly addressed separately. I just want to make sure they are separate entries. It may be good to show a map of the Em. Notices and salvage logging that has been conducted and planned in the near future.

Salvage logging, subsequent to the Valley Fire, focuses on removing the dead and damaged trees. The entire BMDSF was assessed by CAL FIRE forestry staff prior to harvesting. The Forestry staff implemented a a retention marking, meaning that trees to be retained were identified by the Departments forestry staff. This assessment evaluated individual trees for crown health, fire scar, pitch streaming, and insect activity. During 2016, trees that survived the fire were dying from pine beetle activity and BMDSF staff were continually reevaluating and

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remarking stands for beetle kill. There are three main species of beetle active on the property: Western Pine Beetle (*Dendroctonus brevicomis*), Ips Pine Engraver Beetle (Ips pini), Mountain Pine Beetle (*Dendroctonus ponderosae*), and Red Turpentine Beetle (*Dendroctonus valens*).

The North slope burned so intensely that there were very few, if any, remaining live trees. The moderate slopes were mechanically logged, primarily by feller-bunchers, resulting in very few remaining standing trees (Figures 2 and 3). Hand felling and skidding was the primary logging method used in the drainages and steep rocky slopes where feller-bunchers could not operate; in these areas, many of the submerchantable trees remain. The majority of the north slope (989 acres) was planted in the spring of 2017 with mixed conifer species at a spacing of 13 feet.

The burn on the ridgetop was patchier in nature, resulting in isolated stands of green trees (Figure 4). The gentle topography of the ridgetop was very conducive to mechanical logging methods, and feller-bunchers were used extensively. This has created a forest structure of isolated individuals and stands of mature green trees, surrounded by large clearings (Figure 5). Sections of the ridgetop (297 acres) were also planted in 2017, with a species composition of pure ponderosa pine.

The stand around Calso Campground (80 acres) is the largest remaining intact stand of green trees. During fire suppression operations, a back fire was lit in this stand, resulting in the consumption of most of the needle litter before the main fire hit. Due to this action, the fire burned very lightly through this area and the stand remains in its pre-fire condition. It is a multi-aged stand though the primary component is approximately 60-year-old trees established after the State first acquired the property. The stand is approximately 76% ponderosa pine, 15% Douglas-fir, 9% sugar pine. The conifer basal area is 164 sq. ft/ ac.

The seedlings planted at BMDSF were 1-0 plug seedlings grown at CAL FOREST nursery in Etna from seed that was collected from BMDSF by the LA Moran Reforestation Center. The overall forest structure developed from this management direction is a plantation of mixed conifer seedlings on the North slope and ponderosa pine seedlings on the ridgetop. Structural complexity is added to these plantations by the remaining standing dead trees and the disjointed stands of mature green trees.

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Figure 2. Fire killed trees on the north slope of BMDSF along road 300.

Figure 3. The same area along road 300 after logging. This area was logged primarily with feller-bunchers and most of the standing dead wood was removed.

Figure 4. On the ridgetop at the intersection of roads 400 and 500 prior to logging operations.

Figure 5. Intersection of roads 400 and 500 after logging operations completed. This spot is along the margins of one of the remaining green stands (left).

Forest Types

BMDSF is comprised of 3,313 acres of commercial timberland and 180 acres of non-timberland. Prior to the 2015 Valley Fire, nearly all the forest land was well-stocked with predominantly conifer species. Conditions for natural regeneration after Setzer's 1947-50 logging were very

favorable and practically all of the areas that were unstocked after logging were regenerated and supported moderately dense stands of reproduction with ponderosa pine (*Pinus ponderosa*) as the predominant species.

The three timber types that dominated the Forest prior to the Valley Fire included ponderosa pine, ponderosa pine/Douglas-fir (*Pseudotsuga menziesii*) and Douglas-fir. Ponderosa pine was dominant on the west slope and on the top of the mountain with about five percent sugar pine (*Pinus lambertiana*) included. The northeast slope of the mountain supported a ponderosa pine/Douglas-fir stand with various densities of ponderosa pine, sugar pine and Douglas-fir. A few small pockets of pure Douglas-fir occurred on the lower slopes on the northeast side of the mountain. A very small patch of California incense-cedar (*Libocedrus decurrens*) was located near the northeast corner of Section 12.

In addition to conifers, hardwood species comprised approximately 15 percent of the total basal area on BMDSF. Hardwood species include black oak (*Quercus kelloggii*), white oak (*Quercus garryana*), canyon live oak (*Quercus chrysolepis*), bay laurel (*Umbellularia californica*), and Pacific madrone (*Arbutis menzsiesii*). Several patches of native brush species, MacNab cypress (*Cupressus macnabiana*), and hardwoods were located at lower elevations along the northeast boundary of the Forest.

The reforestation plan for BMDSF seeks to reestablish what was present on the Forest prior to the Valley Fire. In late March of 2017, 312,415 seedlings were planted across 1,286 acres of the Forest. This planting effort covered 989 acres of the north slope, and 297 acres of the ridgetop (Figure 6). The seedlings planted in 2017 were grown from seed collected at BMDSF prior to the fire by the LA Moran Reforestation Center.

The species composition chosen for the replanting was based on the Continuous Forest Inventory data collected before the fire. The north slope of the Forest was planted with a mixed conifer composition of 45% ponderosa pine (*Pinus ponderosa)*, 40% Douglas-fir (*Pseudotsuga menziesii)*, and 15% sugar pine (*Pinus lambertiana*). The ridgetop was planted with 100% ponderosa pine.

The hardwood species of BMDSF are prolific stump sprouters and have regenerated well post-fire. As part of the vegetation control prescription, some of these hardwood species have been targeted for herbicide application to reduce competition with planted conifer seedlings. This prescription recommends the retention of 3-5 individuals per acre of the best phenotypes of the native hardwoods.

Prior to the Valley Fire BMDSF contained several areas of marginal timberland and unique ecosystems. The areas shown as brush/hardwood in Figure 7 feature serpentine soils and chaparral ecosystems. These environments are well adapted to fire and have seen good regrowth in stump sprouting hardwood species. Knobcone pine (*Pinus attenuata*), a serotinous species that responds to fire, has reestablished aggressively in some of these marginal sites.

Several open wet meadow areas are also present on BMDSF and were spared the worst effects of the fire. They were also generally avoided during the salvage logging and remain in good condition, though there has been aggressive ingrowth of wooley mullein (*Verbascum thapsus),* an invasive plant and early colonizer of disturbed soils.

Commented [DM7]: Are they in "good condition" if being colonized by non-natives? Maybe "undisturbed from mechanical treatments"

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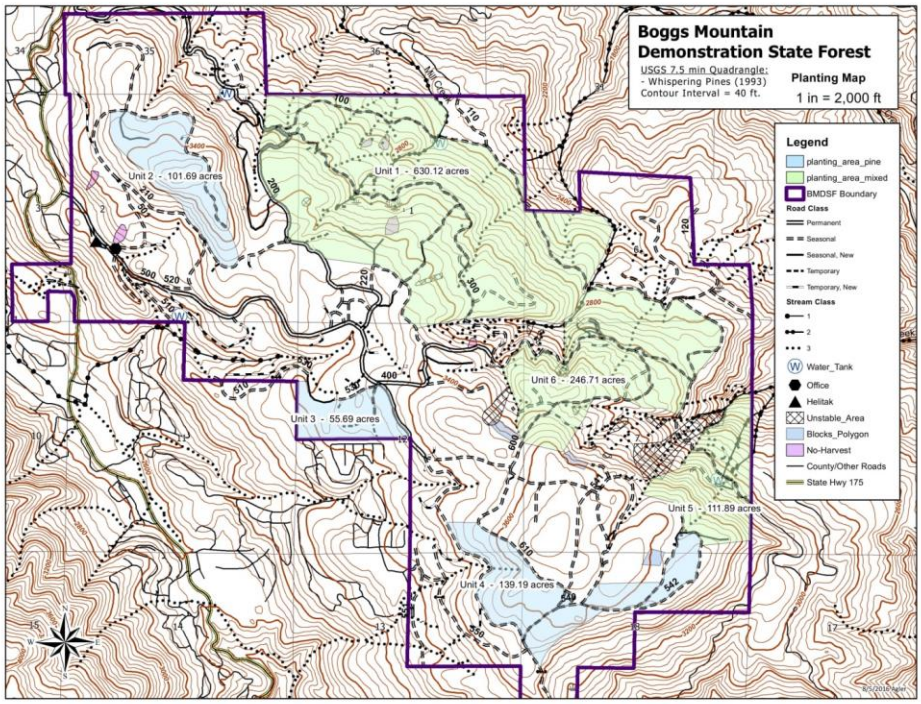

Figure 6: This map shows the areas that were planted in March of 2017. The area shown in green was planted with a mixed conifer composition and the area shown in blue was planted with ponderosa pine.

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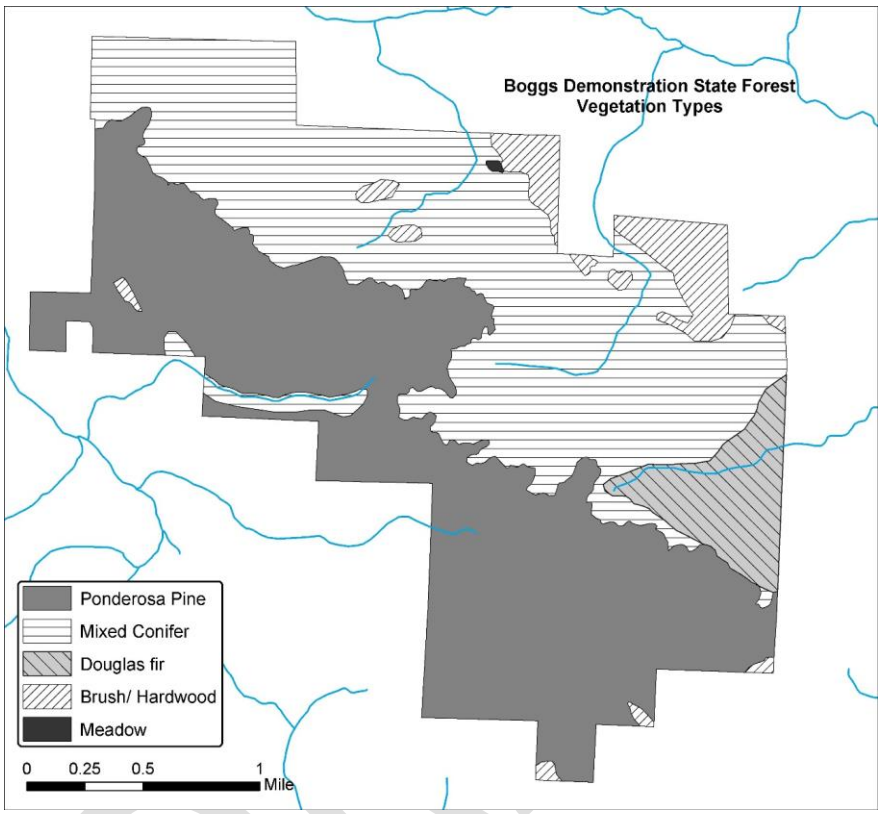

Figure 7. Forest vegetation types at BMDSF.

Site Quality

The average 50-year site index for the Forest is approximately 80 feet, based on Krumland and Eng (2005) site index equations. BMDSF will use Dunning's classification system for planning and Forest Practice Rule (FPR) compliance (as specified in the FPR's for stocking and retention standards). Beyond FPR compliance, the site classifications are used primarily to quantify stand acreage by site index values for management and growth projection purposes. Growth projections for the Forest are based on the actual site index measurements in Table 1. The site index is not expected to have changed due to the fire. Forest staff will be monitoring the growth of the planted seedlings and will update information on site class as this data becomes available.

Table 1. Site Classes for BMDSF

Dunning Site Class	50-year Breast-High Age Average Site Index (Krumland and Eng, 2005)	Percent of Forest
IA	91	5
I	83	84
II	72	8
III	46	3

Forest Inventory and Growth

Commented [DM8]: There is no mention of inventory addressing stocks and flux in carbon. Is that going to be part of the inventory into the future?

There is no current inventory estimate of timber resources on BMDSF. This is due to the recent catastrophic fire and the ongoing salvage operations. Historically, measurements of vegetation resources on the Forest, including timber volume and growth, have been derived from a system of plots referred to as the BMDSF Continuous Forest Inventory (CFI). The CFI consists of a 17 by 17 chain grid of 114 permanent plots, with 108 of the plots on areas that support the growth of commercial conifer species. Plots are measured every five years with 2011 being the last completed re-measure prior to the Valley Fire.

The 2011 inventory measured the gross timber volume as 60,778,200 board feet on 3,493 acres (17,400 bf/ac). Hardwood volume was 1,757,356 cubic feet (516 cf/ac). Initial post fire surveys found that 98 of the 114 plots (86%) experienced 100% conifer mortality. The remaining plots had partial damage that ranged from minor charring at the base of the boles to extensive crown scorching. These findings showed strong correlation with the burn severity maps produced at the time of the fire. There is also ongoing tree mortality due to drought-related stress and the subsequent beetle attacks. To date, salvage operations have resulted in approximately 50 million board feet of timber sales. Although no systematic post-fire inventory has been initiated, it is reasonable to assume, based on the numbers above, that the current inventory of standing green timber is less than 5 million board feet.

Analysis of the 2006-2011 CFI measurements indicated that conifer growth was approximately 410 board feet per acre per year (bf/acre/year). The 2008 Option A plan estimated a long-term sustained yield of 475 bf/acre/year for a fully stocked and regulated forest. This represents the growth potential of the Forest, but the next few decades will achieve only a small fraction of that potential due to the limited stock of merchantable size trees and the normal lag associated with young even-aged plantations reaching merchantable size classes.

Inventory efforts over the next few years will focus on completing a high intensity temporary plot system to assess the areas that have residual green timber and to get an initial estimate of the stocking and species composition of the young plantations. The grid of CFI plots will also be re-established to track changes on the Forest, including the development of the post-fire plantations.

Soils

The USDA Soil Conservation Service surveyed and mapped the soils on BMDSF in the early 1980's. Soil maps and descriptions are found in the 1989 publication "Soils Survey of Lake County" (Table 2; Figure 8). The soils on BMDSF are moderately deep to very deep, well-drained very gravelly loam and loam derived. Parent material for these formations are mainly from the mountain's lava cap of andesite, basalt, and dacite. Igneous rock derived Aiken and Collayomi soils are the Forest's most productive soils.

A limited amount of timber soils and most of the non-timber soils are derived from Great Valley formation sandstone or shale parent materials (See Geology and Landslide Section). Sanhedrin, Whispering, Speaker, and Marpa are lower site timber soils. Maymen, Estel, Snook, Hopland, Mayacoma, Millsholm, and Bressa soils are non-timber soils.

Local, site-specific soils classifications were performed by Dr. Susan Edinger-Marshall and Chelsea Obeidy (2016) as part of a post-fire erosion study being conducted by Dr. Joe Wagenbrenner[1]. Work completed included excavating and characterizing three soil pits and collecting soil samples for specific gravity measurements, particle size distribution analyses, and several pH measurements. Data from the work completed suggest the soils characterized are in a yet-to-be-named soil series in the Andisol soil order, which was added to the USDA Soil Taxonomy since the Lake County Soil Survey was completed.

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1 http://www.bof.fire.ca.gov/board_committees/effectiveness_monitoring_committee_/pdfs/emc_5.1_draft_concept_proposal_emc-2016-002_04__14_16.pdf

Soil Series No.	Name	Parent Material	Slope Range (percent)	Acres	Dominant Vegetation
126	Collayomi Complex	Andesite, Basalt, Dacite	50-75	71	Ponderosa pine, Black oak, Douglas-fir, Sugar pine
127.	Collayomi-Aiken-Whispering Complex		5-30	1917	Ponderosa pine, Black oak, Sugar pine, Douglas-fir
128.	Collayomi-Aiken-Whispering Complex	"	30-50	712	Ponderosa pine, Black oak, Sugar pine, Douglas-fir
129.	Collayomi-Whispering Complex	"	30-50	437	Ponderosa pine, Black oak, Sugar pine, Douglas-fir
224.	Speaker-Marpa-Sanhedrin Complex	Sandstone	30-50	106	Ponderosa pine, Douglas-fir, Black oak, Live oak
245.	Whispering-Collayomi Complex	Andesite, Basalt, Dacite	50-75	78	Ponderosa pine, Black oak, Sugar pine
TIMBER SOIL TOTALS				**3321**	
168.	Maymen-Estel-Snook Complex	Sandstone, Shale	15-30	56	Chamise, Manzanita, Buckbrush
169.	Maymen-Estel-Snook Complex	"	30-75	21	Chamise, Manzanita, Buckbrush
173.	Maymen-Hopland-Mayacama Association	"	30-50	52	Chamise, Manzanita, Buckbrush, Black oak, Madrone, Live oak. Scattered Douglas-fir and Laurel
174.	Maymen-Hopland-Mayacama Association	"	50-75	5	Chamise, Manzanita, Buckbrush, Black oak, Madrone, Live oak. Scattered Douglas-fir and Laurel
175.	Maymen-Millsholm-Bressa Complex	"	30-50	6	Chamise, Manzanita, Buckbrush, sometimes Blue oak
177.	Millsholm-Bressa Loams	"	30-50	5	Blue oak, Grass
178.	Millsholm-Bressa-Hopland Association	"	30-50	27	Blue oak, Grass
NONTIMBER SOILS TOTAL				**172**	

Table 2. Soil Series on BMDSF.

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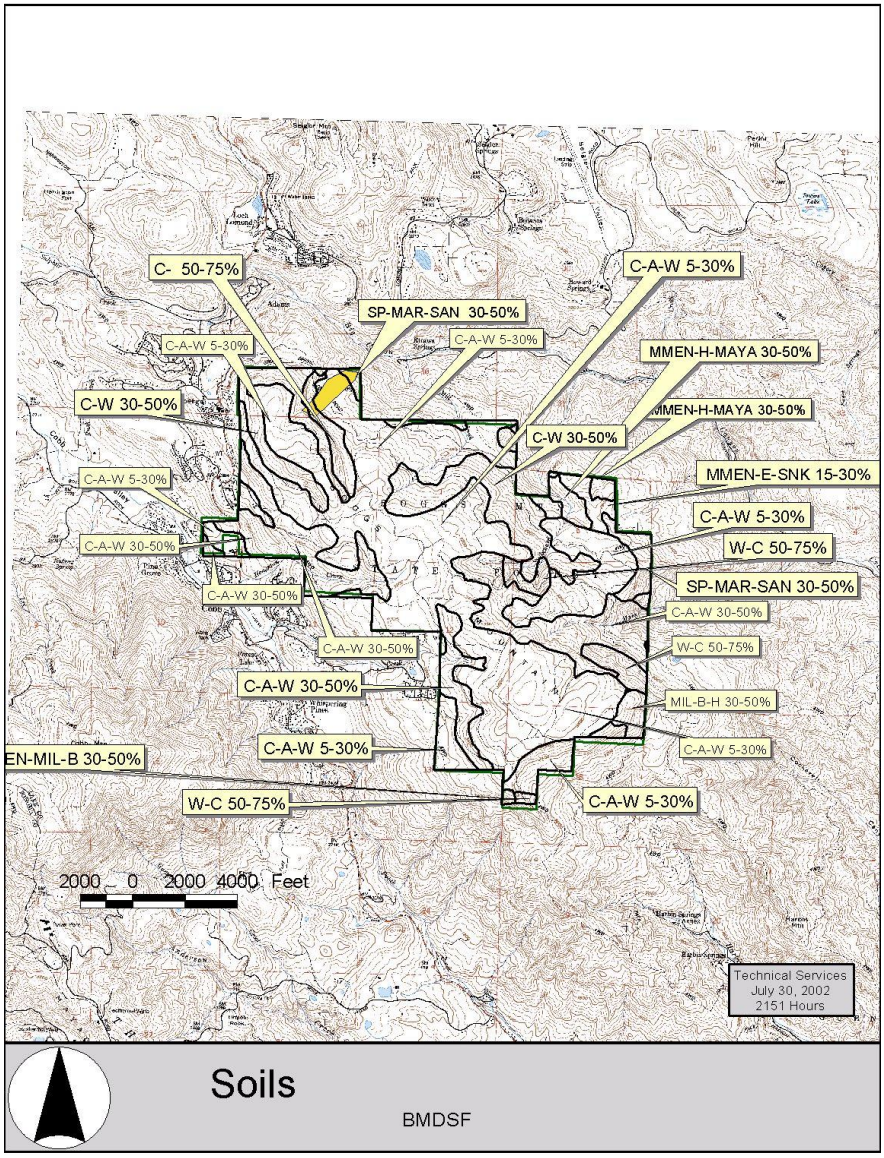

Figure 8. Soils map of BMDSF.

Geology and Landslide

Commented [DM9]: This is a well written section.

BMDSF is within the north-central section of the Coast Ranges Geomorphic Province (CGS 2002). The Coast Ranges are northwest trending mountain ranges and valleys extending from the Oregon border to the north, to the Transverse Ranges to the south, and the Great Valley province to the east. The western edge of the province along the Pacific Ocean is uplifted, terraced and wave-cut. The Coast Ranges run subparallel to the active San Andreas Fault, which runs approximately 600 miles from Point Arena to the Gulf of California. The province is divided into northern and southern sections separated by a depression containing the San Francisco Bay. Within the geomorphic province, the bedrock is generally comprised of Mesozoic and Cenozoic era (65 million years to 250 million years) sedimentary rocks which are overlain in areas by young Holocene and Pleistocene age (1.6 million years to 65 million years) volcanic rocks.

Figure 9 provides a geologic map of the BMDSF (adapted from Hearn et al.,1995). The BMDSF is underlain mostly by relatively young, Pleistocene-age volcanic rock (abm) composed of andesitic flows associated with the Clear Lake Volcanics. These flows are relatively erosion resistant and form a caprock along the broad, gentle-sloping ridgetop of Boggs Mountain. Boggs Mountain is bounded to the northeast and southwest by several primary, northwest-southeast-trending normal faults associated with the Konocti Bay Fault zone and the Colloyomi Fault Zone, respectively. Secondary faults that strike at normal to oblique angles to these primary faults cross-cut Boggs Mountain. Offset, landsliding, and weathering along the primary and secondary faults has created steep, undulating ground that flank Boggs Mountain to the north, southeast, and northeast, and has exposed bedrock belonging to the Upper Cretaceous to Upper Jurassic-age Great Valley Sequence (KJgv). Within the BMDSF, the Great Valley Sequence unconformably underlies the Clear Lake Volcanics and is composed of friable greywacke sandstone with interbedded shale and siltstone layers. A small, isolated area of tectonically intruded serpentinite (Jsp) is mapped along a primary fault that bisects the north part of BMDSF, east of Mill Creek.

Holocene-age colluvium (co) and landslide deposits (ls) are mapped within BMDSF along the steep slopes that flank Boggs Mountain. The majority of the mapped unstable areas consist of deep-seated, dormant-mature to dormant-old[2] landslide complexes that contain areas of more recent (suspended to active) slope failures along over-steepened slopes associated with prominent breaks-in-slope (e.g., bench faces) and incised channel banks, such as along Malo, Spikenard, and Mill creeks. The nested landslide complexes appear to be concentrated along the contact between the Great Valley Sequence and the overlying Clear Lake Volcanics. It is speculated that landslides initiate along this contact due largely to a contrast in the hydrologic properties and the material strengths of the two formations. Groundwater likely percolates down through the more permeable volcanics until it reaches the less-permeable Great Valley Sequence bedrock resulting in a perched groundwater table at the contact, as evidenced by the presence of springs that daylight along the contact (e.g., Grouse Springs). The hydrostatic pressures resulting from the perched groundwater table increase the buoyant forces in the slope and, in the presence of weathered (weak) bedrock material and soil along the contact, reduce the slide-resisting forces sufficiently to result in slope failure.

Many of the large-scale, deep-seated landslide complexes shown on the geologic map (Figure 9) are interpreted to have occurred during periods of geologic and climatic conditions that don't persist today, and are therefore not generally susceptible of becoming destabilized through

[2] Age classes are as described in Keaton and DeGraff 1996.

timber management practices (i.e. logging, road construction, etc.). However, the presence of more recent, small-scale failures nested within the larger landslide features indicate the presence of landslide prone slopes that fail naturally and that may be susceptible to reductions in canopy and ground disturbance resulting from timber management practices. Additionally, following the 2015 Valley Fire that burned within the BMDSF, shallow-seated landsliding has been observed that may be related to the effects the fire had to the landscape. For this reason, at the request of CAL FIRE, California Geological Survey (CGS) is currently performing reconnaissance-level geomorphic mapping to identify the extent of landsliding within BMSDF. A Certified Engineering Geologist will be consulted as deemed appropriate by an RPF where timber operations are proposed on or upslope of unstable features.

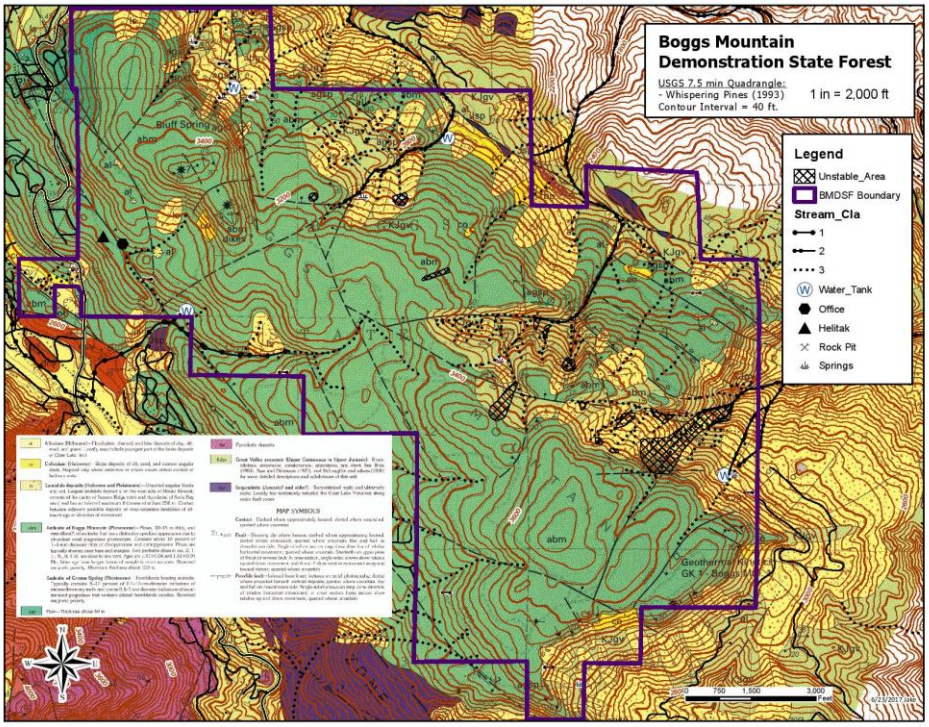

Figure 9. Geologic map of BMDSF

Water Resources

BMDSF is a part of the top of Boggs Ridge, which runs northwest/southeast separating the Putah Creek and Kelsey Creek watersheds. Boggs Mountain is located in the headwaters of the Kelsey Creek and Putah Creek drainages. Kelsey Creek is in the Clear Lake watershed; Putah Creek is in the Lake Berryessa watershed. Watercourses on the Forest are first and second order with no fisheries resources, with the exception of a short segment on Houghton Creek. Several landowners use water for domestic purposes that comes directly from BMDSF. Most of

these non-forest water uses are located on the east side of the Forest, including Ettawa Springs and Harbin Hot Springs. BMDSF has at least one easement for water originating on the Forest.

Surface water is uncommon on the Forest. There are 3.8 miles of perennial streams, including portions of Grouse Spring, and Houghton, Malo and Spikenard creeks (Table 3). The three springs that exist on the Forest are Big Springs, Bluff Springs and Houghton Springs, all of which have been developed to fill fire suppression storage tanks.

Table 3. Perennial streams on BMDSF.

Name	Length
Big Springs Creek	0.50 mi
Grouse Spring Creek	0.25 mi
Houghton Creek	0.76 mi
Malo Creek	0.76 mi
Mill Creek	0.76 mi
Spikenard Creek	1.14 mi
TOTAL	3.8 mi

Roads

An access road system, based on the original logging road network, was established shortly after the BMDSF was acquired. Starting in 1965, major portions of the original road system were rebuilt to improve road grades, alignment, and drainage. Some short sections of new roads were constructed to avoid adverse grade problems. After the Valley Fire, Forest staff classified existing roads on BMDSF (Figure 10). Currently BMDSF has 15.6 miles of permanent all-weather roads, and 19.3 miles of seasonal roads, for a total of 34.9 miles of road.

The entire Forest road system had to be upgraded to accommodate the truck traffic involved in logging the Valley Fire burn area. This involved reshaping and regrading the main haul roads, replacing stream crossings and ditch relief culverts, application of surface rocking in some locations. An onsite rock quarry was developed in order to facilitate the surfacing of roads. In early 2016, a rock crushing contractor (Northern Aggregate) was brought in to develop the quarry and crush 13,000 yards of 2-inch minus road base from the native rock available at the quarry (Figure 11). Most of the main haul roads were rocked to facilitate hauling during wet weather. In addition, asphalt tailings were acquired from Caltrans and spread on the first two miles of the main haul road 500. The tailings were rolled into the graded road and then treated with magnesium chloride. These tailings held up well to the summer logging traffic and reconstituted from the continued traffic into a surface close to asphalt.

~~-~~New road construction was required to support salvage operations. ~~-~~New construction was limited~~, but~~ due to the property historically being managed for timber production. ~~, there was already an extensive road system in place.~~ Most ~~of the~~ new road construction was limited to ~~s were~~ spur roads used to access harvest units that had not been ~~harvested~~ managed for decades.~~in a long time. This new~~New road construction took advantage of historic road and skid trail alignments to minimize ~~excavation~~excavation and soil disturbance.

Commented [MK10]: Peter, Matt's edits don't make sense to me here. I'm going to let you review so I don't change the intended meaning of the paragraph.

All roads on BMDSF that are no longer required for management and recreational purposes will be considered for abandonment. Roads to be abandoned will include user-generated roads, temporary roads, and roads to be permanently closed. User-generated roads are those that vehicles have made by not following a recognized BMDSF road and creating tracks for others to

follow. Temporary roads can be defined as roads that are used for one or two years for timber sale activity and then abandoned; they may be reopened and reused in the next timber sale entry.

Commented [DM11]: This is a defined term in the forest practice rules. Maybe us that definition for consistency.

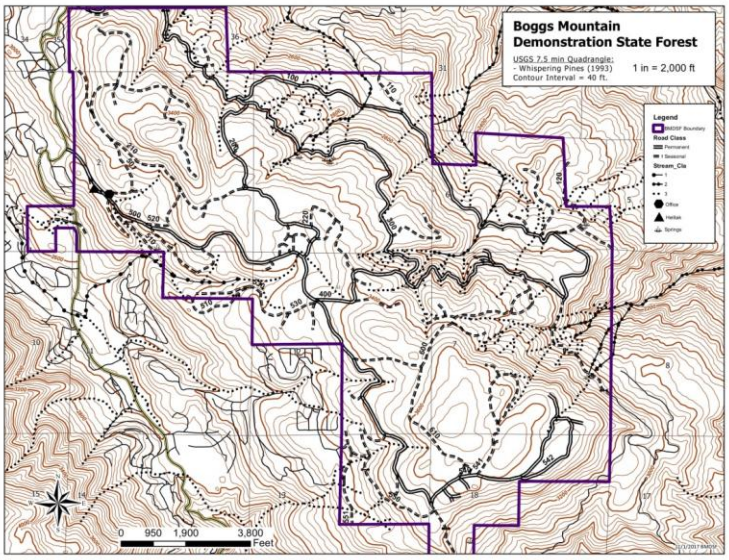

Figure 10. Road system on BMDSF. The basic footprint of the road system has remained the same, though new spur roads were added during the salvage operation.

Continued upgrading of the road network is essential for long-term resource management, administrative access, fire control, and recreational purposes. Erosion control, watershed restoration, and road rehabilitation work will be accomplished by implementing a Road Management Plan. A major goal of the Road Management Plan is to guide the establishment of a road system that is hydrologically disconnected and largely self-maintaining and/or requiring low levels of maintenance where feasible. A systematic approach to road management problems has been employed to identify, document, prioritize and cost-effectively treat current and potential future sediment sources on the Forest.

Figure 11. Rock crusher operating at the BMDSF quarry site.

During 2016, eleven stream crossings were replaced and upgraded to support salvage logging operations. These crossings were designed to support a 100-year flow and size was determined in consultation with CGS using the rational method (Figure 1~~Figure 1~~2). However, the record-breaking rains during the winter of 2016-2017 severely impacted the Forest road system and BMDSF staff has since been engaged in ongoing monitoring of stream crossings and other active erosion sites. To date, there have been no major failures of crossings on the main haul roads, though a landslide has closed one of the secondary seasonal roads that is now proposed for abandonment.

One road segment is currently proposed for abandonment under the BMDSF Timber Harvest Plan currently in review. A section of seasonal road 0.7 mi in length is proposed for abandonment in the eastern portion of the property. This road was used for timber operations under the Emergency Notices, but was heavily impacted by the extreme 2016-2017 precipitation events which brought roughly 130 inches of rain to BMDSF. This road crosses a deep seated unstable feature that has become more active after the winter period. The road prism has also been destabilized by larger slides downslope of the prism and the road is falling into disrepair. The portions of the Forest accessed by this road were planted in the spring of 2017 and no further timber operations require the use of this road segment; therefore, the BMDSF Manager has proposed to abandon this road and remove all crossings of classified watercourses. This will be completed under the review process of a Timber Harvest Plan and will require preparation of a new road work contract, tentatively scheduled for 2018.

Commented [DM12]: Are these two separate roads? If not, I don't think that you need to reference the ongoing THP.

The road abandonment work will include the removal of three classified watercourse crossings: a Class III (RP1) crossing with a 24" diameter culvert, a Class III rocked ford crossing (RP 2), and an 18" culvert that drains flow from a Class II spring across the road (RP 5). The rock ford will not be completely removed, as it is heavily rock reinforced and designed for maintenance-free functionality. However, the fill around the crossing will be pulled back to improve the road

drainage at this crossing. These watercourse crossings proposed for abandonment will be completed under a Lake or Streambed Alteration Agreement (1600-2016-0207-R2).

Figure 12. New Class II watercourse crossing at Mill Creek. Two 30 inch culverts were replaced with one 60-inch pipe.

Two other points will be treated as part of this road abandonment that are not on classified watercourses. One is a critical dip that has begun to fail (RP 4), though there is no potential for delivery to a classified watercourse. The other is an area where cutbank seeps that developed during the winter 2016-2017 began to erode the road prism (RP 3). This area also has low potential to deliver to a classified watercourse, as these seeps flow onto a large flat below the road.

Two other points will be treated as part of this road abandonment that are not on classified watercourses. One is a critical dip that has begun to slide outward (Pt 4), though there is no potential for delivery to a classified watercourse. The other is an area where cutbank seeps that developed during the winter 2016-2017 began to erode the road prism. This area also has low

potential to deliver to a classified watercourse, as these seeps flow onto a large topographic flat below the road.

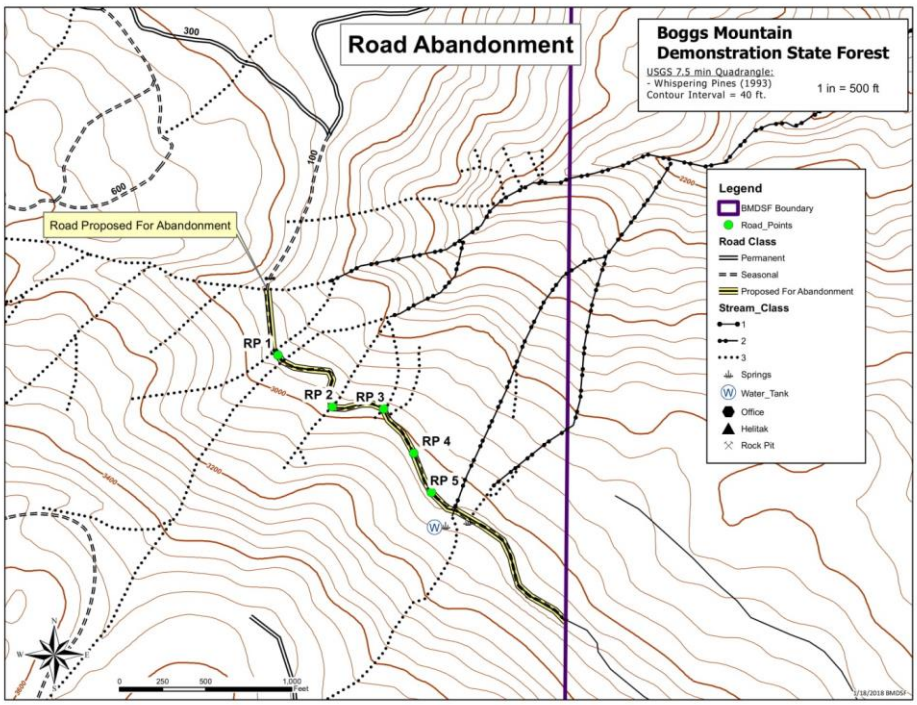

Figure 13: This section of seasonal road (from the point indicated by the text box to the property line) is proposed for abandonment under the THP currently in review (1-17-126 LAK).

Table 4: Road work points associated with the proposed abandonment shown in Figure 13.

RP#	Road #	Feature	Mitigation
1	100	24" culvert crossing of Class III	Crossing fill and metal culvert will be removed with an excavator. The excavated fill will be place away from the crossing to prevent transport to the watercourse during precipitation events. A second Class III watercourse is located approximately 25 ft. from the main channel. Originally both watercourses were directed into the culvert crossing. During the winter of 2016-2017 the secondary Class III breached the berm directing the flow into the crossing. Once removed, the crossing will be dipped out to collect the flow from both watercourses.
2	100	Rocked ford crossing of Class III	Excess fill will be removed from the crossing area to prevent transport to the watercourse during precipitation events. Most of the rock will remain in place as this crossing was designed for long term maintenance free functioning.
3	100	Critical dip with wood at outlet	Not on a classified watercourse. Critical dip slumping outward along with some of the road fill. The actively moving portion of the road fill will be pulled back and placed away from the dip to prevent transport to a classified watercourse.
4	100	Road eroding where bank seeps developed during the winter time	Water seeping from the cutbank has eroded section of the road surface. The road will be shaped in this area to transport water off the road surface. This area does not discharge immediately to a classified watercourse.
5	100	18 in culvert at Class II draining Class II spring	This culvert drains a perennial Class II spring which is also the beginning of the Class II elements of Malo Creek. The culvert will be removed and the crossing will be excavated to channel grade. The fill will be pulled back to prevent transport into watercourse.

Ground Cover

Prior to the 2015 Valley Fire, ground cover within the forested areas varied from pine needle litter to patches of shrubs typical of central and northern inland California Coastal Range. Under the denser stands of timber, the ground was park-like and open with little or no undergrowth, then progressed into sparse grass and dense brush in the more open stands.

The fire consumed virtually all the duff and litter layer across BMDSF. The subsequent logging and site prep (i.e., contour ripping and mechanical piling) further disturbed the soil profile. Since the fire, the ground cover has begun to reestablish to varying degrees. In the areas that burned the hottest (mostly the north slope) there were no needles left on the remaining trees and the ground cover has been very slow to reestablish. In some ridgetop areas, the needles on the fire-killed conifers were not completely consumed and so quickly dropped to the forest floor after the fire.

The herbicide treatment used in the 2017 planting units repressed the grasses and forbs, therefore the ground cover in these units has been very slow to reestablish. The herbicide

prescription developed for BMDSF required a 100-foot buffer of all classified watercourses. It is within these buffered areas that a dense cover of grasses and forbs has reestablished (Figure ~~Figure~~ 13).

Prior to the fire the understory at BMDSF was generally open with occasional clearings vegetated with predominantly ponderosa pine reproduction and/or brush. The brush patches were composed principally of Konocti manzanita (*Arctostaphylos manzanita ssp. elegans*), and Sonoma manzanita (*Arctostaphylos canescens ssp. sonomensis*). Ponderosa pine reproduction had overtaken the brush canopy in many of the brush patches.

Konocti manzanita (*Arctostaphylos manzanita* ssp. *Elegans)* and Sonoma manzanita (*Arctostaphylos canescens* ssp. *Sonomensis)* are two rare species of manzanita that have been identified during botanical surveys conducted on BMDSF. These species are listed as CNPS 1B, but are considered locally common on Boggs Mountain. Considering the large population of these two manzanita species observed and documented across the forest prior to the fire, and their regenerative capabilities from both resprouting and seed germination, the proposed management should have no substantial long-term adverse effect to either species.

Figure 14. Understory grasses and forbs beginning to reestablish in the spring of 2017. This image is of a deep-seated unstable area where the primary harvesting methods were hand felling and cable yarding. Due to the higher cost of this harvesting method, much of the unmerchantable wood was left standing.

Economic Situation

Towns and Communities

Commented [DM13]: This section touched on population increase affecting the Forest (i.e fuelwood), but not on increased recreation, if any. Maybe this is later in the plan.

BMDSF is located in the community of Cobb, which is about equidistant from the communities of Middletown, Kelseyville, and Lower Lake. These three towns are about 30 minutes driving time from the Forest over paved state highways. In recent years, Middletown has become an affordable alternative to the high housing prices in Sonoma County. The increasingly expensive urban areas surrounding both Santa Rosa and Ukiah are causing people to migrate into the area to take advantage of lower housing costs. Many of the residents of Middletown join the commuter traffic to Santa Rosa each morning.

Up until the early 1970's, the Cobb area was a major resort area. Since the early 1970's, Cobb's resort industry has significantly declined and most of the old resorts are owned by groups as conference centers or retreats and are not open to the public, or were destroyed in the 2015 Valley Fire.

The energy crisis that occurred in the 1970's and resulting demand for alternate energy sources greatly accelerated the exploration for and development of the geothermal resource in Lake County in the 1980's. The greatest development was in the Cobb Mountain area where Calpine operates 13 plants, known as "The Geysers," with a generating capacity of 725 megawatts. The Forest is within a few miles of The Geysers' geothermal field, which has been developed extensively since 1976. The geothermal industry brought new economic prosperity to the Cobb area during the late 1970's and early 1980's. During the 1980's, as geothermal energy development leveled off, the community continued to grow due to the relatively inexpensive land and housing prices.

The population of Lake County has increased by almost 50 percent since 1986. However, since 2010 the population of Lake County has decreased by 0.8%. Much of the increase occurred in the southern Lake County where Boggs Mountain is located. Subdivision development and home construction have increased the population pressures on commercial development, schools, demand for recreation, and increased demand for services. The 2015 Valley Fire destroyed over 1,900 structures in Lake County, at least 50 of which were homes in the community of Cobb. Though the effect of the fire on the population of Cobb, as well as Lake County in general, was insignificant, BMDSF has been closed indefinitely to the public since September 12, 2015.

Commented [DM14]: Are you sure about this?

Prior to the fire, the population growth increased the demand for fuel wood from BMDSF. This demand was heightened by the relatively high heating fuel costs in Lake County, which is not served by natural gas. This population growth and the increasing demand for more services is anticipated to increase the workload and demands on the staff at BMDSF upon reopening the Forest to the public.

Markets for Forest Products

Prior to BMDSF being closed to the public, CAL FIRE offered to public and private commercial interests the opportunity to purchase minor forest products, subject to specific rules and constraints. Permits could be purchased for the collection of products including salvage sawlogs, poles, split products, greenery (e.g. boughs, shrubs, and ferns), rocks, and firewood. Class I Sale Permits will be issued for the collection of these minor forest products.

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The market for sawlog timber was very limited when the first BMDSF timber sales were offered in 1967. Only one mill in Ukiah showed interest in the first sale and two mills, one in Ukiah and one in Marysville, bid on the second sale. Currently, sawlog timber from BMDSF is marketable with more mills and loggers showing interest in BMDSF timber sales. However, the limiting factors continue to be proximity to market outlets, or haul distance, which can result in low stumpage prices when market conditions are poor, and the fact that most timber present on BMDSF is dead and dying. For this reason, timing is critical in the preparation and marketing of timber sales from BMDSF. In addition to the sale of sawlogs, staff at BMDSF continue to explore opportunities within the pole timber and biomass markets.

The salvage timber sales put out to bid in the aftermath of the Valley Fire attracted some local mills early on, however many of the sales fell through as bidders became concerned about the viability of the forest product. The first timber sale was sold to Sierra Pacific Industries who milled most of the logs at their Lincoln Sawmill. Other sales were sold individually to logging companies who negotiated deals at Mendocino Forest Products, Collins Pine, and Scotia. The majority of the Douglas-fir on the Forest was sold, however much of the pine was not. A major obstacle in the marketability in the forest products from BMDSF, especially the salvage material, was the legislative mandate prohibiting the export of forest products from State Forests.

Biomass has been considered as an option for the unmerchantable woody material left after the initial salvage logging entries. However, the closest biomass facility is in Anderson, which is approximately 145 miles from BMDSF. Due to the low value of the product and the long trucking distance from the Forest to the energy plant, this option is uneconomical. Biomass fuel production may become a more viable option in the future if either a new plant opens closer to the Forest, there is an increase in value of the product, or the government begins to subsidize the transport costs.

Table 5. Forest products mills in California North of San Francisco Bay.

Mill	Location	Miles from BMDSF
Almquist Lumber	Arcata	212
Unity Forest Products	Yuba City	90
Marysville Forest Products	Marysville	92
Harwood Products	Branscomb	95
Humboldt Redwood Company	Scotia	173
Mad River	Arcata	209
Mendocino Forest Products	Ukiah	57
Sierra Pacific Industries	Richfield	115
Sierra Pacific Industries	Lincoln	117
Sierra Pacific Industries	Anderson	145
Sierra Pacific Industries	Camino	160
Sierra Pacific Industries	Shasta Lake City	165
Sierra Pacific Industries	Quincy	195
Collins Pine Company	Chester	205
Shasta Green, Inc	Burney	210
Shasta Forest Products	Yreka	258
Sierra Pacific Industries	Burney	210
Sierra Pacific Industries	Chinese Camp	225
Sierra Pacific Industries	Standard	235
Sierra Pacific Industries	Susanville	235
Trinity River	Eureka	199
Trinity River	Korbel	223

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Transportation Facilities

BMDSF is accessible by state highways. Highway 175 is adjacent to the northwestern boundary of the Forest and within four miles of all the Forest roads. Between 1965 and 2017, major highway improvements were made on State Highways 20 and 29.

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3. Desired Future Conditions and Planned Management

This section describes the planned management on BMDSF over the next decade. The goals for management of the Forest are described in terms of desired forest structural conditions, beginning with the establishment of conifer plantations subsequent to the Valley Fire. The management of BMDSF is intended to balance sustained long-term biological productivity of the timberland with the protection of public trust resources. The timber management program under this plan is expected to reestablish an uneven-aged forest capable of a sustained harvest of forest high quality forest products while maintaining the productive capacity of the soils and other forest resources in perpetuity. The goal of this aggressive reforestation program to is develop a financially viable timber management program in order to remain relevant as a research laboratory for sustainable forestry on private timberlands. This program reflects the need to maintain the widest possible range of forest conditions to accommodate potential future research studies.

The cornerstones of planned management at BMDSF are silvicultural and plantation treatments aimed at reestablishing a productive commercial forest, fire hazard reduction through fuels treatment, and maximum sustained production of high quality forest products.

Desired Future Conditions

The overall management goal is to, in time, reestablish mid-seral forest types that are resilient to catastrophic wildfire. This goal is not discretionary, but rather follows directly from the research and demonstration mandate for BMDSF. Rather than a park or reserve, the legislated mandate for the Forest is that of a working forest for demonstration and research purposes, serving a clientele of small to medium size landowners. It is under this mandate that the aggressive reforestation plan for BMDSF was developed.

Fire resilience will be managed through controlled levels of stocking in plantations by projects such as timber harvest, implementation of fuelbreaks, pre-commercial thinning, prescribed fire, chipping, and biomass harvesting. Most merchantable timber was harvested in the post fire salvage operations, though secondary forest products (e.g. biomass, wood chips, firewood, etc.) will still be produced. An important criterion for the timing of commercial timber harvests within remaining mid-seral and early seral stands will be to target forested areas that are over stocked and contain high levels of ground litter and ladder fuels.

To remain relevant as a research forest, BMDSF aims to create a wide range of forest types, ages, size classes, successional stages, and structural characteristics. It is going to be very difficult to maintain pure stands of each of these characteristics on a forest this size; therefore, the approach will be to incorporate a continuum of types, age classes, successional stages, and structures mixed within stands across the Forest as far as possible.

The concept of the fully regulated forest, with an approximately equal representation of all age and structure classes, averaging out to an overall mid-seral forest, lends itself well to the goal of maintaining as wide a range of forest conditions as possible to accommodate future research. This concept will be used as a guide in maintaining and cultivating the aggregate of individual stands on BMDSF.

Stands will be a mixture of conifer and hardwood species typical of the ponderosa pine and Klamath mixed conifer types. The prevalent age class structure will be that of uneven-aged

stands, in which individual trees of a range of ages and size classes are present in the stands. Once the desired long-term forest structure conditions have been accomplished, it is anticipated that the oldest trees on the Forest will be about 100 years-old.

Prior to the 2015 Valley Fire, and informed by field work and forest inventory data, stands were assessed for meeting late-successional forest (LSF) definition (14 CCR § 895.1). Due to the fact that the Forest was largely clearcut at the time of transfer to State ownership, most stands on the Forest were 50-60 years old, and no late-successional stands currently existed on BMDSF. Some of the functional characteristics of LSF, such as large downed logs and large decadent trees and snags, existed throughout the Forest, but not in aggregated stands that would constitute LSF. Regardless, these biological legacies will be retained and recruited wherever feasible.

Structural characteristics such as snags, downed woody debris, decadent trees, and irregular tree characteristics (large branches, irregular form, hollows) will be retained to a density where they do not pose a safety hazard, fire hazard, impede the establishment and growth of new trees on the site, or provide a source of pest and disease to infect nearby healthy trees. Recruitment of large diameter snags will be accomplished by leaving, where feasible, dead trees, large trees that show signs of poor vigor, stress, or disease. No treatments are planned to actively create snags by girdling or topping live trees, unless prescribed on individual research installations. Snags from the dominant and predominant trees are preferred to promote recruitment of downed logs.

Silvicultural Methods

Silvicultural methods will be used that promote growth and regeneration in order to develop and maintain an all-aged forest composed of a mosaic of age and size classes consistent with the desired future forest structure conditions. Specific research projects may occasionally utilize unconventional methods that do not follow the general direction for silvicultural methods described below.

Uneven-aged management will be the dominant forest silviculture at BMDSF. Prior to the Valley Fire, ponderosa pine, Douglas-fir and mixed conifer stands were comprised of aggregates of even-aged size classes resulting from the 1949 and 1950 harvesting. Currently, the property does retain isolated stands that are representative of the pre-fire condition, however, as of the preparation of this report, even-aged pine and mixed conifer stands are being established over most of the property through artificial regeneration.

Special and Alternative silvicultural prescriptions will be used to a lesser extent to develop a fully regulated all-aged forest. Even-aged methods will be used sparingly to address wildland fire prevention, pest and disease abatement or difficulties with regeneration efforts. Specific research projects may also prescribe even-aged silviculture for demonstration purposes. In most cases, even-aged harvests will incorporate a green-tree retention method, where mature trees from the previous stand are left on site to provide structural and habitat diversity and to enhance natural regeneration. Although timber harvesting will focus on the removal of conifers, some hardwoods may also be removed to maintain natural relative site occupancy of hardwood to conifer species for this area. Though the majority of the property is occupied by plantations that are too young for most silvicultural methods, the following regeneration methods will remain as options for the residual green stands:

Selection (uneven-aged): Under the selection method, trees are harvested individually or in small groups sized from .25 acres to a maximum of 2.5 acres. Single tree selection will be the primary prescription for the Douglas-fir and mixed conifer stands. Group selection will be used within the pine stands to avoid species conversion and to maintain species diversity. Openings will be created to obtain more pine regeneration rather than the more shade tolerant Douglas-fir which is favored by single tree selection. For purposes of natural regeneration, group openings shall retain at least one seed tree per acre greater than 18 inches DBH, with full crown and superior phenotype. Artificial regeneration may be used to supplement natural regeneration.

Transition (uneven-aged): The transition method will be used to develop an uneven-aged stand from a stand that currently has an unbalanced irregular or even-aged structure. The transition method involves the removal of trees individually or in small groups from irregular or even-aged stands to create a balanced stand structure and to obtain natural reproduction. This method will be used no more than twice in order to increase stocking and improve the balance of age classes. The residual stand will be managed by the single-tree selection or group selection methods during future harvests.

Commercial thinning (Intermediate): Commercial thinning is the removal of trees in a young-growth stand to maintain or increase average stand diameter of the residual crop trees, promote timber growth, and/or improve forest health. The residual stand will consist primarily of dominant and codominant trees from the preharvest stand. The residual stand will be managed by the single-tree selection or group selection methods during future harvest.

Sanitation-Salvage (Intermediate): Sanitation is the removal of insect attacked or diseased trees in order to maintain or improve the health of the stand. Salvage is the removal of only those trees which are dead, dying, or deteriorating due to damage from fire, wind, insects, disease, flood, or other injurious agents. Salvage provides for the economic recovery of trees prior to a total loss of their wood product value. Sanitation and salvage may be combined into a single operation. This has been the primary silvicultural methods employed on the property post-fire, and will likely remain so in the future as harvesting of fire killed trees continues and as trees continue to die from insect attacks

Rehabilitation of Understocked Areas (Special): The rehabilitation prescription will be used for the purposes of restoring and enhancing the productivity of commercial timberlands which do not meet the stocking standards defined in the Forest Practice Rules.

Fuelbreak/Defensible Space (Special): Trees and other vegetation and fuels will be removed to create a shaded fuel break or defensible space in an area to reduce the potential for wildfires and the damage they might cause. The most likely location for this prescription is in the stands that remain near the property lines, campgrounds, and newly established plantations.

Alternative Prescriptions: An alternative prescription will be included in a Timber Harvesting Plan (THP) when, in the judgment of the Forest Manager, an alternative regeneration method or intermediate treatment offers a more effective or more feasible way of achieving the objectives of the management plan than any of the standard silvicultural methods provided in the Forest Practice Rules.

Shelterwood (even-aged): The shelterwood regeneration method reproduces a stand via a series of harvests (preparatory, seed, and removal). The preparatory step is utilized to improve the crown development, seed production capacity, and wind firmness of designated seed trees. The seed step is utilized to promote natural reproduction from seed. The removal step is utilized

when a fully stocked stand of reproduction has become established and this step includes the removal of the protective overstory trees. The shelterwood regeneration method is normally utilized when some shade canopy is considered desirable for the establishment of regeneration.

Reforestation

The reforestation plan for BMDSF is to reestablish an uneven-aged, mid-seral conifer forest from artificial regeneration. These seedlings were grown from seed collected at BMDSF prior to the Valley Fire. As of the preparation of this management plan 1,286 acres have been planted, with an additional 1,650 of planting planned for the spring of 2018.

The Forest has been divided into two main forest types: the pine forest of the NW/SE trending ridgetop and the mixed conifer forest of the north slope. The Houghton Creek drainage on the southern border of the property will be planted with a mixed conifer composition, representative of pre-fire species composition. Research plots developed by CAL FIRE's Forest Resource Assessment Program (FRAP) will also be planted with a mixed conifer composition. Table 6 shows the planned species composition for future plantations.

Table 6. Planned tree species compositions for reforestation of BMDSF

Year	Location		Ponderosa Pine	Douglas-Fir	Sugar Pine	Incense Cedar	Giant Sequoia
2017	Ridgetop		100%	0%	0%	0%	0%
	Mixed Conifer	Unit 1	45%	40%	15%	0%	0%
		Unit 5	50%	40%	10%	0%	0%
		Unit 6	50%	40%	10%	0%	0%
2018	Ridgetop		100%	0%	0%	0%	0%
	Mixed Conifer		45%	40%	10%	4%	1%

The seedlings planted in 2017 were container stock 1-0 seedlings. The pine seedlings were grown in styro 6 containers and the Douglas-fir seedlings were grown in styro 8 containers. Container stock was chosen over bareroot seedlings due to the ease of transport and planting. Areas planted in 2017 were aggressively site prepped with contour ripping and herbicide applications, therefore it was determined that 1-0 seedlings would be appropriate. The larger 2-0 or 1-1 seedlings have the advantage of being hardier, but the increased cost of cultivation and planting would likely have offset any increased survival rates. Based on the success of this previous planting effort BMDSF will continue using the same size container stock for reforestation efforts.

Thinning

Precommercial thinning guidelines are developed to accomplish the desired spacing of young growth stands on the Forest for maximum diameter growth of future crop trees. Thinning operations are laid out and supervised by BMDSF staff. Priority thinning areas are on the most densely stocked areas of the Forest. Two stands—each roughly 80 acres—survived the Valley Fire and may be thinned over the life of this Plan. The first stand is in the area surrounding Calso Camp, and the other is the Grouse Springs area. Both stands are in roughly their pre-fire

condition. The Calso Camp stand is proposed for group selection under the BMDSF salvage Timber Harvest Plan (THP), currently in review.

Material developed from the precommercial thinning operations will be sold for firewood under a Class I timber sale permit, chipped, or piled and burned. Commercial thinning operations will be used under the THP process as an intermediate silvicultural treatment to promote growth and vigor of the residual stands. Material developed from commercial thinning operations will be sold for sawlogs, poles, and biomass as a Class III timber sale and sold as firewood under a Class I timber sale permit. The residual stand will be managed under the Selection or Group Selection silvicultural methods during subsequent harvests.

Depending on growth rates, the plantations may be ready for a precommercial thin in as little as 10-15 years. BMDSF staff is already observing high survival rates among planted seedlings (~90%), indicating that precommercial thinning may be used to achieve optimum spacing and developing fire resistance of young forests. Thinning processes will become the primary silvicultural method as the Forest is developed from an even-aged plantation to an uneven-aged forest.

Pruning

Prior to the Valley Fire, natural pruning occurred throughout the Forest due to the dense stocking of the timber stands. Mechanical pruning in the surviving stands will only be used for purposes of reducing ladder fuels or for research and demonstration. Mechanical or hand pruning may be utilized in the young plantations for the purposes of reducing ladder fuels.

Hardwood Management

The majority of hardwoods on BMDSF were killed in the Valley Fire. After the fire and subsequent salvage logging, hardwoods were among the first species to regenerate through stump sprouting. Species considered for management include black oak, canyon live oak, and madrone. Prior to replanting, a Pest Control Advisor recommendation was developed for the Forest that considered the vegetative profile and the expected growth over the coming years. The recommendation was for a three-stage treatment. The first stage was for herbaceous vegetation, the second for woody vegetation and hardwood stumps sprouts, and the final treatment, a pre-emergent spray in the spring immediately prior to planting conifer seedlings. The desired distribution of hardwood sprouts after herbicide treatment is roughly 15 square feet of basal area per acre in order to reduce competition among planted conifers.

Prior to the Valley Fire, hardwoods on BMDSF were scattered and only occasionally occurred in dense stands. Hardwoods on the Forest that are mixed with young conifers will be managed for their wildlife habitat and forest structure values. Hardwood management is aimed at reducing competition for planted seedlings, maintaining wildlife habitat and, to a lesser extent, reducing the fire hazard. The management goal for hardwoods is to maintain an evenly distributed basal area component in the ponderosa pine/Douglas-fir timber type at approximately 15 ft^2 of basal area per acre.

Brush Management

Brush, primarily in the form of manzanita, coffeeberry and oak, covered several hundred acres of the Forest with and without intermingled conifers of varying sizes. Approximately 155 acres of brush types are occupying soils that are incapable of growing commercial timber. These lands

Commented [DM15]: What species of oak, shreve, tan, etc.

are valuable for watershed protection and wildlife habitat, therefore conversion to grass or rangeland is not planned.

Various methods of brush management aimed at increasing regeneration and growth of conifer in areas of soils that would or currently support coniferous species will be initiated. These treatments will continue to be a major component of the Forest's management and demonstration program. Herbicides shall only be used on BMDSF for the reduction of competition in areas of conifer seedling replanting, and the periodic control of invasive or noxious weeds. Prescribed burning and mastication are additional practices that may be used for brush management and fuel reduction.

Commented [DM16]: What about for maintenance of shaded fuel breaks?

Fertilization

The various aspects of forest fertilization to increase timber growth and yield have been investigated in the past. Investigations will be continued in the future as opportunities arise.

Forest Management

Prior to the Valley Fire, the area of BMDSF stocked with coniferous trees (the timberland base) was 3,313 acres. One hundred eighty acres was occupied by non-coniferous forest types, primarily early seral brush and hardwood species. These acres were maintained over time to provide a continuous habitat for species that rely on early seral forest conditions and to provide research opportunities in early seral forest conditions.

Post-fire, the area previously stocked with conifer trees will be returned to timber production through the reforestation plan. Currently the Forest staff is engaged in the dead tree removal, site preparation, and replanting of the property. Once this stage is complete, the management focus will shift towards developing an uneven-aged forest from an even-aged plantation. From there the future Forest staff will be able to return to a system of regular cutting cycles under an uneven-aged system.

The average growth rate for all conifer stand types on BMDSF prior to the fire was 357 board feet per acre per year, or roughly one million board feet annually. Due to variations in stand densities and structures, site specific growth rates in individual stands can vary significantly around the mean. In addition to conifers, hardwood species comprised 15 percent of the Forests' basal total area. The hardwood species present are black oak, white oak, canyon live oak, bay laurel, and madrone. The average Forest-wide volume of black oak, the major hardwood species, was estimated to be 1,023 cubic feet per acre.

The objective of the hardwood management component of the reforestation plan is to develop a similar ratio of hardwood to softwood basal area as was present before the Valley Fire. Significant volume in dead hardwood remains on the Forest, as the salvage logging focused primarily on the removal of conifer sawlogs. Once BMDSF reopens to local firewood cutters it is expected that much of the easily accessible volume will be removed.

Commented [DM17]: This info is nearly all redundant, other than the 357 board feet an acre growth rate info. Consider deleting and move growth info below.

Sustainable Harvest Levels

The concept of sustainable harvest at BMDSF is not applicable over the next decade. Due to the extent of the Valley Fire, approximately 90% of the mature trees on the forest burned and have been harvested through salvage operations. The only context in which this level of harvest

would have occurred is in a catastrophic wildfire, and is far beyond what would have been planned for a healthy unburned forest. In order to create a sustainable balance to this harvest, the entire salvage area is being replanted. This area will then likely be thinned by future staff in 3 or 4 decades, and will be ready to transition to an uneven-aged stand in approximately 50 years.

Thinning and sanitation salvage will be the primary silviculture at BMDSF for the timeline of this management plan update (5 to 10-year outlook). This silviculture focuses on removing trees that are already dead or dying, so there is not the same need to balance harvest with growth as with green tree harvesting. The sanitation cuts in pine beetle-affected areas will focus on slowing the progression of beetle infestations, and will naturally balance the volume removal with a decrease in mortality.

Commented [DM18]: There are previous statements that indicated that "thinning" is the primary silvicuture. Maybe for consistency the Plan should read thinning and salvage are the primary…….

There are some isolated green stands remaining on the Forest that represent the mid-seral forest type present before the fire. The largest and most representative of the pre-fire condition is the 80-acre stand surrounding the Calso Campground. The fire in this area mostly burned through the understory, resulting in a minimal impact to the overstory trees. This unit is designated as group selection under the current THP, while the rest of the unplanted area is planned as sanitation salvage.

Commented [DM19]: This appears that this is planned for a 80 acre group selection…..maybe mention that up to 20% of the 80 acres will be harvested under groups selection (16 acres)

Since the green stands are still representative of the pre-fire condition, the allowable cut is based upon the long-term sustainability analysis in the BDSF Option A plan (California Department of Forestry and Fire Protection 2008). The following analysis was developed prior to the Fire, and while the property-wide data is no longer applicable, the per acre numbers still are valid representations of some of the remaining stands. The long-term sustained yield (LTSY) was 1.66 million board feet per year for the whole property (475 board feet per acre per year). Current annual growth is 357 board feet per acre per year. The corresponding near term sustainable annual harvest level in the first decade was 770 thousand board feet per year (220 board feet per acre per year). This constituted a harvest intensity of 1.5 percent of inventory. The potential unrestricted LTSY that could have been realized if BMDSF were to be managed for optimal sustainable timber production is 650 to 700 board feet per acre per year, depending on the silvicultural methods used. As part of the salvage effort, approximately 50 million board feet of timber was removed from the property.

Planned harvests will be designed to increase stand growth and productivity by implementing optimal stocking and spacing configurations in individual stands. The annual harvest is less than the LTSY due to the constraints on forest management activities imposed by other forest values on BMDSF, and the fact that most of the stands on the Forest are still young and will accumulate significantly more growth as they mature. In addition to the constraints placed on the calculation of the long term sustained yield in the harvest schedule, there are also discretionary commitments to planned management practices for non-timber resources. These commitments are in large part discretionary management practices which are necessary to maintain a healthy managed forest ecosystem. They are also necessary to avoid foreclosing on future management options. A goal of BMDSF is to have an active research program, which in turn depends on a diverse mix of forest structures, from early to late seral.

Management compartments have been established for the Forest. So that forest management and research projects will not be concentrated in any single large area, an effort will be made to implement projects in a systematic manner in these compartments, based on silvicultural and economic factors. Under the pre-fire condition, harvests would normally occur in one of the State Forest's nine management units once every 18 years. Adjustments to the cutting cycle in

specific units can occur if necessary due to disease, insects, fire, or new resource inventory data becoming available. The harvest limit includes salvage as well as green tree sales. Biomass harvesting was planned to be conducted within the Highpoint and Starview Management Units (Figure 14) approximately 10 years prior to standard commercial harvesting operations. As the forest matures, staff will evaluate whether to return to harvest schedules based on the previous management units, or develop new management units based on existing forest conditions.

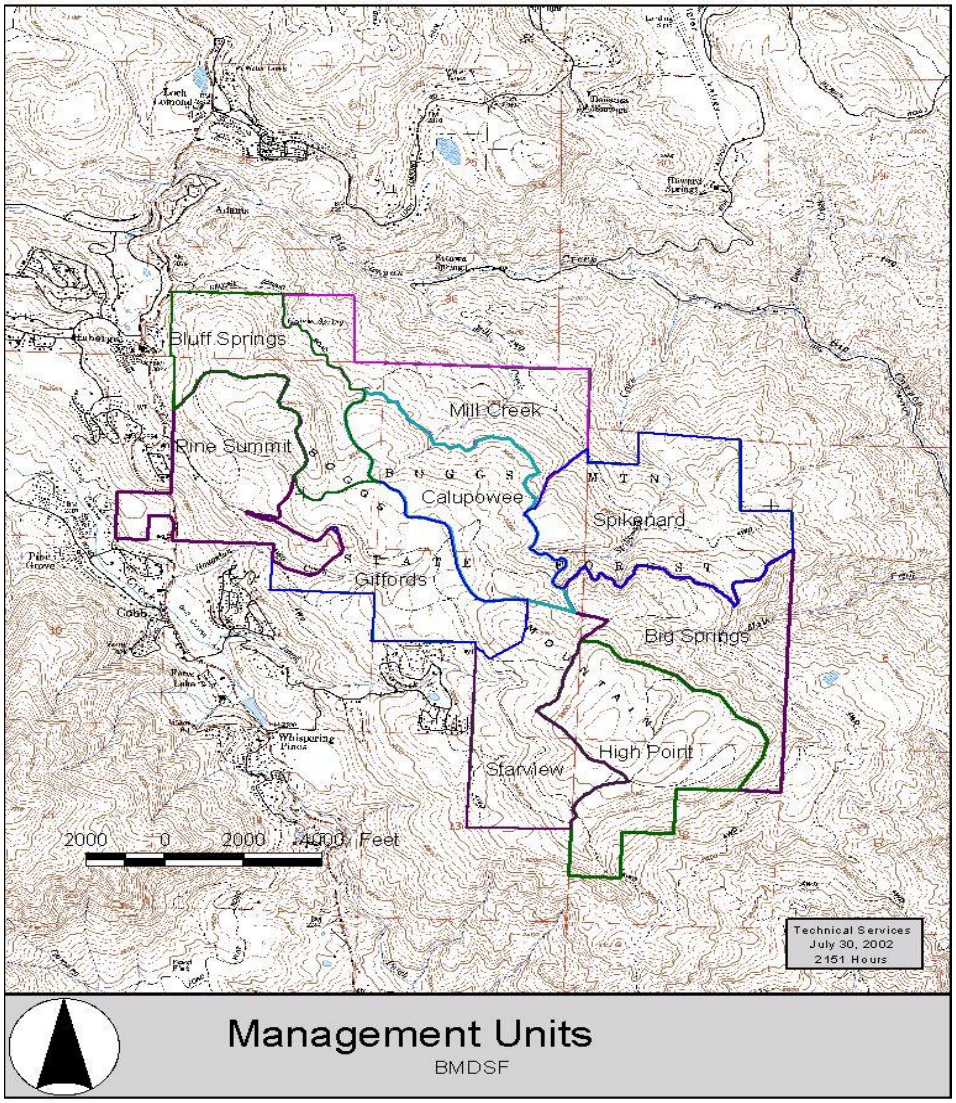

Figure 15. BMDSF Management Units

Harvest Cycles

Prior to the Valley Fire, an 18-year cutting cycle was planned for BMDSF; it will be roughly 50 years before this cycle is applicable again.

Timber Sales

California's State Forests plan for and schedule regular timber sales as directed by Board policy and existing management plans. Forest product sale transactions are broken into two categories based on size and/or value. These are Class I sales and Class III sales (an intermediate Class II category was discontinued in 1976). Class I sales are limited to no more than 100 thousand board feet in volume, and cannot exceed $10,000 in value. These sales tend to consist of salvage operations, power line right-of-way clearance, and other small lots of timber. Class I sales of other forest products have a limit of $10,000, and typically include firewood, split products, poles, greenery, and mushrooms. California's Department of General Services exempts CAL FIRE from the requirements for competitive bidding for Class I sales, although these sales can be bid when it is appropriate. (For example, it may be desirable to use a bidding process to select a purchaser of a small sale when there are many people interested.)

Class III Timber Sales:
Class III sales cover the major timber sale program and are awarded through a competitive bidding process. Following Forest staff review of the management plan, a THP and sale contract are prepared. The sale is appraised and advertised. A prospectus for each sale is sent to potential purchasers, local logging contractors, and other interested parties. The sale is also listed on the California State Contracts Register website.

An advertising period of four to five weeks is typically provided to allow purchasers and contractors ample time to evaluate the sale and the contract provisions. Sales usually have bid dates in late winter or early spring, which allows the contract to be awarded, approved, and operations to begin shortly after the end of the winter period. Sale contracts are valid for one to two operating seasons, depending on the complexity of the operation and how early in the year the sale is awarded.

Administrative inspections work to ensure compliance with the timber sale contract. Inspections of the sale area are made at least bi-weekly and more often during critical or sensitive phases of operation. Additional administrative duties include monitoring harvesting progress and the request of stumpage payments on a timely basis.

State Forest sale administrators do not double as CAL FIRE Forest Practice inspectors on the sales that they administer. Although sale administrators, as Registered Professional Foresters and as CAL FIRE employees, have a duty to enforce the Forest Practice Act and Rules, there is potential of a perception of conflict of interest. It is important that there be oversight of Act, Rule and THP compliance by CAL FIRE inspectors that are not State Forest staff.

The contract administrator's responsibilities extend beyond the completion of timber harvesting, to include inspection and arrangement of maintenance of erosion control facilities during the maintenance period and ensuring that harvest units meet stocking requirements.

During the salvage logging process, BMDSF grossed $1,819,717 from Class III timber sales.

Class I Timber Sales:
Class I sales are limited to no more than 100 MBF in volume or $10,000 in value. They may or may not be awarded through a competitive bidding process. Following Forest staff review of the management plan, a timber harvest document is prepared. In order to keep the small number of local loggers in business (and available for salvage sales) it may be in the State's interest to award a Class I sale without a competitive bid.

Logs may be purchased from the State Forest, subject to permit constraints and applicable state regulations. Payments are generally made on the basis of log volume removed from the State Forest. The purchaser is responsible for paying all applicable yield and sales taxes. The removal of timber requires the purchaser to be in possession of a valid timber operator's license. Prices for logs to be removed are subject to negotiation between the purchaser and the State Forest manager. All timber operations are limited by the Forest Practice Rules and constraints established by the State Forest manager. Logging requires a THP approved by CAL FIRE. Typical State Forest constraints include provisions for protection zones for watercourses, slope limitations, wet weather restrictions, and pre-location of yarding and hauling facilities. Trees must not exhibit signs of active nests.

During the 2016 salvage logging BMDSF grossed $88,557 from Class I timber sales.

Minor Forest Products:
BMDSF offers the public and private commercial interests the opportunity to purchase minor forest products, subject to specific rules and constraints. Permits can be purchased for collection of products including salvage sawlogs, poles, split products, greenery (e.g. boughs, shrubs, and ferns), rocks, and firewood. Class I sale permits are issued for the collection of these minor forest products. Payment is made on an item or volume basis and the purchaser is responsible for payment of all applicable taxes.

Harvesting Methods

Tractor yarding is appropriate for BMDSF since over 95 percent of the timberland on the Forest is under 50 percent slope and has an existing tractor road network in place from past harvesting operations. Rubber tired skidders, forwarders, and track laying equipment may be utilized over most of the Forest. Areas with slopes over 65 percent are small and reachable with a tractor long line; however, cable and/or helicopter yarding systems may be used when economically feasible. Horse logging has been done primarily for research and demonstration purposes and may be used again in the future.

Commented [DM20]: Make sure this is applicable to Boggs…

Harvesting operations will be planned and implemented to minimize conflicts with neighbors and, once reopened to the public, visitors where possible. To accomplish this, road and skid trail construction will be designed with potential users in mind. For example, specific logging trails can be designed to serve as future recreation trails where appropriate. Certain logging trails may be closed, however, following harvesting activities where public access is inappropriate (e.g., research or sensitive areas, or where trespass across private property would occur). New roads and skid trails will be carefully located to minimize visual impacts.

Carbon Sequestration and Greenhouse Gas Emissions

In 2006, the State of California passed the Global Warming Solutions Act (AB 32), which set targets to reduce greenhouse gas emissions to 1990 levels by 2020 and 80 percent below 1990

levels by 2050. Subsequently, the California Air Resources Board (ARB) was tasked with obtaining compliance with the cap through regulatory and market approaches.

Forestlands are, in general, a net carbon sink where CO_2 is captured and fixed by the process of photosynthesis, which removes carbon from the atmosphere and sequesters carbon in wood fiber. (OFRI 2006, U.S.E.P.A. 2005). As of 2015, California's forests in the North Coast sequestered 8.6 MMT CO2e per year, including net flux from soils, forest land conversions, non-CO2 emissions from wildfires, and harvested wood products (Christensen et. al, 2015). Growing forests sequester and store more carbon over time until growth stagnates as trees reach a mature age. Older trees sequester carbon through new growth at a declining rate, but they remain pools of stored carbon until they decay through decline, death, or consumptive use.

Forests can also play a significant role in non-regulated strategies to reduce greenhouse gas emissions by means of offsets within the California cap and trade system, through voluntary measures and by targeted greenhouse gas reduction projects funded by revenues generated from ARB's Cap-and-Trade program.

Recognized strategies to mitigate greenhouse gas emissions and enhance terrestrial carbon sequestration include reforestation, forest management, and fuels treatments. BMDSF will contribute to the targets of AB 32 by replanting the area harvested under the salvage logging project and maintaining this land in timber production. Stand replacing wildfires usually release large amounts of carbon into the atmosphere and also greatly diminish the ability of whatever forest cover remains to sequester new carbon for many decades afterwards. By harvesting fire-killed timber and replanting the acreage, the long-term carbon stocks of the Forest are projected to increase over time.

Any forest products produced from BMDSF will also sequester carbon during their life cycle. We anticipate being able to significantly increase the level of carbon sequestration at BMDSF by increasing the productivity and yield of the stands on the Forest using the silvicultural methods described in this management plan. These silvicultural methods will also improve the resiliency of the Forest to another catastrophic wildfire.

Biomass fuels produced on the Forest also provide an opportunity to replace fossil fuels with an alternative energy source that is close to carbon neutral. Biomass chips are one of the several secondary products that are being explored for the remaining timber that is unmerchantable as sawlogs.

Aquatic and Terrestrial Wildlife and Botanical Species

Due regard will be given to the preservation of aquatic and terrestrial wildlife values. Prior to the Valley Fire, BMDSF had two California Wildlife Habitat Relationship (WHR) System habitat types; ponderosa pine and Douglas-fir. Brush or meadows cover approximately 2 percent of the total landbase. The ponderosa pine habitat type was mainly on the south and west slopes and the Douglas-fir habitat type mainly on the north and east slopes.

Hunting, urbanization, and resource extraction are obvious impacts to wildlife on the Forest. Because of its easy access and its proximity to large urban areas, BMDSF has historically been used for hunting and target shooting. In addition to the hunting pressures, the Forest is bounded by high density subdivisions on its south and west sides, with the Loch Lomond rural residential area located across Big Canyon to the north.

Hunting is permitted on the Forest under applicable State game laws and regulations. Although BMDSF Management has little control over hunting and urbanization pressures placed on wildlife and their habitat, it does have a responsibility to consider the maintenance and enhancement of biological diversity when proposing forest management projects. Biological diversity can be defined as the variety and variability of living organisms and the ecological complexes in which they occur. Biological diversity is an important ecosystem characteristic for a variety of ecological, economic, and aesthetic reasons. For snag recruitment, on case-by-case basis, trees larger than 40 inches DBH (currently 0.2 per acre on average) will be evaluated for retention based on aesthetic, wildlife, and genetic values.

The development of BMDSF as a true all-aged forest will provide for a more biologically diverse habitat than is found in the current predominantly young forest. Managing the forest for a multilevel forest canopy will provide habitat for the wildlife that lives in the various levels of the forest canopy. When the forest matures, variable crown canopy density will allow varying amounts of light to reach the forest floor which will determine the amount and types of vegetation which may grow on the forest floor and provide cover, food, and shelter for wildlife that utilizes the forest floor.

Rare, Threatened or Endangered Species

CAL FIRE generated a list species, including species of special status, potentially present on BMDSF and surrounding areas (see Appendix D). Select species are discussed below as they or their habitat are present or previously present on the Forest.

Northern Spotted Owl

Prior to the 2015 Valley Fire, the timber stands on BMDSF were classified as type C spotted owl habitat, as defined in 14 CCR § 895.1. No nesting or roosting habitat remains after the fire while there are small stands of trees interspersed around the forest that can be classified as foraging or low-quality foraging, although none provide functional habitat. Northern spotted owl (NSO) surveys have been conducted on the forest since 1990, with occasional years of no surveys (Table 7). The last nesting pair was detected in 1998, which established activity center LAK0046, and the last pair detection was in 2005. The last detection of any NSO was a single female in 2006. Protocol surveys conducted in 2007 and 2010-2015 yielded no further detections. In 2016, CAL FIRE requested Technical Assistance from the United States Fish and Wildlife Service (USFWS to have LAK0046 abandoned due to previous survey results and the fire functionally destroying most of the nesting, roosting and foraging habitat within the activity center. USFWS issued Technical Assistance AFWO-16B0062-16TA0116 to allow abandonment of LAK0046 depending on the results of NSO surveys in 2016. Spot check surveys for survey year 2016 resulted in no NSO detections and the activity center was officially abandoned. Periodic owl surveys will be conducted by Forest and/or CAL FIRE biology staff in residual stands of habitat to determine if NSO are using the Forest in any manner.

Table 7. BMDSF NSO survey history by year and detection results for male - M, female - F or unknown with dates and (station number) of detection

1990		1996		2002		2008	No surveys	2014	
1991		1997	No surveys	2003		2009	No surveys	2015	
1992		1998	4/16 (31) nesting 4/28 (33) unknown	2004	No surveys	2010		2016	
1993	No surveys	1999	3/28 (16) unknown 4/15 (33) unknown	2005	7/7 (33) MF 7/13 (33) MF 7/16 (33) MF	2011		2017	Stand searches
1994		2000	No surveys	2006	6/26 (33) F	2012			
1995		2001		2007		2013			

Botanical Species

The California Natural Diversity Data Base indicates that Rincon Ridge ceanothus (*Ceanothus confuses*) (California Rare Plant Rank 1B.1[3]) was identified and last seen in 1940, more than one mile northwest of the Forest along what is now State Highway 175. Botanists working on the BMDSF fauna and flora assessment in 1991-92 (Baad, 1992) identified the closely related mahala mat (*Ceanothus prostratus*) on the Forest but have not found Rincon Ridge ceanothus. If this species is present on BMDSF, the ground disturbance and openings in the forest canopy created by the Valley Fire and subsequent salvage harvest will likely improve its habitat by reducing competition and allowing more light to reach the forest floor.

Konocti manzanita *(Arctostaphylos manzanita* ssp. *Elegans)* (CRPR 1B.3[4]) was identified on the Forest during a 2006 botanical survey as a species that could potentially be impacted by timber harvesting operations. Manzanita is dependent on fire as part of its ecology and is an obligate seeder that germinates readily after a fire. While mature populations of manzanita may have been greatly impacted by the fire, new sprouts are expected to propagate post-fire. Impacts to these species would primarily occur from construction of new skid trails and application of herbicide. Considering the large population of this manzanita species found throughout the Forest combined with the recent fire, proposed silvicultural methods, and the use of existing road network, no significant adverse impact to the population should occur.

Foothill Yellow-Legged Frog

BMDSF is within the range of the foothill yellow-legged frog (*Rana boylii*) which is currently a candidate species for listing as threatened under the California Endangered Species Act. No known occurrences of the species have been reported on the Forest. The potential for habitat

[3] California Rare Plant Rank (CRPR) 1B.1 include plants that are rare, threatened, or endangered in California and Elsewhere and seriously threatened in California (over 80% of occurrences threatened/high degree and immediacy of threat).

[4] CRPR 1B.3 include plants that are rare, threatened, or endangered in California and Elsewhere and not very threatened in California (less than 20% of occurrences threatened/low degree and immediacy of threat or no current threats known).

for the species is marginal. The species is strongly associated with shallow, flowing streams and rivers that have a component of cobble substrate. BMDSF is situated from mid-slope to ridgetop so most watercourses are ephemeral with some limited stretches of perennial flow. Houghton Creek flows in the western portion of the forest and has a short segment that provides perennial flow and the upper extent of fish-bearing habitat for a relatively short distance on the forest. No operations on BMDSF occur directly within watercourses, including water drafting, and any operations proposed near watercourses have appropriate buffers applied to them. No negative impacts to the frog are expected to occur should the species be present on the forest.

Watershed and Fisheries

BMDSF lies within four Calwater 2.2 Planning Watersheds: Big Canyon Creek (5512.300105), Upper Kelsey Creek (5512.300103), Anderson Creek (5512.300101), and Hoodoo Creek (5512.300102). Protection of watershed values is an important part of the overall management of the Forest and will be directly integrated with silvicultural practices and logging standards pursuant to PRC § 4651 (Forest Practice Act).

The Upper Kelsey Creek, Anderson Creek, and Hoodoo Creek planning watersheds have been designated as within the Evolutionary Significant Unit (ESU) for Chinook salmon, coho salmon, and steelhead trout, as documented in the FRAP Forest Practice Watershed Mapper. However, consultations with DFW personnel indicate that Timber Harvesting Plans submitted within these watersheds may operate under the standard Forest Practice Rules because of non-restorable downstream barriers to anadromous salmonid species.

Table 8. Planning watersheds covering part of Boggs Mountain Demonstration State Forest.

Planning Watershed/Sub-Watersheds	Acres	Percent of Forest
Upper Kelsey Creek Watershed	913	26
Houghton Creek	506	
Jones Creek	241	
Kelsey Creek	166	
Anderson Creek Watershed	197	6
Putah Creek	197	
Hoodoo Creek Watershed	213	6
Harbin Creek	196	
Cockerell Creek	23	
Big Canyon Creek Watershed	2170	62
Grouse Spring	197	
Malo Creek	459	
Mill Creek	449	
Big Canyon Creek	238	
Spikenard Creek	797	
Unnamed Tributaries	30	
TOTAL		**100**

There is a short segment of fish bearing stream (i.e., Class I watercourse) on Houghton Creek and no watercourses supporting anadromous salmonids within the Forest boundary. However, BMDSF management recognizes that watercourses and associated riparian zones form a critical link between the terrestrial and aquatic environments, exerting a strong influence on the biological and physical processes that create and maintain properly functioning aquatic habitats. In addition to providing important habitat elements for a variety of plants and animals, riparian

vegetation provides shade that moderates stream water temperatures, sediment filtration, and large woody debris (LWD) which influences the aquatic and terrestrial food web.

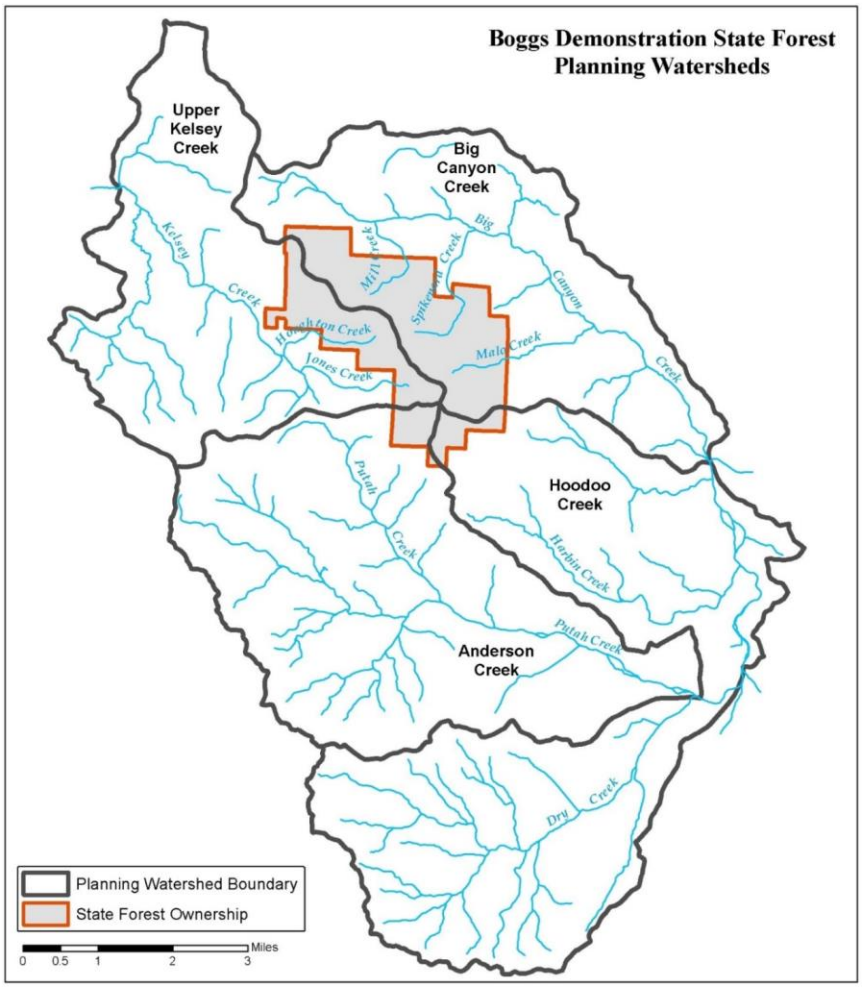

Figure 16. Planning watersheds covering Boggs Mountain.

Recreation

Prior to the Valley Fire, recreational opportunities found on BMDSF were informal, unsupervised, and diverse. Due to the indefinite closure of the Forest property, there are currently no public recreational opportunities. Primary recreational activities included camping, picnicking, hiking, single-track mountain biking, driving, equestrian activities, target shooting, and hunting. Upon reopening the Forest to the public, it is anticipated that these will once again be the primary recreational activities. Forest staff did not collect any fees for recreational uses, other than a ten-dollar nightly fee for camping.

Once BMDSF reopens to the public, it will be open to the public year-round, except for temporary area closures for public safety and the periodic closure of roads to motorized vehicles during wet weather. Prior to the fire, public use on the Forest had not diminished over time, however priorities for implementing a recreation program have fluctuated with political goals and their resultant budgets. The management of BMDSF will be directed toward the goal of integrating recreation management, forestry education, resource protection, and timber harvesting to demonstrate compatible use.

The road system and easy access from Cobb, Whispering Pines, Hobergs, and Loch Lomond had allowed for extensive day use. It is estimated that day use comprised at least four times as many visitor-days as overnight camping. Day use was heaviest on evenings and weekends. Peak visitor use periods tended to be two to three hours before the start and two to three hours after the end of the workday with another peak in usage occurring around 10 pm to 2 am. The typical recreational uses were walking dogs, horseback riding, walking, jogging, mountain biking, hunting, and camping. Firewood cutting and trail use and were the predominant public use of the Forest.

The popularity of the trail system for walking, mountain biking, and horseback riding was a major factor in recreational use for BMDSF and, prior to its closure, the Forest was used very much like a local park. Prior to the fire, the Forest had 22 miles of single track multi-use trail, most of which were destroyed by the heavy equipment used during the logging operations. Forest staff have begun meeting with the volunteer group Friends of Boggs Mountain (FOBM) to develop a plan for reestablishing the trail system. A contract has been awarded for replacement of all of the trail markers and road signs damaged or lost in the fire. Current plans for trail restoration revolve around reestablishment of the trail system identical to pre-fire conditions. Trail reestablishment will be accomplished using small sized tracked equipment and hand tools. Volunteer groups are currently not allowed access to the property without supervision, so the on-the-ground work of laying out a trail system has not yet begun.

Camping had not been the primary draw for recreationists on BMDSF since the campgrounds were generally never full. In a survey conducted by Community Development by Design (McNally, 1993), "camp overnight" was the third most frequent response in the case of Jackson Demonstration State Forest (60 percent) and Mountain Home Demonstration State Forest (71 percent); it was 20th in the BMDSF results (only 28 percent). The number one reason for visiting BMDSF was the peaceful forest environment.

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Table 9. Recreational Carrying Capacities

Recreation Use	Maximum Physical	Current Sustainable
Campgrounds (camper-days)	58,400	23,000
Trails (hiker-days)	163,520	65,400

In accordance with Board policy, future recreational facilities will generally be maintained to provide a rustic and informal experience. An estimate of recreational carrying capacity was developed as part of the prior management plan to guide the development of new campgrounds, picnic areas, and trails. There are several approaches to defining "carrying capacity." Most approaches focus either on the maximum physical capability of the facilities or on the level of use that can be sustained without an unacceptable impact on the facilities and other resources (Table 9).

There is a need for future studies regarding the expansion of recreational uses and facilities. When issues arise as a result of recreational impacts, the user is typically made a part of the solution through education and awareness of State Forest rules.

Archaeological Resources

BMDSF's cultural resources management procedures are evaluated per the requirements of the Forest Practice Rules and the California Environmental Quality Act (CEQA) for identifying, recording, evaluating and protecting cultural resources. BMDSF also adheres to procedures set forth in CAL FIRE's statewide Management Plan for Historic Buildings and Archaeological Sites (Foster and Thornton, 2001) and its accompanying Environmental Impact Report (Foster and Sosa, 2001). These documents prescribe general measures for identifying, evaluating, and managing cultural resources on CAL FIRE lands statewide, including BMDSF.

As of the February 2016 Ownership – Wide Northwest Information Center (NWIC) Records Check for BMDSF, 18 separate cultural resource studies have been undertaken (Whatford 2016a: Table 4). Since the February 2016 Ownership wide records check, one further study has been generated within BMDSF (Whatford 2016c). As a result of these studies, 100% of BMDSF has been archaeologically surveyed (Whatford 2016b:12). Several of the studies summarize prior archaeological surveys and provide extensive overviews of the prehistory and history of the forest (Gerike and Stewart 1988; Dillon 1993; Whatford 2016b). The latter of these provides recent observations and current conditions of nearly all the archaeology sites within BMDSF after the Valley Fire.

The record search consists of archaeological site records, survey reports and resource location base maps for the entire BMDSF ownership and are updated every five years. Information on archaeological site locations is exempt from public access, as provided by the California Public Records Act (California Government Code 6254.10) and CEQZ (PRC 21082.3(c))which provides confidentiality protections for information California tribes have provided through consultation. This record search allows background research efforts to be conducted prior to archaeological reconnaissance as a means to guide identification efforts within the project area. It includes reviewing previous survey efforts, existing information on known cultural resources, and any data concerning possible not yet identified cultural resources.

The identification phase for archaeological studies typically involves conducting a records search, continuing consultation with Native Americans, conducting an archaeological field

survey of the project area and documenting the results of the survey (both prehistoric and historical archaeological sites) in an archaeological report. While BMDSF has extensive survey coverage, there is always a possibility that previously unrecorded cultural resources will be identified.

To ensure the identification and protection of cultural resources on BMDSF the following procedures are in place:

1. The CAL FIRE Archaeologist will be contacted by BMDSF personnel to review any new projects for cultural resource regulatory compliance before project approval.

2. The CAL FIRE Archaeologist will be contacted to evaluate any new activities within or immediately adjacent to previously recorded or newly identified archaeological sites.

3. The appropriate level of archaeological research, survey and documentation will be undertaken to identify all previously recorded and unrecorded cultural resources within the project area.

4. Native American consultation.

5. Archaeological surveys will be conducted by professional archaeologists or BMDSF staff who meet the requirements set forth in 14 CCR § 929.4 of the Forest Practice Rules.

6. The archaeology report is reviewed by a CAL FIRE archaeologist to determine the adequacy of the prefield research, survey methods and coverage, site significance determinations and site protection measures.

7. If any previously recorded or unrecorded sites are discovered during surveys or management activities, a CAL FIRE Archaeologist will be contacted to determine the appropriate protection measures.

8. On recorded sites that have been used as roads and landings and that will be used again as roads or landings, a surface survey will be made prior to, during, and after the area is used. If cultural materials are found on the site, a collection of the materials will be made. The collected material, if any, will be recorded and mapped, defining where it was collected, by whom, and when. The artifact(s) will be returned to this site after use or maintenance at the site is completed or the collected artifacts may be retained at the Forest Headquarters for protection and/or further study. Sites that have been heavily damaged in the past will be managed in this manner.

9. Sites that have had minimal or no disturbance will be avoided. If use is necessary, the recommendations of the CAL FIRE Archaeologist will be followed.

10. If, during active operations, cultural resources (i.e., prehistoric sites, historic sites, and/or isolated artifacts) are discovered, work shall be halted immediately within 100 feet of the discovery until a CAL FIRE archaeologist has determined the nature of the find and the appropriate protection measures.

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Forest Protection

Sanitation Cutting and Hazard Reduction

Sanitation-salvage will be the major focus of the logging on BMDSF for the next few years. Currently a contract is underway to cut and pile submerchantable trees that were not harvested during the first harvest entry post-fire. Hazard reduction is the driving force behind this harvesting activity, both for fire protection and recreation hazards. The standing dead trees pose a significant safety hazard, therefore prior to reopening BMDSF to recreation, more hazard reduction work will need to be completed to make the property safe for the public.

BMDSF staff will continue to harvest dead, dying, and diseased trees through the THP that is in review during the preparation of this report. Opportunities exist for widespread site preparation activities leading up to plantation development. BMDSF Foresters will work diligently to identify opportunities for site preparation in the form of heavy equipment piling, feller-buncher work, mastication, contour ripping, and hand piling. Most of this work will be considered timber operations and as such the CA Forest Practice Rules will serve as mitigation in most instances.

Prescribed Fire

Prescribed burning could be a useful tool in the future management of BMDSF. Operations are already underway in the second year of widespread pile burning operations related to the salvage logging of burned timber on the forest, and will likely continue in the short term. Broadcast burning opportunities may exist in in areas of the forest that have not been planted yet.

Fire Protection

The Sonoma-Lake-Napa (LNU) Unit Chief is responsible for fire protection in BMDSF. The South Lake County Fire Protection District and CAL FIRE provide local fire protection on and adjacent to the Forest. Initial attack can be provided by the CAL FIRE Boggs Mountain Helitack Base, which is located on the Forest property. Detection strategies include patrol, searching for evidence of fires, and patrol flights during extreme fire danger periods or after lightning storms. The Unit's Emergency Command Center personnel routinely check the Automatic Lightning Detection System for possible strikes in the Forest. The period of high fire danger generally occurs between July and November, though this period may be extended by severe weather conditions.

During periods of high fire danger, BMDSF will follow LNU's Red Flag Alert Plan. The Forest Manager coordinates with the Unit Duty Chief to determine necessary actions to be employed. The steps may include increasing patrols of the Forest, posting alert signs, providing more fire prevention information and awareness of current conditions to Forest visitors, and reducing activity in the Forest by closing specific areas.

Currently the Forest is as a very low risk for fire due to the recent burn and the aggressive salvage logging. Once the conifer plantation is reestablished, fire prevention will become a major focus for Forest staff. Pre-suppression fire protection activities will be conducted to ensure successful fire prevention and suppression. The road system will act as effective fuel breaks along many of the plantations, though fuels reduction will be needed along the property

line and within some of the remaining green stands, Forest fuels reduction through timber harvesting and stocking control, as well as brush and slash control will be ongoing programs which will supplement and eventually replace the fuel break system as the Forest's main defense against wildfire. Prescribed fire will continue to be used on the Forest. Fire is a natural ecosystem process within the Forest. Fire exclusion over the long run is not possible and is generally not desirable in maintaining natural ecosystem processes. The use of prescribed fire can facilitate fire hazard reduction, silvicultural and habitat research, and ecosystem management research.

The existing road system developed from the original logging road network provides adequate access for fire protection purposes. The major roads and trails in the Forest are maintained to provide access for fire protection purposes. Seven spring-fed water storage tanks with a total capacity of 54,000 gallons were constructed on the Forest but are currently non-operational. It is the desire of the Forest Manager to restore these tanks to operational status for fire protection and dust abatement purposes, and contracts are in development to return three of the seven water tanks to operation.

Potential ignition sources such as campfires and smoking are controlled on the Forest. Campfires are restricted to developed fire pits within campgrounds. Smoking is only allowed in areas sufficiently cleared of light fuels.

Insects and Disease

Native forest pests such as insects, pathogens, and vertebrate animals have long been established in California's native timberlands. Populations of pests are dynamic and fluctuate in response to climatic and environmental parameters such as precipitation amount, ambient temperature, soil characteristics, forest stocking, and tree species as well as disturbances such as long-term droughts, wind events, floods, and fires. Pest attacks may reduce tree growth, affect species composition, or impact forest stocking. At the same time, other forest resources, such as wildlife habitat, may be impacted by pest-caused changes in forest structure.

Various species of bark and woodboring beetles, *e.g., Ips, Dendroctonus,* and *Phaenops* spp. in pine and *Phaenops, Scolytus, and Pseudohylesinus* spp. in Douglas-fir, are endemic pests on the Forest. Periodic short dry periods and longer droughts cause varying levels of mortality. Native pathogens are found throughout the Forest, including *Leptographium wageneri,* cause of black stain root disease of Douglas-fir and *Heterobasidion irregulare,* cause of *Heterobasidion* root disease of pine. Western gall rust, caused by *Endocronartium harknessii,* is very visible on ponderosa pine throughout the Forest, while dwarf mistletoe (*Arceutholiurn campylopodum*) is found on ponderosa pine in localized areas. State Forest staff monitor for early signs of forest pests or conditions that may lead to pest infestations. Forest pest management specialists will be used to train employees in forest pest recognition and management. BMDSF remains available for forest pest research opportunities to interested agencies, institutions, or organizations.

Prior to the Valley Fire, drought conditions on the Forest were contributing to an increase in the pine bark beetle population. Pockets of ponderosa pine were dying from western pine beetle (*Dendroctonus brevicomis)* infestations, individual sugar pines were being killed by mountain pine beetle (*Dendroctonus ponderosae*), and Ips (primarily *Ips paraconfusus)* and red turpentine (*Dendroctonus valens*) beetles weakened trees. These beetles are all still active on the Forest, along with woodboring beetles active in dead and dying trees. Most trees attacked and killed by bark beetles were likely already infected with *Heterobasidion irregulare,* which causes root

disease, can be exacerbated by management activities, and has been tracked at BMDSF for over forty years.

Measures taken to protect against infestations of insects and diseases on BMDSF will include the following:

- Maintain a diverse species composition and favor resistant species during harvest operations, e.g. establish ponderosa pine in Douglas-fir mortality pockets caused by black stain root disease.
- Promptly treat bark beetle brood material during timber sales.
- Treat all freshly created stumps >4 inches DBH with a borate formulation such as Cellu-Treat® designed to exclude stump infection with *Heterobasidion irregulare.* This will help reduce future bark beetle attacks, as attacks by the two pests are tightly linked.
- Minimize injuries to residual trees during timber sales.
- Harvest ponderosa pine with heavy gall rust or dwarf mistletoe infection or with any dwarf mistletoe if it overtops smaller trees. If heavily infested stands exist, consider sanitizing them using clearcuts or large-group selection.
- Promote vigorous growth through appropriately timed commercial and pre-commercial thinning.
- Release conifer stands from brush and hardwood competition.

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Sudden Oak Death

BMDSF is located within Lake County, which has been declared a zone of infestation for Sudden Oak Death (SOD), a disease caused by the plant pathogen *Phytophthora ramorum*. Currently there is no indication that this pest is present on the Forest. The BMDSF General Management Practices for controlling the spread of SOD will be followed during THP preparation and prior to movement of merchantable material off site (see Appendix C).

Table 10. Pests common to commercial species on BMDSF.

Scientific Name	Common Name	Host
Arceuthobuim campylopodum	(western dwarf mistletoe)	PP
Armillaria mellea	(Armillaria root disease)	DF, PP, SP
Dendroctonus brevicomis	(western pine beetle)	PP
Dendroctonus ponderosae	(mountain pine beetle)	SP, PP
Dendroctonus valens	(red turpentine beetle)	PP, SP
Endocronartium harknessii.	(western gall rust)	PP
Gymnosporangium libocedri.	(incense-cedar rust)	IC
Heterobasidion irregulare	(*Heterobasidion* root disease)	SP, PP
Ips paraconfusus	California five-spined Ips	PP
Leptographium wageneri var. *pseudotsugae*	(black stain root disease)	DF
Phaenops drummondi	(flatheaded fir borer)	DF
Phaenops californica	(California flatheaded borer)	SP
Pseudohylesinus nebulosus	(Douglas-fir pole beetle)	DF
Scolytus unispinosus	(Douglas-fir engraver beetle)	DF
Porodaedalia pini	(white pocket rot or red ring rot)	PP, DF
Phaeolus schweinitzii	(schweinitzii root disease)	SP, DF

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Other Management Factors

Law Enforcement

State law requires CAL FIRE to protect the State Forests "from damage and to preserve the peace therein." The Forest Manager, Fire Prevention Battalion Chief, local CAL FIRE Battalion Chief, and Fire Prevention Captain work together to ensure that all relevant state laws are enforced. There are a number of laws that are specific to the State Forest system that address camping, campfire permits, noise, firearms use, firewood, rubbish dumping, smoking, and the protection of archeological features. Forest regulations and policies are posted on signs. The Department of Fish and Game wardens enforce fishing, hunting, and trapping laws.
All roads on BMDSF are public roads, and all motorized vehicles therefore must have a license. No motorized vehicles are permitted on trails. Off-road use by four-wheel drive vehicles and motorcycles has been on the increase for several years and has resulted in soil erosion in some areas and the destruction of native and planted seedlings. This use also poses a definite fire hazard by vehicles without spark arrestors, and in some cases without mufflers, being driven over forest litter in areas remote from access from the Forest roads. Efforts to block known off-road trails have met with only limited success. Off-roading will be a significant enforcement concern once the Forest reopens. The open sight lines and clear understory will likely be very attractive to off-road enthusiasts, but the young plantations will be very susceptible to damage from these activities.

BMDSF is currently closed to the public, and trespassing continues to be a nuisance to forest staff. Most cases are minor, and once the offending parties are informed of the conditions of the forest closure they leave the property without incident. Access to the Forest is primarily from the main entrance on Forestry Rd. and the main gate is kept closed to deter entry. Some people walk in from the adjacent neighborhoods, though the impact from this is minimal. Illegal camping and squatting has been virtually nonexistent.

The cutting of green trees, the destruction of Forest roads and informational signs, and the dumping of garbage were significant issues prior to the fire, and will likely be an problem again once the Forest reopens. The Lake County Sheriff's office has made many arrests on BMDSF in the past ten years. CAL FIRE employs a Forest Manager and Assistant Manager who enforce state laws on the State Forest as part of his/her duties. Unit Prevention Officers also assist with law enforcement issues.

Acquisition and Exchange

There are timberland parcels adjacent to the Forest, which may be available for purchase in the future, prior to subdivision or rural residential development. The pressure to pass through BMDSF to home or cabin sites that are landlocked could be greatly reduced and future problems avoided if the State were to purchase these sites.

Other options for improving public access aside from direct land purchases will be considered. These options include purchase or trade of rights-of-way or easements, lot line adjustments or land trades. Any land acquisitions funded by timber harvest revenues from the State Forest Program shall be limited to those which improve access to BMDSF or otherwise directly enhance BMDSF. All acquisitions for BMDSF will comply with CEQA.

PRC § 4648 governs acquisition of forestland. Acquisition is made only upon the approval of the Director. Approval by the Director is based on satisfactory evidence presented to him by the

Board as to the suitability and desirability of lands under consideration for purchase for State Forest purposes. This suitability and desirability is predicated on, but not limited to, the land being:

(a) Suited primarily to timber growing.
(b) Representative of growing capacities not below the average for the timber region.
(c) Favorably situated for multiple use and economical administration, management, and utilization.

The Director cannot approve the acquisition of any lands unless the Board of Supervisors, following a public hearing, adopts a resolution recommending State acquisition. Notice of the hearing will be published pursuant to Gov Code § 6066. The holding of a hearing is optional to the Board of Supervisors for areas of 2,000 acres or less. Upon approval of a purchase by the Director, the Department may negotiate for and consummate the purchase of the lands.

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Chapter 4. Research and Demonstration

The primary purpose of California's State Forests is to demonstrate responsible and innovative silvicultural practices and timber harvesting methods that protect environmental values. Targeted and long-term research studies are crucial to understanding the effects of forest management actions, as well as the effects of broader changes in forest influences, such as global climate change. As a publicly-owned forest dedicated to research and demonstration, BMDSF provides an ideal venue for long-term research. Some research projects on BMDSF have been periodically monitored for decades.

In the past, ecologists focused on studying seral stages with pioneer through climax conditions. Once reaching a climax condition it was thought that stands of trees would always proceed in a steady-state, small-scale disturbance regime. This concept is now considered the exception for most ecosystems, with disturbance being the rule rather than the exception (Botkin 2006). The challenge now is to understand the disturbance regimes of the past and future, integrate that understanding into our silvicultural and forest management practices, and translate that understanding into useful information for forest managers and landowners.

BMDSF provides a productive outdoor laboratory for researchers. The Forest, with a mix of older and young forest structure, and utilization of a variety of uneven-aged and even-aged silviculture techniques, was well-suited for silvicultural studies prior to the 2015 Valley Fire, which killed over 90 percent of the mature trees. After that significant disturbance, research opportunities for the next several decades will focus on forest regeneration, early stand management, and post-fire watershed and wildlife studies. The post-fire landscape of BMDSF offers a unique opportunity for research on post-fire ecosystems in the northern part of the California Coast Ranges, and the impacts and results of different management techniques.

As forest stands become reestablished on BMDSF, broader research questions facing BMDSF can be posed. These include how forest management influences:

- Forest health and productivity
- Growth and yield
- Fire hazard
- Forest resilience to wildfire
- Wildlife habitat dynamics
- Plant community dynamics
- The wildland-urban interface
- Climate change and carbon sequestration potential of the Forest
- Recreation use
- Water
- Other ecosystem services
- Relative proportions of forest structure classes.

Research Program Objectives

1. Continue to provide access to BMDSF as an outdoor laboratory where researchers from CAL FIRE, universities, other agencies and research institutions can conduct targeted and long-term research projects that address important questions about forests and forest management.

2. Ensure that all ongoing studies are carried out to completion and the results are documented in the form of a California Forestry Note/Report, technical report, and/or peer-reviewed journal paper. Technical reports should be published in professional journals when significant results are found. BMDSF staff are to confirm that researchers properly document their study results.
3. Encourage BMDSF staff to be alert for potential studies and initiate studies whenever possible. Seek advice from research institutions and forest managers on potential studies that could be conducted.
4. Continue to utilize research funds and leverage professional contacts, Forest data, infrastructure (housing), and assistance with field work to encourage researchers to conduct studies on BMDSF.
5. Provide field tours to groups and individuals to explain the research projects currently being conducted.

Five-Year Strategic Outlook for Research and Demonstration

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This section of the Plan identifies specific objectives to be accomplished within the next five years and resource requirements. The goal is to build upon the current demonstration program by emphasizing research infrastructure, applied demonstration targeted towards small forest landowners, and outreach.

Research Planning

Research and demonstration on BMDSF typically takes two forms: (a) projects initiated by CAL FIRE staff, either with or without outside researchers' involvement, and (b) research undertaken by outside researchers, typically universities. This latter type of research project usually arises when the Forest staff are approached by researchers looking for locations for their research projects, and is difficult to anticipate. BMDSF staff are continually accepting proposals for new research projects from outside institutions. Planning future research projects therefore involves both creating the diverse forest structure conditions necessary to make the Forest an attractive location to conduct research, and planning research and demonstration projects initiated by CAL FIRE staff.

The purpose of conducting demonstrational and experimental programs, either independently or in cooperation with other public agencies and educational institutions, is to gather and disseminate the information to forest landowners and the public. It has generally been the responsibility of the Forest Manager to implement these programs using the operating funds available for forest operations. There have also been a limited number of cooperative agreements with outside agencies to conduct research projects . The advantages of a cooperative research efforts include the influx of additional expertise and a broader funding base.

The next five years will be critical for the development and implementation of new research projects. BMDSF staff will also be updating ongoing research and monitoring projects to reflect the impact of the 2015 Valley Fire. Both the Continuous Forest Inventory (CFI) and the Mortality and Growth Study will require plots to be reestablished and inventory updated in the coming years. The CFI was last updated in 2011 and the Mortality and Growth plots were last updated in 2012. Both of these studies are due to be remeasured every 5 years.

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As a response to the fire, four new research projects have been initiated on BMDSF since 2015. These projects and the supporting institutions are:

1. *Post-Fire Runoff and Erosion Studies at Boggs Mountain Demonstration State Forest* (Drew Coe and Will Olsen, CAL FIRE; Don Lindsay, CGS; Dr. Joe Wagenbrenner, USFS PSW; Dr. Kevin Bladon and Ryan Cole, Oregon State University; Dr. Sergio Prats and Dr. Maruxa Malvar, University of Aveiro, Portugal).

2. *Carbon, Fire Hazards, and Forest Regeneration Dynamics following High Severity Wildfire in a Mixed-Conifer Forest at Boggs Mountain Demonstration State Forest* (Dave Sapsis, Tadashi Moody, David Passovoy, CAL FIRE-FRAP; Jeff Leddy, CAL FIRE).

3. *Using Automated Bird Recorders to Determine Differences in Bird Occupancy of Four Silvicultural Treatments in a Post-Fire Setting* (Stacy Stanish, CAL FIRE).

4. *Dead and Dying Tree Assessments using Tree Note No. 33, Bark Beetles and Annosus Root Disease and Black Oak Study* (Dr. Christopher Lee, CAL FIRE).

CAL FIRE-funded research comes from revenues created by timber harvest or through external grants. The periodic timber sales on the Forest can also incorporate demonstration and experimental projects by including research project tasks or costs in timber sale agreements to be charged against stumpage.

Research Infrastructure

Both simple demonstrations and complex research projects are undertaken on BMDSF. Some projects are accomplished by simply observing the management action and documenting the outcome (i.e., demonstration). Many others, however, require the rigors of the scientific process to further the state of knowledge about forest resources (i.e., research or experiment).

Infrastructure is defined as the basic elements necessary to facilitate further activity. For this plan, research infrastructure includes researcher facilities, baseline data, and information systems.

Objective: Maintain the available barracks, including bunks and kitchen facilities, at BMDSF headquarters.

This will be an ongoing function of BMDSF staff that will include routine maintenance, materials for minor building repairs, necessary supplies including propane, diesel, and cleaning supplies. The housing available at BMDSF is instrumental in facilitating projects by visiting researchers. By providing onsite storage for equipment and housing for personnel, the Forest is a more attractive option for partnering institutions from outside of the area. BMDSF has recently expanded the storage capabilities of the facilities by adding one additional equipment shed and has received a FEMA grant to replace the conex box lost in the Valley Fire. The estimated cost for research infrastructure is $5,000 annually.

Objective: Collect, organize, and store data on tree and plant inventories; wildlife and fish inventories; and soil, geologic, meteorological, and watershed data so that the data are available to researchers.

Established in 1976, the Continuous Forest Inventory (CFI) is an ongoing, multi-resource terrestrial inventory conducted on BMDSF that provides important long-term data on forest growth. Meant to be updated every five years, the last BMDSF update occurred in 2011. Significant BMDSF staff time must be allocated to collecting and managing this data. The CFI inventory is periodically reviewed for appropriateness and efficiency by BMDSF staff and State Forests Biometrician and Research Coordinator. The possibility exists to expand both the intensity (number of plots) and the range of parameters being measured.

CAL FIRE staff have expanded the BMDSF inventory and monitoring programs in the aftermath of the Valley Fire. Biologist Stacy Stanish has been engaged in ongoing monitoring of the wildlife population, continuing the Northern Spotted Owl (NSO) monitoring program, and installing automated wildlife cameras and bird song recorders on the Forest. Pathologist Dr. Christopher Lee has identified trees on the property for studying of the progression of bark beetles and fungal pathogens through the remaining green stands.

The USDA Forest Service Pacific Southwest Research Station (PSW), in cooperation with CAL FIRE, has undertaken a comprehensive post-fire runoff and erosion study that is generating data on peak flows and sediment movement within the watersheds at BMDSF. Study objectives include (1) quantifying the impacts of different burn severities on runoff and erosion, (2) assessing the impacts of post-fire salvage logging and site preparation on runoff, erosion, and soil properties, and (3) assessing processes that control post-fire and post-salvage logging. Funding for this study is being provided through the State Water Resources Control Board's 319(h) non-point source grant program.

At least one weather station will be installed on the Forest. Installation is dependent upon adequate research budget and staffing. Ongoing maintenance and data collection will be the responsibility of BMDSF. Currently the weather station belonging to the State Forest is out of service and will require a new contract to be returned to operating condition. In the interim, both the United States Geological Survey and the California Air Resources Board are operating weather stations on the Forest as part of long-term monitoring projects. The data from these stations are available online and are being monitored by Forest staff. Estimated annual BMDSF monitoring project costs are $3,000 and the staff time of the BMDSF Research Forester.

Applied Demonstration

Objective: Research targeted at studying regeneration units established following the Valley Fire will be encouraged. This research will look at regeneration success and herbaceous vegetation growth, and methods of controlling competing vegetation.

Eventually, as stands are reestablished, demonstrating various means of applying group and single tree selection so that practical implementation issues and multi-resource implications may be examined will be encouraged.

Objective: Demonstrate methods to inventory and update the BMDSF road network to reduce erosion and maintenance needs.

The road inventory and improvement program on BMDSF will continue to be implemented. Road improvement projects will document before and after conditions, particularly regarding inside ditch conditions and watercourse crossings. Records on costs will be retained, as will estimates of sediment savings derived from road improvement work.

Since the Valley Fire, the road network on the Forest has been substantially upgraded, predominately involving reshaping the road surface, replacing existing crossings, and upgrading seasonal roads to permanent classification with adequate rock surfacing. During this time, Forest staff have put substantial effort into inventorying and mapping the extent of the forest road system. Immediately following the fire, BMDSF contracted with the California Geological Survey (CGS) to perform a comprehensive road inventory. The crossing replacements and upgrading that have been completed to date are a result of this initial road inventory. In 2016, 11 crossings were replaced with new structures designed to pass 100-year flood flows, as well as sediment and debris.

Applied Demonstration Costs: The road improvement demonstration is part of an ongoing operational program started in 1998. BMDSF staff time requirements will increase due to information tracking requirements. Road improvement funds are required from CAL FIRE Sacramento Headquarters. These projects will result in BMDSF staff time requirements for outreach projects such as report writing, presentations, and tours.

Objective: Demonstrate proper tree falling techniques to CAL FIRE employees.
Continue to allow the felling of dead, dying, and diseased trees as part of the CAL FIRE employee safety training curriculum (S-212).

Board policy allows for State Forest lands to be used for Department administrative sites when such use will benefit State Forest programs or protection. In accordance with Board Fuel Management Policy 5022, a training program to fell dead, dying, and diseased trees in other than timber sale areas, will be developed and implemented using Conservation Camp and other CAL FIRE resources. The trees will be felled under an existing timber harvesting plan, or Forest Practice Rule Exemption or Emergency Notice operations. Snags with wildlife value will be retained in accordance with the California Forest Practice Rules.

Applied Demonstration Costs: Training costs are absorbed by the Sonoma-Lake Napa Unit (LNU) and will vary depending on class size. The BMDSF receives a net financial benefit through the sale of wood products under the Class I Timber Sale permitting process. Downed material resulting from the training program will be sold as saw logs or made available to the public for personal use firewood.

Outreach

A strong outreach program to convey information and disseminate results complements the investment in research and demonstration. Outreach is accomplished through production of published papers and articles, presentations, field tours, and the posting of information on the internet.

Objective: Research results from BMDSF are provided to forest managers, forest landowners, and the public. Each project will be evaluated as to the most appropriate outlet for dissemination (Table 11 provides possible approaches).

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Table 11. Guidelines for BMDSF publications.

Type	Outlet	Criteria for Use	Responsible Persons
Peer Reviewed Scientific Journal	Forest Science, Canadian J. of Forestry, J. of Forestry, discipline specific journals such as the J. of Wildlife Mgmt. Intl. J. Wildland Fire	Strongly encouraged for rigorous scientific studies, enforces objectivity and thorough review of methods	Authors are responsible for writing and editing; some assistance from Sac. Pubs. Coordinator
Peer Reviewed Applied Journal	Western J. of Applied Forestry	Strongly encouraged for studies with direct field applicability	Same as above
Institution Specific Pub. (non-CAL FIRE)	Hilgardia (UC), General Technical Report (USDA For. Serv.)	Lengthy publications, publication not appropriate for other journals, but of high value	Same as above
CAL FIRE Publication	California Forestry Note	Applied articles of six pages or less; may be a shorter summary of journal paper	May be written either by author or Sac. Pubs. Coordinator; edited and published in Sac.
CAL FIRE Publication	California Forestry Report	Applied articles of greater than six pages; may be a longer more detailed version of a journal paper	Authors are responsible for writing; Sac. Pubs. Coordinator responsible for editing and publishing
CAL FIRE Publication	California Demonstration State Forests Newsletter	Quarterly publication that includes research, demonstration, recreation, and other news	All state forests staff contribute articles, Sac. Pubs. Coordinator responsible for editing and publishing
Presentations	Poster Presentations	Appropriate at any stage of development for a project	Author has primary responsibility with assistance from Sac.
Presentations	Oral Presentations	May be conference or meeting presentation, strongly encouraged for critical research results	Author has primary responsibility with assistance from Sac.
Tour	Educational	May be conducted for any interest group including professionals, politicians, or students.	BMDSF staff has primary responsibility
Tour	Workshop	Usually directed towards natural resource professionals	BMDSF staff has primary responsibility with assistance from author(s) if required
Web Site	California Demonstration State Forests Web Site	Part of the CAL FIRE web site, this will contain electronic copies or links to all relevant publications, posters, etc.	Sac. Pubs. Coordinator has primary responsibility with assistance from BMDSF staff

Objective: The public has access to information about the State Forest mission as well as past and current projects at BMDSF.

BMDSF publications documenting research results will be posted on the California Demonstration State Forests website, which is under the CAL FIRE website (http://calfire.ca.gov/resource_mgt/resource_mgt_stateforests). Publications will also be distributed to appropriate libraries in the State.

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Outreach Costs: BMDSF staff time requirements for outreach will vary with the number of publications produced in-house and the number of tours and workshops held on the Forest. Editing of contracted publications by BMDSF staff also consumes staff time and will vary with the number and complexity of projects.

As part of the demonstration mandate of the State Forest Program, Forest staff conduct tours for professional organizations. Some of the recent tours that have occurred include:

- Santa Rosa Press Democrat photographer Ken Porter
- CAL FIRE Director Ken Pimlott and State Senator Bill Dodd on February 11, 2016 as part of a review of damages to the Valley Fire area.
- Northern California Prescribed Fire Council on March 25, 2016.
- Forest Landowners of California on June 6, 2016.
- Soil Science Professor Linda Green with her Humboldt State University class in April 2016 to see effects of fire on soils and meet with researchers involved with the post-fire runoff and erosion study.
- Board of Forestry and Fire Protection's Monitoring Study Group tour on May 18, 2016
- Board of Forestry and Fire Protection tour on July 26, 2016
- Tahoe Chapter of Society of American Foresters in October 2016
- Dr. Fred Euphrat and his Santa Rosa Junior College forestry class
- Due to the level of public interest in the recovery of BMDSF, the Forest was featured in the Press Democrat article "Will fire blackened lumber make grade?" (January 15, 2016).

A new Facebook page was started for the Forest in cooperation with CAL FIRE's Sonoma-Lake Napa Unit Public Information Officer. Friends of Boggs Mountain also have their own Facebook page and Forest staff have been working with them to provide information to the public through that online source and their quarterly newsletter.

Many of the outreach costs are borne over the entire Demonstration State Forests system, such as the Demonstration State Forests website.

Conclusion

This five-year research and demonstration outlook for BMDSF provides a direction for the continued success of BMDSF. Growth in demonstrations and experiments will result from the attention to research infrastructure and outreach. The specific demonstration and research projects described above will add significant value to current operational practices by using them as models for sustainable forest management.

Research Projects

General management and operations guidelines for State Forest properties are outlined in existing documents such as management plans, work plans, timber sale reports, and work project reports. Similar plans are deemed necessary for experiments and demonstrations (Ref: 5061).

Research projects that are long-term (i.e., will continue for over two years), as opposed to short-term demonstrations or reports on observations, will be reviewed prior to commencement by at least two experts from outside of CAL FIRE. The principle investigator (PI) may suggest persons to review the study design and may have this review prior to submitting the project for approval. These experts should be employed by organizations engaged primarily in research activities

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(e.g., University of California, USFS Pacific Southwest or Northwest Research Stations, California State University system, or UC Cooperative Extension) (Ref: 5061.1).

Planned Projects

Commented [DM23]: Mention the Michael Baker Bat project?

A high priority for research on BMDSF is successfully regenerating ponderosa pine and Douglas-fir in this part of the interior Coastal Ranges of California. The demonstration and experimental goals will be attained by testing different cultural practices in plantations established after the 2015 Valley Fire.

Climate change and carbon sequestration is an emerging fertile research area. Climate change, along with geological processes, has been shaping the range and genetic configuration of forests for millions of years. Scientists have modeled what may be near term alterations in climate, but there is a large degree of uncertainty. There is no significant environmental climate change impact related to management of BMDSF that can be predicted given the current state of scientific knowledge.

Three strategies will be employed on BMDSF to address the uncertainty regarding climate change:

- Manage the newly established plantations to maximize resilience to perturbations in moisture, temperature, forest pests, and storm events.
- Monitor species abundance and health as part of a long-term monitoring strategy.
- Develop partnerships, undertake and fund research.

Relatively little is known about the potential for sequestering carbon in forests and how different management regimes can result in different amounts of carbon sequestered over long periods of time. Part of the goal of the study undertaken by CAL FIRE-FRAP is to monitor carbon storage over time and quantify how carbon storage is affected by difference post-fire management programs.

Current and Ongoing Projects

Growth and Mortality Plots (1952/53 – CAL FIRE)

Ten, 2 1/2-acre plots distributed throughout the Forest are measured every five growing seasons. Originally these plots were established on cutover areas to determine growth and mortality, especially to document losses from insect attack following extensive logging that took place in 1950/51. The distribution and the small number of the plots render them unsuitable for inventory purposes. The results given are for the plots only and cannot be projected to other areas of the Forest with any degree of accuracy. The plots have been maintained in recent years because they offered a relatively long periodic growth record of several individual and groups of trees, and because individual and groups of plots allowed for useful learning settings for measuring exercises. The plots were last measured in 2012 and will need to be relocated and reestablished following the Valley Fire for a new inventory.

Post-Fire Runoff and Erosion Studies at Boggs Mountain Demonstration State Forest (Drew Coe and Will Olsen, CAL FIRE; Don Lindsay, CGS; Dr. Joe Wagenbrenner, USFS PSW; Dr. Kevin Bladon and Ryan Cole, Oregon State University; Dr. Sergio Prats and Dr. Maruxa Malvar, University of Aveiro, Portugal)

This study's objectives are to quantify the impacts of different soil burn severities on runoff and erosion, assess the impacts of post-fire salvage logging and site preparation on runoff and erosion, and to assess processes that control post-fire and post-salvage erosion. Burn severity impacts are being studied in six headwater catchments ("channels") that were instrumented in November 2015 with varying degrees of soil burn severity to measure runoff and erosion prior to the 2015-2016 winter season. Assessment of post-fire salvage logging and site preparation on runoff and erosion is being studied at the plot scale (15 m x 5 m). Five untreated control plots (high burn severity) were installed in November 2015. Plots for treated areas were installed in the summer and fall of 2016. Treatments are being assessed using four replicated blocks, and each of the five treatments is represented on one plot in each block. The study includes the following treatments:

1. Salvage logged with ground-based methods following practices in larger sale units (i.e., logged only).
2. Logged and contour subsoiled (ripped).
3. Logged and pre-emergent herbicide site preparation.
4. Logged and delayed application of defoliant herbicide site preparation.
5. Logged, ripped, and pre-emergent herbicide (space dependent).

Additional components of the BMDSF post-fire runoff and erosion studies include (1) validation of post-fire erosion and runoff models; (2) rainfall simulations to evaluate the effects of compaction and slash cover on salvage logged hillslopes with microplots; (3) best management practice surveys for effectiveness in the post-fire and salvage logged environment, including waterbar location; and (4) documentation of the effects of wildfire on rill networks and sediment delivery. Results to date have increased our knowledge of post-fire processes in the inland Coast Ranges of California, and the collective research will illuminate the changes that occur in the post-fire landscape with and without intensive forest management practices.

Fire Effects, Carbon, and Forest Regeneration (Dave Sapsis, Tadashi Moody, David Passovoy, CAL FIRE-FRAP; Jeff Leddy, CAL FIRE)

The research and goals associated with this study are divided into two phases, with the first phase based on an observational study involving data collection from the CFI permanent plots established throughout the Forest. This analysis forms the basis for estimating direct impacts of the fire on vegetation, fire hazards, and carbon stocks. A second phase of research is based on a manipulative experiment looking at the influence of salvage logging and site preparation techniques on post-fire forest recovery. A randomized block experimental design has been implanted with a total of four different treatments applied to five replicate units (twenty units total), where each unit is roughly 7 acres in size to allow for buffer area between treatments. The four treatments are:

1. No harvest.
2. Harvest; site preparation (woody debris piling, burning, and herbicide treatment); and planting.
3. Harvest; site preparation (woody debris piling, and burning); unplanted.
4. Harvest; site preparation (woody debris piling, burning, and herbicide treatment); contour ripping; and planting.

Permanent plots have been installed in each treatment area to measure mortality and growth of any residual trees; they will be expanded to include measurement of surface vegetative cover (including both planted and natural regeneration), leaf litter, and downed woody material. An expansion of the proposed study to include soil carbon dynamics is in the planning stages in cooperation with California Polytechnic State University, San Luis Obispo. The experimental

horizon for the study is intrinsically long-term, but should provide initial results in the 3-5-year post-treatment window.

Post-fire Wildlife Habitat Impacts (Stacy Stanish, CAL FIRE Biologist)

Senior Biologist Stacy Stanish has been engaged in ongoing monitoring of the impacts of the Valley Fire and subsequent salvage logging on forest wildlife populations. This has included three main studies/projects:

Forest Monitoring Program for the Northern Spotted Owl
This project involves nighttime surveys in the spring to assess the presence of nesting spotted owls. No detections have occurred as of the writing of this report. The activity center that was previously located on the Forest was declared abandoned with technical assistance from the U.S. Fish and Wildlife Service.

Post-fire Avian Occupancy Study
Approved and funded by the Board of Forestry and Fire Protection's Effectiveness Monitoring Committee, this study is collecting baseline bird occurrence and diversity for stands subject to different disturbance and/or management treatments following wildfire, with the goal of determining if significant differences exist between treatments. This study utilizes four replicates in four different silviculture stand types on BMDSF (field plots use the treatment blocks established for the Fire Effects, Carbon, and Forest Regeneration study). Initial data were collected in the spring of 2017 using automated bird recorders to determine bird occupancy. Additional data will be collected in the spring of 2018 and 2019. This study will also establish a baseline for documenting bird usage on the Forest and document long-term trends for species to re-establish following intense wildfire.

Wildlife Camera Station Monitoring Study
Wildlife cameras with bait stations (comprised of raw chicken, wet cat food, oats, and Gusto, a scent attractant) are placed strategically on the Forest to identify which mesocarnivores, such as fox, fisher, or marten, are using the Forest in a post-fire setting. Cameras are deployed in the winter to minimize raiding from bears or mountain lions and are operated for a month consistent with current protocols. Camera deployment on BMDSF began in 2016.

Dead and Dying Tree Assessments using Tree Note No. 33, Bark Beetles and *Annosus* Root Disease and Black Oak Study (Dr. Christopher Lee, CAL FIRE Forest Pathologist)

Pathologist Christopher Lee has been monitoring specific study trees to observe long term mortality of trees impacted by the Valley Fire, and the impact of bark beetles in the years following the initial event. Dr. Lee has also been monitoring the presence of the root disease *Heterobasidion annosum* using fungal spore traps deployed on the Forest.

<u>Completed Projects</u>

- Dogwood Control project - terminated in 1974.
- *Fomes Annosus* Stump Protection Studies (State Forest Note #39, published in 1969).
- Pine Fertilization Test #1 (Final Report submitted in 1973).
- Demonstration Planting Project 1971 - terminated in 1974. Possible plantation release study site.

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- Manzanita Control in a Ponderosa Pine Regeneration Area - completed in 1971.
- Competing Vegetation Study (State Forest Note #49, published in 1972).
- Yield Study, Even-aged Ponderosa Pine - completed in 1970.
- Chemical Control of Dwarf Mistletoe - completed in 1970.
- Cut Surface Hardwood Treatment "Herbicide Injection of Cull Hardwoods with a Tree Marking Paint Gun" - completed in 1971.
- Commercial Firewood Harvesting Study (State Forest Note #70, published in 1979)
- 1972 Commercial Thinning Plot - terminated in 1982.
- Biomass Cutting Study - completed in 1982.
- 1983 Horse Logging Demonstration - completed in 1983.
- Decision Analysis in the Evaluation of Wildfire Reduction by Prescribed Burning in the Wildland-Urban Interface – Anderson et al. 1994 published paper
- Boggs Mountain Nature Trail - 1987 - Cooperative CDF/Middletown Unified School District - Cobb Mountain School.
- Plant Succession, Planted Pine Seedlings, and Competing Vegetation in a Group Selection Cutting - 1989 - CDF Funding: Cooperative CDF/USFS Study - Researchers: Philip McDonald and Gary Fiddler, USDA Pacific Southwest Forest and Range Experiment Station, completed in 1993.
- Prescribed Fire Effects in Douglas-fir and Extended Decision Analysis - CDF Funded: U.C. Berkeley - Researcher: Robert Martin, completed -1991.
- Control of Western Dwarf Mistletoe with Ethephon (Floreltm) - 1988 - USFS/CDF Researchers: Susan Frankel/Dave Adams, completed in 1993.
- Variable Commercial Thinning Plots - 1983 – CDF, completed in 1998.

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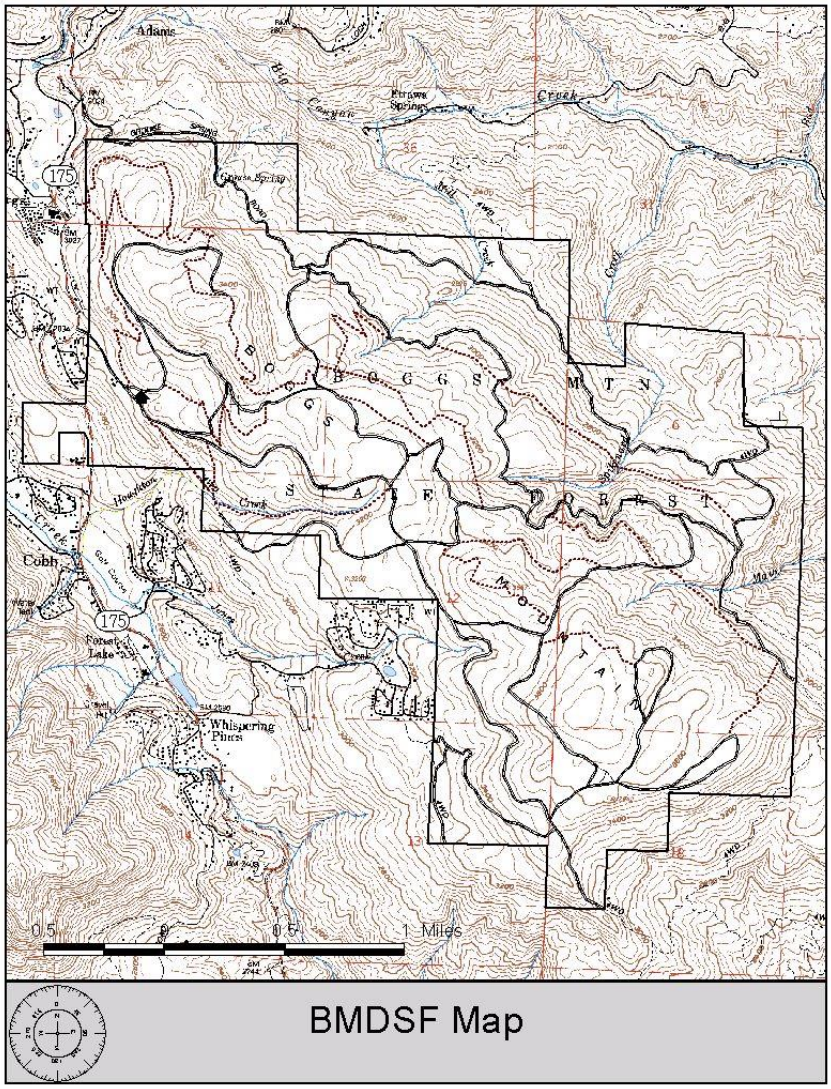
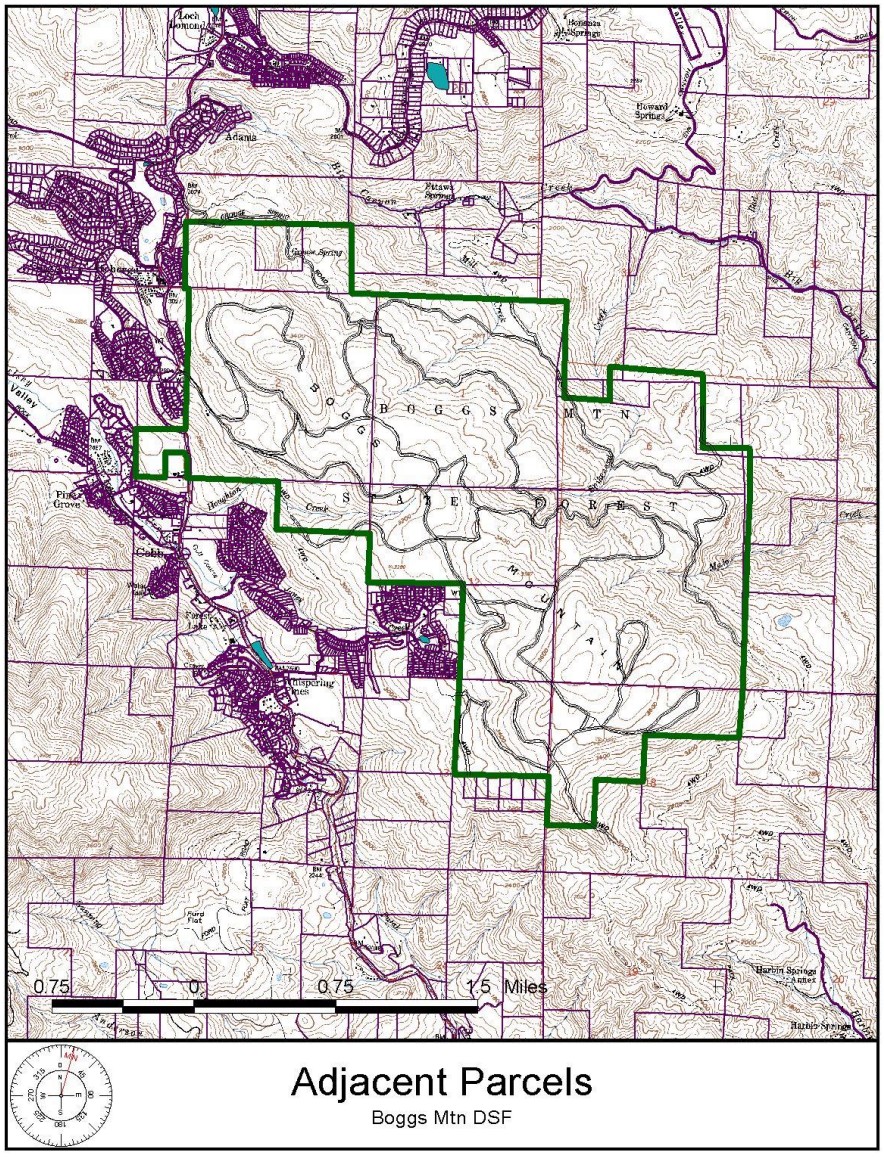
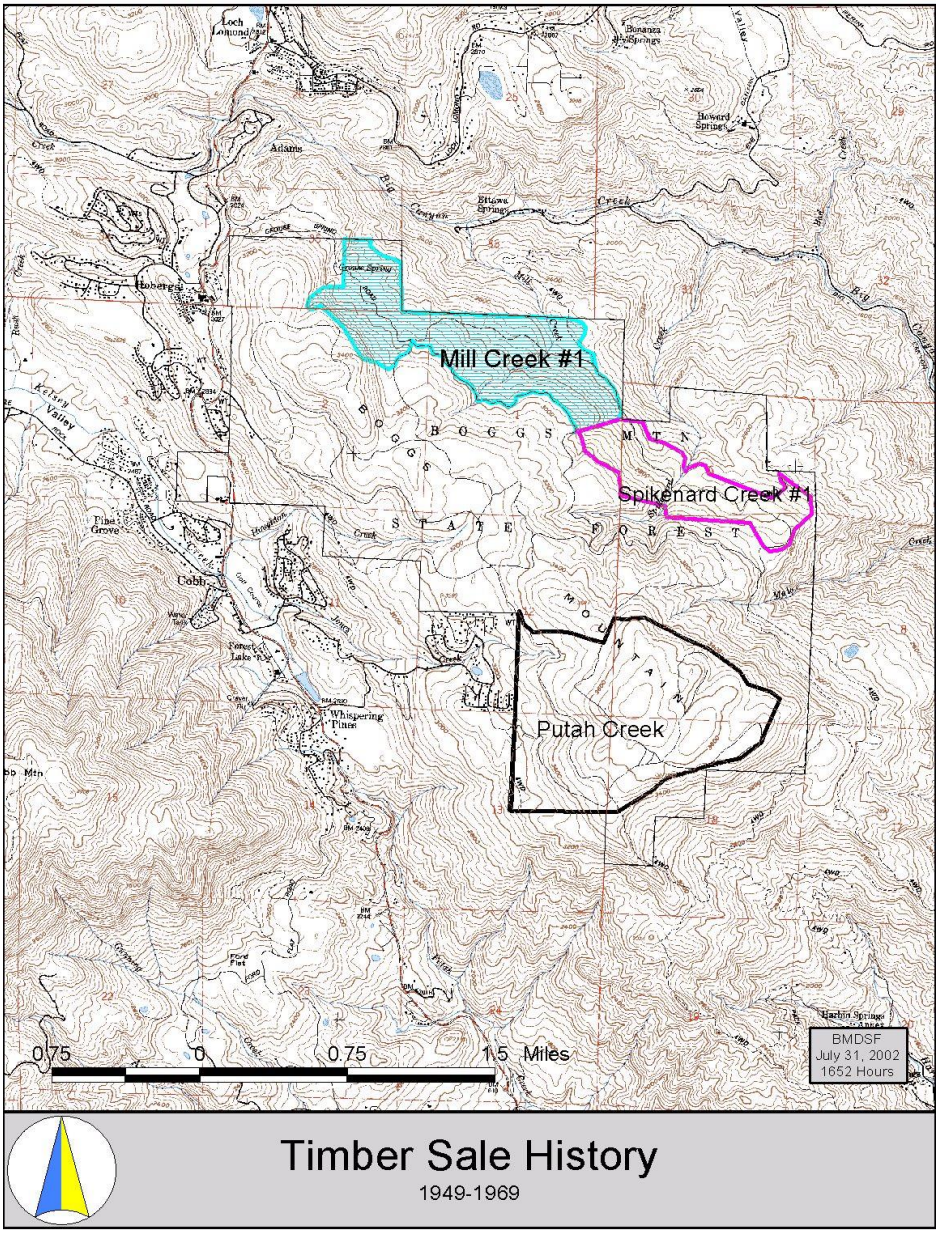
Appendix A. Maps





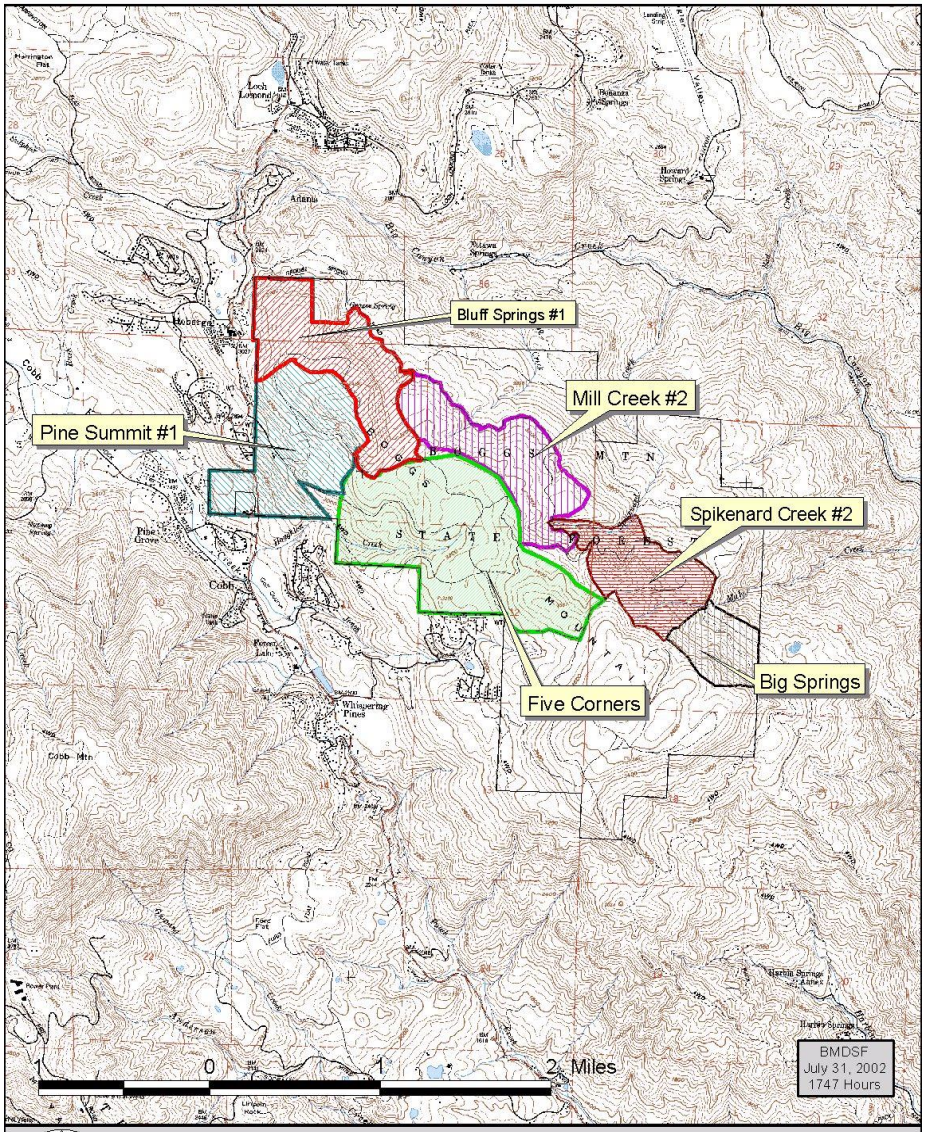
Adjacent Parcels

Boggs Mtn DSF



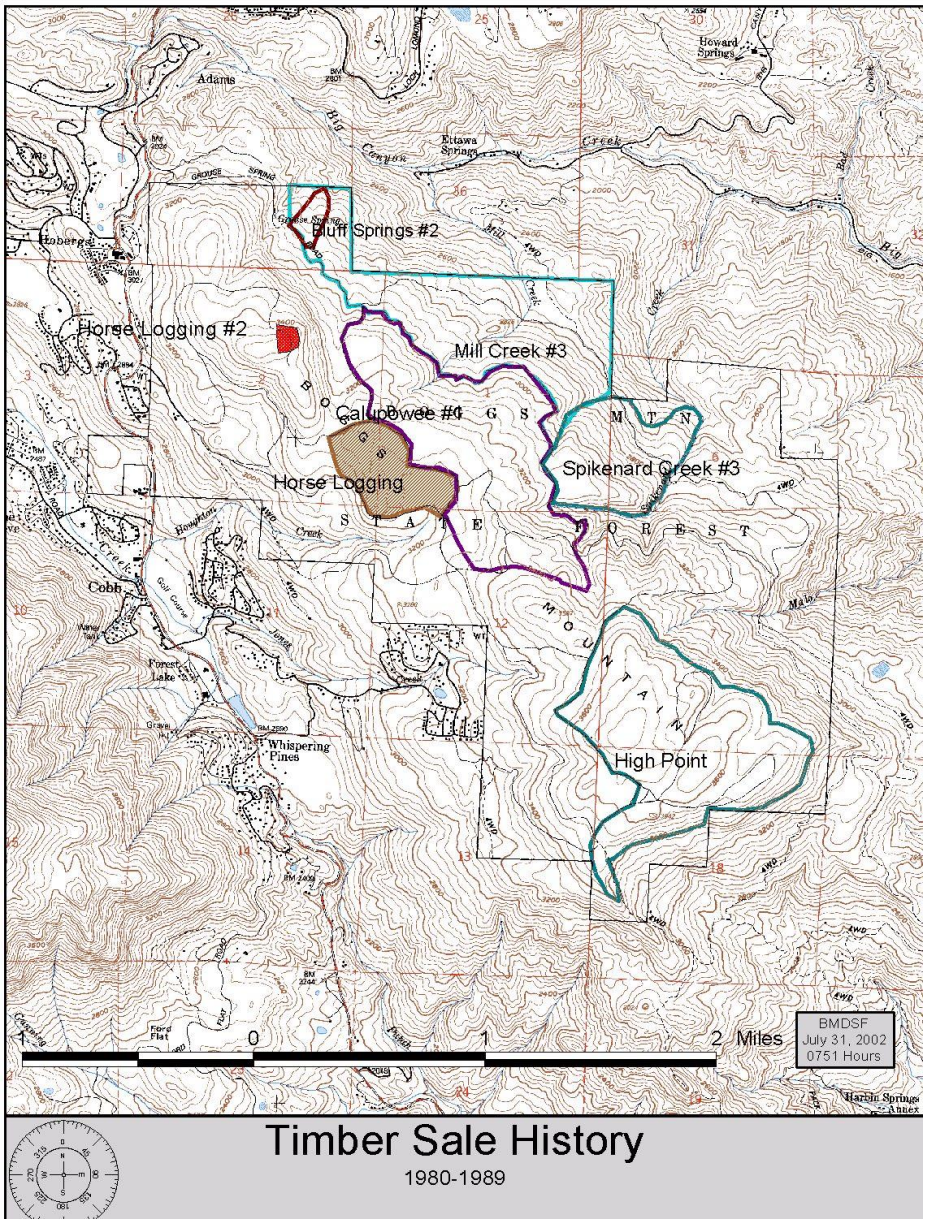
Timber Sale History

1949-1969



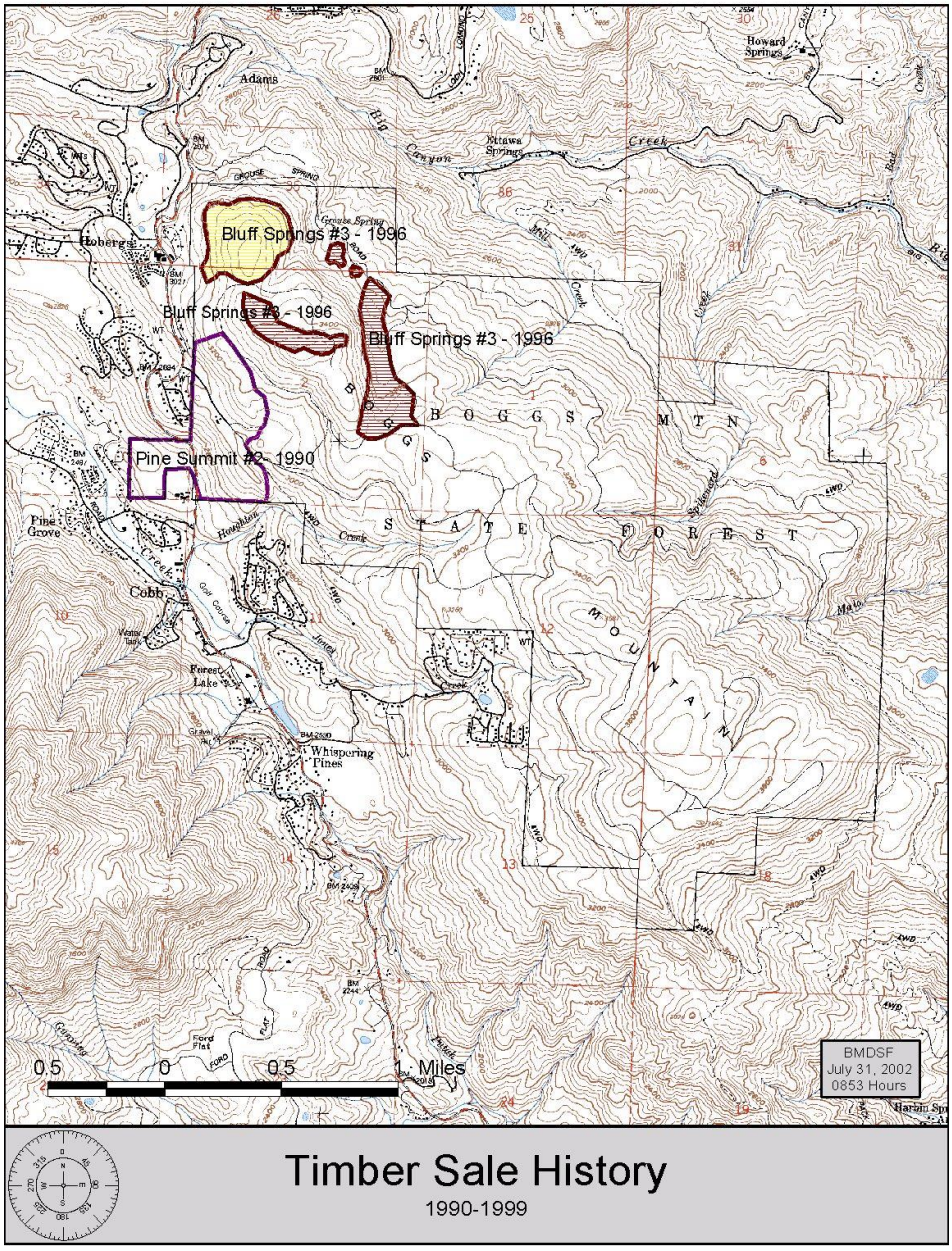
Timber Sale History

1970-1979



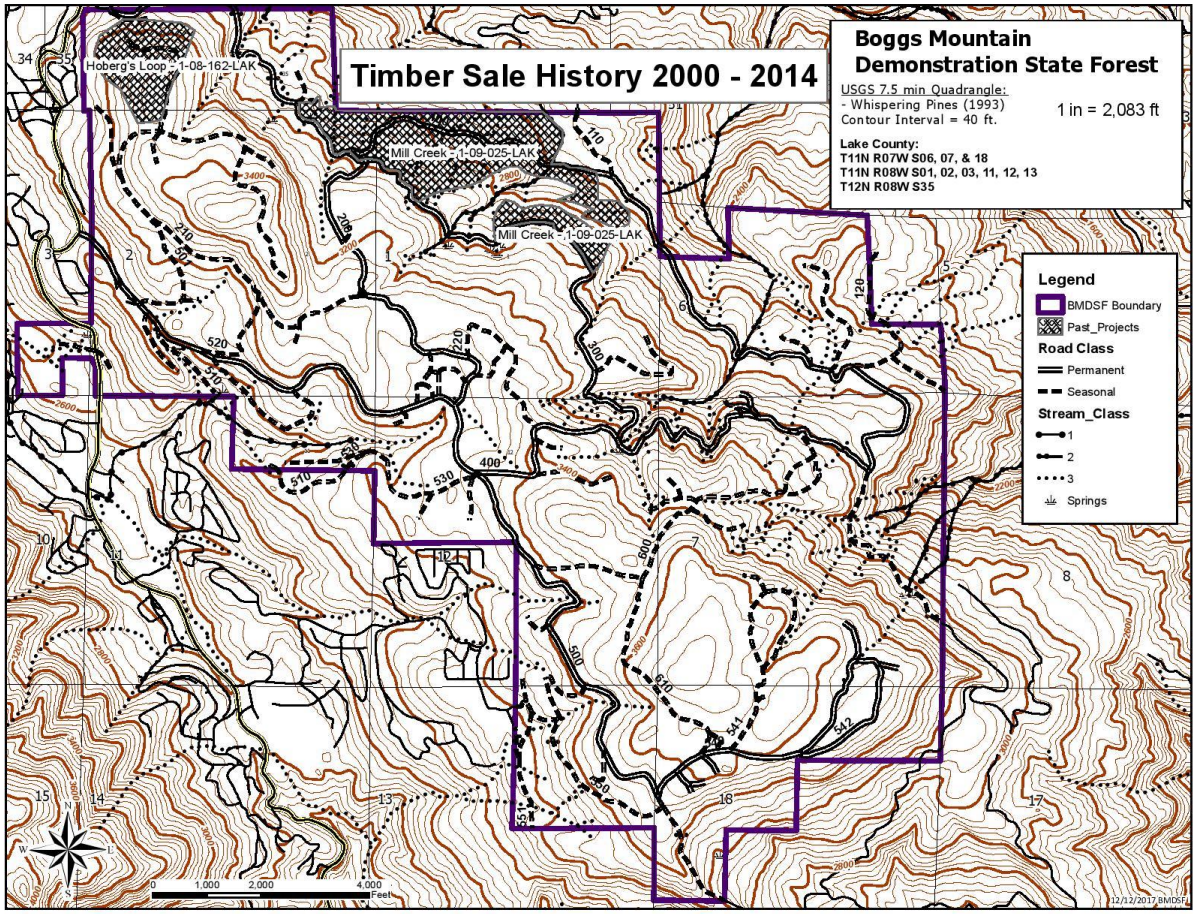
Timber Sale History

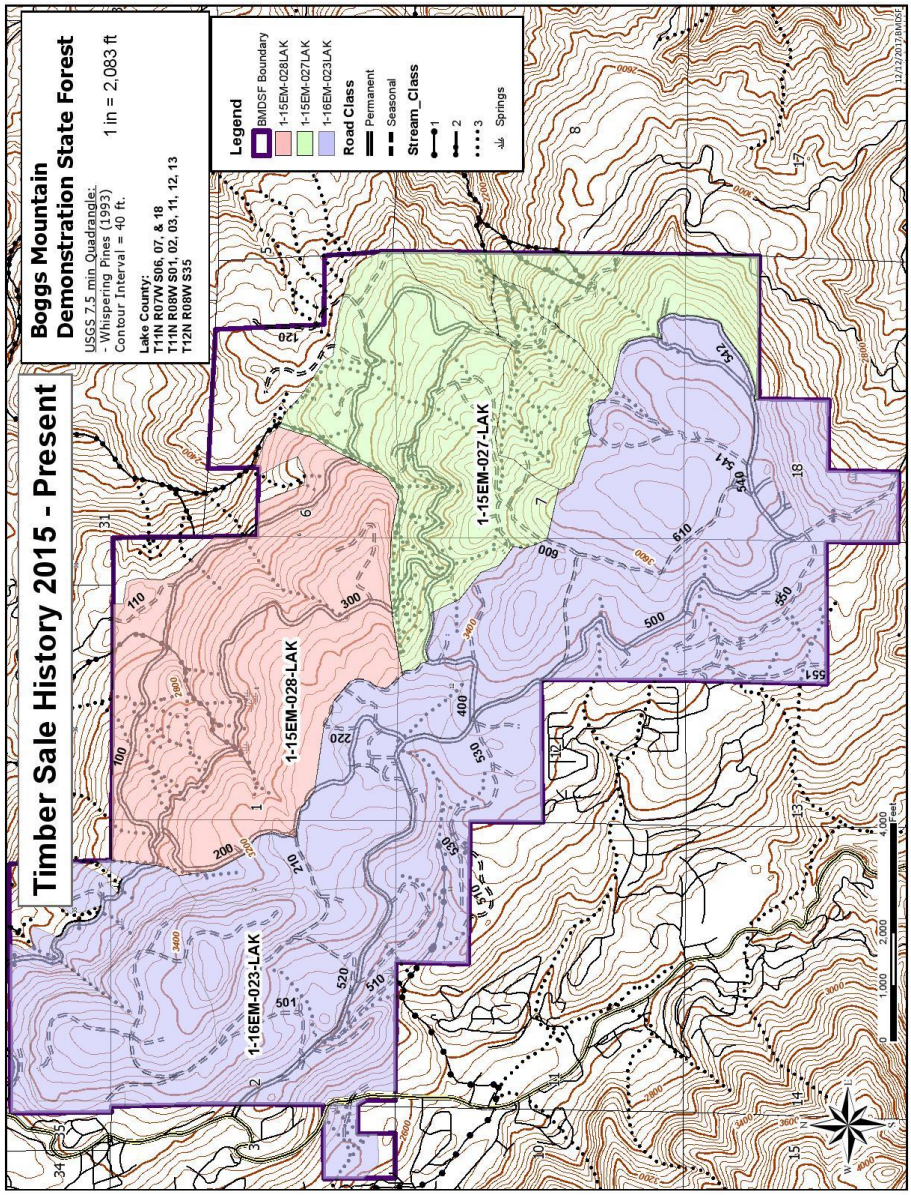
1980-1989

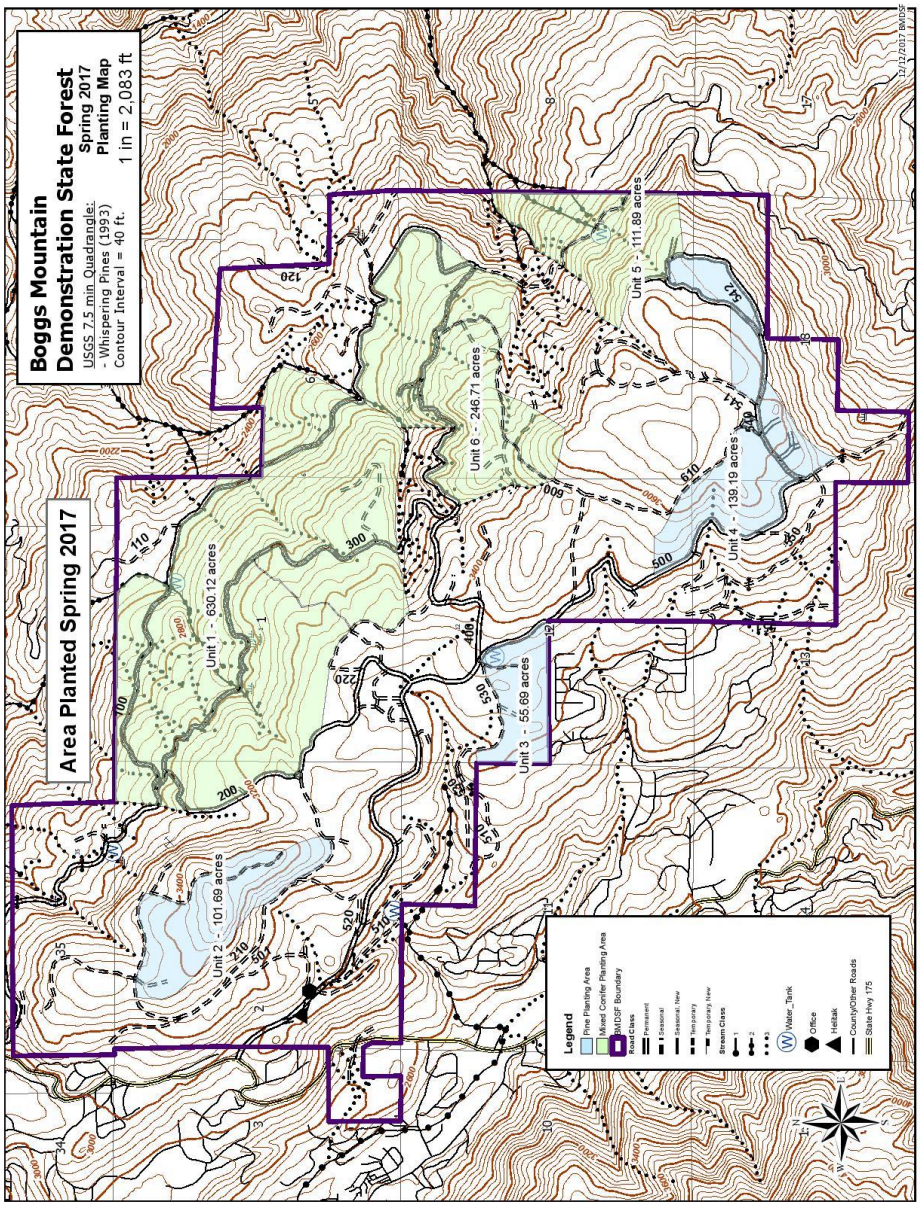


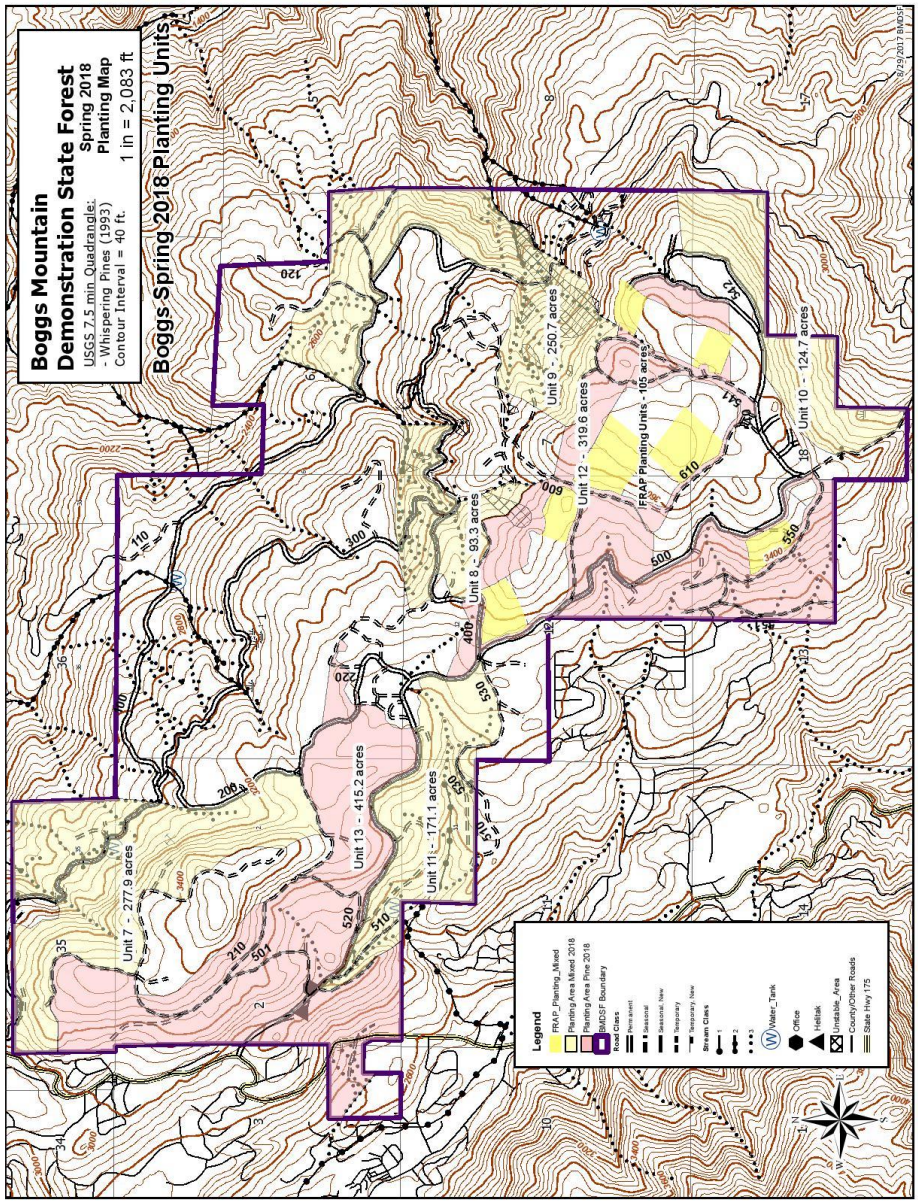
Timber Sale History

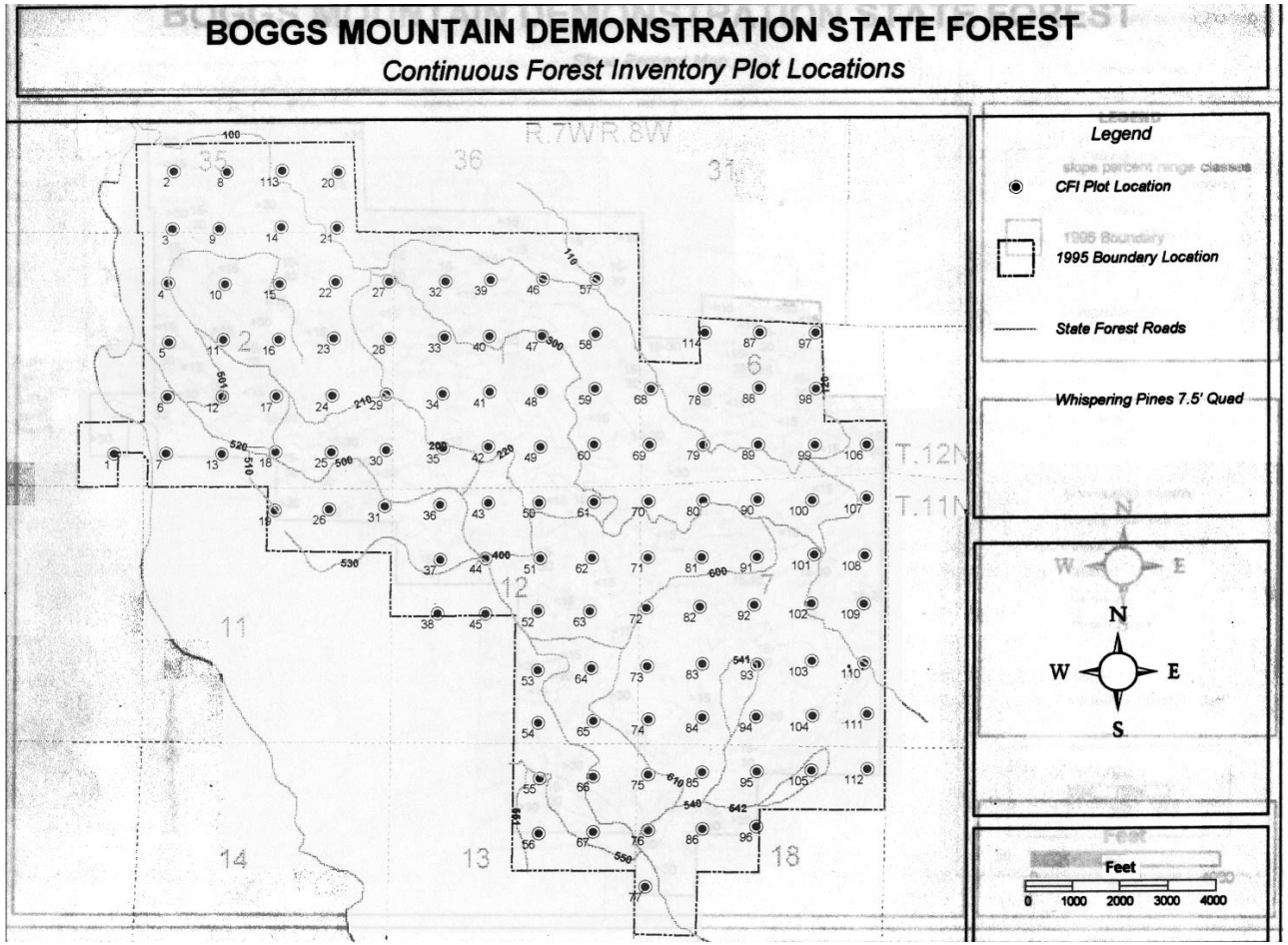
1990-1999


Timber Sale History 2000 - 2014
Boggs Mountain
Demonstration State Forest
USGS 7.5 min Quadrangle:
- Whispering Pines (1993)
Contour Interval = 40 ft.
1 in = 2,083 ft
Lake County:
T11N R07W S06, 07, & 18
T11N R08W S01, 02, 03, 11, 12, 13
T12N R08W S35
Hoberg's Loop - 1-08-162-LAK
Mill Creek - 1-09-025-LAK
Mill Creek - 1-09-025-LAK
Legend
BMDSF Boundary
Past_Projects
Road Class
Permanent
Seasonal
Stream_Class
1
2
3
Springs
0 1,000 2,000 4,000
Feet
12/12/2017 BMDSF


Timber Sale History 2015 - Present
Boggs Mountain
Demonstration State Forest
USGS 7.5 min Quadrangles:
- Whispering Pines (1993)
Contour Interval = 40 ft.
1 in = 2,083 ft
Lake County:
T11N R07W S06, 07, & 18
T11N R08W S01, 02, 03, 11, 12, 13
T12N R08W S35
Legend
BMDSF Boundary
1-15EM-028LAK
1-15EM-027LAK
1-16EM-023LAK
Road Class
Permanent
Seasonal
Stream_Class
1
2
3
Springs
1-16EM-023-LAK
1-15EM-028-LAK
1-15EM-027-LAK
0
1,000
2,000
4,000
Feet
12/12/2013MMS

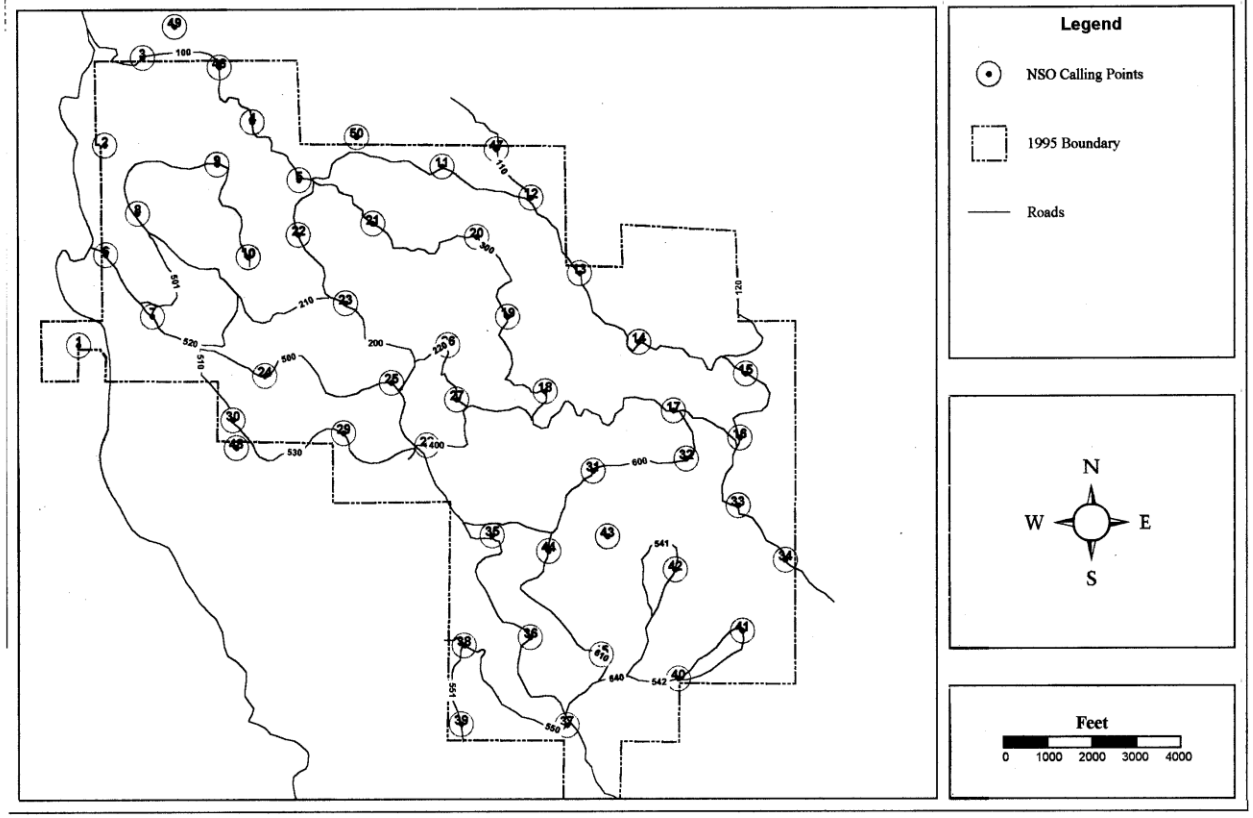

Boggs Mountain
Demonstration State Forest
Spring 2017
Planting Map
USGS 7.5 min Quadrangle:
- Whispering Pines (1993)
Contour Interval = 40 ft.
1 in = 2,083 ft
Area Planted Spring 2017
Unit 1 - 630.12 acres
Unit 2 - 101.69 acres
Unit 3 - 55.69 acres
Unit 4 - 139.19 acres
Unit 5 - 111.69 acres
Unit 6 - 246.71 acres
Legend
Pine Planting Area
Mixed Conifer Planting Area
BNDSF Boundary
Road Class
Permanent
Seasonal
Seasonal, New
Temporary
Temporary New
Stream Class
1
2
3
Water_Tank
Office
Helitak
County/Other Roads
State Hwy 175
12/12/2017 BMDSF

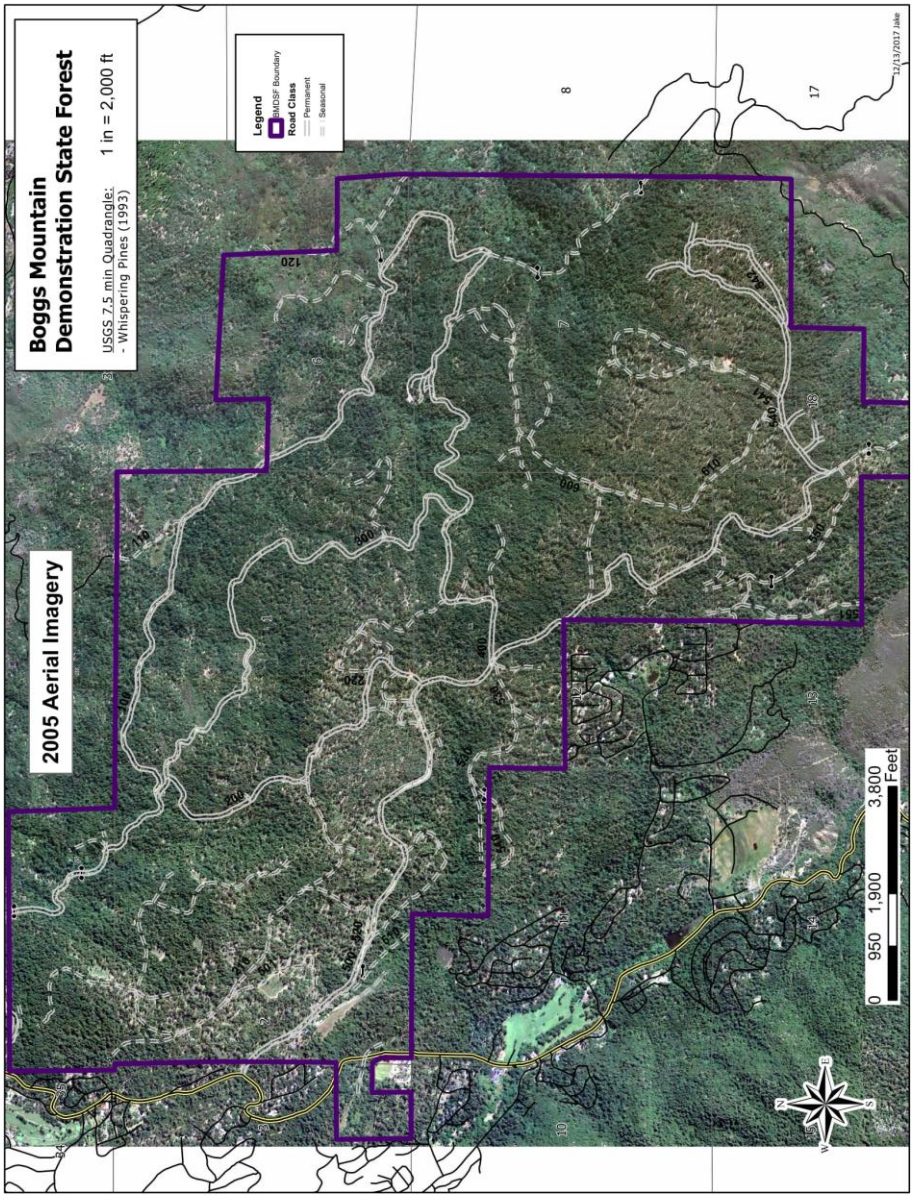

Boggs Mountain
Demonstration State Forest
Spring 2018
Planting Map
USGS 7.5 min Quadrangle:
- Whispering Pines (1993)
Contour Interval = 40 ft.
1 in = 2,083 ft
Boggs Spring 2018 Planting Units
Unit 7 - 277.9 acres
Unit 13 - 415.2 acres
Unit 11 - 171.1 acres
Unit 8 - 93.3 acres
Unit 12 - 319.6 acres
Unit 9 - 250.7 acres
FRAP Planting Units - 105 acres
Unit 10 - 124.7 acres
Legend
FRAP_Planting_Mixed
Planting Area Mixed 2018
Planting Area Pine 2018
BMDSF Boundary
Road Class
Permanent
Seasonal
Seasonal, New
Temporary
Temporary, New
Stream Class
1
2
3
Water_Tank
Office
Helitak
Unstable_Area
County/Other Roads
State Hwy 175
N
W
E
S
02/23/2017 BA/DFS

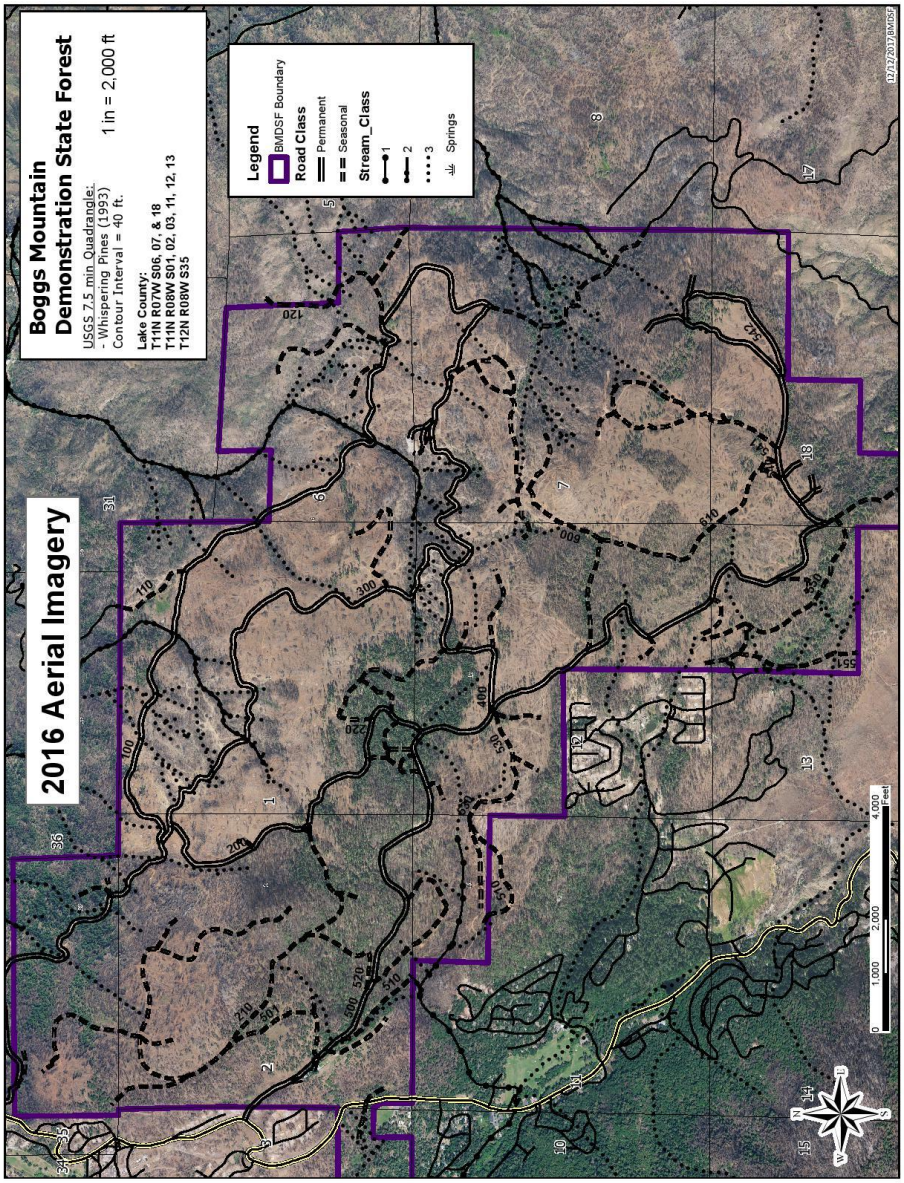

BOGGS MOUNTAIN DEMONSTRATION STATE FOREST
Continuous Forest Inventory Plot Locations
R.7W R.8W
T.12N
T.11N
Legend
CFI Plot Location
1995 Boundary Location
State Forest Roads
Whispering Pines 7.5' Quad
N
W
E
S
Feet
0 1000 2000 3000 4000

BOGGS MOUNTAIN DEMONSTRATION STATE FOREST

Spotted Owl Calling Points




Boggs Mountain
Demonstration State Forest
USGS 7.5 min Quadrangle:
- Whispering Pines (1993)
1 in = 2,000 ft
2005 Aerial Imagery
Legend
MMDSF Boundary
Road Class
Permanent
Seasonal
0 950 1,900 3,800
Feet
12/13/2017 Jake


2016 Aerial Imagery
Boggs Mountain
Demonstration State Forest
USGS 7.5 min Quadrangle:
- Whispering Pines (1993)
Contour Interval = 40 ft.
1 in = 2,000 ft
Lake County:
T11N R07W S06, 07, & 18
T11N R08W S01, 02, 03, 11, 12, 13
T12N R08W S35
Legend
BMDSF Boundary
Road Class
Permanent
Seasonal
Stream_Class
1
2
3
Springs
0
1,000
2,000
4,000
Feet
12/12/2017 BMDSF

Appendix B. Road Management Plan

Introduction

After the Valley Fire, salvage logging on Boggs Management Demonstration State Forest (BMDSF) required a complete overhaul of the existing road system. Winter operations necessitated upgrading much of the road system to permanent roads. Roads 100, 200, 300, 400, and 500 were rocked with a minimum of 6” of base rock. A contract was prepared for onsite rock crushing at the quarry on Road 300, and base rock was also purchased from outside vendors. Road inventories were conducted by CALFIRE Foresters in concert with the California Geological Survey (CGS), and two contracts were developed with logging companies to complete the work. All the primary forest roads were evaluated for hydrologic disconnection, culvert sizing, and watercourse crossing diversion potential. Roads were rocked and shaped with a grader. All non-functional watercourse crossings were upgraded to allow for the passage of the 100-year flood flow. Inside ditches were cleared and numerous ditch relief culverts were added to reduce ditch length. Hydrologic disconnection was achieved wherever feasible. Some additional road spurs were created in order to facilitate logging operations (Figure B.1).

Moving forward from the current condition, a road management plan shall be prepared pursuant to 14 CCR 1093. Updated road inventories will be completed by Forest Staff or under contract with CGS. The target date for completion of this project shall be 2020, once plantation establishment has been achieved. Current road management includes routine maintenance of the existing road system and ongoing evaluation of the effectiveness of the work done following the fire. Maintenance of the existing road system includes maintaining functional drainage facilities and structures to limit erosion potential.

Short term road improvement projects include the abandonment of one existing road segment, realignment of the 600 road to eliminate through-cut road segments, and upgrading the rocking on the 400 road.

A section of seasonal road 0.7 mi in length is proposed for abandonment in the eastern portion of the property (See Figure B.2.). This road was used for timber operations under the Emergency Notices, but was heavily impacted by the extremely wet winter of 2016-2017. This road crosses a deep seated unstable feature that has become more active after the winter of 2016/2017. The road prism has been destabilized by larger slides downslope, and the road is falling into disrepair. The areas accessed by this road were planted in the spring of 2017, therefore the Forester proposes to abandon this road and remove all crossings of classified watercourses.

There are three classified watercourse crossings that will be removed. One Class III (Pt 1) crossing with a 24” diameter culvert, one Class III rocked ford crossing (Pt 2), and one 18” culvert that drains flow from a Class II spring across the road (Pt 5).

The rock ford will not be completely removed, as it is heavily rock reinforced and designed for maintenance free functioning. However, the fill around the crossing will be pulled back to improve the road drainage at this crossing.

A new Lake or Streambed Alteration Agreement has been submitted for review with the BMDSF THP 1-17-126 LAK. This agreement will cover the removal of the three classified watercourse crossings referenced above.

Two other points will be treated as part of this road abandonment that are not associated with classified watercourses. One is a critical dip that has begun to slide outward (Pt 4), though there is no potential for delivery to a classified watercourse. The other is an area where cutbank seeps that developed during the winter began to erode the road prism. This area also has low potential to deliver to a classified watercourse, as these seeps flow onto a large flat below the road.

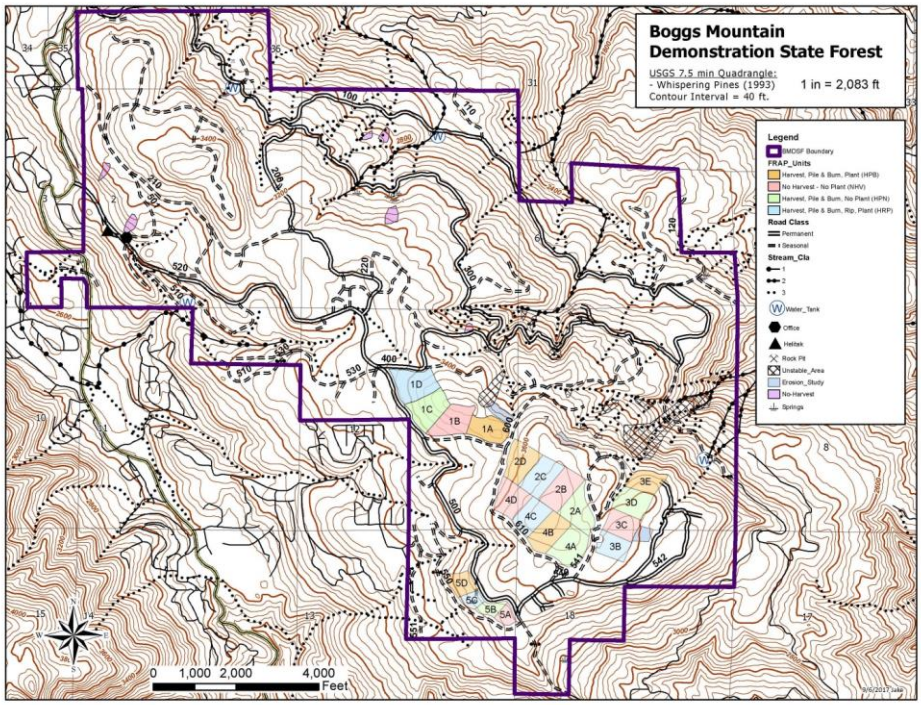


Figure B.1. Current roads classification and location

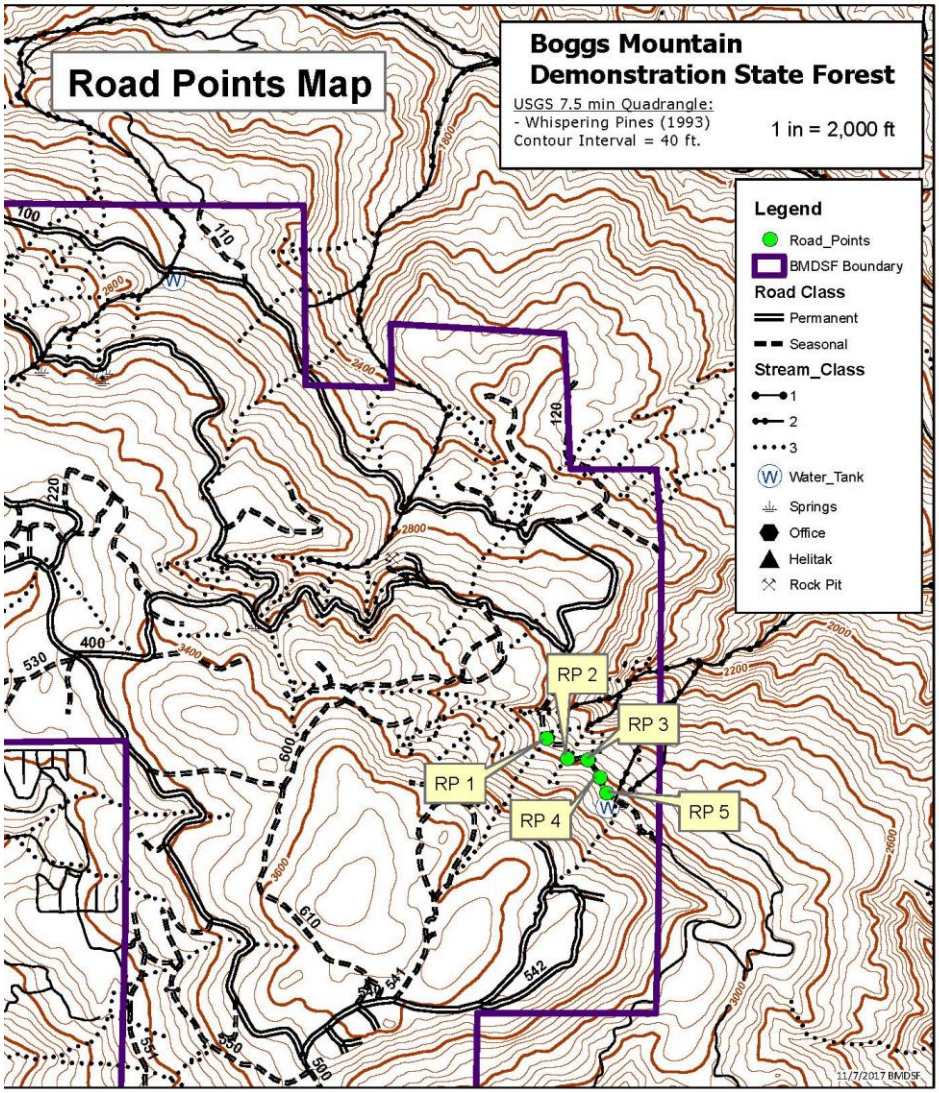


Figure B.2. Road Points map of road abandonment proposed in THP 1-17-126 LAK

Techniques for Mechanical Erosion Control

Erosion control will be achieved with maintenance of the following road drainage facilities:

1. Water bars

   A water bar is a shallow ditch excavated at an angle across a road or trail to drain surface runoff. They are usually built on seasonal or temporary roads, which are to receive little or no traffic during the winter period. The water bar should be extended to the cutbank to intercept all ditch flow and extend beyond the shoulder of the road. A berm must block and prevent ditch flow from continuing down the road during flood flows. The excavated water bar should be skewed 30 degrees to the ditch-line with the excavated material bermed on the downhill grade of the road. Water should always be discharged onto the downhill side on a stable slope protected by rip-rap or vegetation. The cross ditch depth and width must allow vehicle cross-over without destroying the function of the drain.

2. Critical Dip (CD)

   Critical dips are broad swales excavated into the bed of the maintained road in order to eliminate the potential for stream diversion if the culvert plugs during a storm or flood. At stream crossings with a high diversion potential, floodwaters back up behind a plugged culvert, flow onto the road surface (or into the ditch) and flow down the road. In a crossing with no diversion potential, floodwaters emerging onto the road surface travel across the road prism and back into the channel on the lower side of the crossing potentially washing out the fill.

   Critical dips may be excavated over the top of the crossing, provided the culvert is deeper than the proposed excavation. If the culvert is located shallow in the crossing fill, the excavation for the critical dip may be made immediately down-road from the crossing site. The excavation work can typically be performed with a crawler tractor in 1 to 1.5 hours.

3. Rolling Dip (RD)

   Rolling Dips are simply breaks in the grade of a road. They are sloped either into the ditch or to the outside of the road edge to drain and disperse road surface runoff (Figure B.3). Rolling dips are installed in the roadbed as needed to drain the road surface and prevent rilling and surface erosion. They are most frequently used on outsloped roads.

   Excavation for a rolling dip typically begins 50 to 100 feet up-road from where the axis of the dip is planned. Material is progressively excavated from the roadbed, slightly steepening the grade until the axis is reached. This is the deepest part of the excavation, with the overall depth being determined by the slope of the road. The steeper the road, the deeper the dip will have to be in order to reverse grade. To effectively direct runoff to the side of the road, the axis of a rolling dip should be angled about 30 degrees to the road alignment. On the down-road side of the rolling dip axis, the road bed slope should actually rise slightly to ensure that runoff cannot continue down the road surface. This is called a “grade change”.

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The rise in grade is carried for about 10 to 20 feet before the road surface begins to fall again at its original slope. This transition from axis bottom, through rising grade, to original falling grade is achieved in a road distance of 15 to 30 feet. The rolling dip should be broad and shallow enough to permit low-boys, log trucks and other equipment to pass without slowing traffic excessively or causing them to scrape bottom.

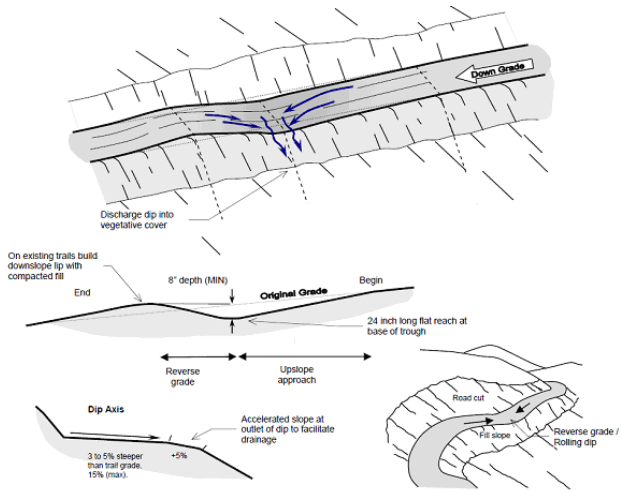

Figure B.3 Rolling Dip

Table B.1 Rolling Dip Dimensions

Road grade (%)	**Upslope approach (distance from up-road start of rolling dip to trough)(ft)**	**Reverse grade (distance from trough to crest)(ft)**	**Depth below average road grade at discharge end of trough (ft)**	**Depth below average road grade at upslope end of trough (ft)**
<6	55	15-20	0.9	0.3
8	65	15-20	1.0	0.2
10	75	15-20	1.1	0.1
12	85	20-25	1.2	0.1
>12	100	20-25	1.3	0.1

4. <u>Outsloping (OS)</u>

This treatment calls for the removal of unstable or excess sidecast material from the outer edge of a road prism and replacing this spoil locally on the adjacent, remaining road bench, or at another stable storage site. In road upgrading, excavated material can be used to build up the roadbed and convert an insloped, ditched road to an outsloped road.

Conditions that might limit road outsloping include: steep road grades, winter use of an unsurfaced road and upslope runoff or excessive spring-flow from the cut bank or roadbed. However, roads, which are outsloped for much of their length, can be insloped to deal with local conditions. Outsloping is most frequently performed using a combination of crawler tractors and excavating machinery. Roads crossing moderate or gentle terrain can be outsloped with tractors alone. On steeper sites or where there are numerous trees along the alignment, hydraulic excavators are often the best tools for performing the outsloping work.

Table B.2 Outsloping “pitch” for roads up to 8% grade

Road grade	**Outslope "pitch" for unsurfaced roads**	**Outslope "pitch" for surfaced roads**
<4	3/8" per foot	1/2" per foot
5	1/2" per foot	5/8" per foot
6	5/8" per foot	3/4" per foot
7	3/4" per foot	7/8" per foot
>8	1" per foot	11/4" per foot

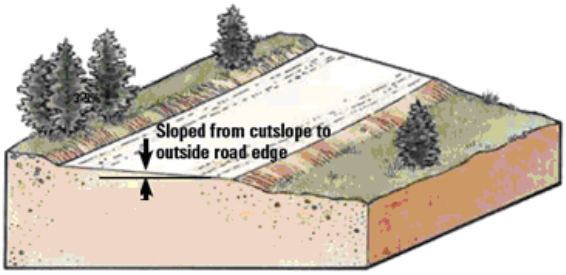

Figure B.4 Sloped from cutslope to outside road edge

5. Straw Mulching

Straw from bales shall be spread evenly over a predesignated area at an application rate of 3000 to 6000 lbs./acre, as specified in the field. At these application rates, the ground surface will be visible in no more than 5% of the mulched area. Covered areas should be 3 to 4 inches deep.

Straw shall be spread evenly at the designated rate and within the designated bare and/or disturbed areas.

Bailing wire shall be removed from the site and disposed of properly.

Straw shall be as free as possible from exotic seeds. Hay shall not be used unless otherwise specified.

Mulching shall be the last task performed on the work area, following any heavy equipment operations, seeding and fertilizer application.

Appendix C. BMDSF General Management Practices for Controlling the Spread of Sudden Oak Disease

Boggs Mountain Demonstration State Forest is located within Lake County, which has been declared a zone of infestation for Sudden Oak Death (SOD). Currently there is no provision that allows moving any host material out-of-state under the federal regulations without removing all bark prior to shipment out-of-state. General Management Practices for operations where products do not move from the state are as follows:

1. A "free-from" survey can be conducted and, if no infected hosts are found, no additional mitigations are required. If the survey is conducted it must be conducted by an RPF or other approved person who has attended training for survey and sampling and is certified as an official sampler. The plan must explain how the survey was conducted as explained in the training. The "free-from" certification and the approved harvest document explaining the survey process act as both compliance agreement and SOD mitigation measures.

2. If a "free-from" survey is not conducted, all hosts are assumed to be infected and SOD mitigations as discussed below should be included in approved harvest documents and will be discussed during the on-site RPF-LTO meeting prior to commencement of timber operations (14 CCR 1035.2). When a free-from survey has not been conducted, the following Management Practices will be incorporated into THPs prepared on BMDSF lands to prevent the spread or introduction of SOD:

    a. Commercial Harvest on a Regulated Site Where Infected Trees Are Not Being Harvested:
        i. Regulations for movement of host material still apply even though logs are not removed from the site. Infected host material (especially foliage) could be picked up on logging equipment and transferred to other sites. Mitigation measures to minimize the unintended movement of host material are required. Forest Staff or contractors will complete inspection of loads of logs and equipment leaving the site to ensure that no host material is being transported without a permit. This may require cleaning dirt or mud from the vehicle to remove host plant material embedded in the dirt or mud, depending on conditions when the timber harvest is conducted.
        ii. If firewood from host material is being removed from the site for commercial or private use, a compliance agreement must be in place. The information as to where and what is being removed, how it will be transported, specifically where it will be moved to, and during what time period should be included in the harvest plan if the plan will act as the compliance agreement. If this information is not included in the plan, a separate compliance agreement will be necessary prior to movement of host material. In addition to the compliance agreement, contractors removing firewood on the Forest must still have the required firewood permit.
        iii.
    b. Commercial Harvest on An Infested Site Where Infected Trees Will Be Harvested:

i. State and Federal regulations apply. Host material cannot leave the site except as authorized by the County Agricultural Commissioner and/or mitigation measures specified in the approved harvest document. Infected host material (especially foliage) and contaminated soil could be picked up on logging equipment and transferred to other sites. Mitigation measures to minimize the unintended movement of host material are required. Forest staff or contractors will inspect loads of logs and equipment leaving the site to ensure that no host material is being transported without a permit. This may require cleaning dirt and mud from the vehicle to remove host plant material contained in the dirt or mud, depending on conditions when the timber harvest is conducted.
ii. If firewood from host material is being removed from the site for commercial or private use, a compliance agreement must be in place in addition to the required firewood permit. The information as to where and what is being removed, how it will be transported, specifically where it will be moved to, and during what time period, should be included in the harvest plan if the plan will act as the compliance agreement. If this information is not included in the plan, a separate compliance agreement will be necessary prior to movement of host material.
iii. In the regulated area, the collection of minor special forest products that are known host plants will be restricted to areas where the "free-from" protocol has been implemented, or where a compliance agreement is in place.

3. Should SOD be identified on BMDSF lands, Management Practices to minimize the unintended movement of host material from infested areas include:

   a. The RPF will inform personnel that they are working in a SOD-infested area, unauthorized movement of plant material is prohibited, and the intent of the mitigation measures is to prevent disease spread (914 CCR 1035.2).

   b. If some sites in the general operating area are found to be disease-free or have a low incidence of disease, initiate and complete operations on these sites before moving to more heavily infested sites.

   c. To the extent practical, locate landings, log decks, logging roads, tractor roads, and other sites of equipment activity away from host plants, especially areas with disease symptoms.

   d. Route equipment away from host plants and trees, especially areas with disease symptoms.

   e. The equipment or vehicles must be inspected for host plant debris (leaves, twigs, and branches each time equipment or vehicles leave the site. Host plant debris must be removed from the equipment and vehicles prior to their departure. This applies to all equipment and vehicles associated with the operation, including logging equipment, log-hauling trucks, pick-up trucks, employee's personal vehicles, etc. An exception will be granted for equipment or vehicles that leave the site temporarily and will not be traveling to uninfested areas prior to their return.

f. In addition to following California Department of Fish and Game (CDFG) drafting guidelines (intake mesh size, etc.), water should not be drafted from a watercourse in a SOD-infected drainage and used in an uninfested area. This is because sporangia from infected leaves (or minute parts of infected leaves), themselves in the watercourse, could be suctioned in the draft and transported to new areas. Infection could be possible if abatement over-spraying landed on susceptible hosts.

4. Management Practices to minimize the unintended movement of soil and host material from infested areas (these practices are not specifically required for operations on infested sites, but the RPF must state and justify what practices will be used to minimize the unintended movement of infested host material):

   a. The SOD pathogen resides in soil in infested areas, and soil is therefore a potential carrier of the pathogen. The greatest threat of disease spread occurs when wet soil is present. Soil movement should be addressed.

   b. Because wet soil and mud will readily adhere to vehicles, equipment, and boots, conduct operations during the dry season, and utilize paved and rocked roads and landings to the extent possible.

   c. After working in an infested area, remove or wash off accumulations of soil, mud, and organic debris from shoes, boots, vehicles and heavy equipment, etc. before traveling to an area that is not infested with SOD. Consider establishing an equipment power wash station. The station should be:
      - Located within the generally infested area.
      - Paved or rocked.
      - Well-drained so that vehicles exiting the station do not become recontaminated by the wash water.
      - Located where wash water and displaced soil does not have the potential to carry fines to a watercourse (see "Saturated Soil Conditions" in 14 CCR 895.1).

   d. Pay particular attention to sites where soil and organic debris may accumulate.

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Appendix D. California Natural Diversity Database List of Species that Potentially May Occur on BMDSF

The California Natural Diversity Database (CNDDB) was queried in October 2017 to identify rare plant and animal species that may potentially occur on BMDSF [California Natural Diversity Database (CNDDB) 2017]. The CNDDB is a positive detection database, meaning that only areas that have been surveyed and had positive detections are recorded, as well as relying on entities conducting monitoring to provide reports to the database. As a result, a typical CNDDB scoping involves incorporating any species detections within the nine USGS quads surrounding the project area. Below are tables of the detections directly within BMDSF (Table D.1) and within the nine-quad area (Table D.2) which resulted in 414 individual occurrences and 100 distinct elements. Table D.2 only lists the individual species elements that may potentially occur. This scoping does not cover whether or not habitat for the species listed in Table D.2 is present on BMDSF.

Table D.1. CNDDB occurrences reported on BMDSF

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS	STATE STATUS	CDFW[5] STATUS	RARE PLANT RANK[6]
Rincon Ridge ceanothus	Rincon Ridge ceanothus	None	None		1B.1
Cobb Mountain lupine	Lupinus sericatus	None	None		1B.2
Greene's narrow-leaved daisy	Erigeron greenei	None	None		1B.2
Sonoma canescent manzanita	Arctostaphylos canescens ssp. sonomensis	None	None		1B.2
dimorphic snapdragon	Antirrhinum subcordatum	None	None		4.3

Table D.2. Distinct species that have the potential to occur on or near BMDSF

COMMON NAME	SCIENTIFIC NAME	FEDERAL STATUS	STATE STATUS	CDFW STATUS	RARE PLANT RANK
AQUATIC WILDLIFE					
Amphibians					
red-bellied newt	Taricha rivularis	None	None	SSC	
California giant salamander	Dicamptodon ensatus	None	None	SSC	
foothill yellow-legged frog	Rana boylii	None	Candidate Threatened	SSC	
Reptiles					
western pond turtle	Emys marmorata	None	None	SSC	
Fish					
steelhead - central California coast DPS	Oncorhynchus mykiss irideus pop. 8	Threatened	None		

[5] CDFW Status – SSC = species of special concern, WL = Watch List, and FP = Fully Protected. See www.wildlife.ca.gov for the definitions of each of these status'.
[6] California Rare Plant Rank – See http://www.cnps.org/cnps/rareplants/ranking.php for status ranking definitions.

Clear Lake hitch	Lavinia exilicauda chi	None	Threatened		
hardhead	Mylopharodon conocephalus	None	None	SSC	
Sacramento perch	Archoplites interruptus	None	None	SSC	
Russian River tule perch	Hysterocarpus traski pomo	None	None	SSC	
TERRESTRIAL WILDLIFE					
Birds					
osprey	Pandion haliaetus	None	None	WL	
white-tailed kite	Elanus leucurus	None	None	FP	
bald eagle	Haliaeetus leucocephalus	Delisted	Endangered	FP	
golden eagle	Aquila chrysaetos	None	None	FP; WL	
American peregrine falcon	Falco peregrinus anatum	Delisted	Delisted	FP	
prairie falcon	Falco mexicanus	None	None	WL	
western yellow-billed cuckoo	Coccyzus americanus occidentalis	Threatened	Endangered		
burrowing owl	Athene cunicularia	None	None	SSC	
purple martin	Progne subis	None	None	SSC	
tricolored blackbird	Agelaius tricolor	None	Candidate Endangered	SSC	
Mammals	Myotis evotis	None	None		
long-eared myotis	Myotis thysanodes	None	None		
fringed myotis					
silver-haired bat	Lasionycteris noctivagans	None	None		
hoary bat	Lasiurus cinereus	None	None		
western red bat	Lasiurus blossevillii	None	None	SSC	
Townsend's big-eared bat	Corynorhinus townsendii	None	None	SSC	
pallid bat	Antrozous pallidus	None	None	SSC	
North American porcupine	Erethizon dorsatum	None	None		
fisher - West Coast DPS	Pekania pennanti	None	Candidate Threatened	SSC	
Macroinvertebrates					
Barr's amphipod	Stygobromus cherylae	None	None		
An isopod	Calasellus californicus	None	None		
brownish dubiraphian riffle beetle	Dubiraphia brunnescens	None	None		
Ricksecker's water scavenger beetle	Hydrochara ricksecker i	None	None		
serpentine cypress wood-boring beetle	Trachykele hartmani	None	None		
Wilbur Springs shorebug	Saldula usingeri	None	None		
western bumble bee	Bombus occidentalis	None	None		
obscure bumble bee	Bombus caliginosus	None	None		
Borax Lake cuckoo wasp	Hedychridium milleri	None	None		

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Mollusk					
Clear Lake pyrg	Pyrgulopsis ventricosa	None	None		
BOTANICAL SPECIES					
Loch Lomond button-celery	Eryngium constancei	Endangered	Endangered		1B.1
Burke's goldfields	Lasthenia burkei	Endangered	Endangered		1B.1
legenere	Legenere limosa	None	None		1B.1
Lake County stonecrop	Sedella leiocarpa	Endangered	Endangered		1B.1
Raiche's manzanita	Arctostaphylos stanfordiana ssp. raichei	None	None		1B.1
Sebastopol meadowfoam	Limnanthes vinculans	Endangered	Endangered		1B.1
Kenwood Marsh checkerbloom	Sidalcea oregana ssp. valida	Endangered	Endangered		1B.1
Brandegee's eriastrum	Eriastrum brandegeeae	None	None		1B.1
Baker's navarretia	Navarretia leucocephala ssp. bakeri	None	None		1B.1
few-flowered navarretia	Navarretia leucocephala ssp. pauciflora	Endangered	Threatened		1B.1
small pincushion navarretia	Navarretia myersii ssp. deminuta	None	None		1B.1
Rincon Ridge ceanothus	Ceanothus confusus	None	None		1B.1
slender Orcutt grass	Orcuttia tenuis	Threatened	Endangered		1B.1
Greene's narrow-leaved daisy	Erigeron greenei	None	None		1B.2
Colusa layia	Layia septentrionalis	None	None		1B.2
Hall's harmonia	Harmonia hallii	None	None		1B.2
bent-flowered fiddleneck	Amsinckia lunaris	None	None		1B.2
serpentine cryptantha	Cryptantha dissita	None	None		1B.2
Freed's jewelflower	Streptanthus brachiatus ssp. hoffmanii	None	None		1B.2
Socrates Mine jewelflower	Streptanthus brachiatus ssp. brachiatus	None	None		1B.2
Three Peaks jewelflower	Streptanthus morrisonii ssp. elatus	None	None		1B.2
early jewelflower	Streptanthus vernalis	None	None		1B.2
green jewelflower	Streptanthus hesperidis	None	None		1B.2
coastal bluff morning-glory	Calystegia purpurata ssp. saxicola	None	None		1B.2
Napa false indigo	Amorpha californica var. napensis	None	None		1B.2
Jepson's milk-vetch	Astragalus rattanii var. jepsonianus	None	None		1B.2
Cobb Mountain lupine	Lupinus sericatus	None	None		1B.2
saline clover	Trifolium hydrophilum	None	None		1B.2
Napa bluecurls	Trichostema ruygtii	None	None		1B.2
glandular western flax	Hesperolinon adenophyllum	None	None		1B.2
two-carpellate western flax	Hesperolinon bicarpellatum	None	None		1B.2
Lake County western flax	Hesperolinon didymocarpum	None	Endangered		1B.2
Sharsmith's western flax	Hesperolinon sharsmithiae	None	None		1B.2
marsh checkerbloom	Sidalcea oregana ssp. hydrophila	None	None		1B.2
Snow Mountain buckwheat	Eriogonum nervulosum	None	None		1B.2
Jepson's leptosiphon	Leptosiphon jepsonii	None	None		1B.2

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many-flowered navarretia	Navarretia leucocephala ssp. plieantha	Endangered	Endangered		1B.2
holly-leaved ceanothus	Ceanothus purpureus	None	None		1B.2
Calistoga ceanothus	Ceanothus divergens	None	None		1B.2
Sonoma ceanothus	Ceanothus sonomensis	None	None		1B.2
Bolander's horkelia	Horkelia bolanderi	None	None		1B.2
Boggs Lake hedge-hyssop	Gratiola heterosepala	None	Endangered		1B.2
Santa Lucia dwarf rush	Juncus luciensis	None	None		1B.2
narrow-anthered brodiaea	Brodiaea leptandra	None	None		1B.2
dwarf soaproot	Chlorogalum pomeridianum var. minus	None	None		1B.2
adobe-lily	Fritillaria pluriflora	None	None		1B.2
Geysers panicum	Panicum acuminatum var. thermale	None	Endangered		1B.2
Toren's grimmia	Grimmia torenii	None	None		1B.3
Hoffman's bristly jewelflower	Streptanthus glandulosus ssp. hoffmanii	None	None		1B.3
Konocti manzanita	Arctostaphylos manzanita ssp. elegans	None	None		1B.3
Porter's navarretia	Navarretia paradoxinota	None	None		1B.3
Sonoma beardtongue	Penstemon newberryi var. sonomensis	None	None		1B.3
California satintail	Imperata brevifolia	None	None		2B.1
northern meadow sedge	Carex praticola	None	None		2B.2
slender-leaved pondweed	Stuckenia filiformis ssp. alpina	None	None		2B.2
eel-grass pondweed	Potamogeton zosteriformis	None	None		2B.2
watershield	Brasenia schreberi	None	None		2B.3
oval-leaved viburnum	Viburnum ellipticum	None	None		2B.3
Mt. Saint Helena morning-glory	Calystegia collina ssp. oxyphylla	None	None		4.2
woolly meadowfoam	Limnanthes floccosa ssp. floccosa	None	None		4.2
elongate copper moss	Mielichhoferia elongata	None	None		4.3
dimorphic snapdragon	Antirrhinum subcordatum	None	None		4.3

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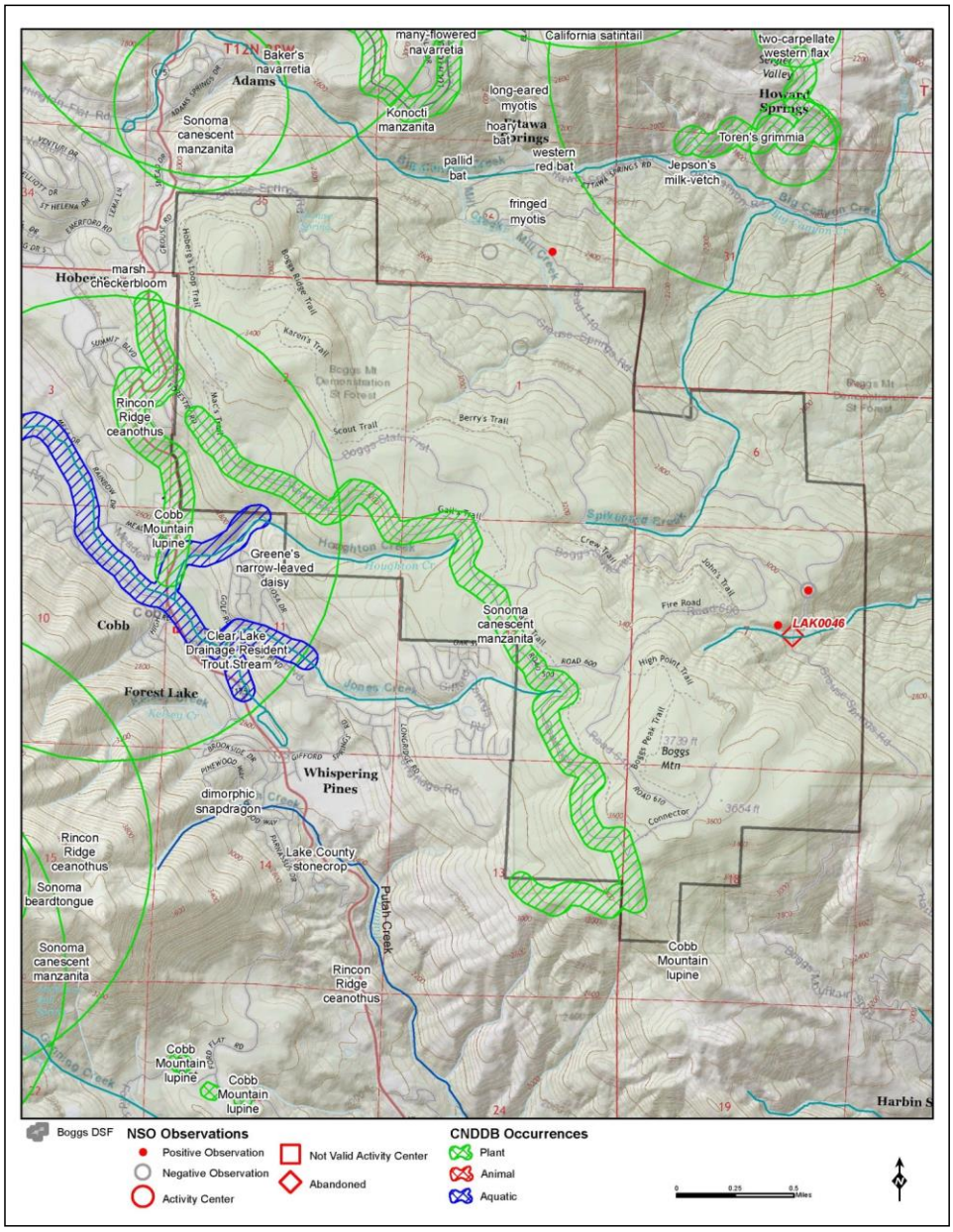

Figure D.1. Map of CNDDB occurrences within BMDSF

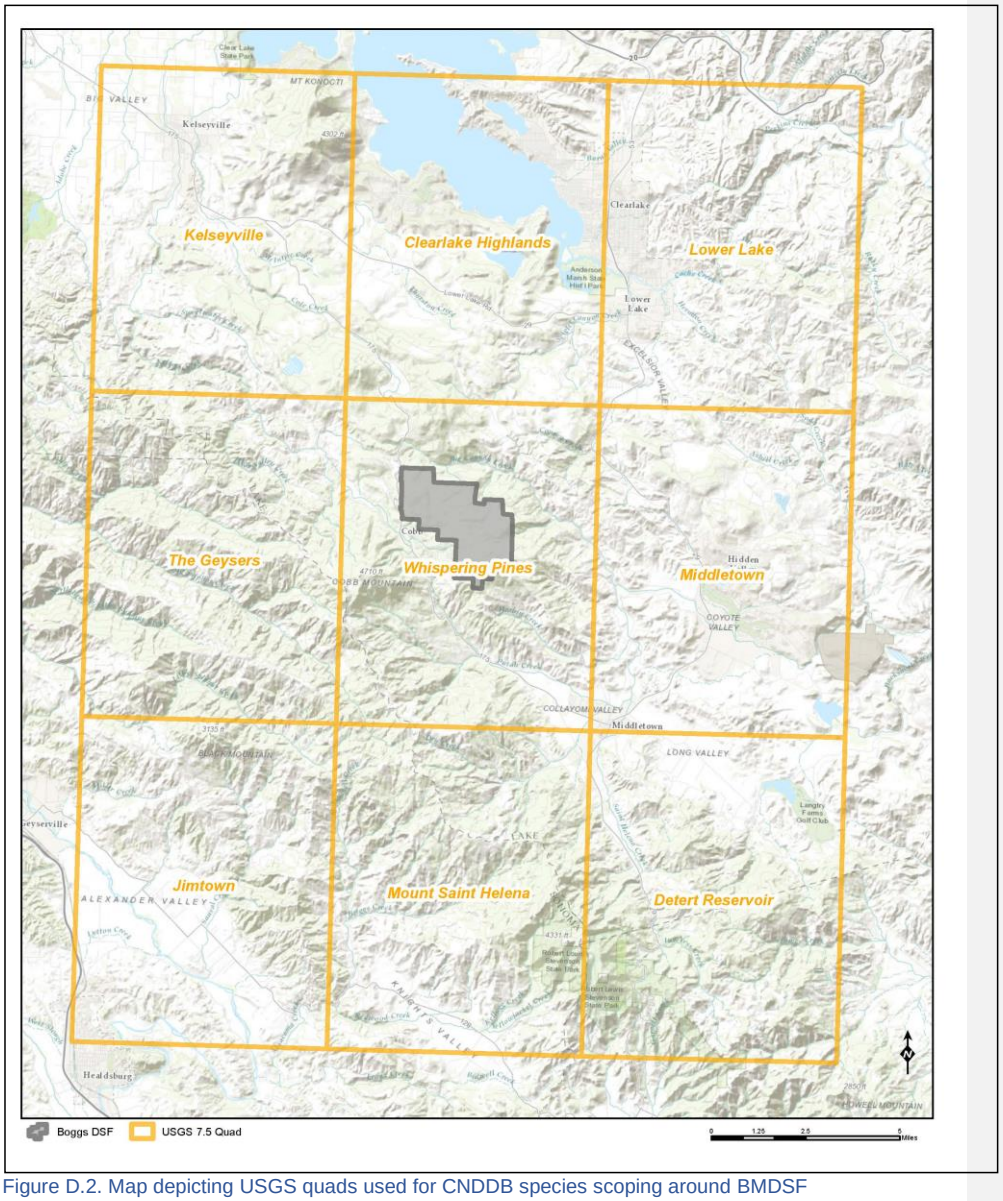

Figure D.2. Map depicting USGS quads used for CNDDB species scoping around BMDSF