LaTour Demonstration State Forest Management Plan

February 2026

California Department of Forestry and Fire Protection
The Resources Agency

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Trees and foresters, growing together.

CERTIFICATION by REGISTERED PROFESSIONAL FORESTER

pursuant to
California Code of Regulations
Title 14, §1602.1

I, Jason S. Poburko, am responsible for the preparation of this Forest Management Plan for LaTour Demonstration State Forest.

Jason S. Poburko, RPF #2769

4-15-2026
Date

APPROVAL of FOREST MANAGEMENT PLAN
for
LATOUR DEMONSTRATION STATE FOREST

Approved by vote of the Board of Forestry and Fire Protection

Terrence O'Brien, Board Chair

4/15/2026
Date

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I. INTRODUCTION

Forests provide important values to the citizens of California. They supply many commodities and amenities that Californians both require and enjoy, including open space, clean water, fish and wildlife habitat, and forest products such as lumber, paper biomass fuel, and values associated with sequestered carbon. They also provide an important destination in the ever-increasing public desire for a variety of outdoor recreational activities.

Many public wildlands in California are set aside as reserves, parks, monuments, or wilderness areas to achieve discrete policy goals of the State Legislature and United States Congress, including to preserve rare ecosystems, advance environmental protection or historic preservation, or provide opportunities for recreation. Demonstration State Forests (DSFs), by contrast, are public lands that, by legislative mandate, have a unique and distinctly different purpose from parks and wilderness areas. DSFs must be used to conduct research, demonstration, and education on sustainable forestry practices.

As explained in Board Policy 0351.1, to attain proper management of private timberlands and state-owned timberlands in California, there is a need to investigate, develop, and demonstrate new and improved forest management methods, monitor the effectiveness of those management techniques, and educate timberland owners and the public on the suitability and practicality of such methods and techniques. The DSFs serve this purpose while contributing to the economic stability and diversity of local communities by providing forest products and outdoor recreation opportunities which sustain local employment and tax bases.

The Demonstration State Forest program meets an important need to advance research and demonstration into sustainable forestry practices, in a State with a growing population that is placing increasing demands on forest lands for recreation, environmental protection, and conversion to other uses. DSFs fill an important role by advancing innovative solutions for forest management and helping the public learn about the benefits of sustainable forestry. The experimental management of DSFs, therefore, must balance periodic timber harvesting with public trust resource values such as recreation, watershed, wildlife, range and forage, fisheries, and aesthetic enjoyment.

The California Department of Forestry and Fire Protection (Department or CAL FIRE) manages 14 properties as DSFs, covering 85,135 acres. LaTour Demonstration State Forest (LDSF) is a 9,033-acre mixed conifer forest located in the northern Sierra Nevada/southern Cascades, in Shasta County, 45 miles east of Redding. LDSF is the second largest DSF.

This management plan for LDSF provides overarching goals and general parameters for the activities that may take place in LDSF during the next ten years and a broad vision for potential development of the Forest through the next century. It serves as a guide to Forest managers, as well as a tool for public disclosure, of the management goals and potential forestry activities that may take place on LDSF to further the important state policies championed by the Demonstration State Forest program.

A. Legal Authority and Existing State Policy

The legislative authority for the State Forest System is contained in Public Resources Code (PRC) sections 4631et seq. PRC section 4651 provides that management of State Forests shall conform to regulations developed by the Director of CAL FIRE and approved by the Board. Such regulations must be in conformity with forest management practices designed to achieve maximum sustained production of high-quality forest products while considering values relating to recreation, watershed, wildlife, range and forage, fisheries, and aesthetic enjoyment. Title 14, Division 1.5, Chapter 9 of the California Code of Regulations (CCR) also contains detailed rules and regulations governing recreational use and the sale of timber and other forest products within State Forests. In addition, pursuant to PRC sections 4645 and 4646, the California Board of Forestry and Fire Protection (Board) has established policy governing management of the DSFs, and CAL FIRE is responsible for managing the DSFs in accordance with that policy. (Board Policy Chapter 0350, section 0351.)

Board Policy 0351.1 provides LDSF is a working forest area managed by Registered Professional Foresters who focus on demonstration of commercial timber management, plantation management, ecosystem restoration, fire prevention (including non-commercial vegetation management and prescribed fire), recreation and monitoring in conformance with detailed management plans.

Board Policy 0351.2 states the primary purpose of the Demonstration State Forest program is to conduct innovative demonstrations, experiments, and education in forest management and all state forest land uses should serve this purpose in some way. Board Policy 0351.2, subd. (a) provides that Timber production will be the primary land use on LDSF. Recreation is recognized as a secondary but compatible land use on LDSF. (Board Policies 351.2, subd. (b); 351.5.) Special uses of state forests may be permitted only when there is a clear benefit to the state and when such uses do not conflict with timber management, demonstration, education, research, and recreation. (Board Policies 0351.6).)

In implementing the Demonstration State Forest program, the Board has directed the Department to conduct a balanced program of demonstrations and investigations in silviculture, mensuration, logging methods, economics, hydrology, resource protection, prescribed fire use, ecological restoration, and recreation. These demonstrations and investigations are intended to meet the needs of the public, small forest landowners, timber operators, and the timber industry. (Board Policy 0351.3, subd. (A).)

Moreover, with respect to timber management on LDSF, the Board has directed that: (1) the Department conduct regular and consistent periodic timber sales; (2) a rotation age, cutting cycle, and allowable annual cut be established; (3) timberlands are to be managed based on the sustained yield principle, defined as management which will achieve and maintain continuous timber production consistent with environmental constraints; (4) timber stands should be harvested on the basis of maximizing sustained production of high quality forest products; (5) timber production and harvesting should provide for coordination with other state forest uses and silvicultural practices should be compatible with recreation, soil, water, wildlife and fishery values, carbon sequestration, and aesthetic enjoyment; (6) the department must pursue economically and ecologically justifiable forest management practices to increase total fiber production, timber quality, and resilient stand structures; and (7) timber sales should have demonstrational value and include experimental and educational aspects whenever possible. (Board Policy 0351.4.)

In addition to complying with these general management policies, DSF staff must manage DSFs in accordance with a management plan approved by the Board. (PRC § 4645, 14 CCR 1510.) Management plans describe general goals and objectives and provide guidance and direction for the managed use of forest resources within a specific DSF. Management Plans for DSFs are prepared by their respective Forest Managers on behalf of the Department, with appropriate public review, and presented for approval by the Board. (Board Policy 0351.10.) The Department must present the Board with a thorough review of each existing plan at least every ten years. After each review, the Board may direct the Department either to continue management under the existing plan, to prepare amendments to the plan, or to prepare a new plan for public review and Board approval. The Department must then submit the revised or newly prepared plan to the Board within a reasonable timeframe as identified by the Board. The Department must continue management under existing plans, with appropriate consideration for changes in law or regulation, until amendments or new plans are approved by the Board. (Board Policy 0351.10.)

In 2020, the Board determined DSF Management Plans may fall within the Class 6 categorical exemption from the California Environmental Quality Act (CEQA). Class 6 consists of basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource, including but not limited to forest surveys and soil erosion studies. These may be strictly for information gathering purposes, or as part of a study leading to an action which a public agency has not yet approved, adopted, or funded (14 CCR §1153(b)). Consistent with this determination, the Management Plan for the LDSF does not dictate a specific course of action the Department must take with respect to the experimental management the DSF but rather constitute a guide and study of possible future forest management activities that, if funded and later approved, would be consistent with existing state law and policy. The Management Plan for the LDSF provides information and guidance on the whole program associated with management of LDSF, and, as such, certain activities addressed under the management plan may be subject to further CEQA review on a project-by-project basis prior to implementation. Further evaluation of these will occur prior to implementation, in conformance with the CEQA guidelines.

The last Management Plan approved by the Board for LDSF was adopted in 2013. The 2026 management plan includes informational updates and continues the goals of the 2013 plan, with a focus on increasing public education and workforce development opportunities with engaged partners.

B. Pre-History and History of LDSF

LDSF falls within the ethnographic territory of the Central Yana (“Yana”). Information on the Yana is scarce (Powers 1874) and based primarily on five informants. All informants were born circa 1855, after the first white settlers arrived in the region. Ethnographies written on the Yana started at the time when the southern Yana were thought to be extinct and the Yahi were still unknown.

Yana diet fell into two categories: gathered plant foods (nut and seed crops were utilized in late summer) and hunted animal products. Very few Yana techniques for processing and preparing nut and seeds have been documented. Both acorns and buckeyes were hulled and ground into flour using a hopper mortar and pestle. In terms of faunal resources, the Yana consumed all available species except wolves, coyotes, dogs, buzzards, reptiles, and amphibians. Large animals were hunted with bows with smaller animals being caught with snares. Fish were

harvested with basket traps, nets, bone hooks, or poisons. Harpoons were also used for salmon at lower elevations.

The northern and central Yana lived in earth covered multifamily dwellings and utilized assembly houses, sweat houses, menstrual huts, birth houses, smoke houses, granaries, and store houses. Architecture was generally a conical bark house made from slabs of cedar or pine bark. The Yana also utilized caves for shelter.

While archeological evidence indicates a complex flaked stone tool, ethnographic information has recorded only three types of chipped stone tools: projectile points, knife blades, and flakes for cutting. These were made from obsidian, basalt, and silicates. Other stone tools reported for the Yana were arrow shaft straighteners, bow smoothers, steatite pipes, pecking stones, pointed anvils, stone pendants, and incised slate slabs. (Adapted from Huberland and Dwyer, 2001)

LDSF Post-Contact History

Evidence from the historical era associated with the gold rush and subsequent period of dramatic emigrant flux to California has not been documented on LDSF, most likely due to the elevation. Given the presence of the Nobles and Lassen Emigrant trails just south of the forest it is possible that resources associated with this period were deposited within the boundaries of LDSF. Given the lack of significant (easily exploited) gold deposits and relatively high elevations of the forest it is unlikely that such resources are present.

The subsequent settlement and intensive exploitation of the surrounding areas by Americans and Europeans from 1850 onwards represents the most likely period during which historic activity within LDSF becomes apparent within the archeological record. Timber harvesting and processing and ranching were introduced and quickly became the major focus of development within the region. The presence of a shake making camp, previously recorded within the forest supports the hypothesis. The Shingletown area south of the project area was intensively developed and exploited and is likely additional evidence of this period of rapid and dramatic growth. (Adapted from Hamilton and Neri, 1997)

Additionally, the property has continuously been owned either by the federal government or the State suggesting that the opportunity for any historical development outside of logging and timbering was limited prior to 1950 due to extremely limited access, and isolated to small-scale episodes, probably by one or two individuals. It was expected, however, that historic evidence dating to post-1940 should be more forth coming, typified by the common “trash” deposits indicative of logging operations. There remains only the slight possibility that resources indicative of earlier historic periods, such as pioneers and trapping activities or exploration for gold resources, could be discovered. The predicted likelihood of such discoveries is considered very low**.** Similarly, the discovery of protohistoric resources, representing contact between Europeans and Native American cultures was considered very unlikely, given the assumed marginal utilization of the forest by both cultures and the brief time span contained in this period. (Adapted from Hamilton and Neri, 1997)

In 1923 legislation was enacted enabling the eventual exchange of various state school lands for National Forest lands of comparable value. On September 28, 1930, the State Lands Commission exchanged 10,957 acres of land administered by them for the land included in the Cow Creek unit of Lassen National Forest.

Purchase of the property by the California Division of Forestry was made possible with the enactment of Chapter 1465 Statutes, dated July 17, 1945. Therein the legislature encumbered the sum of $100,000 from the State Treasury for the purchase of the Cow Creek Unit by the Division of Forestry from the State Lands Commission. The patent deed to the property known as “LaTour State Forest” was executed on January 8, 1946. LDSF was the first sizable State Forest acquired.

When LDSF was acquired by the Department, it was essentially an unmanaged forest with very little previous harvesting and no management activities. Christmas tree sales were initiated in LDSF in 1946. The first manager was assigned in 1948, and forest management activities began with the first timber sale in 1951. Since that time, 201 million board feet have been harvested from LDSF. These sales have allowed the Department to operate LDSF as a self-sustaining enterprise, meaning LDSF operational costs are generally covered by LDSF revenues.

C. Management Goals

To effectuate the requirements of existing state law and policy, the following management goals for LDSF may be pursued by the Department. Each project on LDSF should meet one or more of these goals:

1. Maintain and strive to improve the research and demonstration program to provide valuable information regarding timber production, harvest methods, fuels management, wildlife habitat requirements for various species that inhabit LDSF, and road management practices that result in reduced sediment delivery. This information should be made available to the public, small forest landowners, resource professionals, timber operators, and the timber industry. Research and demonstration projects will be aimed at providing practical information for forest landowners who need to manage a host of forest resources, including but not limited to, wildlife, water, soil, botanical resources, and timber. Due to limited staff resources, cooperative research projects will be sought with other public and private researchers who share a common interest and direction in forest management. Staff will seek opportunities to disseminate information to landowners and educate the public on management practices undertaken and demonstrated to maintain healthy forest ecosystems. Continue research into forest-based carbon sequestration and forest management techniques to promote forest adaptation and resiliency to climate change.

2. Maintain a timber inventory for purposes of estimating growing stock by species and site class. The timber inventory data will be used to calculate the current standing inventory and timber growth for future sustained yield calculations. The timber inventory will also be used to estimate the quantity of certain wildlife habitat attributes such as snag retention and stand structure. The collection of this data will assist managers in evaluating wildlife use and habitat condition on LDSF. All historic inventory data will be maintained and made available for potential future research projects.

3. Provide low impact recreational opportunities for forest visitors. Work toward expansion and improvement of existing recreational facilities and the development of new recreational opportunities in suitable areas.

4. Harvest timber utilizing sustained yield management methods and levels of harvest which permit the continuous production of timber that achieves maximum sustained production of high-quality timber products, consistent with PRC section 4513, without degrading the productivity and health of the forest, and contributes to local employment and tax revenue. Timber production will be conducted to provide local job opportunities, consistent with the overall objectives of providing for recreation, wildlife, fisheries, aesthetic enjoyment, protection of soil resources, and protection of water quality.

5. Maintain and improve watershed protection through forest practices and erosion control efforts. Continue operating under the existing road management plan to maintain public access and prevent degradation of watercourses from road water runoff.

6. Continue an aggressive pest management program to reduce the spread of tree damaging insect populations and keep inherent tree diseases and pathogens at endemic levels. Harvest salvageable mortality when and where economically feasible and compatible with the management of other forest resources.

7. Continue the fire prevention and hazard reduction programs and construct fuel breaks in critical areas to reduce the potential for catastrophic wildfire to affect the entire forest in a single event and to lessen the damage from wildfires, should they occur. Continue an aggressive vegetation management program using prescribed fire or other non-fire treatments to help reduce the hazard associated with catastrophic wildfires.

8. Work toward maintaining a wide diversity of managed forest stands in different successional stages to foster ecosystem resiliency and adaptability to climate change. Develop an in-field laboratory of representative forest conditions across the landscape for research. Seek opportunities to maintain or enhance functional wildlife habitat (14 CCR 895.1) within the planning watersheds.

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

10. Continue to provide safe conditions for employees and visitors, identifying potentially hazardous situations and, where appropriate, provide for safety guidelines, procedures, and equipment.

11. Provide public service in forest education. Through the employment of foresters and the maintenance of the LDSF compound, the forest will work to serve as an educational facility in close association with school groups, colleges, universities, and the CAL FIRE Learning center, to provide a facility for in- forest learning opportunities. This objective may be achieved through a full range of options, including but not limited to offering the use of facilities to direct education and curriculum that is co-developed with educational partners.

II. PROPERTY DESCRIPTION

A. Property Description and Location

LDSF is located in eastern Shasta County in Townships 32 and 33 North, Ranges 2 and 3 East M.D.B & M. It ranges in elevation from 3,800 feet to over 6,700 feet with 80 percent of LDSF above 5,000 feet. LDSF comprises 9,033 acres of which the timber land base for the forest types constitutes 8,968 acres. See the Appendix for maps illustrating LDSF boundaries and topography.

LDSF is situated approximately forty-five miles east of Redding and twenty-one miles south of Burney. Lassen Volcanic National Park is located seventeen miles southeast of LDSF. The nearest community is Whitmore located eleven miles to the west. See the Appendix for the general location of LDSF from various communities, mills, and landmarks.

B. Adjacent Ownership

Ownerships adjacent to LDSF are comprised of both private and Lassen National Forest (LNF) lands. All adjacent private lands are managed primarily for timber production. Lands to the north and west are administered by Sierra Pacific Industries (SPI). Lands to the east and south are administered by LNF and SPI. LNF lands are currently managed to the suite of management goals established by the LNF multiple use policy as documented in the 1993 Final Environmental Impact Statement and Land Resource Management Plan.

C. Climate

LDSF has a Mediterranean climate with warm dry summers and cold wet winters. Precipitation averages 46 inches with most of the precipitation occurring and accumulating as snow (74 percent) between November and March. Summer rainfall in the form of thundershowers is very sporadic and unpredictable. Temperatures range from a low of 0º Fahrenheit in the winter to a high of 85º in the summer at the 6,000 foot elevation. The snow pack ranges from 1’ at the lower elevations to over 12’ at the higher elevations.

D. Soils

The soils on LDSF were inventoried in the early 1960s by the “State Cooperative Soil-Vegetation Survey” and the report was published in 1964. Soils are developed from four parent materials. Dark colored volcanic rocks and tuff breccia cover 60 percent of the area; light colored volcanic rock covers 25 percent; mixed unconsolidated glacial deposits occupy 10 percent; and mixed alluvial deposits resulting from faulting or glacial activity make up the remaining 5 percent.

There are eight soils derived from the above described parent materials. Table 1 lists the acreage and dominant vegetative cover generally found on the soil types comprising LDSF. See Appendix for a soils map. The Windy, Cohasset, and Nanny soils are the most productive soil types with the Cohasset series having the highest timber site classifications. The Jiggs,

Lyonville, and Windy variant have lower timber site classifications, with Jiggs soils being the least productive.

Jiggs, Lyonville, Windy, and Windy variant soils are found on the ridges and uplands of LDSF. The Cohasset soils are found at the lower elevations on the heavily forested sites. The Elam, Nanny, and Childs soil types are found in or adjacent to meadows.

Table 1. Soil Series Found on LDSF

SOIL SERIES	PARENT MATERIAL	ACREAGE	DOMINANT COVER TYPE
Windy	Dark colored igneous rock	3,660	True fir, shrubs
Cohasset	Dark colored igneous rock	2,250	Mixed conifers
Lyonsville	Light colored igneous rock	1,000	Shrubs, mixed conifers
Windy-Variant	Glaciated light igneous rock	700	Shrubs, mixed conifers
Jiggs	Light colored igneous rock	600	White pine, mixed conifers
Nanny	Mixed glacial deposits	100	Lodgepole pine, fir
Elam	Glacial alluvial material	20	White pine, fir
Misc. Soils*	Igneous & glaciated materials	703	Grasses, shrubs, moss-lichens

*Miscellaneous soil series include Childs, Cone, and rock outcrops.

E. Water Resources

The headwater source of two major streams, Old Cow Creek and South Cow Creek, originate on LDSF. A tributary to the North Fork of Battle Creek and South Fork of Bear Creek drains small portions of the south side of LDSF. See Appendix for watershed map.

Old Cow Creek arises from Huckleberry Meadows. Two intermittent tributaries that contribute to Old Cow Creek are Peavine Gulch and White Fawn Gulch, both located outside the LDSF boundary.

South Cow Creek originates in the South Cow Creek Basin, above the meadows, and flows westerly. Spring areas in the meadows and subsequent tributaries located on LDSF contribute to its flow so that it becomes a major stream before leaving LDSF. Perennial tributaries to South Cow Creek that originate on or cross portions of LDSF include Bullhock, Beaver, and Atkins Creeks. Three intermittent streams that contribute to South Cow Creek are Beal Creek, Dry Gulch, and Lee March Gulch.

Table 2 lists the creeks and drainages on LDSF and the acreages they drain. Table 3 lists the miles of Class I and II streams that flow year-round from LDSF.

Table 2. LDSF Acres by Watershed

Huckleberry Creek	
Peavine Gulch	446.8 acres
White Fawn Gulch	307.4 acres
Old Cow Creek	720.2 acres
Total	1,474.4 acres
Beal Watershed	
Beal Creek	524.8 acres
Beaver Creek	236.5 acres
Bullhock Creek	1,265.2 acres
Dry Gulch	120.6 acres
South Cow Creek	3,865.7 acres
Total	6,012.8 acres
Atkins Creek	
Atkins Creek	755.0 acres
Lee March Gulch	413.8 acres
Total	1168.8 acres
Upper South Fork Bear Creek	
Bear Creek	228.4 acres
Total	228.4 acres
Upper Battle Creek	
Battle Creek	148.6 acres
Total	148.6 acres
Grand Total	9,033.0 acres

Table 3. Miles of Perennial Streams (Class I and II) on LDSF

South Cow Creek	2.7 miles
Bullhock Creek	1.9 miles
Old Cow Creek	1.4 miles
Atkins Creek	0.5 miles
Beaver Creek	0.25 miles
Total	6.75 miles

*Measured from points with year-round stream flows

Several springs on LDSF are important to a wide variety of wildlife resources. Grouse Spring is the only spring to have been developed for domestic use. This spring was developed to provide water for the LDSF Headquarters. It also provides a source of potable water for the Old Station Campground located along Bullhock Creek and below the Headquarters.

F. Vegetation

There are two major commercial timber types found on LDSF, mixed conifer and true fir. The mixed conifer type is found at lower elevations on drier south and west facing slopes. Tree species for this type include ponderosa pine (Pinus ponderosa), sugar pine (*Pinus lambertiana*), white fir (*Abies concolor*), incense-cedar (*Calocedrus decurrens*), Douglas-fir (*Pseudotsuga menziesii*), and at the upper elevations jeffrey pine (*Pinus jeffreyi*) and red fir (*Abies magnifica*). Due to the higher elevation, the major component of the mixed conifer type located on LDSF is white fir. Pacific Yew (*Taxus brevifolia*) can also be found along watercourses and in other wet areas in association with the mixed conifer type.

The true fir type is found at the higher elevations and on the north slopes. This type is characterized by almost pure even aged stands of white and/or red fir, depending upon elevation. Other species found in association with the true firs are sugar pine, jeffrey pine, lodgepole pine (*Pinus contorta*), western white pine (*Pinus monticola*) and, in an isolated area, mountain hemlock (*Tsuga mertensiana*).

A small hardwood component is found in association primarily with the mixed conifer type and include black oak (*Quercus kelloggii*), canyon live oak (*Quercus chrysolepsis*), big leaf maple (*Acer macrophylum*), vine maple (Acer circinatum), and Pacific dogwood (*Cornus nuttallii*).

Coniferous forests cover 83 percent of LDSF with the remaining 17 percent comprised of brush, rocky areas, and meadows. The brush fields are generally composed of manzanita (Arctostaphylos spp.) and chinkapin (*Castanopsis sempervirens*) with minor components of the genera *Prunus* and *Ceanothus*. See Appendix for a complete list of vegetation species found on LDSF.

G. Improvements

There are four primitive campgrounds that have been developed adjacent to various streams on LDSF. Each of these campgrounds includes vault toilets, tables, barbeques, and fire pits. In the summer of 2002, potable water was piped into Old Station Campground. Water from a spring is available at South Cow Creek Campground. Old Cow Creek and Butcher Gulch Campgrounds each have hand pumps that campers can use to obtain water.

LDSF headquarters are used during the summer and early fall months, typically May through November. During the winter the headquarters are inaccessible by conventional means due to snow. The headquarters consist of a lower barracks, a second (upper) barracks building, garage, storeroom, generator room/gas house, and a kitchen/mess hall. The facilities provide housing for seasonal Forestry Aides and visiting researchers.

Five water tanks are located on LDSF. Three tanks, one 10,000-gallon, one 5,500-gallon, and a 1,000-gallon tank are used to store water for fire control. One 10,000-gallon and one 5,500-gallon tank have been constructed to provide water for the LDSF Headquarters.

H. Zoning

The entire LDSF is zoned as Timberland Production Zone (TPZ). This means the land is devoted to and used for growing and harvesting timber and compatible uses. Compatible use is defined as any use that does not significantly detract from the use of the land for, or inhibit, growing and harvesting timber. Compatible uses include watershed management, fish and wildlife habitat management, hunting and fishing, and grazing.

III. FOREST MANAGEMENT

A. Vegetation Resources Inventory

The timber volume on LDSF has increased significantly since the property was purchased in 1946. Based on a timber inventory completed in 1928 the total estimated merchantable timber volume was 95,833 thousand-board feet (MBF). In 1946 a timber inventory determined an estimated volume of 102,460 MBF. The current estimated gross volume is **253,876** MBF according to the Continuous Forest Inventory (CFI) plot re-measurements conducted in 2025. A large portion of this increase is due to the young growth true fir stands that have developed and become merchantable. In 1928 only 3,787 acres were considered stocked with timber, while today over 7,530 acres are considered stocked with timber. In addition to this growth in inventory, over **206,875** MBF have been harvested from 1946 through **2025**.

In 1965 a Continuous Forest Inventory (CFI) system was developed. A 20 X 20 chain grid system was placed over the ownership and 221 permanent plots were established. Every five years the plots are re-measured. Information gained from the CFI data includes gross and net merchantable volume, number of trees per acre, species composition, diameter distributions, ingrowth, volume per acre, and volume growth per acre. This information is used primarily to monitor forest resource conditions over time, notably forest growth and health, and to provide valuable data to support forest management and the decision-making process.

Another vegetation resources inventory conducted on the Forest is the Timber Atlas Inventory (TAI) initiated in 1998. Initially, each section was broken into 40-acre lots and 16 variable radius plots were installed per lot using a systematic grid, specific to the bearing lines of the lot subdivision. In addition to the standard timber inventory information, a variety of other vegetation parameters are collected including live crown ratios, crown diameters, snag information, large woody debris (LWD) components, and brush and forb species composition, size and density. The information gathered is used in conjunction with the CFI data for timber inventory and other reporting, modeling and research purposes. The temporary TAI plots were re-established and re-measured on approximately 900 acres per year, with the goal of maintaining inventory data that is no more than ten years old across the Forest.

Beginning in 2013, the plot intensity was reduced to eight (8) plots per 40-acre lot and further modified in 2017 to a 7-by-7 chain grid to maintain roughly the same survey intensity, while abandoning the complexity of the 40-acre lot methodology in favor of a grid that is based on each legal Section.

Beginning in 2017, re-measurement efforts were prioritized and focused on those areas that have been altered through management activities, such as harvesting activities or prescribed fire, and then on those areas with the oldest plot data either at or approaching the 10-year threshold. LDSF will seek to implement this post-harvest inventory of all major timber sales on an annual basis, following the year of harvest to maintain a current depleted inventory database. Such post-harvest inventory may assist the Department in documenting the achievement of management goals, such as retention of desired residual stocking levels.

While white fir has always been the dominant species on LDSF, it is becoming more dominant, both in terms of stems and merchantable volume, for several reasons. In terms of volume, the young growth true fir stands are becoming merchantable which account for the increase in the

white fir volume component. In addition, ingrowth of shade tolerant white fir is occurring in the mixed conifer stands, and white fir cone crops are more numerous and plentiful than other conifer species. Finally, the extensive brush fields that historically accounted for much of the vegetation cover on LDSF at the time of acquisition, as described above, have been converted to white fir stands, both through natural succession with conifer encroachment, as well as through artificial means. While the objective is not to completely eradicate the brush component, as this vegetation type provides habitat for a variety of wildlife species, there remain expanses and fragments of dense and decadent brush that can be treated to improve both timber productivity and the quality of wildlife habitat elements on LDSF.

The red fir species component, in untreated stands, is still showing signs of decline due to an on-going infestation of *Cytospora abietus* (fir canker). Those areas most heavily infected with *Cystophora* fungus have been treated to eliminate the source and re-planted, where appropriate, with white fir and/or other species to halt the cycle of infection.

Figure 1. LDSF Stand Table Based on 2025 CFI Data

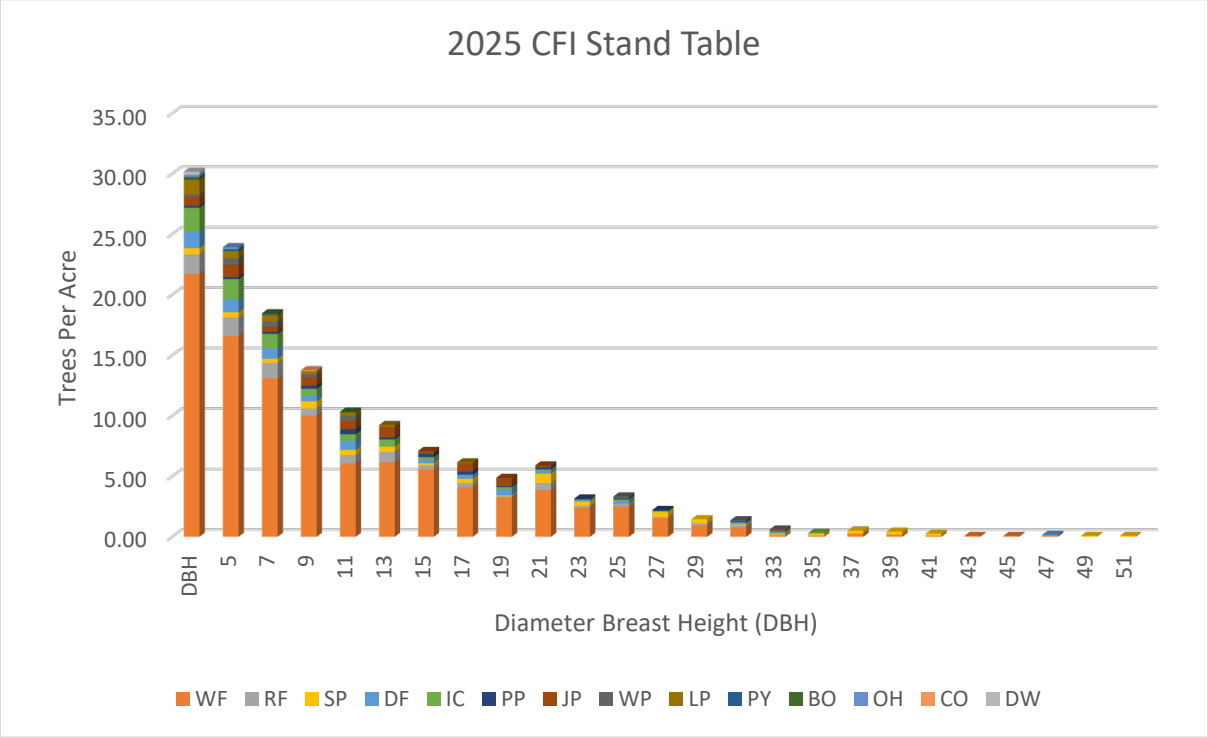
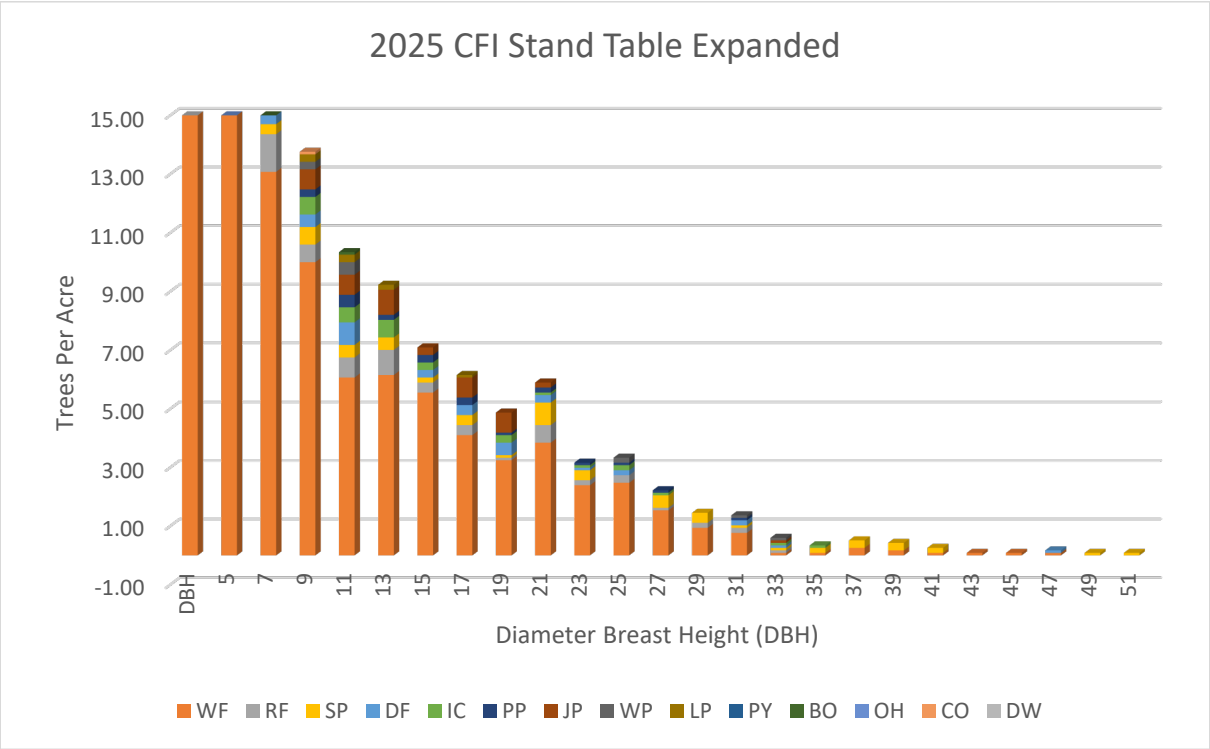


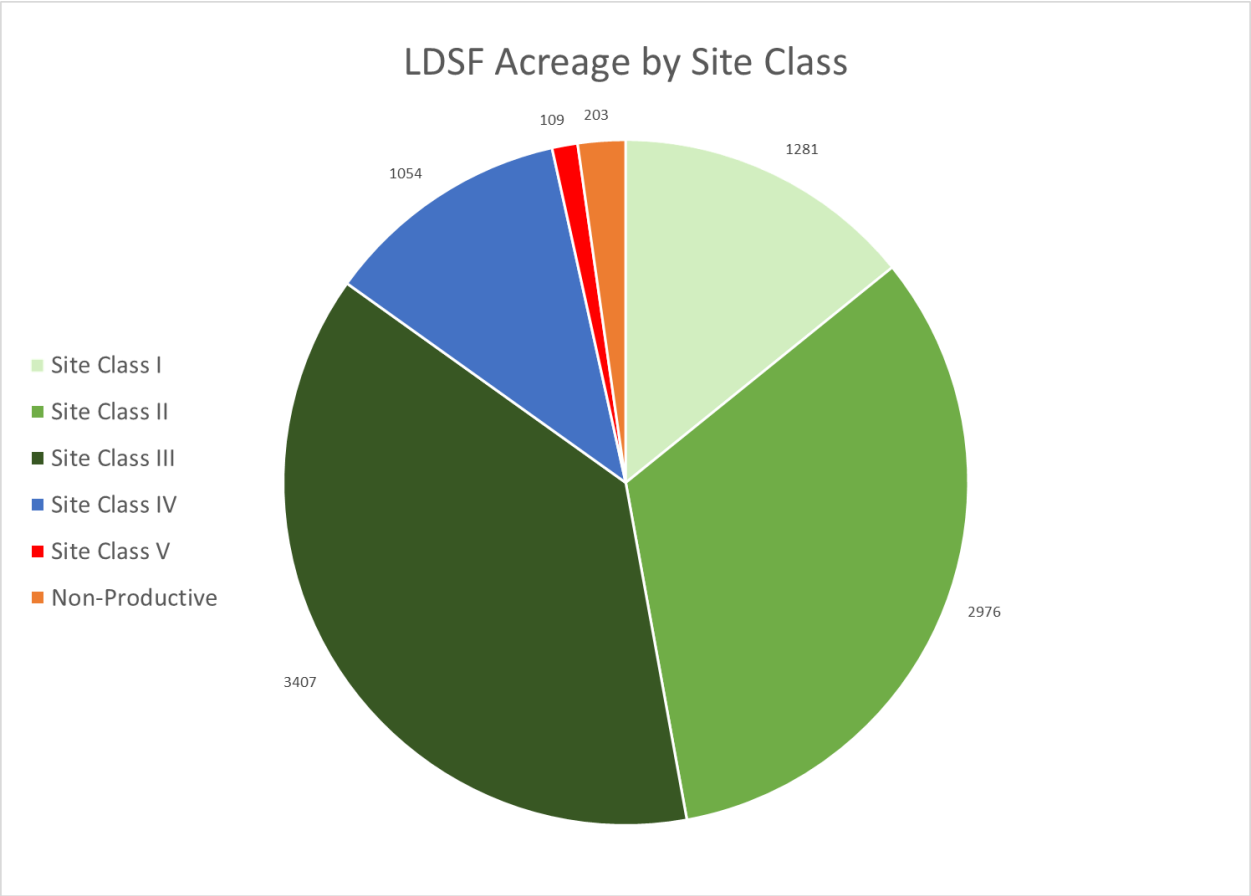
Figure 2. LDSF Stand Table Based on 2025 CFI Data (Expanded for larger DBH Classes)



B. Timber Site Quality

LDSF timber site quality is based on "Site Classification for Mixed Conifer Forests of the Sierra Nevada," by Dunning. Site determination is based on a combination of information gathered from the Soil Vegetation Survey of 1964 (Gladish and Mallory 1964) and LDSF's Continuous Forest Inventory system. The overall weighted mean average is a low site II for the entire LDSF.

Figure 3. LDSF Acreage by Site Class



C. Growth

Annual growth rates are determined by utilizing the network of Continuous Forest Inventory plots and computing the volume difference of individual plot trees between two Continuous Forest Inventory measurement periods, for example 2010 and 2020, and dividing by the number of years between measurements. This information is then extrapolated to provide per acre estimates of annual growth in the period. Gross growth was 429 board feet per acre per year in 1970, and the 2010-2020 re-measurements indicate that the periodic annual gross growth rate is 669 board feet per acre per year. The 2020-2025 current periodic annual growth rate is 594 board feet per acre per year.

Conifer mortality is showing a slow downward trend. Mortality rates in the small diameter classes are still high due to the overcrowded conditions of many of the dense young growth white fir stands. As these young stands are treated to reduce overstocked conditions mortality rates are expected to further decline.

D. Planned Management and Forest Structure

This section describes the direction for management on LDSF over the next ten years. The management goals for the Forest are described in terms of desired forest structural conditions. As required by existing law and policy, management of LDSF should balance long-term sustained timber production with the long-term biological productivity of the timberland, as well as protection of other public trust resources. The timber management implemented under this plan is expected to generate a moderate, perpetually sustainable harvest level. Harvest levels will aim to support a financially viable timber management program to remain relevant as a research destination for sustainable forestry on private timberlands. The goals for planned harvest levels are somewhat lower than those of the typical private ownership due to additional landscape and wildlife habitat constraints imposed on LDSF as a public forest, and the desire to maintain a wide range of forest conditions that may accommodate a wide range of potential future research activities.

Desired Forest Structures

The overall goal is to maintain LDSF as a mid-seral forest type that is characteristic of the southern Cascades. Early seral stands and stands with late seral elements will also be represented. However, overall, the Forest will predominantly maintain the characteristics of a mid-seral forest. This goal is not discretionary but rather follows directly from the research and demonstration mandate for LDSF. Rather than a park or preserve, the legislature has directed that LDSF be operated as a working forest property for demonstration and research purposes, directed towards serving a clientele of small to medium size landowners. (PRC §§ 4631 - 4631.5.)

To remain relevant as a research forest, LDSF forest managers should aim to create and maintain a wide range of forest types, ages, size classes, successional stages, and structural characteristics. As it is very difficult to maintain pure stands comprised of each of these characteristics on a Forest of this size, LDSF's approach is to incorporate a continuum of forest types, age classes, successional stages and structures mixed within stands across the Forest as far as possible and practical.

Stands will typically remain a mixture of conifer and hardwood species typical of the southern Cascades Forest type (Miles and Goudey, 1997). As is typical of this area, barring regular fire disturbance or aggressive thinning operations, the characteristically shade tolerant white fir has in many areas of the Forest been able to affect a species shift towards white fir dominance over time, at the expense of pine and other less shade tolerant species (Collins Pine, 1998). Establishing a more historical species mix will, in many cases, require a dedicated effort to decrease the white fir component within stands and cultivating more shade intolerant species such as ponderosa pine, sugar pine and Douglas-fir.

The prevalent age class structure will be that of uneven-aged stands in which a wide range of ages and size classes are present. Once the desired long-term forest structure conditions have been achieved, it is anticipated that the oldest trees in LDSF will be approximately 200 years old.

Other structural elements and characteristics such as snags, downed woody debris, decadent trees and irregular tree characteristics (large branches, irregular form, hollows) will be retained at 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. Forest managers should also attempt to recruit large diameter snags (greater than 30 inches dbh) in stands if they are available and lacking. This may be accomplished by leaving, in addition to dead trees, large trees for snag recruitment that show signs of poor vigor, stress or disease or live green culls (less that 25 percent sound wood). No treatments are planned to actively create snags by girdling or topping live trees, unless prescribed as part of an individual research project.

Based on ground-truthing and forest inventory data, stands on LDSF were assessed as to whether they met the Board of Forestry **Late Succession Forest Stands** (LSFS) as defined by 14 CCR 895.1, which states:

> ***Late Succession Forest Stands*** *means stands of dominant and predominant trees that meet the criteria of WHR class 5M, 5D, or 6 with an open, moderate or dense canopy closure classification, often with multiple canopy layers, and are at least 20 acres in size. Functional characteristics of late succession forests include large decadent trees, snags, and large down logs.*

In 2017, an analysis of the 3,174 Timber Atlas Inventory (TAI) plots, found that 64 plots (2.02%) fall within WHR class 5M, 5D, or 6. The inventory was based on 16 plots per 40-acre lot, with each plot representing 2.5 acres. An analysis of the plots determined that the maximum number of contiguous qualifying WHR types was 4 plots or 10 acres, and there was only one occurrence of 4 contiguous plots. 41 of the 64 potentially LSFS plots presented as single plots with no continuity to other qualifying plots.

No stands meeting <u>all</u> criteria of the LSFS definition were found on LDSF. There are small areas that contain many of the functional characteristics, but do not meet the specified minimum acreage of twenty acres. Some of the key characteristics of late-successional forest stands include the decadent trees, snags, and large down logs. Many areas throughout LDSF exhibit some of these functional characteristics. LDSF Forest managers should recruit and retain these attributes wherever feasible. In addition, the biological resources associated with late successional forests attributes may also be enhanced and serve as a demonstration opportunity by providing important habitat elements in other forest types as well.

Projections of future forest structure were made based on the California Wildlife Habitat Relationships (CWHR) classification system (Mayer and Laudenslayer, 1988). The projections indicate that within the next two decades, a large number of plots will move into CWHR size classes 5 and 6. At the end of the 100-year planning horizon, almost half of the plots on LDSF will be in CWHR size classes 5 and 6. The stands represented by these plots have the potential to develop late successional characteristics and, according to the modeling, it is reasonable to expect that a significant number of plots may meet the BOF late successional minimum 24” QMD. These stands will contain large trees, because of the repeated harvest cycle and continued management.

In the near term, mid- to late- successional stands may be a modest portion of LDSF. However, the current forest structure distribution on LDSF is one that may produce a large number of acres of late successional forest stands over the next few decades. Therefore, the management challenge on LDSF is not going to be one of cultivating late successional forest structure for the future. To the contrary, the challenge will be to maintain a balanced stand structure over the landscape comprised of early and mid-seral successional stages, which also provide important wildlife habitat elements, in addition to the late successional forest structures

that are predicted to develop and emerge over time. Management strategies for balancing the forest stand structure distribution should focus on cultivating functional late successional characteristics in some of the CWHR size 5 and 6 stands, and to cultivate other CHWR size 5 and 6 stands as managed working forests for research and demonstration.

Table 6 Key to California Wildlife Habitat Relationship Size Classes.

CWHR Classification	Description	QMD Tree Size
WHR1	Seedling	Less than 1
WHR2	Sappling	1 - 6
WHR3	Pole	6 - 11
WHR4	Small Tree	11 - 24
WHR5	Medium/Large Tree	>24
WHR6	Multi Layered	Size 5 Over Size 4 Or 3; Total Tree Crown Closure Greater Than 60%

Table 7 Key to California Wildlife Habitat Relationship Density Classes.

CWHR Classification	(% Canopy Closure)
WHR#S	10 - 24
WHR#P	25 -39
WHR#M	40 - 59
WHR#D	60 - 100

E. Silvicultural Systems

A single silvicultural system, or regeneration method, is not applicable across LDSF due to the diversity of the timber stands, age and size classes, species composition, and goals for research and demonstration, wildlife habitat diversity and other management considerations found on the Forest. The wide variability in structure found within timber stands often necessitates mixing silvicultural systems in some stands while other stands may be more suited for treatment using only one system.

Prior to 1982, the entire Forest was managed under an uneven-aged management approach. It was decided in 1982 that the young growth even-aged true fir stands would be managed as they existed, using even-aged silvicultural methods. At this point, it has become evident that large areas of even-aged true fir stands are difficult to manage to meet LDSF's objectives, and optimal forest structure diversity is difficult to achieve.

The 2026 Management plan is designed to provide direction for increased silvicultural flexibility to LDSF Foresters by favoring neither even-aged nor uneven-aged management but rather providing equal opportunity for both silvicultural methods to achieve a wide array of stand conditions.

Even-aged management in the form of clearcuts may be used as needed for research, demonstrations, insect and disease mortality areas, and in emergency situations, such as stand rehabilitation following moderate to high intensity wildfires.

Mixed Conifer stands, which are generally comprised of a wide range of age and size classes, should be managed predominantly under uneven-aged management. The silvicultural systems to be utilized in these stand types will primarily include selection, group selection, but may include clearcut regeneration methods (up to 5 acres) to reduce the edge effect of traditional group openings. Openings created by harvesting may use a combination of natural regeneration and artificial regeneration, to ensure that they are successfully regenerated to a desired mix of representative species. To maintain species diversity within the mixed conifer stands, larger openings up to 5 acres, may be created to promote shade intolerant regeneration rather than the more shade tolerant true fir species.

Additionally, the true fir stands will be managed under a combination of even- and uneven-aged management, primarily consisting of maintenance thinning of the matrix stands, group selection, and clearcut regeneration methods (up to 5 acres) to reduce the edge effect of traditional group openings. Many of these stands consist of dense young growth that primarily occurs naturally above 5,500 feet. These stands are, for the most part, 85 to 105 years old with diameters ranging from 12 to 24 inches. The intent of these silvicultural systems is to improve individual tree growth and stand health, and to promote regeneration. This broad and flexible management may allow the LDSF team to develop a wider range of stand conditions to achieve management goal 8, described in Section I-c. of this management plan. Most stands of this type and of commercial size have been thinned by the completion of the third cutting cycle in 2010 and will require maintenance harvests to salvage mortality and improve individual tree growth.

Clearcut (Small) (less than 5 acres): Under the clear-cut method, trees may be harvested in medium groups sized from 2.5 acres to a maximum of 5 acres. Clearcut(s) should be a secondary prescription option for both the mixed conifer and pure white fir stands. Openings should be created to obtain pine and Douglas-fir regeneration rather than the more shade tolerant species that are favored by single tree selection. Artificial regeneration of pine, cedar, Douglas-fir and potentially giant sequoia may be used, as necessary, to supplement natural regeneration and attempt to obtain complete site occupancy and provide additional options at PCT between year 5-10 post planting. LDSF staff may use small clearcuts. We want to recognize the difference between traditional scale clear cuts verses essentially large groups.

Clearcutting (greater than 5 acres) may be utilized in a few instances where chronic disease or insect infestations have severely damaged stands, for research/demonstration purposes (such as regeneration treatments under even-aged silvicultural systems) or in connection with natural catastrophic events such as fire. As described previously, red fir on LDSF is very susceptible to infection by dwarf mistletoe and *Cytosphora*. There are a few scattered pockets of dense young red fir stands that are heavily damaged by these diseases and exhibiting high mortality rates. These stands may be clearcut over a period of time, taking into consideration adjacency constraints, and artificially regenerated with white fir, pine, cedar, Douglas-fir and potentially giant sequoia to reduce the prevalence and impact from these diseases.

The majority of the forest silvicultural activities should be conducted using the following silvicultural methods:

Selection/Group Selection (uneven-aged regeneration method): Under the selection method, trees may be harvested individually or in small groups sized from 0.25 acres to a maximum of 2.5 acres. Single tree selection should be the primary prescription for the Douglas-fir and mixed conifer stands. Group selection should be prescribed within the pine stands to avoid species conversion and to maintain species diversity. Openings may be created to obtain pine regeneration rather than the more shade tolerant species that are favored by single tree

selection. Artificial regeneration of pine, cedar, Douglas-fir and potentially giant sequoia may be used, as necessary, to supplement natural regeneration and prevent brush species from invading the site.

Transition (uneven-aged): The transition method may 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 may be used no more than twice in any one stand. The residual stand may be managed using single-tree selection or group selection silviculture during future harvests.

Commercial thinning (Intermediate treatment): Commercial thinning is the removal of trees in a 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 healthy and vigorous dominant and codominant trees from the preharvest stand. The residual stand may 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 to maintain or improve the health of the stand. Salvage is the removal of only those trees which are dead, dying, or deteriorating, because of 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. These methods should be used judiciously to also consider the commitment to retain forest structural characteristics such as snags and downed woody debris. Sanitation and salvage treatments are typically applied concurrently either as a stand-alone prescription or included in the marking guidelines with other prescriptions, if appropriate and necessary, and may be combined into a single harvest operation.

Rehabilitation of Understocked Areas (Special prescription): The rehabilitation prescription should be used for the purposes of restoring and enhancing the productivity of any forest land on LDSF which does not meet the stocking standards as defined in the California Forest Practice Rules.

Fuel Break/Defensible Space (Special): Trees and other vegetation and fuels are removed to create a shaded fuel break or defensible space in an area to reduce the potential for catastrophic wildfires and to protect infrastructure. This prescription primarily should be applied to main access roads, dominant trending ridgelines, near campgrounds, and within 300’ of the forest headquarters.

Shelterwood (even-aged regeneration method): The shelterwood regeneration method reproduces a stand via a series of harvest treatments including the preparatory, seed, and removal steps. The preparatory step is utilized to improve the crown development, seed production capacity and wind firmness of designated seed trees to be retained. 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.

Seed tree (even-aged): The seed tree regeneration method can be viewed as a simplified version of the shelterwood method described above. Using just the seed step, a number of mature seed-bearing trees are left after harvest to ensure natural reproduction from seed. The overstory seed trees can be removed after new regeneration has become established, or they

may be retained as legacy structure and habitat trees along with the next generation of trees on the site.

Variable Retention (Special): Variable retention is an approach to harvesting based on the retention of existing structural elements or biological legacies (trees, snags, logs, etc,) found within the pre-harvest stand for integration into the post-harvest stand to achieve various ecological and social objectives. The major variables to consider in this treatment include retention types, densities, and spatial arrangement of retained structures. In addition, application of this prescription requires the retention of the retained elements throughout the rotation, thus limiting future operational flexibility. As of the date of this management plan, three variable retention demonstrations have been established on LDSF. This prescription may be used sparingly in the future until such time as research or future demonstrations are deemed necessary and in the public interest.

Alternative Prescriptions: An alternative prescription may be applied when, in the judgment of the Forest Manager, it offers a more effective or more feasible way of achieving the management objectives than any of the standard silvicultural methods provided in the Forest Practice Rules.

In most cases, forest regeneration that may be necessary for any of the above prescriptions will be achieved by tree planting to ensure successful and timely reforestation. Tree planting may also take place for research and demonstration purposes, to allow for experimentation with alternative means of forest regeneration. Natural regeneration may also be used either unaided or in conjunction with artificial regeneration, depending upon natural regeneration success, to ensure that treatment areas are successfully restocked with the appropriate and desired species mix. LDSF staff may also engage in the planting of giant sequoia at low densities to support genetic conservation and carbon sequestration associated with their rapid growth.

F. Harvest Cycles

The cutting cycles of the past have ranged from 16 to 25 years. The second cutting cycle was completed in 1990. During the third cycle, stands have been entered approximately 15-20 years after the previous entry. The shorter cutting cycle was created mainly due to young growth management. Higher volumes of young growth are available due, in large part, to the conversion of brush fields into timber plantations, pre-commercial stands becoming of merchantable size, the 1978 Whitmore Burn area of 500 acres coming back into production, and areas heavily logged in the past becoming more productive. The fourth entry cycle began in 2010 and continues today. During this cycle, stands should not be harvested more frequently than 10 years after the previous entry, except in the case of emergencies, salvage operations, necessities of research or where overlapping acreage from previous plans provide for more effective harvest units.

G. Sustainable Harvest Levels

As reported in the 2013 Forest Management Plan, the long-term sustained yield (LTSY) is 5.51 million board feet per year, or 615 board feet per acre per year. Based on the 2010-2020 CFI analysis the current growth is 669 board feet per acre per year. Based on the 2020-2025 CFI analysis the current growth is 594 board feet per acre per year. Standing gross inventory has increased from 253.8 million board feet (2020) (28,394 BF/acre) to 253.876 million board feet (28,401 BF/acre) over the same period, indicating that current harvest levels, which average

about 3 million board feet per year, are well below growth and the projected LTSY. The ten-year rolling average harvest from 2016-2025 has been 2.196 MBF, well below sustainable harvest levels.

It is hoped that the “green sale” log market will improve after several down years caused by fires and the availability of salvaged timber, during which time some advertised timber sales received no bids. The greatest risk to sustainable harvesting on LDSF is catastrophic wildfire due to overstocked stands. To reduce that risk, an increase in harvest levels, and the creation of resilient stand structures through adaptive management, should be a primary goal moving forward.

H. Roads

The road system is mainly used to gain access to various parts of the Forest for management purposes and to provide haul routes for harvested timber. Most roads were constructed to an 18-foot width plus an inside ditch. Drainage structures were designed into all roads. Crossing structures include box culverts, metal culverts, pipe arches, steel bridges, rock fords, and temporary crossings.

Road maintenance is accomplished largely as a part of timber sale agreements. When areas are harvested, the operator is required to grade the roads they use, and address repair sites identified in the THP and/or contract. The other roads are graded, and repairs are made either with state equipment, when available, or by contract, when road improvement money is available.

LDSF staff should continue to maintain all permanent and seasonal roads in serviceable condition and prevent road related erosion and sediment transport by adhering to LDSF Road Management Plan and maintaining and updating the road system database (See LDSF Road Management Plan in Appendix E).

I. Harvest Methods

The primary logging system utilized on LDSF has been tractor logging. Other systems include cable logging, helicopter, and in special circumstances animal logging. Generally, cable logging or helicopter logging will be utilized on slopes greater than 65 percent.

Horse logging was conducted once on the Forest in the 1980’s principally for research and demonstration purposes but may be utilized again in the future if conditions allow or necessitate the use of this harvest method.

Tractor logging will likely continue to be the major harvest method utilized over most of LDSF. The majority of the terrain is conducive to this system since 85 percent of LDSF is under 65 percent in slope. Constructed main skid trails are considered permanent and should be utilized for future harvests. When skid trails are laid out and constructed in areas not previously logged, they should be planned for future harvests as well as the immediate harvest. Both rubber tired skidders and track equipment are utilized for harvesting. Generally, skidders are operated on slopes up to 35 percent and track machines on slopes up to 65 percent.

J. Markets for Forest Products

Timber markets for LDSF are reasonably diverse and generally conducive to obtaining a fair market price for timber. Table 10 provides a list of the seven sawmills within the market range of LDSF, their location, and average annual production. Logs manufactured on LDSF have gone to the three Sierra Pacific Industries mills, Timber Products Company, and Trinity River Lumber Company. Logs from LDSF have not yet been purchased by Shasta Green Inc., Roseburg Forest Products, or Collins Pine Company.

Table 8. Forest Product Mills Near LDSF

Name	Location	Est. Production (mmbf)
Colllins Pine Company	Chester	77
Sierra Pacific Industries	Anderson	80
Sierra Pacific Industries	Burney	80
Sierra Pacific Industries	Shasta Lake	75
Shasta Green Inc.	Burney	80
Timber Products Company	Yreka	57

K. Christmas Trees

The management for Christmas tree production has been an objective of LDSF since its inception as a State Forest. The demand for “silver tips” (red fir) and white fir Christmas trees have always been high. A survey of Christmas trees in 1947 estimated that there were potentially 81,000 Christmas trees present on LDSF. Data tabulated through 2025 documented that over 107,699 Christmas trees have been harvested from LDSF.

Areas selected for Christmas tree management have included readily accessible low timber site areas with little commercial size timber or with most of the commercial size timber removed. These areas have a natural high stocking density, and the trees are slow growing. Historically, the primary area where Christmas tree work has been concentrated is in the area known as Table Mountain, located in Section 6. This area lies above 6,000 feet in elevation and is an excellent area for Christmas tree management. Trees that do grow to commercial size are poorly formed and suffer high wind damage. The dense stocking and lower site quality in this area provide an excellent environment for Christmas tree management.

Some areas managed in the 1950s and early 1960s for Christmas trees are no longer manageable for that purpose because the trees have become too large. Currently these stands are occupied with pole and small saw log size timber. Previously they were comprised of dense sapling and young pole size trees. The removal of Christmas trees over time acted as a thinning to release the remaining trees allowing them to grow faster into merchantable size timber. Additional areas currently utilized for Christmas tree harvesting today will likely also become productive mature timber stands. These areas largely consist of dense stands of natural regeneration in which selected trees are removed to release the remaining trees.

A coppice system of management is regularly used for Christmas tree management on LDSF. This harvest method consists of leaving three live branch whorls on the tree bole when a

Christmas tree is cut so that one or more branches turn up to form a new tree. Basal scarring is also used on fast growing and sparsely formed trees to slow growth, allowing them to fill in with more branches and foliage to produce better formed and higher quality Christmas trees. Future Christmas tree management may include the conversion of brush fields and rehabilitation of red fir stands heavily infected with *Cytospora* initially into Christmas tree plantations that will ultimately develop into merchantable timber stands as well.

L. Near-Term Harvesting Plan

Timber volume to be harvested between 2026 and 2036 may not exceed the LTSY. Due to a lack of timber sales over the past few years, some increase in harvest rate is anticipated: approximately 40-45 million board feet. Timber harvesting activities should occur primarily in the Beal, Upper Battle Creek, and Huckleberry Watersheds. Though annual timber sales are planned for LDSF, the actual number of timber sales will depend on and be a function of market conditions, harvesting systems used, and research and demonstration needs.

Unforeseen catastrophic events, such as high severity wildfire, may impact planned harvest activities. The goal in such an event should be to rapidly salvage the affected acres to foster restoration efforts and restore productivity.

M. Plantation Management

LDSF currently has approximately 912 acres of plantations, the majority of which are a result of the 1978 Whitmore Fire. The plantations are in varying stages of regeneration, from very poor survival and stocking to very successful plantations with dense stocking. The least successful plantations have a high manzanita and chinquapin brush component in combination with over stocking. The management of these plantations will vary, depending upon the plantation age, stocking level, and health of the trees. Management activities may include pre-commercial thinning, manual or chemical brush control, interplanting, and possibly rehabilitation.

N. Forest Management Objectives

1. Concentrate harvesting in the young growth true fir stands to increase growth on residual trees and improve regeneration and biological diversity. Selection, group selection, and small clear cuts (<5 ac.) should be the primary silvicultural methods used.

2. Manage mixed conifer stands to increase growth on residual trees and improve regeneration and biological diversity.

3. Conduct management under a combination of appropriate silvicultural prescriptions including both even-aged and uneven-aged management. Even-aged management should be used as needed for research, demonstrations, insect and disease mortality areas, and in unforeseen situations, such as following wildfires.

4. Maintain the LDSF Marking Guide to assist personnel in the marking of timber for timber sales.

5. Maintain harvest levels at or near the long-term sustained yield (LTSY) to meet the Maximum Sustained Production of High Quality Timber Products (MSP) guidelines.

6. Maintain all roads in serviceable condition and adhere to the LDSF Road Management Plan.

IV. OTHER FOREST MANAGEMENT VALUES

A. Fisheries

Trout occur in South Cow Creek and Old Cow Creek. The only other creek that has trout is Bullhock Creek in the lower 600 to 800 feet during the early part of the year. All planning watersheds within the assessment area are included within the Evolutionarily Significant Unit (ESU) for Chinook salmon and steelhead trout due to known downstream populations. Only the Beal and Atkins planning watersheds are classified as "Threatened and Impaired Watersheds" under the Forest Practice Rules. No anadromous salmonids occur on LDSF, nor are there historical records of observations.

Species of trout found on LDSF are rainbow trout (*Salmo gairdnerii*), brown trout (*Salmo trutta*), and an occasional eastern brook trout (*Salvelinus frontinalis*). South Cow Creek primarily has rainbow trout and Old Cow Creek is inhabited primarily by brown trout.

The desired future condition for watershed and fisheries resources on LDSF includes maintaining and improving current riparian conditions and in-stream habitat. Management in WLPZ areas on LDSF will, in most cases, exceed the requirements for riparian area protection specified in the State Forest Practice Rules. Riparian areas will likely be a fertile area for future research on the Forest. Management in and near these areas should be focused on maintaining maximum future management flexibility so as not to preclude future options for management and opportunities for research and demonstration.

Although there are no current or historical records of anadromous salmonids on LDSF, all planning watersheds within the Forest are included within the Evolutionarily Significant Unit (ESU) for Chinook salmon and steelhead trout due to known downstream populations, and the Beal and Atkins planning watersheds are classified as "**Watersheds with Listed Anadromous Salmonids**" under the Forest Practice Rules. Timber Harvest Plans submitted within the Beale and Atkins planning watersheds will comply with the forest practice rule, as per 14 CCR 936.9, "Protection and Restoration of the Beneficial Functions of the Riparian Zone in Watersheds with Listed Anadromous Salmonids." All stream channels, streambanks, and riparian zones will be protected during forest management activities. Protection of watershed values should be an integral part of the overall management of the Forest and will be directly correlated with silvicultural practices and logging standards pursuant to section 4651 of the Public Resource Code and the Forest Practice Act.

The following are general guidelines for watershed and fisheries resources on LDSF:

1) Maintain conifer and hardwood trees in buffer zones along watercourses and around springs to maintain water temperature or prevent increases in water temperature from direct solar radiation.

2) Allow for the natural recruitment of large woody debris to the stream channel to improve or maintain instream habitat quality and stream ecosystem function.

3) Minimize the number of temporary watercourse crossings.

4) No significant increase in erosion or sedimentation over background levels is expected to result from timber harvesting at the anticipated levels. Commonly used estimates of sedimentation rates attributable to timber operations do not account for the reduction in sedimentation that will result from watershed remediation projects that will be implemented in conjunction with timber operations. Such projects are in addition to the mitigation measures required by the Forest Practice Rules to reduce erosion. Examples of planned watershed remediation efforts on LDSF that have been implemented over the last decade include rocking main roads as needed, replacing culverts at risk of failure with larger culverts, and out-sloping road segments with rolling dips. Where necessary, the existing road system will be upgraded under the methodologies included in the LDSF Road Management Plan.

Each timber harvesting operation will be evaluated for sediment source remediation. High-priority remediation sites will be considered when selecting areas for upcoming harvests. In some cases, remediation at locations other than timber harvest areas could constitute offsite mitigation for potential watershed impacts from harvesting.

B. Wildlife

LDSF supports a variety of wildlife species. Most species found are those associated with high alpine or mixed coniferous forests. Many species migrate in or out of LDSF with seasonal changes. An estimated 195 species are found or known to utilize LDSF. There are fifteen (15) reptiles and amphibians, sixty (60) species of mammals, and one hundred twenty (120) species of birds. (See Appendix for a listing of wildlife species.)

There is one known Federal Endangered Species Act (ESA) threatened species documented as having been present on LDSF; the grey wolf. One individual of this species was documented by a game camera on April 20, 2019, at the northeastern corner of the forest. The animal was collared and identified by GPS tracking by the California Department of Fish and Wildlife as OR-58.

The Cascades frog, listed as a California Endangered Species Act (CESA) candidate species since 2017, is assumed to be present in suitable habitat on LDSF. They are observed in areas covered by winter snow, hibernating throughout winter buried in mud under several feet of water or in saturated areas around ponds. They inhabit wet mountain areas in open coniferous forests to near the timberline, including small watercourses, small pools in meadows, lakes, bogs, ponds, and marshy areas near watercourses. They are typically found in water with no predatory fish.

Goshawks, Peregrine falcons, and bald eagles, which are all BOF Sensitive Species (BSS), have occasionally been observed on LDSF.

The deer occurring on LDSF comprise part of the Cow Creek herd. The Department of Fish and Wildlife conducted a study of this herd from 1984 through 1987.

Hunting of regulated game species is allowed on LDSF. The primary species hunted is deer with the occasional hunting of gray squirrels, mountain quail, turkey, blue grouse, and black bear.

Although no other threatened or endangered terrestrial species have been confirmed to occur on LDSF, ongoing monitoring and research may detect special-status species (ESA, CESA, NPPA, BSS). Monitoring should include keeping current with state and federal lists as well as conducting periodic game camera studies. Inventories should emphasize special status species expected to be present but not yet observed, as well as those currently known to exist or occur on LDSF.

Future activities on LDSF should aim to restore, maintain, or enhance occurrence of special habitat elements and unique habitats to promote species diversity and habitat quality. Measures to achieve this may include:

1) Large DBH snag recruitment and retention,

2) Retention and recruitment of down logs and large woody debris as needed in aquatic and terrestrial environments,

3) Maintenance and possible enhancement of natural ponds and springs,

4) Riparian zone protection and restoration,

5) Retention and recruitment of late-successional forest attributes in the near term.

6) Design forest management activities based on landscape perspectives. Components to consider will include horizontal and vertical forest structure, vegetation density, edge effect, corridor size, and biological diversity.

Wildlife habitat improvement opportunities will be identified during the planning and implementation of timber sales, demonstration and education activities, and recreational facilities.

Measures to control or eradicate exotic plant species should be incorporated into management activities, as opportunities are identified.

C. Prescribed Fire

Prescribed fire should continue to be utilized to help reduce the fire hazard, improve deer habitat, and regenerate some brush fields with conifer seedlings.

The primary brush species comprising the brush fields on the better timber sites is chinquapin (*Castanopsis sempervirens*). If brush is treated with prescribed fire, the areas may then be planted with conifer seedlings. Conifer species selection and planting density will depend upon the site.

In addition to the brush fields there are many young growth true fir stands that have been or will be commercially thinned under various silvicultural prescriptions. These stands are available for consideration to be underburned to reduce the fire hazard and develop a mineral soil seed bed, conducive to conifer regeneration. The absence of natural fire on LDSF has resulted in the significant development of organic duff of predominantly white fir needle cast mixed with various levels of residual logging slash from past harvest and mortality. This medium is extremely conducive to snow mold in the spring and is most likely an inhibitor of seed establishment.

All stands treated under a THP should be considered for opportunities for the use of low intensity fire to reduce fuel loading.

Under-burning should be designed to reduce the fuel loading by disposing of fine and medium fuels (1 – 100-hour fuels). The reduction of these fuels would significantly reduce the ability of the forest floor to carry a fire. Initially these burns should be tested in small areas to evaluate the results of the burning in terms of fuel consumption and damage to residual trees. The treatment could then be adjusted, as necessary, and prescribed on a larger scale if proven successful.

Management Objectives

1. Reduce the fire hazard on LDSF.

2. Improve deer habitat by maintaining various age classes of brush.

3. Conversion of existing brush fields to conifer plantations on good timber sites (site class III or higher).

D. Education and Work Force Development

LDSF provides a natural classroom for training and work force development. Training and work force development opportunities include all aspects of forest management, fire suppression, fire prevention, law enforcement, recreational studies, wildlife management, erosion control, hydrology, logging administration, logging, and road design.

The following list of potential activities may occur at LDSF as training and work force development opportunities present themselves. The list is not comprehensive and is intended to provide examples only.

Timber Felling	Fire-Line Construction	Heavy Equipment Use
Meadow Restoration	Forest Practice Inspection	Road Maintenance
Crossing Installation	Erosion Control Methods	Prescribed Fire
Pre-Commercial Thinning	Proper Herbicide Use	Cone Collection
Wildlife Survey Methods	Timber Cruising	Timber Marking
Forest Insects and Diseases	Watercourse Protection	Search and Rescue
ATV/UTV Safe Rider	Winter Search Control	Snowmobile Safe Rider

These opportunities should be utilized whenever time and funding allow.

E. Archaeological Resources

5,102 acres (62% of the forest) of higher probability areas on LDSF have been surveyed by professional archeological staff under studies conducted by Chico State (1989-90) and North Coast Resource Management (1995-96). All professional surveyors were, “carefully selected for their field experience in archeological field work, orienteering skills, and familiarity with general resource types within the region” (Hamilton and Neri, 1997). Survey intensity was based

on pedestrian transects with spacing approximately 10-20 meters. “Portions of the forest deemed to have a high likelihood of containing cultural resources were investigated more intensively than others (Hamilton and Neri, 1997). It should be noted that, “Generally, access to all of the forest is excellent on the many miles of well-maintained roads; skid trails provide further access to those portions of the forest not accessible by seasonal roads” (Hamilton and Neri, 1997). “The remaining areas were deemed to lack a high enough degree of archeological sensitivity to warrant intensive investigation” (Hamilton and Neri, 1997). Additionally, of the 48% of the forest, not surveyed by professional archeologists, large portions of these areas have been surveyed by trained staff under past THPs.

In addition, all LDSF timber sale areas are surveyed prior to harvest by a CAL FIRE or contract archaeologist, or by CAL FIRE personnel trained in archaeology. Both permanent and seasonal LDSF personnel should remain alert for potential archaeological finds while performing regular tasks.

It is believed that Native Americans spent very little time in the area due to the short growing season. Hunting parties visited the area but did not stay long and no permanent campsites have been discovered. Based on the completed professional survey efforts, it is unlikely significant undetected sites exist on LDSF.

There are 3 documented sites on LDSF. The conservation measures regarding the cultural resources within LDSF are intended to protect and preserve significant archeological sites, while simultaneously providing for the continuation and facilitation of various programs and activities undertaken within the forest, such as timber harvest programs, silviculture, watercourse enhancement and recreation (Hamilton and Neri, 1997).

General Conservation recommendations are

1. If additional cultural resources are discovered during the course of future timber operations or forest management activities, all ground disturbing actives within 100’ of the discovery shall immediately cease, forest personnel shall flag the discovered location, indicate the discovery location on a resource location map, consult with a CAL FIRE or professional archeologist to determine the significance and extent of the discovery.

2. Future timber operations of forest management activities within 100’ of a prehistoric or historic archeological site shall require a site-specific management plan which will be developed by a CAL FIRE or professional archeologist in consultation with the Forest Manager

If a cultural resource site is discovered within a project area during operations, the following applies:

I. Project activities within 100 feet of the newly discovered cultural resource should be immediately halted until the CAL FIRE Project Manager can identify and ensure avoidance of the site. Project activities may continue outside this 100-foot perimeter during the identification and avoidance process.

II. If the newly discovered site has been negatively impacted by project operations the appropriate CAL FIRE Archaeologist will be notified to assist in development of protection measures and any necessary remediation.

III. The CAL FIRE Project Manager should ensure the newly discovered site is recorded and its discovery and protection measures are documented in the project files.

IV. If the newly discovered site is a Native American Archaeological or tribal cultural resource (defined in the Forest Practice Rules and CEQA), the CAL FIRE Project Manager should notify the appropriate Native American tribal group and the NAHC, if appropriate.

F. Range Resources

The range resource on LDSF, where present, is essentially transitory due to timber operations, except for meadow areas. The limited suitable grazing areas with grasses and forbs are decreasing due to tree encroachment and the absence of a natural fire return interval. This trend is being reversed by meadow restoration work which removes or reduces the encroaching trees and attempts to maintain these areas to provide the niche habitat values associated with the resultant microclines.

Timber operations additionally create successional diversity (holes) in which grasses and forbs may increase for a short time until the tree canopy closes again.

The primary user of the LDSF's range resource is wildlife. However, use of LDSF for grazing or browsing by appropriate livestock species may be allowed pursuant to PRC 4656, which states:

> The use of state forest lands for grazing and mining purposes shall be permitted pursuant to regulations established by the board in accordance with Chapter 3.5 (commencing with Section 11340) of Part 1 of Division 3 of Title 2 of the Government Code.

Board Policy 0351.6, Special Uses of State Forests, provides:

> Use of State Forests for grazing or browsing by appropriate livestock species shall be allowed pursuant to PRC 4656. Grazing may be allowed on state forestlands with an approved permit when grazing provides a management benefit to the property (e.g. prescribed herbivory to manage vegetation, improve soil health, and/or achieve other ecological goals). This may include grazing that is in conjunction with a research project where the potential management benefits of the project are undefined or unclear and may include existing grazing agreements on land that is transferred to or purchased by the State. Grazing shall be allowed in each State Forest consistent with the Forest's management goals as outlined in the Forest Management Plan

While grazing by livestock is not an existing management activity, Shasta County is an open range county. To keep livestock out, fences would have to be built. However, fences in high elevation snow country are not practical. While casual use by livestock (1-8 head) that drift in from adjacent lands does occur on the Forest, this use is minor. This presence of livestock may potentially conflict with water quality goals and could result in non-point source degradation of stream banks in certain areas along Atkins Creek, South Cow Creek and South Cow Creek Meadow, and Old Cow Creek. However, these impacts have not been realized or documented on adjacent lands or within the upper portions of the subject watersheds.

G. Carbon Sequestration and Greenhouse Gas Emissions

In 2007 the State of California passed the Global Warming Solutions Act (AB 32), which set targets to reduce greenhouse gas (GHG) emissions to 1990 levels by 2020 and 80 percent below 1990 levels by 2050. To implement this statute, the California Air Resources Board prepared the 2022 Scoping Plan for Achieving Carbon Neutrality, which outlines the state's strategy to achieve these goals. Natural and working lands, including working forests, play a key role in this strategy for their ability to sequester and store atmospheric CO_2. The scoping plan relies on significant increases in the pace and scale of climate-smart actions on natural and working lands. Climate-smart forest management enhances and maintains carbon storage and sequestration, reduces the risk of high intensity wildfire, and mitigates disturbances or land-use changes that would reduce carbon storage. The scoping plan sets a target of treating 2.3 million acres with climate-spart activities annually by 2025 as a strategy for achieving success.

California's 2022 Natural and Working Lands Climate Smart Strategy identifies ways the state's land base can contribute to carbon neutrality goals while enhancing their resilience against the impacts of climate change. The strategy calls for climate-smart management to stabilize forest carbon stocks and reduce risk of loss from drought, forest pests, and wildfire. The strategy recognizes that timber harvest, fuel reduction, and prescribed fire may result in short-term emissions that are outweighed by the long-term benefits of creating and maintaining healthy and resilient forests. The Demonstration State Forest Program is specifically referenced in this strategy as a steward of state managed lands and as an existing effort to show how forests can be managed for multiple objectives at once—timber production, recreation, watershed protection, and restoration.

California's 2021 Wildfire and Forest Resilience Action Plan provides further guidance on how the state plans to achieve its goals for climate resilience through active forest management. It sets a target to scale up forest management to meet the state and federal governments' 1-million-acre annual restoration target by 2025. The action plan urges state agencies to lead by example by expanding forest management on state-owned lands to improve resilience against wildfires and other impacts of climate change. State agencies are working on a comprehensive strategy to scale up prescribed fire and fuel reduction, expand local and regional collaboration, increase outreach and education, and implement an effective monitoring program.

The statewide plans and strategies summarized above each recognize practices to mitigate GHG emissions and enhance terrestrial sequestration and storage, including practices that are central to the management of LDSF: reforestation, forest management, and fuels treatments to avoid catastrophic losses.

LDSF will contribute to the targets of AB 32 by increasing the resiliency of the Forest to catastrophic mortality by improving the general health of stands, pre-fire implementation of shaded and other fuel breaks, and maintenance of firefighting infrastructure such as roads, signage, and water sources. The long-term carbon stocks of the LDSF are anticipated to increase over time. Sequestration rates are expected to stay high through periodic density control, while biomass removed will contribute to carbon storage in durable wood products and energy generation. The lessons learned from experiments and research conducted at LDSF will extend the impact of these treatments by informing management practices of California's private forestland owners, land managers, regulatory agencies, and the public.

V. RESOURCE PROTECTION

A. Insects and Disease

Damage and loss from insects and disease are ever present but growing stock losses have generally been minimal on LDSF and widely scattered across LDSF. Insect activity increases during periods of drought, but not to epidemic proportions. Losses typically occur with individual trees or within small groups of 4 to 5 trees. The majority of losses from insects on LDSF are caused by the fir engraver beetle (*Scolytus ventralis*), mountain pine beetle (*Dendroctonus ponderosae*), and the pine engraver beetle (*Ips spp*.).

The main cause of growing stock loss from disease on LDSF is the fir canker (*Cytospora abietis*). *Cytospora* infects red fir and has caused substantial degradation and mortality in some stands. The Variable Retention harvests that have been conducted and may continue to occur focus primarily on stands of red fir that are heavily infected and dying. Stands that have not become heavily infected are those that have been thinned or are isolated from the disease and growing well.

Another disease that is causing problems on LDSF, primarily in sapling size trees, is blister rust (*Cronartium ribicola*). Blister rust infections have increased in both sugar pine and western white pine. To help combat blister rust, a study was undertaken in 1987 on LDSF to find trees that produce blister rust resistant offspring. Only 13 trees were identified in the study as blister rust resistant.

Although dwarf mistletoe is widespread in all conifer species on LDSF it is not causing significant mortality or severely hampering growth.

The primary control of insects and disease is by sanitation-salvage harvesting, fuel hazard reduction, and looping of brood material during harvest operations. Commercial thinning operations are used to thin dense stands of true fir to keep them in a healthy growing condition. The treatment of problem areas should occur quickly to capture mortality and prevent further spread of infestation. See Appendix for a listing of pests commonly found on LDSF.

B. Animal Damage

Animal damage is attributed to gophers, porcupines, and deer. Gopher damage is minimal. There are few grassy areas on LDSF except meadows and wet areas so the gopher population is very small. Though gophers may also impact newly established plantations, this has not been observed to a large extent on LDSF. Porcupines cause some damage to pole size timber in a few scattered areas near water. The damage they cause results in killing the tops of trees by eating the cambium layer and girdling the tree about two thirds of the ways up the tree bole. The losses are widely scattered and insignificant.

The primary source of animal damage is from deer that browse heavily on Douglas-fir and true fir seedlings. In areas where these species are planted, they may be protected from deer to reduce heavy browse damage and mortality. Vexar tubing is currently used to protect the seedlings from deer browse; annual maintenance is required to keep the tubes in an upright position.

C. Fire Protection

The primary cause of fire on LDSF is lightning. There is an average of two to three summer lightning storms each year, but the occurrence of fire has traditionally been low. The Whitmore Fire was the largest fire to occur on LDSF since it was established. This fire occurred in 1978 and was lightning-caused. It burned approximately 6,000 acres in total, 500 acres of which was on LDSF.

Since the Whitmore Fire, several fire safety and defensive improvements have been developed. A 1,000-gallon water tank and a 10,000-gallon tank have been constructed. In addition, the domestic water system that supplies LDSF Headquarters has one 10,000-gallon tank and two 5,500-gallon tanks that can be used for fire suppression activities. Water holes have been developed at strategic points to make water drafting easily available for fire control as well. Fuel breaks have also been constructed and maintained in critical and strategic areas. Additional locations for strategic water reserves may be developed in the future. These tanks would be off channel water sources, built with overflow bypass systems.

The CAL FIRE Shasta-Trinity Unit Chief is responsible for fire protection on LDSF. LDSF staff respond to fires on LDSF and assist unit personnel. In addition, staff regularly contact campers and other people using LDSF for recreational purposes and remind them to be cautious with fire.

To help keep the fire danger down the following measures are encouraged:

1. Slash on timber sales and pre-commercial thinning projects is 100 percent lopped.

2. Areas with high slash accumulations are piled and burned.

3. Fuel breaks have been constructed along high use roads such as the Bateman and Huckleberry Roads. Additional fuel breaks may be constructed along McMullin Mountain, the Cutter Road, the Bateman Road, and segments of the Rim Road.

D. Contingency Plans for Emergency Salvage Operations

The reality of managing forest resources in the Cascades in a time of climate change enhanced disturbances requires a plan to address the fact that some portion or all of the forest may be impacted by uncontrolled fire.

In the event of a fire of moderate or serve intensity, the Department should implement the following immediate restoration activities to the extent practicable:

1. Fire killed trees should be salvaged expeditiously.

2. Fire damaged trees should be evaluated and marked for harvest individually based on factors including percentage of crown scorch, height of bole scorch, signs of insect attack. Trees likely to die within 5 years should be salvaged expeditiously.

3. All culls > 30 inches should be retained, as well as all hardwoods that do not pose a safety risk (i.e., trees greater than 200 feet from roads.)

4. Salvaged areas should be planted at the first climatic opportunity that seedlings are available, preferably seedlings grown from local sources from within the appropriate elevational band.

VI. RESEARCH AND DEMONSTRATION

A. Background

Per Board of Forestry and Fire Protection Policy 0351.1, to attain proper management of private timberlands and state-owned timberlands in California, there is a need to investigate, develop, and demonstrate new and improved forest management methods, monitor the effectiveness of those management techniques, and educate timberland owners and the public on the suitability and practicality of such methods and techniques. The state forests serve this purpose while contributing to the economic stability and diversity of local communities by providing forest products and outdoor recreation opportunities which sustain local employment and tax bases. Additionally, outdoor recreation is an important public benefit, and a primary objective, of several of the state forests.

Research has been conducted by cooperators from the U.S. Forest Service, Pacific Southwest Research Station (P.S.W.), California Department of Fish and Wildlife, University of California at Berkeley (U.C.B.), Sierra Pacific Industries, and consultants. In addition, projects have been carried out by LDSF staff.

The initial research conducted at LDSF was focused on site preparation and regeneration techniques. As time progressed, various herbicides were tested on LDSF's brush species. Research has been focused on how to manage the numerous young growth true fir stands. Various thinning densities have been tried in both commercial and precommercial stands. In addition, different logging techniques have been used such as horses, tractors, and mechanical harvesting.

Since 1981 funds have been available intermittently for LDSF through the Forest Resources Improvement Fund (FRIF) to contract with personnel to conduct research projects on the State Forests. Recently, additional funds have been made available to cooperating researchers through other CAL FIRE programs. These funds have made it possible to contract with professional researchers to conduct projects on the State Forests. Information gained through these projects is reported in various forms. Project results have been written up and disseminated through the California Forestry Note system, peer reviewed journals, and conferences. Project tours are also given for education and demonstration purposes.

B. Research and Demonstration Projects

Ongoing Research Projects

The following is a list of current and ongoing research and demonstration projects at LDSF:

Continuous Forest Inventory (CFI) – Two hundred and twenty-one (221) permanent CFI plots were established in 1965 with re-measurement every 5 or 10 years. This research provides information on growth rates, standing volume, number of trees per acre, and ingrowth.

Timber Atlas Inventory (TAI) - Three thousand six hundred thirteen (3613) temporary variable plots on a systematic grid throughout LDSF are re-inventoried approximately every ten years. This inventory provides additional timber stand data. In 1996, the TAI re-inventory was expanded to include measurements of wildlife habitat elements to provide for WHR predictions, analysis, and monitoring.

TAI and CFI databases -- Version one of the TAI database was written in 2000 with the complete data set for LDSF entered (449,891 data entries, 27,970 trees measured) in early 2002. This data set has been updated and maintained annually since then. A CFI database has also been developed with all measurement and re-measurement data entered from 1965 forward. Both these databases will provide a significant amount of information and prediction about volume, growth rates, in-growth, mortality, WHR, and wildlife habitat elements. In 2002 for example, the CFI site tree data (35 years of data) was used for a tree growth modeling and evaluation project, now called FORSEE, as part of a statewide contract involving CAL FIRE and other private landowners.

Road Management Plan for LDSF, February 2000, by Kelly Dreesmann – Internal document for evaluation of LDSF road system and methodology for road improvement work to reduce sedimentation and improve water quality. Improvement work is partially complete and ongoing when funds are available. Road improvements provide a practical and visual demonstration for field tours.

Variable Retention Harvest – LDSF prepared a THP to demonstrate the different retention standards described within the Forest Practice Rules. The Rim Buck THP was operated in 2011, and brush and slash clearing were completed in 2012, with piles burned the fall of that year. The prescription covered approximately 50 acres. The area was planted in the fall of 2013.

Meadow Restoration – Lodge Pole Pine encroachment is diminishing the acreage of LDSF meadow systems. LDSF plans to develop and implement meadow restoration projects on Bullhock Creek, Atkins Creek and South Cow Creek. Photo monitoring points will be established to follow the project through time. The Huckleberry Meadow restoration research project, located on Bullhock Creek, was hand cleared and pile burned as part of the 2011 Rim Buck THP. Additional clearing is needed to complete this project.

Meadow Restoration - Lodge Pole Pine encroachment is diminishing the acreage of the limited LDSF meadow systems. LDSF has developed and implemented a meadow restoration project on Atkins Meadow. Photo monitoring points have been established to follow the project through time. The Meadow restoration research project, located near the Butcher Gulch Campground was treated via feller bunchers with accumulating heads, including treatment within the WLPZ, to within 10 feet of the Watercourse and Lake Transition Line as part of the 2-15-0024 -SHA Boucher THP.

White Fir Plantation Density and Shrub Control Study – Initiated in 2008 by PSW researchers Martin Ritchie and Jianwei Zhang, the study is designed to evaluate the development of white fir and red fir in plantations with different initial spacing and treatment regimes. Annual tree survival and growth measurements are recorded. The study is on-going. This original study area has been proposed to be augmented by a below ground Carbon Study by Dr. Jianwei Zhang. Not yet funded.

Group Selection/Natural Regeneration Study – This study was undertaken by LDSF staff in 2012 on the McMullin Mtn. Timber Sale to evaluate the effects of various group selection unit configurations on their ability to naturally regenerate in predominantly true fir stands. Pine will be planted into the Units in the fall of 2013 at 100 trees per acre to improve stand diversity and to initiate and ensure timely stocking. Stocking surveys will be conducted in the future, project is on-going.

VTAC Project – A proposal was prepared by LDSF staff and submitted in February of 2013 to the BOF Technical Advisory Committee for a pilot project, as per 14 CCR 9.6.9(v) (10), to implement site-specific or non-standard operational provisions within the WLPZ of South Cow Creek. The purpose of the project is twofold: 1) to create group selection openings within the WLPZ in order to reduce the potential for catastrophic wildfire to utilize the WLPZ corridor to further spread into the upper reaches of the watershed, and 2) to test the viability of this provision of the FPR's and the proposal process for potential application on private timberlands. The Cave Rock THP expired before the project could be implemented due to market conditions

AMEX STUDY - The Adaptive Silviculture for Climate Change Experiment, conducted by Dr. Sarah Bisbing of University of Nevada-Reno supported 2-4 visiting student researchers. They have installed permanent plots, within portions of the Boucher and Royston THPs, and control plots on the USFS. The study is funded by a $2.8 million grant from CAL FIRE's Forest Health Grants Program. The study is being conducted over four degrees of latitude from the northern to southern Sierra Nevada (Shasta to Tulare counties), as a long-term, multi-decade study to compare treatments representing fundamentally different climate change impact scenarios and a suite of potential approaches forest managers may take to mitigate impacts on the ecological, economic, and social services provided by forest ecosystems.

Common Garden Study – Within the group opening created under the AMEX study area, 5 species from 13 different seed zones have been/will be planted by the late spring of 2022. The function of the study is to evaluate the movement of seed zones in light of potential climate shifts.

Bobcat Population Monitoring Project - Researchers from CDFW selected LDSF as a refence site for baseline populations studies for the California Bobcat. In 2021, the study installed game cameras are a rate of 1 per 40 acres over the forest and conduct fecal DNA samples. The project's goal is to estimate a state-wide population estimate. The project was funded under AB 1254, effective January 1, 2020.

Bentley Lab Study - Researchers from Sonoma State University visited the forest to conduct reconnaissance in preparation for their terrestrial and UAV Lidar study, which completed in 2022. Their study, Forest Health Grant Study, 18-CCI-FH-0055-MEU, will evaluate the use of innovative remote sensing techniques to rapidly and more accurately estimate Above Ground Carbon (AGC), calculate AGC allometric relationships to tree properties (e.g., DBH, height) and estimate crucial fuels parameters to help validate or refine fire probability and behavior models across diverse California forests. The study used a state-of-the-art terrestrial laser scanner (TLS) and a low-cost unmanned aerial system (UAS), combined with modern data processing techniques, to acquire detailed measurements of 3-dimensional forest structure in coastal and southern Cascade forests of northern California.

Whitmore Plantation Reinvigoration Study - University of California Cooperative Extension and FRAP staff, with the help of the abovementioned researchers and LDSF staff installed 51 permanent plots within the 1978 Whitmore Fire Plantation. The function of the plots was to

evaluate treatments to restore the vigor of the plantation that has been reduced due to overcrowding, and brush competition. The plots are 10th acre plots centered in a 100' radius buffer of the applied treatment, to mask any edge effect. The treatments are a control, small tree thin to 100 TPA and 50 TPA. The plots, besides collecting tree data also included a brush and fuels components and will evaluate brush treatment options that will be conducted after the initial thinning. Harvest of the treatments areas was conducted under the Boucher THP 2-15-0024-SHA.

Planned Future Research Projects

The following is a list of planned research and demonstration projects that may be conducted on LDSF:

Performance based Forest Practice Rules – LDSF staff may continue discussion with the California Licensed Foresters Association on a potential demonstration of performance-based rules.

Regeneration success of small clear cuts – LDSF staff may seek to test the hypothesis that regeneration success of shade intolerant species is benefited by openings larger than 2.5 acres. LDSF staff may investigate whether the use of these small clearcuts may reduce costs and increase the efficiency associated with obtaining regeneration of shade intolerant species on LDSF

Historical Research and Demonstration Projects

The following is a list of completed research and demonstration projects conducted on LDSF from 1980 - present

Forest wide Northern Goshawk Survey- In conjunction with the CDF&G, a forest wide goshawk survey was conducted in 2006. Survey plots were on a 10 X10 chain grid across all WHR types found on LDSF. Results are to be published in Tree Notes, Cal Fire publication.

California Spotted Owl Survey- A two-year protocol survey was conducted in 2006 and 2007. Results are to be published in Tree Notes, Cal Fire publication.

Dwarf Mistletoe Thinning – Precommercial thinning of true firs infected with dwarf mistletoe to determine if the trees will outgrow the spread of mistletoe. Bob Scharf of P.S.W. Completed and published: Dwarf Mistletoe Infected Red Fir: Growth After Release. PSW Research Paper #143

Response of Red Fir Saplings to Brush Removal – Plots have been established in naturally regenerated red fir stands coming up through chinkapin and manzanita brush species. Portions of the brush have been controlled to evaluate the effect on tree growth. Bill Oliver and Leroy Dolph, PSW. Completed and published: Little Response of True Fir Saplings to Understory Shrub Release, Western Journal of Applied Forestry, January 2002.

Response of Pine to Release Treatments – Competing vegetation was controlled by three herbicides in a young pine plantation to measure the response of seedling growth. A significant difference in stem diameter was found five growing seasons after treatment. Philip McDonald of

PSW. Completed and published; *Response of Young Ponderosa Pines, Shrubs, and Ferns to Three Release Treatments*, Western Journal of Applied Forestry, January 1994.

Releasing Young Conifers from Competing Vegetation – Competing vegetation is being controlled by three herbicides in a young pine plantation to determine the effects of competing vegetation on seedling growth and the effectiveness of three herbicides on different brush species. Philip McDonald of PSW. Completed and published: Development of a Shrub-Fern-Ponderosa Pine Community Eleven Years After Site Preparation and Release, Western Journal of Applied Forestry, October 1999.

Shrub Competition on Plantations –Determine the effects of various levels of shrub competition on sapling growth in a pine plantation. John Helms of U.C.B. Completed report to CDF as results were inconclusive due to tree growth variability, June 1988.

White Fir Thinning Study – Tree stand growth simulation model for development of thinning prescriptions. Edward Stone and Janet Cavallero, U.C.B. Known as GSPACE (growing space) thinning guidelines. Software available, awaiting final report.

Cutting Trials for Risk Rating System for Mature Red Fir and White Fir – These are cutting trials to check the effectiveness of a risk rating system in mature true firs. George Ferrell of P.S.W. Completed the risk rating system: mortality was reduced by 89 percent when compared to a non-harvested stand.

White Fir Plantings – White fir was out-planted and handled in different ways by various nurseries to help improve white fir artificial regeneration through the True Fir Cooperative. The members of the True Fir Cooperative have retired and the Cooperative no longer exists. Data was collected and handled by the Cooperative. Results were incorporated into a general paper.

Escort Trials – The herbicide Escort has been placed on chinkapin at different rates to check its effectiveness in controlling chinkapin in cooperation with Bill Seamen of Dupont. Completed: marginal success with Escort.

Dwarf Mistletoe Control – The pesticide ethephon was sprayed on mistletoe plants located on Jeffrey and lodgepole pine to check its effectiveness in controlling the mistletoe plants. This study was done in cooperation with Susan Frankel of the U.S. Forest Service as part of the efficacy test required for registration in California. Completed; results showed mixed success in preventing seed release by causing abscission of mistletoe shoots.

Dwarf Mistletoe Fertilization – Sapling size red fir trees heavily infected with mistletoe have been fertilized to check the effect on tree growth. This study is in cooperation with Bob Scharf of P.S.W. Completed and published: Dwarf Mistletoe Infected Red Fir: Growth After Release. PSW Research Paper #143

White Fir Thinning Plots – Plots have been installed in white fir stands pre-commercially thinned to various densities to help find the best density to thin white fir. Completed; no publication as the thinning plots were not set up with paired or control plots.

Fertilizer Trials – In October of 1981 fertilizer pellets were buried 6" near each tree in a white pine plantation to determine the effects on tree growth. Results: final measurement in 1987 demonstrated there was not a significant difference. No publication.

Vegetation Management – Various herbicides at different rates have been applied to different brush species to determine their effectiveness. Also hand clearing of brush species in plantations has been done to check the effects on tree growth. Visual observation indicated that herbicide treatments were effective. Herbicide trials on private ownership in the local area had similar results and statistical data was collected.

CACTOS Growth Plots – Plots have been installed in commercially thinned true fir stands and in pine plantations to obtain growth data to verify the CACTOS growth model. Completed; results demonstrated that the CACTOS prediction had a less than one (1) percent error.

Horse Logging at LDSF – Demonstration of horse logging which verified that it can be an economically viable system for commercially thinning a small to medium diameter timber stand. Published as a California Forestry Note, September 1983.

Can Horses Compete with Tractors? - An economic cost analysis of a horse logging operation. Horse logging is economically competitive with tractor logging in dense stands. Published as California Forestry Note, January 1985.

Timbco Study 1995 - Completed and submitted as a California Forestry Note. Mechanical harvesting decreased damage to the residual stand, increased productivity, and decreased fuel loading as a result of whole tree harvesting.

Biomass Harvesting 1990 – Internal document. An average of 35 dry tons per acre was produced resulting in revenues of $20 per acre.

Partial Archaeological Survey at LDSF by the Archaeological Research Program California State University, Chico – Published as CDF Archaeological Report #9, 1993.

Comprehensive Archaeological Survey & Inventory at LDSF by North Coast Resource Management– Published as CDF archaeological Report # 20, 1997.

Furbearer Survey - A cooperative project between Sierra Pacific Industries and LDSF to survey the presence of furbearers on managed timberlands in Northern California. Pine Marten and Pacific Fisher were detected on managed timberlands. Completed and published in 1990 as *Survey of Furbearer Presence on Managed Timberlands of Interior Northern California* by Wildland Resource Managers.

An Annotated Species List of Terrestrial Vertebrates on LDSF– Formal vertebrate surveys conducted in 1993 and 1994. Report to CDF by Bise and Barrett, College of Natural Resources, University of California at Berkeley 1995.

Milled on Site System– An evaluation of an on-site milling system of salvage trees. Internal report to CDF. Results recommended further studies to determine the economic viability. Chico State University and California Department of Forestry & Fire Protection, April 1999

Archaeological Excavation at Butcher Gulch Campground – Published as Archaeological Research Program Report #41, July 2001, Department of Anthropology, California State University, Chico and CDF Archaeological Report # 28.

Watershed Monitoring Project by Sacramento Watersheds Action Group – Completed with final report to CDF, February 2001. Overall the watercourses at LDSF have properly functioning channels and water temperature beneficial to fisheries.

Geographic Synthetic Aperture Radar Program by the Jet Propulsion Laboratory & National Imagery and Mapping Agency – Testing of an airborne radar mapping system to penetrate foliage and generate 3-D bald-earth models of the earth's surface. LDSF was selected as one of the two test sites in California due to its intensive vegetation inventory.

Precommercial Thinning of White Fir – Young white fir stands were thinned in 1981 to various basal area densities to help find the best density to thin white fir. Remeasurements have been conducted every five years. This study is being done in cooperation with Bill Oliver of P.S.W. The on-going project was remeasured in 2001 with future remeasurements planned. Internal document to CDF from PSW titled Response of White Fir Poles to Various Thinning Levels, April 2002. Bill Oliver plans to incorporate these findings into a general paper on response to thinning white fir stands in northern California.

Goshawk Study - A cooperative study with the California Department of Fish & Wildlife (CDF&W) on telemetry monitoring of the nesting Y2K female goshawk located in 2000. A different nesting pair was located at LDSF in 2001. Annual goshawk surveys will be conducted to monitor movement.

Economic Feasibility of Biomass Harvesting – Precommercial trees were marked using the GSPACE model. The use of this thinning method as well as biomass harvesting will be evaluated. This project is dependent upon market conditions for implementation. This proposed project is within approved THP 2-01-161SHA.

WHR determination for LDSF from TAI data – Ongoing project. WHR inventory completed during 2001 and data was entered into Microsoft Access during early 2002. Objective is determination of WHR class from measured crown radius and DBH by establishing a regression of crown area to DBH.

Crown Canopy Comparison - Ongoing project. TAI re-inventory was completed in 2001 and data was entered into Microsoft Access in early 2002. Objective is to compare TAI data of crown radius versus GRS densiometer to estimate crown canopy closure.

Quadratic Mean Diameter (QMD) - Ongoing project. TAI re-inventory completed 2001 and data was entered into Microsoft Access during early 2002. Objective is to compare QMD by the GRS densiometer versus TAI plot data.

Carbon Sequestration Project – LDSF, in cooperation with WESTCARB, were demonstrating various projects to improve carbon sequestration in forested environments and the protocols in carbon registration.

Bird Recorder surveys – LDSF in cooperation with CDF&W, conducted annual surveys of avian species use of brush fields and forest stands. The survey will expand to compare avian species use pre and post timber harvest and pre and post brush conversion.

Blister Rust Study - Sapling size western white pine trees infected with blister rust were monitored to evaluate the effects of blister rust infections on western white pine. The intent of

the cooperative (CAL FIRE/USFS) blister rust program was to identify mature resistant sugar pine and western white pine.

Red Fox and Pine Martin surveys – Dr. Zelenski protocol surveys were conducted forest wide to determine presence of mid-sized carnivore species. Surveys were conducted year round using infrared trail cameras and/or track plates.

Blister Rust Resistance in Sugar and Western White Pine – This was a genetic study, testing sugar pine and western white pine seedlings to find blister rust resistant parent trees. Paul Stover, USFS.

WLPZ Road Treatments – The Bullhock spur road was located within a Class II WLPZ and was needed to conduct timber harvest activities under the 2010 Rock Pit THP. Three different erosion control treatments were applied upon the road surface, post use. The three treatments were monitored for sediment transport by the installation of silt fences.

C. Management Objectives

1. All ongoing studies should be carried out to completion. Final reports should be written on these studies. Reports should be in the form of a California Forestry Note whenever possible. Technical reports should be published in other journals when significant results are found. LDSF staff should follow up with researchers to ensure publication of results.

2. Encourage LDSF staff to be alert for potential studies and initiate studies whenever possible. Seek advice from research institutions and forest managers, the Forest practice and Effectiveness and Monitoring Committees of the BOF, the CAL FIRE Climate and Energy Program, and the CAL FIRE Fire and Resource Assessment Program on potential studies that could be conducted.

3. Continue to utilize research funds and leverage professional contacts, Forest data, infrastructure (housing), and assistance with labor to encourage researchers to conduct research on LDSF.

4. Give tours to groups or individuals to show projects being conducted.

D. Ten-Year Strategic Plan for Research and Demonstration

The goal of this plan is to build upon the current demonstration program by emphasizing research infrastructure, applied demonstration targeted towards small forest landowners and outreach. This plan identifies specific objectives to be accomplished within the next 10 years and resource requirements.

Research and Education Infrastructure

A demonstration forest is also a research forest. Some projects are accomplished by simply observing the process and the outcome (strictly demonstration). Many others, however, require the rigors of the scientific process to further the state of knowledge about forest resources (research or experimental).

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 lower barracks, including bunks and kitchen facilities, at LDSF headquarters. LDSF staff should provide routine maintenance, materials for minor building repairs, necessary supplies including propane, diesel, and cleaning supplies.

Objective: Restore the functionality of the Mess Hall and the Upper barracks, at LDSF headquarters. LDSF staff should undertake initial reinvestment into the structures to support their designed use. Once these facilities are restored to functionality, they should be made available for use by the Department, Shasta College (currently under MOU), Universities, and local High School FFA class groups attending overnight classes on the forest.

Objective: Restore the original footprint of the LDSF compound to include a rebuilt garage structure, with second story classroom(s) and office space.

LDSF staff should continue to work with DGS on initial reinvestment into the structure to support the redesigned use. The replacement building is in the concept phase of design and is being investigated as a mass timber demonstration project. Once this facility is restored to functionality, LDSF staff should make the facility available for use by the Department to store rolling stock such as the Forest's backhoe and utility pickups, to protect them from rodent damage, theft, or vandalism. Additionally, the facility can serve as a multipurpose meeting room/classroom.

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

Two multi-resource terrestrial inventories are conducted on LDSF, the Continuous Forest Inventory (CFI) and Timber Atlas Inventory (TAI). The CFI inventory was established in 1965 providing important long-term data on forest growth. Both should be updated on a schedule such that the CFI is re-measured every 10 years and a portion of the TAI data is collected each year, following stand changing events or following harvest. Significant LDSF staff time should be allocated to collecting and managing this data. Both inventories should be periodically reviewed for appropriateness and efficiency by LDSF staff and State Forests Biometrician and Research Coordinators, if staffed. To the extent feasible and appropriate, all inventory should be collected using the Survey 123 app from ESRI. The acquired data should be stored as a feature hosted layer in the Cloud and be made available to researchers with GIS access as permission is granted by the Department.

A water monitoring station may be installed on South Cow Creek to monitor water quality and quantity to support research and data acquisition.

Documents relating to historical inventories of any of the above elements may be entered into a GIS database. Raw data sets (Access database files) should be made available along with the scanned documents. The information system will allow researchers to access data collected and stored by the Forest. Relational databases containing the CFI and TAI data should be maintained. Both the CFI and the TAI databases should retain historical data as well as current data. The CFI database should contain all measurements back to its inception in 1965. Users'

guides and cruise procedures should be made available for these databases as a key to the database fields.

GIS data layers should be available for boundaries, public land survey, roads, watercourses, soils, and other attributes including both CFI and TAI plot locations. Downloads of these databases and files should be made available by request.

Research Infrastructure Costs: The TAI and CFI data collection is part of the ongoing operational cost of LDSF. Ongoing maintenance and data collection should be the responsibility of LDSF staff, with some additional assistance from the Forest Biometrics Program staff.

The existence of these research infrastructure elements may, over time, draw increased interest to LDSF from a variety of wildland researchers. This may entail additional workload requirements on LDSF and Sacramento staff. An increased volume of proposals may require an associated request for increased funding from the research funds in Sacramento.

Applied Demonstration

Objective: Demonstrate various means of applying group and small clear cuts < 5 acres so that practical implementation issues and multi-resource implications may be examined.

Objective: Demonstrate various means of applying group and single tree selection so that practical implementation issues and multi-resource implications may be examined.

Demonstration areas that can be used for research may be installed on LDSF. Two or more levels of residual stocking, for each silvicultural method, should be demonstrated. Unit sizes should be selected to maximize the multi-disciplinary research opportunities. But this must be balanced against the fact that this is a long-term study and impacts on future research opportunities for other studies should be minimized. Control unit(s) should also be identified. Records should be kept, by unit, pertaining to costs, inventory summaries, research data and results, implementation issues, stand treatment records, photo records, etc.

Applied Demonstration Costs: The selection silviculture demonstration project will require both LDSF and Sacramento staff's time to initiate and track. It is not anticipated that any additional forest inventory plot work over and above the current TAI and CFI will be necessary.

Research targeted at regeneration units within clearcuts < 5 acres, group selection areas, or even-aged management areas where they occur, should be encouraged. This research should look at regeneration and herbaceous vegetation growth, methods of controlling competing vegetation, and possibly the use of fire and/or mechanical means for site preparation.

Objective: Demonstrate methods to inventory and update roads to reduce erosion.

Continue to implement a road inventory and improvement program on LDSF. Document projects to show before and after conditions, particularly regarding inside ditches and watercourse crossings. Records on costs should be retained, as should estimates of sediment savings derived from improvements.

The road improvement demonstration is part of an ongoing operational program started in 1998. LDSF staff time requirements may increase due to information tracking requirements. Road improvement funds from Sacramento should be fully funded.

These projects may result in LDSF staff time requirements for outreach projects such as report writing, presentations, and tours.

Outreach

A strong outreach program to convey information and display results complements the investment in research and demonstration. Outreach may be accomplished through papers, articles, presentations, tours, and via internet-based media.

Objective: Research results from LDSF should be provided to interested stakeholders.

Each project should be evaluated for the most appropriate outlet for dissemination.

Conclusion

This ten-year research and demonstration plan for LDSF provides a direction for the continued success of LDSF. Added interest and growth in demonstrations and experiments may result from the attention given to research infrastructure and outreach. The specific demonstration projects outlined above may add significant value to current operational practices by using them as models for sustainable forest management.

VII. RECREATION

A. Facilities

There are four primitive campgrounds with a total of eleven camping sites located near streams on LDSF. See Appendix for a map showing campground locations. The only developments currently in the campsites are tables, vault toilets, barbeques, and fire pits. In the summer of 2002 potable water was piped into the Old Station Campground. Water from a spring is available at South Cow Creek Campground. Old Cow Creek and Butcher Gulch Campground have hand pumps that campers can use to obtain water. All campsites are accessible with a small- to medium-size camping trailer or motor home. Camping areas are generally accessible from mid-May to November. During the remaining portions of the year, access is restricted due to snow conditions.

The location and number of campsites are as follows:

Campground	Location	Campsites
Old Cow Creek	Section 6	3
South Cow Creek	Section 18	4
Old Station	Section 12	2
Butcher Gulch	Section 3	2

At peak usage, the existing facilities are marginally adequate based on the current demand for campsites. During the first two weeks of deer season, the old log landings in Sections 3 and 10 and within the area burned during the 1978 Whitmore Fire are utilized by people in self-contained camp trailers and tents.

The Lassen National Forest (LNF), in association with the Redding Sno Riders, grooms approximately 30 miles of roads on LDSF and an additional 30+ miles of roads on LNF for snowmobile use during the winter months. The grooming machine is stationed at the Ashpan Flat Snowmobile Park located off Highway 44 approximately 12 miles southeast of LDSF.

Other recreation attractions on LDSF include hiking, fishing, and hunting. Fishing is popular early and late in the season. Deer hunting is very popular in the fall and campsites are occupied most of the season. The hot summer months attract regular day and weekend use on LDSF with people escaping the hot valley temperatures.

B. Future Development

The existing campground facilities are generally capable of handling current recreational demands. At both Old Cow and South Cow Creek Campgrounds additional campsites may be developed. Additional campsites may also be developed at the Old Station Campground. As funding becomes available, additional campsites at existing campgrounds could be developed at minimal cost. Additional campground locations may also be evaluated for feasibility and construction cost for development when funds become available. Short term goals associated with the existing camp sites could be to remove the existing native rock fire rings and replace them with metal rings that are easier to clean out. The trash cans on the forest are normal

metal cans with lids, as the forest has yet to experience any “raiding” of trash cans by local wildlife. However, should this become a factor, the forest may elect to upgrade the trash collection system to fixed bear proof containers. The forest may also elect to install recycling containers to encourage visitors to separate their trash and reduce landfill waste leaving the forest.

Currently no hiking trails have been developed. Nature trails may be developed for people utilizing LDSF, as resources are available. A nature trail may be developed from both Old Cow and South Cow Creek campgrounds. Additionally, an interpretive/educational trail may be developed from the head quarter to support ecological and silvicultural outreach. The potential trails to be developed should be an easy walk with signs posted to identify various trees, plants, and other features observed along the trails. Absent developed trails, people generally walk the roads, along streams, or the old skid trails in the logged areas. Developed nature trails on LDSF could serve as an important educational tool for plant identification and an added attraction to enhance public use.

Another improvement to forest recreation could be the establishment of a warming hut / safety shelter in the vicinity of the Old Cow campground to support the winter snow mobile use of the forest. This structure would serve as a destination point for sno-riders utilizing the Ashpan winter OHV area. The structure would serve as a rendezvous and emergency shelter for snowmobilers internal to the snow riding area. The picture below is a similar existing structure at the staging area of the Ash Pan OHV park at the intersection of HWY 44 and FS16.

C. Management Objectives

1. Existing facilities should be maintained and any hazards identified should be mitigated.

2. Evaluate the usage of campsites annually. Expand/improve existing facilities, as funds become available.

3. Evaluate water use and develop potable water systems when necessary and where available.

4. Develop nature trails from Old Cow and South Creek campgrounds, as funding allows.

5. Develop an interpretive trail from headquarters, as funding allows.

6. Develop infrastructure that supports year-round recreational opportunities, as funding allows.

Literature Cited

2006a. Cruise processing user's guide. USDA Forest Service, Washington Office, Fort Collins, CO.

2006b. Landscape Management System. University of Washington, College of Forest Resources.

Biging, G. S. and L. C. Wensel. 1985. Site index equations for young-growth mixed conifers in northern California. Research Note No. 8, Northern California Forest Yield Cooperative, Dept. of Forestry and Resource Management, University of California, Berkeley. 14 p.

CDF, 1989. LaTour Demonstration State Forest Management Plan. California Department of Forestry and Fire Protection, Redding, California. 63 p.

CDF, 2003. LaTour Demonstration State Forest Management Plan. California Department of Forestry and Fire Protection, Redding, California.

CAL FIRE 2013 LaTour Demonstration State Forest Management Plan. California Department of Forestry and Fire Protection, Redding, California.

CDF, 2005. LaTour Demonstration State Forest Strategic Research Plan. California Department of Forestry and Fire Protection, 1416 Ninth Street, Sacramento, California 95814.

California Department of Water Resources (DWR). 1969. Upper Sacramento River basin investigation. Bulletin No. 150-1. 104 p.

Collins Pine Company. 1998. Collins Almanor Forest sustained yield plan. Collins Pine Company, P.O. Box 796, Chester, CA 96020.

Dixon, G.E., 1999. ICASCA Variant (Inland California / Southern Cascades) Forest Vegetation Simulator. Unpublished report, USDA Forest Service, Fort Collins.

Dunning, Duncan, 1942. A site classification for the mixed-conifer selection forests of the Sierra Nevada. USDA Forest Service, California Forest and Range Experiment Station, Forest Research Note 28. 21 p.

Gladish, Edward and James Mallory, 1964. A Close Look at the Soil and Vegetation Mosaic of LaTour State Forest. State of California, Office of State Forester.

Hamilton Jr., D.A., 1994. Uses and abuses of multipliers in the stand prognosis model. USDA Forest Service Intermountain Research Station, INT-GTR-310: 9.

Hamilton, Jefferey and Max Neri, 1997. History and Prehistory of the LaTour Demonstration State Forest Shasta County, California, Prepared for the California Department of Forestry and Fire Protection.

Hannaford, M. and North State Institute for Sustainable Communities. 2000. Preliminary water quality assessment of Cow Creek tributaries. Final Report submitted to U.S. Fish and Wildlife Service, Red Bluff, California. 42 p.

Huberland, Amy and Erin Dwyer, 2001. Results of Archeological Test Excavation at CA-SHA-1486, LaTour Demonstration State Forest, Prepared for the California Department of Forestry and Fire Protection.

Hunter, M.L., 1990. Wildlife, forests and forestry: principles of managing forests for biological diversity. Regents/Prentice Hall, Englewood Cliffs, New Jersey.

Mallory, J.I., B.F. Smith, E.N. Gladish, and E.B. Alexander. 1966. Soils and vegetation of the Manzanita Lake (15') Quadrangle, Shasta County, California. California Department of Forestry, U.S. Forest Service Pacific Southwest Forest and Range Experiment Station, and the University of California Division of Agricultural Sciences, Cooperative Soil-Vegetation Survey, Maps 22D-2 and 22D-3, scale 1:24,000.

Mayer, K. E., and W. F. Laudenslayer. 1988. A guide to wildlife habitats of California. California Department of Forestry and Fire Protection, 1416 Ninth Street, Sacramento, CA 95814.

Miles. S. R., and C. B. Goudey. 1997. Ecological subregions of California. R5-EM-TP-005. USDA Forest Service Pacific Southwest Region. San Francisco, California.

Pillsbury, N.H. and Kirkley, M.L., 1984. Equations for total, wood and saw-log volume for thirteen California hardwoods. Research note PSW-414: 52.

Powers, Stephen, 1874. The California Indians, No. XI. Overlan Monthly and Out West Magazine, 12, 412-424.

Sacramento Watersheds Action Group. 2001. LaTour Demonstration State Forest watershed monitoring project—Stream channel and fish habitat assessment. Redding, California. 60 p.

SHN Consulting Engineers and Geologists and VESTRA Resources. 2001. Cow Creek watershed assessment. Final Report prepared for the Western Shasta Resource Conservation District and the Cow Creek Watershed Management Group. Redding, California. 370 p.

Stewart, W. 2002. Regional economic role of Jackson Demonstration State Forest. In: CDF, 2202. Jackson Demonstration State Forest management plan. California Department of Forestry and Fire Protection, 1416 Ninth Street, Sacramento, California 95814.

U.S. Army Corps of Engineers. 1971. Floodplain information, Cow Creek, Palo Cedro, California. Department of the Army, Sacramento District, Sacramento, CA. 36 p.

U.S. Department of Agriculture, Soil Conservation Service (USDA-SCS) and U.S. Forest Service, in cooperation with the University of California Agricultural Experiment Station. 1974. Soil survey of Shasta County area, California.

Wensel, L.C. and Olson, C.M., 1993. Tree volume equation for major California conifers. Northern California Forest Yield Cooperative, Dept. of Forestry and Res. Mgt., University of Cal, Berkeley. Research Note No. 37: 73.

Western Shasta Resource Conservation District (WSRCD). 2005. Cow Creek watershed management plan. Anderson, California. 64 p.

APPENDIXES

APPENDIX A: PLANT SPECIES FOUND ON LDSF

CONIFEROUS TREES – GYMNOSPERMS

FAMILY	*GENERIC NAME*	*COMMON NAME*
Pinaceae	*Abies concolor*	white fir
	A. magnifica v. shastensis	red fir
	Pinus ponderosa	pondersosa pine
	P. jeffreyi	Jeffrey pine
	P. lambertiana	sugar pine
	P. monticola	western white pine
	P. contorta murrayana	lodgepole pine
	Pseudotsuga menziesii	Douglas-fir
	Tsuga mertensiana	Mountain hemlock
Taxaceae	*Taxus brevifolia*	Pacific Yew
Cupressaceae	*Calocedrus decurrens*	incense cedar
Taxodiaceae	*Sequoiadendron giganteum*	Sierra redwood

BROAD LEAF TREES – ANGIOSPERMS

FAMILY	*GENERIC NAME*	*COMMON NAME*
Aceraceae	*Acer. glabrum*	mountain maple
	A. macrophylum	big leaf maple
	A. circinatum	vine maple
Betulaceae	*Alnus tenufolia*	mountain alder
Cornaceae	*Cornus nuttallii*	Pacific dogwood
Fagaceae	*Quercus chrysolepis*	canyon live oak
	Q. wislizenii	interior live oak
	Q. kelloggii	California black oak
	Q. kelloggii v. cibata	California scrub black oak
Oleaceae	*Fraxinus latifolia*	Oregon Ash
Salicaceae	*Populus tremuloides*	quaking aspen

TALL WOODY SHRUBS – ANGIOSPERMS

FAMILY	*GENERIC NAME*	*COMMON NAME*
Caprifoliaceae	*Symphoricarpos vaccinoides*	mountain snowberry
	S. mollis	snowberry
Ericaceae	*Arctostaphylos parryana Pinetorum*	pine manzanita
Fagaceae	*Quercus vaccinifolia*	huckleberry oak
	Castanopsis sempervirens	Sierra chinkapin
Salicaceae	*Salix scouleriana*	nuttall willow
Rhamnaceae	*Ceanothus integerrimus*	deerbrush
	C. velutinus	snowbrush
Roseaceae	*Amelanchier pallida*	western serviceberry
	Prunus emarginata	bitter cherry
	P. virginiana demissa	western choke-cherry
	Spiraea douglasii	Douglas spiraea
	Sorbus scopulina	mountain ash
Rubaceae	*Sambucus caerulea*	mountain blue elderberry

LOW WOODY SHRUBS AND VASCULAR PLANTS

FAMILY	*GENERIC NAME*	*COMMON NAME*
Aristolochiaceae	*Asarum hartwegii*	hartwig wild ginger
Saxifragaceae	*Ribes roezlii*	Sierra gooseberry
	R. nevadense	Sierra currant

FORBES – WEEDS – VINES

FAMILY	**GENERIC NAME**	**COMMON NAME**
Amaryllidaceae	*Allium spp*	wild onion
	Brodiaea congesta	ookow
	B. laxa	grass-nut
	B. multifore	many-flowered brodiaea
	B. pulchella	wild-hyacinth
Anacardiaceae	*Rhus diversiloba*	poison oak
Apocynaceae	*Apocynum pumilum*	mountain hemp
	A. sibiricum salignum	dogbane
Boraginaceae	*Cynoglossum occidentale*	houndstongue
	Hackelia californica	California stickseed
	Plagiobothrys spp	popcorn flower
Campanulaceae	*Campanula prenanthoides*	California harebell

FAMILY	*GENERIC NAME*	COMMON NAME
Caryophyllaceae	*Silene lemmonii*	Lemmon campion
Compositae	*Aster integrifolius*	mountain aster
	Eriophyllum lanatum Grandiflorus	common wooly sunflower
	Hieracium albiflorum	white-flower hawkweed
	Madia gracilus	gumweed madia
	Senico aronicoides	California groundsel
	Stephanomeria lactucina	forest stephonomeria
	Whitneyea dealbata	whitneya sunflower
Crassulaceae	*Sedum obtusatum*	Sierra Sedum
Cruciferae	*Erysimum capitatum*	wallflower
Euphorbiaceae	*Euphorbia crenulata*	chinese caps
Fumariaceae	*Dicentra formosa*	bleeding heart
Hydrophyllaceae	*Hydrophyllum occidentale* *Nama lobbii*	California waterleaf wooly nama
Irisaceae	*Iris tenuissima*	Iris
Labitae	*Mentha arvensis*	mint
Leguminosae	*Lathyrus sulphureus*	sulphur pea
	Lupinus adsurgens	lupine
	Trifolium breweri	tree clover
	T. longipes	meadow clover
	Vicia californicas	California vetch
Liliaceae	*Chloragalum pomeridianum*	Indian soap plant
	Disporum hookeri trachyandrum	Sierra fairy bells
	Fritillaria recurva	Scarlet fritillary
	Veraturm Californicum	cornlily
	Lilium Washingtonianum	Washington lily
	L. Wash. Var. minus	Shasta lily
	L. Humboldtii	Tiger lily
Linaceae	*Smilacina racemosa*	slim solomon
Onagraceae	*Linum micranthum*	common dwarf flax
	Clarkia rhomboidea	forest clarkia
	Eplobium paniculatum	annual fireweed
Orichidaceae	*Gayophytum spp*	gayophytum
	Goodyera oblongifolia	rattlesnake plantain
Plantaginaceae	*Habernaria elgans*	woods orchid
Polemonicaceae	*Plantago major*	common plantain
Polygonaceae	*Collomia grandiflora*	mountain collomia
	Eriogomium lattifoleum	wild buckwheat
Polygalaceae	*Rumex spp*	dock weed
Portulacaceae	*Polygala cornuta*	Sierra milkwort

FAMILY	*GENERIC NAME*	COMMON NAME
Portulacaceae	*Calyptridium umbellalatum*	pink pussy paws
Primulaceae	*Montia perfoliata*	miners lettuce
	Dodecatheon spp	shooting stars
Pyrolcaceae	*Trientalis latifolia*	star flower
	Chimaphila menziesii	pipsissiwa
	C. umbellata occidentalis	prince's pine
	Pterospora andromedea	pinedrops
Ranunculaceae	*Sarcodes sanguinea*	snow plant
	Anemone quinquefolia	anemone
Rosaceae	*Ranunculus occidentalis*	western butter cup
	Frangaria california	wood strawberry
	Holodiscus microphylus Glabrescens	glandular rock-spirea
	Horkelia tridentata	three-toothed horkelia
Rubiaceae	*Potentilla glanulosa*	common cinc foil
	Galium bollanderi	Bollander galium
Saxifragaceae	*Kellogia galiodes*	Kellogia
Scrophulariaceae	*Parnassia spp*	Parnassus grass
	Castilleja spp	Indian paint brush
	Mimulus guttatus	seep-spring monkey flower
	Pedicularis densiflora	Indian warrior
	Penstemon spp	penstemon
Umbelliferae	*Verbascum thapsus*	common mullein
Urticaceae	*Lomatium spp*	wild carrot
Violaceae	*Osmorhiza chilensis*	mountain sweet cicely
	Viola purpurea	mountian violet
	V. bakeri	baker violet
	V. lobata integrifolia	pine violet

FERNS

FAMILY	*GENERIC NAME*	*COMMON NAME*
Aspidiaceae	*Polystichum lemmonii*	Shasta fern
Blechnaceae	*Woodwardia fimbriata*	chain fern
Pteridaceae	*Adiantum pedantum aleuticum*	five finger fern
	Pellaea mucronata	birds-foot fern
	Pteridium aquilinum Lanuginosum	bracken fern

GRASSES

FAMILY	*GENERIC NAME*	*COMMON NAME*
Gramineae	*Agrophyron parishii leave*	wheat grass
	A. cristatum	crested wheatgrass
	A. intermedium	intermediate wheatgrass
	A. tricophorum	pubescent wheatgrass
	Agrostis exarta	spike red top
	A. idahoensis	Idaho bent.
	A. scabra	ticklegrass
	A. tenuis	colonial bent.
	A. thurberiana	Thurber bent.
	Aira caryophyllea	silver hairgrass
	Bromus carinatus	California brome
	B. commutatus	hairy chess
	B. laevipes	woodland brome
	B. marginatus	mountain brome
	B. mollis	soft chess
	B. orcuttianus	Orcutt brome
	Dactylis glomerata	orchardgrass
	Elymus glaucus	blue wild rye
	Festuca idahoensis	Idaho fescue
	F. occidentalis	western fescue
	Hordeum spp	barley
	Lolium perenne	perennial ryegrass
	L. multiflorum	Italian ryegrass
	Melica artista	awned melic
	Phalaris tuberosa stenoptera	Hardinggrass
	Poa bulanderi	Bolander bluegrass
	Sitanion hystrix	squirreltail
	Stipa stillmanii	needle grass
	Trisetum cernuum canescens	tall trisetum

RUSHES – SEDGES

FAMILY	*GENERIC NAME*	*COMMON NAME*
Cyoeraceae	*Carex multicaulis*	many-stem sedge
	Juncus spp	wire grass
Equisetaceae	*Equisetum laevigatum*	Braun's scouring-rush

WILDLIFE SPECIES

BIRD REPRESENTATIVES

FAMILY	*GENERIC NAME*	*COMMON NAME*	*REMARKS*
Anatidae (Swans, Geese, Ducks)	*Anas platyrhynchos*	Mallard duck	csv
	Aix sponsa	Wood duck	csv
Cathartidae (Vultures)	*Cathartes aura*	Turkey vulture	sv
Accipitridae (Hawks)	*Accipter atricapillus*	Goshawk	r
	A. striatus	Sharp Shinned Hawk	r
	A. cooperii	Cooper's Hawk	sv
Buteoninae (Buzzard Hawks, Eagles)	*Buteo jamaicensis*	Red-Tailed Hawk	r
	Haliaeetus leucocoephalis	Bald Eagle	c
	Aguila chrysaetos	Golden Eagle	sv
Pandionidae (Fish Hawks)	*Pandion haliaetus*	Osprey	c
Falconinae (Falcons)	*Falco peregrinus*	Peregrine Falcon'	csv
	F. mexicanus	Prairie Falcon	c
	F.columbarius	Merlin Falcon	sv
	F. sparverius	Sparrow Hawk	sv

Symbol Key
r = year round resident
m = migrant
c = casual sighting
sv = summer visitor
wv = winter visitor

CRACIDAE (Gallinaceous Birds)

FAMILY	*GENERIC NAME*	*COMMON NAME*	*REMARKS*
Tettraonidae	*Bonasa umbellus*	Ruffed Grouse	sv
	Dendrogapus obscurus	Blue Grouse	r
Meleagrididae	*Meleagris gallopavo*	Turkey	sv
Phasianidae	*Oreortyx pictus*	Mountail Quail	r
Charadriidae	*Charadrius vociferus*	Killdeer	sv
Scolopacidae	*Capella gallinago*	Common Snipe	sv
	Actitis macularia	Spotted Sandpiper	sv
Columbidae (Pigeons & Doves)	*Columba fasciata*	Band-Tailed Pigeons	sv
	Zenaidura macroura	Mourning Dove	sv
Strigidae (Owls)	*Otus asio*	Screech Owl	r
	Bubo virginianus	Great Horned Owl	mv
	Asio otus	Long Eared Owl	cr
	Aegolius acadius	Saw-Whet Owl	cr
	Glaucidium gnoma	Pygmy Owl	sv
	Strix occidentalis	Spotted Owl	c
Caprimulgidae (Goatsuckers)	*Chordeiles minor*	Common Night Hawk	sv
Trochilidae (Hummingbirds)	*Calypte anna*	Anna's Hummingbird	csv
	Selasphorus rufus	Rufous Hummingbird	msv
	Stellua calliope	Calliope Hummingbird	r
	Archilochus alexandri	Black-chinned Hummingbird	msv
Alcedinidae (King Fisher)	*Megaceryle alcyon*	Belted Kingfisher	msv
Picidae (Woodpeckers)	*Calaptes cafer*	Red-shafted Flicker	r
	Dryocopus pileatus	Pileated Woodpecker	r
	Melanerpes formicivorus	Acorn Woodpecker	msv
	Sphyrapicus varius	Yellow-bellied Sapsucker	msv
	S. thyroideus	Williamson's Sapsucker	msv
	Dendrocopos villosus	Hairy Woodpecker	r
	D. pubescens	Downy Woodpecker	r
	D. albolarvatus	White-headed Woodpecker	r

PASSERIFORMES (Perching)

FAMILY	*GENERIC NAME*	*COMMON NAME*	*REMARKS*
Tyrannidae	*Tyrannus verticalis*	Western Kingbird	svm
	Sayornis nigricans	Black Phoebe	sv
	Myiarchus cinerascens	Ash-throated Flycatcher	sv
	Empidonax traillii	Traill's Flycatcher	sv
	E. hammondii	Hammond's Flycatcher	sv
	E. oberholseri	Dusky Flycatcher	sv
	E. difficilis	Western Flycatcher	msv
	Contopus sordidulus	Western Wood Pewee	sv
	Nuttallornis borealis	Olive-sided Flycatcher	sv
Hirondinidae (Swallows)	*Iridoproncne bicolor*	Tree Swallow	msv
Corvadae (Jays, Crows)	*Aphelocoma coerulescens*	Scrub Jay	r
	Cyanocitta stelleri	Steller's Jay	r
	Perisoreus canadensis	Gray Jay	wv
	Corvus corax	Common Raven	csv
	C. brachyrhynchos	Common Crow	sv
	Nucifraga columbiana	Clark's Nutcracker	rc
Paridae (Chickadees)	*Parus atricapillus Chickadee*	Black Capped	sv
	P. gambeli	Mountain Chickadee	sv
	P. inornatus	Plain Titmouse	sv
	Psaltriparus minimus	Common Bushtit	sv
Cinclidae (Ousels)	*Cinclus mexicanus*	Dipper or Water Ousel	sv
Sittidae (Nuthatches)	*Sitta carolinensis Nuthatch*	White-Breasted	r
	S. pygmaea	Pygmy Nuthatch	v
	S. canadensis	Red-Breasted Nuthatch	v
Certhiidae (Creepers)	*Certhia familiaris*	Brown Creeper	sv
Troglodytidae (Wrens)	*Caltherpes mexicanus*	Canon Wren	sv
	Troglodytes aedon	House Wren	sv
	Thryomanes bewickii	Bewick's Wren	sv
	Salpinctes obsoletus	Rock Wren	sv
Mimidae	*Toxostoma redivivum*	California Thrasher	r
Turdidae (Thrushes)	*Hylocichla guttata*	Hermit Thrush	sv
	H. ustulata	Swainson's Thrush	sv
	Sialia mexicana	Western Blue Bird	sv
	S. currucoides	Mountain Blue Bird	csv
	Turdus migratorius	Robin	sv

FAMILY	*GENERIC NAME*	COMMON NAME	REMARKS
Turdidae (Thrushes)	*Myadestes townsendi*	Townsend's Solitaire	csv
	Ixojeus naevius	Varied Thrush	sv
Sylviidae (Kinglets)	*Regulus satrapa*	Golden-crowned Kinglet	r
	R. calendula	Ruby-crowned Kinglet	v
Bombycillidae (Waxwings)	*Bombycilla garrula*	Bohemian Waxwing	csv
	B. cedrotum	Cedar Waxwing	sv
Laniidae (Shrikes)	*Landius ludovicianus*	Loggerhead Shrike	csv
Vireonidae (Vireos)	*Vireo solitarius*	Solitary Vireo	sv
	V. huttoni	Hutton's Vireo	sv
	V. gilvus	Warbling Vireo	sv
Parulidae (Warblers)	*Dendroica petechia*	Yellow Warbler	sv
	D. audubonoi	Audubon's Warbler	sv
	D. nigrescens	Black-throated Gray Warbler	sv
	Geothlypis trichens	Yellowthroat Warbler	sv
	Icteria virens	Yellow-breasted Chat	sv
	Oporornis tolmiei	MacGillivary's Warbler	sv
	Wilsonia pusilla	Wilson's Warbler	sv
Ictridae (Meadowlarks)	*Strunella neglecta*	Western Meadowlark	sv
Thraupidae (Tanagers)	*Piranga ludoviciana*	Western Tanager	
Fringillidae (Grosbeaks, Finches, Sparrows, Buntings)	*Amphispiza belli*	Sage Sparrow	sv
	Carpodacus mexicanus	House Finch	sv
	C. purpureus	Purple Finch	sv
	C. cassinii	Cassin's Finch	r
	Chlorura chlorura	Green-tailed Towhee	sv
	Hesperiphona vespertina	Evening Grosbeak	sv
	Junco oreganus	Dark-eyed Junco	sv
	Loxia curvirostra	Red Crossbill	r
	Melospiza lincolnii	Lincoln's Sparrow	sv
	Melospiza melodia	Song Sparrow	r
	Passerina amoena	Lazuli Bunting	sv
	Passerella iliaca	Fox Sparrow	sv
	Pheucticus melocephalus	Black-headed Grosbeak	sv
	Pinicola enucleator	Pine Grosbeak	sv
	Pipilo erythrophthalmus	Rufous-sided Towhee	sv
	P. fuscus	Brown Towhee	sv
	Spinus pinus	Pine Siskin	r

FAMILY	*GENERIC NAME*	COMMON NAME	REMARKS
Fringillidae	*S. tristis*	American Gold Finch	sv
	S. psaltria	Lesser Gold Finch	r
	Spizella passerina	Chipping Sparrow	sv
	Zonotrichia leucophrys	White-crowned Sparrow	r
	Z. atricapilla	Golden-crowned Sparrow	wv

REPTILES

FAMILY	*GENERIC NAME*	*COMMON NAME*	*REMARKS*
Ambystinatudae (Salamander)	*Ensatina xanthoptica*	Yellow-eyed salamander	r
Salamondridae	*Taricha torosa*	California Newt	r
Ranidae (Frog)	*Rana Cascadae*	Cascade Frog	r
Hylidae (Tree Frog)	*Hyla regilla*	Pacific tree frog	r
Iguanidae (Lizard)	*Sceloporus scalaris*	Bunch grass lizard	r
	S. occidentalis	Western fence lizard	r
Scincidae (Skink)	*Eumeces skiltonianus*	Western skink	r
Anguidae (Alligator Lizard)	*Gerrhonotus coeruleus*	Northern alligator Lizard	r

SNAKES

FAMILY	*GENERIC NAME*	*COMMON NAME*	*REMARKS*
Boidae	*Charina bottae*	Rubber boa	r
Colubridae	*Contia tennis*	sharp tailed snake	r
	Pituophis melanoleucus catenifer	Pacific gopher snake	r
	Lampropeltis zonata Multicincta	Sierra Mountain King Snake	r
	Thamnophis eleganselegans	Mountain garter snake	r
	T. couchi	Western aquatic garter snake	r
Viperidae (Vipers)	*Crotalus viridis*	Western rattlesnake	r

FISHES

FAMILY	*GENERIC NAME*	*COMMON NAME*	*REMARKS*
Salmonidae	*Salmo gairdnerii*	Rainbow trout	r
	Salvelinus fontinalis	Eastern brook trout	r
	Salmo trutta	Brown trout	r

Symbol Key
r = year round resident
m = migrant
c = casual sighting
sv = summer visitor
wv = winter visitor

MAMMALS

FAMILY	*GENERIC NAME*	*COMMON NAME*	*REMARKS*
Soricidae (Shrew)	*Sorex palustris*	Water shrew	r
	S. monticolus	Dusky shrew	r
	S. vagrans	Vagrant shrew	r
	S. trowbridgii	Trowbridge's shrew	c
Talpidae	*Scapanus latimanus*	Broad-footed mole	r

CHIROPTERS (Bats)

FAMILY	*GENERIC NAME*	*COMMON NAME*	*REMARKS*
Vespertilionidae	*Eptesicus fucus*	Big Brown Bat	r
	Lasionycteris noctivagans	Silver-haired bat	m
	Lasiurus cinercus	Hoary bat	r
	Myotis Californicus	California myotis	sv
	M. thysanodes	Fringed myotis	sv
	M. lucifugus	Little brown myotis	sv
	M. leibii	Small-footed myotis	sv
	M. evotis	Long-eared myotis	sv
	M. yumanensis	Yuma myotis	sv
Molassidae	*Tadarida braziliensis*	Brazilian free-tailed bat	sv
Ochotonidae (Pika)	*Ochontona princeps*	Pika	r
Leporidae	*Lepus americanus*	Snowshoe hare	r
	L. californicus	Black-tailed Jackrabbit	
	Sylvilagus bachmani	Brush rabbit	r

RODENTIA (Rodents)

FAMILY	*GENERIC NAME*	*COMMON NAME*	*REMARKS*
Aplodontidae (Mountain Beaver)	*Aplodontia rufa*	Mountain Beaver	r
Sciuridae (Squirrel)	*Spermophilus lateralis*	Golden-mantled ground squirrel	r
	S. beecheyi	California ground squirrel	r
	Glaucomys sabrinus	Flying squirrel	r
	Sciurus griseus	Western grey squirrel	
	Tamiasciurus douglasii	Douglas squirrel	r
	Eutamias cinereicollis	Gray-collared chipmunk	
Marmot (sub) family	*Marmota flaviventris*	Yellow-bellied marmot	r
Geomyidae (Gopher)	*Thomomys monticola*	Mountain pocket gopher	r
	T. bottae	Botta's pocket gopher	r
Cricetidae (Rats-Mice)	*Microtus longicaudes*	Long-tailed meadow mouse	r
	M. montanus	Montane meadow mouse	r
	Neotoma fuscipes	Dusky-footed woodrat	r
	Peromyscus maniculatus	Deer mouse	r
	P. boylii	Brush mouse	r
	P. truei	Pinyon mouse	r
	Reithrodontomys megalotis	Western harvest mouse	r
Zapodidae (Jumping Mice)	*Zapus princeps*	Western jumping mouse	r
Castoridae (Beaver)	*Castor canadensis*	Beaver	r
Erethizontidae (Porcupines)	*Erethizon dorsatum*	Porcupine	r

Symbol Key
r = year round resident
m = migrant
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sv = summer visitor
wv = winter visitor

CARNIVORIDAE (Carnivores)

FAMILY	*GENERIC NAME*	*COMMON NAME*	*REMARKS*
Canidae (Wolves, Coyote, Foxes)	*Canis latrans*	Coyote	r
	Urocyon cinereoargenteus	Grey fox	r
	Vulpes vulpes	Red fox	r
	Canis lupes	Gray Wolf	m
Didelphidae	*Didelphis marsupialis*	Common opposum	sv
Felidae (Cat)	*Felis rufus*	Bobcat	r
	F. concolor	Mountain lion	r
Ursidae (Bear)	*Ursus americanus*	Bear black	r
Procyonidae (Raccoon)	*Procyon lotor*	Raccoon	sv
	Bassariscus astutus	Ringtail cat	sv
Mustelidae (Weasel-skunk)	*Gulo gulo*	Wolverine	cm
	Martes americana	Pine Martin	r
	M. pennanti	Fisher	c
	Mustela erminea	Ermine	cm
	M. frenata	Long-tailed weasel	r
	Mephitus mephitis	Striped skunk	r
	Spilogale gracilis	Spotted skunk	m
	Taxidae taxus	Badger	m
	Mustela vison	Mink	m
	Lutra canadensis	River otter	sv

Symbol Key
r = year round resident
m = migrant
c = casual sighting
sv = summer visitor
wv = winter visitor

BOVIDAE

FAMILY	*GENERIC NAME*	*COMMON NAME*	*REMARKS*
Cervidae	*Odocoileus hemionus columbianus*	Black-tailed deer	sv
	Cervus elaphus nelsoni	Rocky Mountain elk (occasional visitation)	

Symbol Key
r = year round resident
m = migrant
c = casual sighting
sv = summer visitor
wv = winter visitor

PEST SPECIES
INSECTS

FAMILY	*GENERIC NAME*	*COMMON NAME*
Scolytidae	*Dendroctonus brevicomis*	Western pine beetle
	D. ponderosae	Mountain pine beetle
	D. jeffreyi	Jeffrey pine beetle
	D. valens	Red turpentine beetle
	Ips spp	Pine engraver beetle
	Scolytus ventralis	Fir engraver beetle
Buprestidae	*Melanophila californicae*	California flathead borer
	M. drummondi	Fir flathead borer
Cerambycidae	*Tetropium abietis*	Roundheaded fir borer
Lymantriidae	*Orgyia pseudotsugata*	Douglas-fir tussock moth

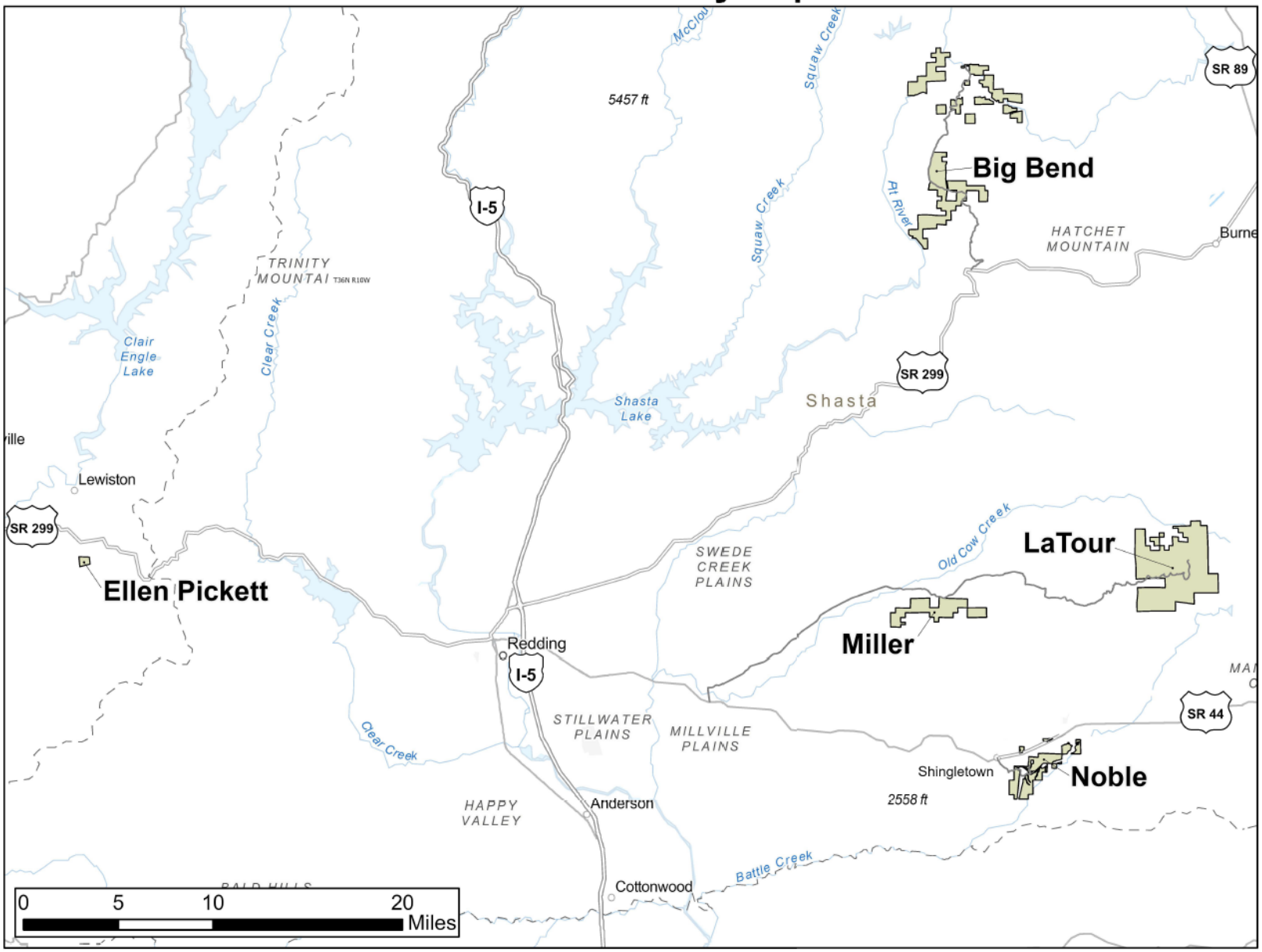
MISTLETOES

FAMILY	*GENERIC NAME*	*COMMON NAME*
Loranthaceae	*Arceuthobium abietinum f. concoloris*	White fir dwarf mistletoe
	A. abietinum f. magnificae	Red fir dwarf mistletoe
	A. campylopodum	Western dwarf mistletoe
	A. californicium	Sugar pine dwarf mistletoe
	A. americanum	Lodgepole pine dwarf mistletoe
	A. douglasii	Douglas-fir dwarf mistletoe
	Phoradendron juniperinum ssp libocedri	Incense cedar mistletoe

FUNGI

FAMILY	*GENERIC NAME*	*COMMON NAME*
Basidiomycetes Coleosporiaceae	*Cronartium harckensii*	Gall rust
	C. ribicola	Blister rust
Polyporaceae	*Echinodontium tinctorum*	Indian paint fungus
	Fomes pini	Red ring rot
	F. laricis	Quinine rot
	F. annosus	Annosus root rot
	F. igniarius	False tinder fungus
	Polyporus schweinitzii	Velvet top root rot
	P. amarus	Pocket dry rot
Tricholomataceae	*Armillaria mella*	Shoestring root rot
Deuteromycetes Sphaeriodaceae	*cytospora abietus*	Fir canker
Ascomycetes Hydrodermataceae	*Elytroderma deformans Davisomycella medusa*	Needle cast Medusa needle blight

SHU DSF Vicinity Map



LaTour Demonstration State Forest

Shasta-Trinity Unit

LaTour Facts

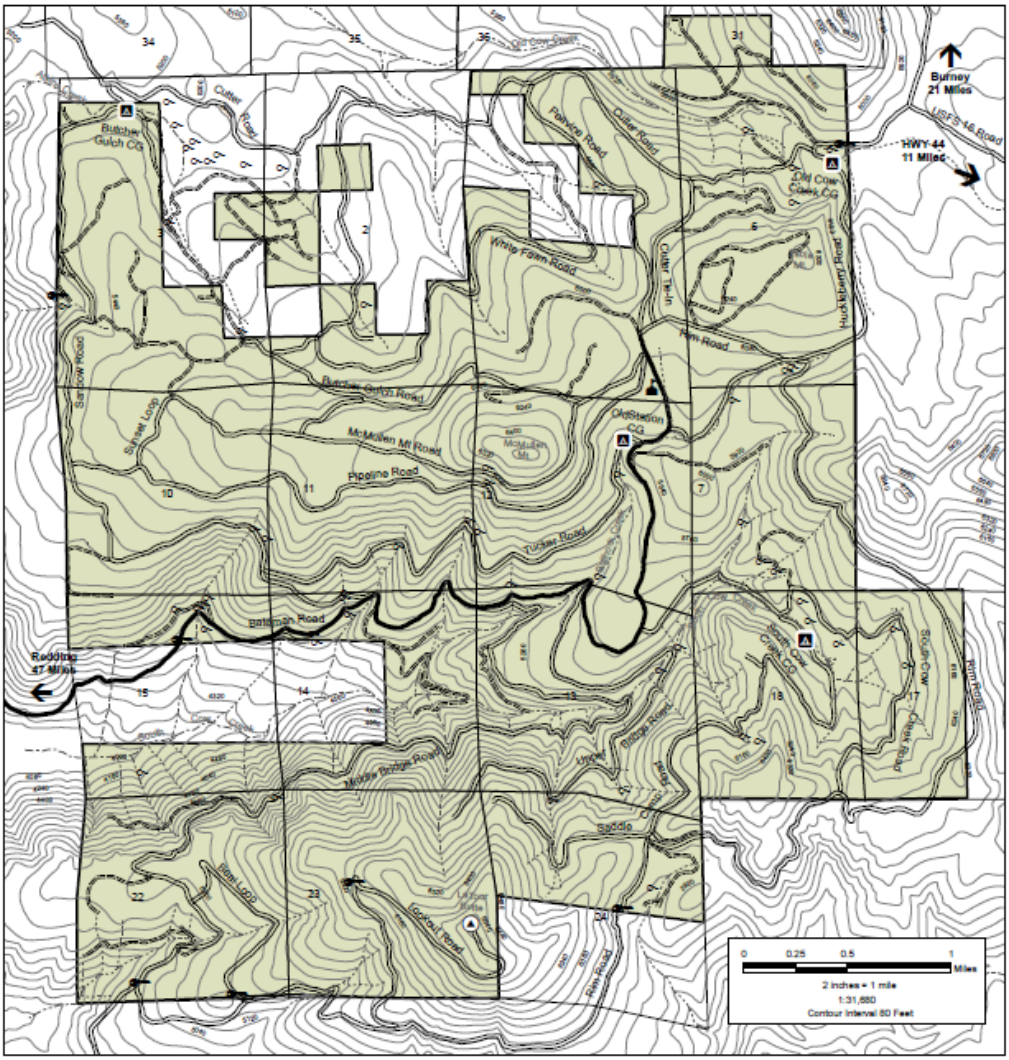
Established	1946
Total Acreage	9,033
Timber Acreage	7,530
Elevation	3,800' to 6,740'
Annual precipitation	46" (mainly snow)
Temperature	0 F (Winter)
	90+ F (Summer)
Average stand volume	21,233 board feet per acre over 12" dbh
Average growth per acre	472 board feet per year

A Few Reminders

To make your stay at LaTour Demonstration State Forest enjoyable here are a few reminders:

1. Campgrounds are designed for single family use. Group camping, in excess of ten people in a single site, is not allowed. Groups need to have a minimum of one campsite for every ten people.
2. Campgrounds have a two week limit per site.
3. Maintain a clean camp. Use trashcans. If cans are full, take your garbage with you.
4. Permits are required for firewood and Christmas tree cutting and can be purchased at the CAL Fire Shasta-Trinity Unit Headquarters in Redding.
5. Use motor vehicles only on the existing roadways. Drive cautiously.
6. Hunting is not allowed near the Forest Headquarters during hunting season. Observe posted closures.
7. Discharging of firearms in or around campgrounds or the Forest Headquarters is prohibited.
8. Be careful with cigarettes, matches and fire.
9. Enjoy this timberland but do not deface the trees, litter the land or pollute the streams.

Campground	Spaces	Water	Toilet	Picnic Tables
South Cow Creek	4	No	Yes	4
Old Cow Creek	3	No	Yes	3
Butcher Gulch	2	No	Yes	2
Old Station	4	Yes	Yes	2



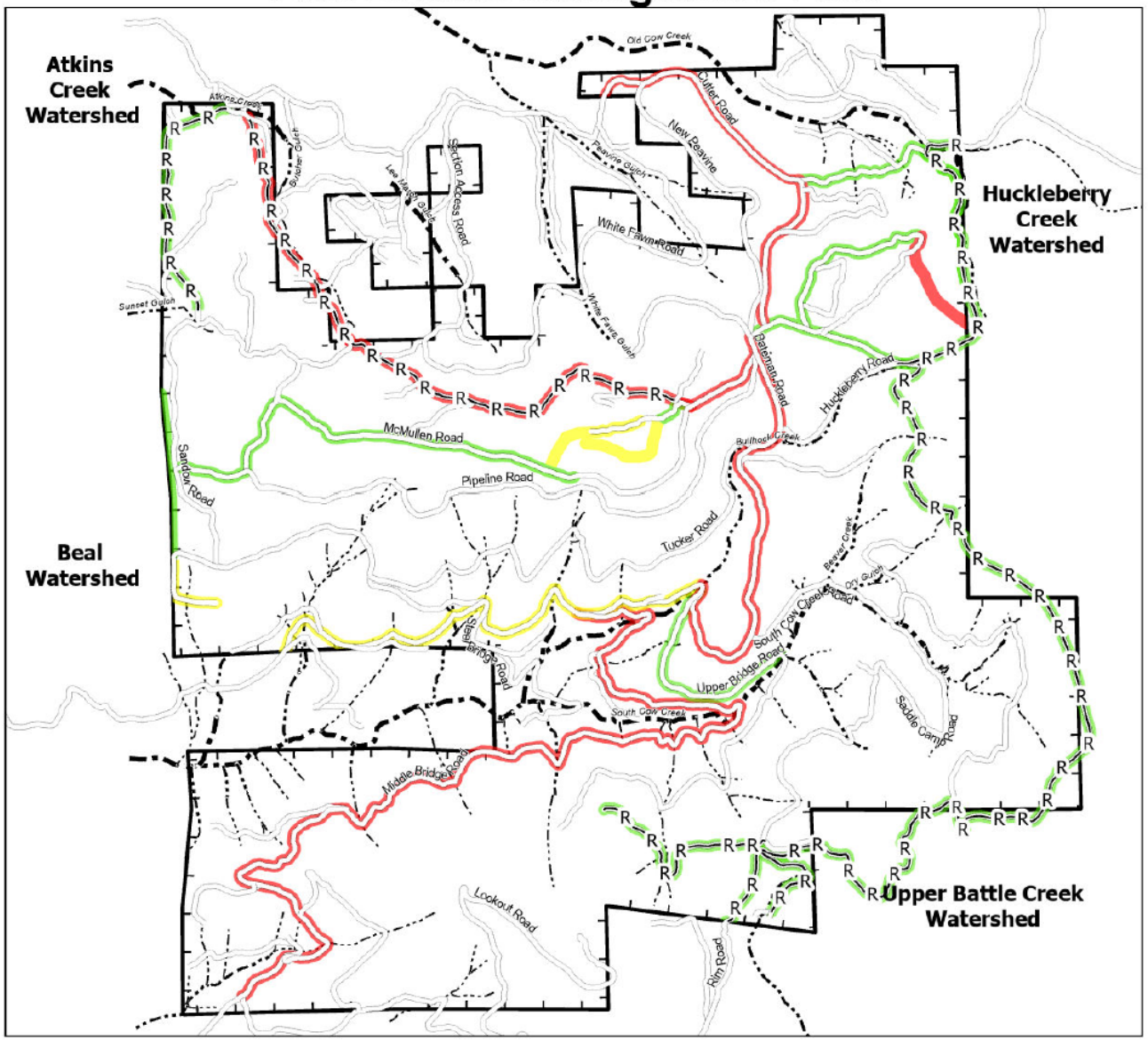
By: N. Ozard
03/27/2017

N W E S

Primary road
Secondary dirt road
Bateman Road
Class 1 watercourse
Class 2 watercourse
Class 3 watercourse
Contours

Forest Headquarters
Campground
Gates
Lookout
Spring
LaTour Property Boundary

LaTour Demonstration State Forest 2025
Fuel Breaks Management Plan



1:42,000

0 2,500 5,000 Feet

- LaTour Property Boundary
- Class I
- Class II-L
- Class II-S
- Class III
- Complete
- Planned
- Proposed Under THP

Roads

- Seasonal Road
- Road as Control Line

N W E S

By: Hannah Jeffris
Date: 3/25/2025

APPENDIX E ROAD MANAGEMENT PLAN FOR LATOUR DEMONSTRATION STATE FOREST

Updated February 2026

A. INTRODUCTION AND BACKGROUND

Forest roads on LDSF are used for timber harvesting, forest management activities, public access, and recreational use. Numerous studies have shown that forest roads are a major source of management-related stream sediment (Furniss et al. 1991). Much of this sediment originates from points at or near where streams are crossed by roads, from inside ditches, and from large fill failures. LDSF has a program to inventory and improve the road system. The goal of this program is to enhance stream channel conditions for resident fish, amphibians, and other sediment sensitive aquatic organisms by reducing both fine and coarse sediment loading. This Road Management Plan (RMP) will also improve water quality by reducing suspended sediment concentrations and turbidity. The RMP includes the following components:

1. **Road Network and Stream Crossing Inventory**: Identify and inventory roads, road-related facilities, and potential hazards associated with roads.

2. **Road Design and Construction Standards**: Guidelines for road location, design, and construction.

3. **Road Use Restrictions**: Guidelines that identify restrictions on use of roads, particularly during wet weather conditions.

4. **Road Inspection and Maintenance Program**: Guidelines for monitoring LDSF roads and establishing a maintenance program.

5. **Road Abandonment Plan**: A comprehensive plan to properly abandon roads on LDSF.

6. **Schedule/Funding for Road Improvement Program**: An annual monetary commitment from CAL FIRE for implementing the Road Management Plan on LDSF, as well as a method to prioritize the work.

The current road network reflects a history of various transportation technologies and forest practices. The road system on LDSF is essentially completed. Currently, there are 64 miles of seasonal roads on LDSF. Approximately 15 to 20 percent of the road network has been rocked. Roads were generally constructed to an 18-foot width specification plus an inside ditch during the 1950's and 1960's (McNamara 1989). The Bateman Road was built in 1953. Approximately 2 percent of the LDSF area is occupied by roads, a relatively low density for intensively managed timberlands. (California Department of Forestry and Fire Protection 1995)

Generally, between 75 and 95 percent of the total erosion associated with timber operations from an area is associated with the forest road network (Rice 1989). Observation of the forest landscape on LDSF confirms that this principle applies here as well. Most of the forest roads on LDSF were constructed with the accepted construction techniques of the time period. Roads were built with an inside ditch and primarily cross drained with culverts. Observations over the past several decades

have shown that while this method can be acceptable, it has several drawbacks for seasonal roads with gradients less than about eight percent. First, it requires a considerable amount of maintenance to keep both the culverts and ditchline open over time, due to blockage by cutslope ravel. Eventually culverts degrade and must be replaced. Secondly, inside ditchlines commonly drain into small or large tributaries and act as a direct linkage for sediment transport into fish bearing watercourses.

The most common erosion observed on LDSF is associated with the inside ditch network draining the roads. Inside ditch erosion has been shown to be a common source of sediment into stream systems, since they often drain into intermittent or ephemeral stream channels and serve as a direct conduit for sediment transport. The 64 miles of seasonal, insloped roads on LDSF are mostly drained with 18-inch culverts for cross drains. Time, rain-on-snow, and snowmelt events have caused several of the 18 inch pipes to become blocked. This has primarily been due to blockage by rocks, not by woody debris (as is usually the case on the North Coast of California). Additionally the ditchlines have been aggraded by cutslope ravel in numerous locations, and water has been forced over the road surface at times, resulting in limited fill slope erosion.

The current preferred road construction alternative is to outslope seasonal roads with little to moderate gradient (up to 8 percent) and drain them with rolling dips. This technique appears generally appropriate for LDSF. However, the inboard ditches are very effective at managing snow melt under normal seasonal conditions. Additionally, some of the soils on LDSF are especially prone to cutslope ravel with input of large quantities of cobbles into the ditchline, others are prone to active downcutting and gullying in the ditchline when cross drain spacing is inadequate. These factors indicate that at problematic locations the seasonal insloped roads with inside ditchlines should be converted to outsloped roads with rolling dips.

Rolling dips have their own impacts associated with the most common winter recreational activities on LDSF. Non-culverted rolling dips result in increased snow melt and cause gaps in the running surface of many commonly used snow mobile trails. This results in the potential for the development of unidentified hazards for winter recreationalists. Given this safety concern, any conclusion that all roads should be out sloped with rolling dips fails to account for all the values associated with the roads current uses.

Over the last two decades LDSF has begun the process of addressing problematic areas. For example, on the 1999 North Timber Sale, 13 culverts were removed on New Peavine, Huckleberry, and Bateman Roads and segments of the roads were outsloped with rolling dips. Where this had been done in the past on LDSF, such as Cutter Road in the northeastern portion of LDSF and Middle Bridge Road before Beal Spur Road, the results have been very successful.

It is also very important to properly abandon unnecessary roads on LDSF. Temporary roads that will not be used for long periods of time (e.g., beyond bridges that are removed) should be adequately drained without culverts, which require maintenance.

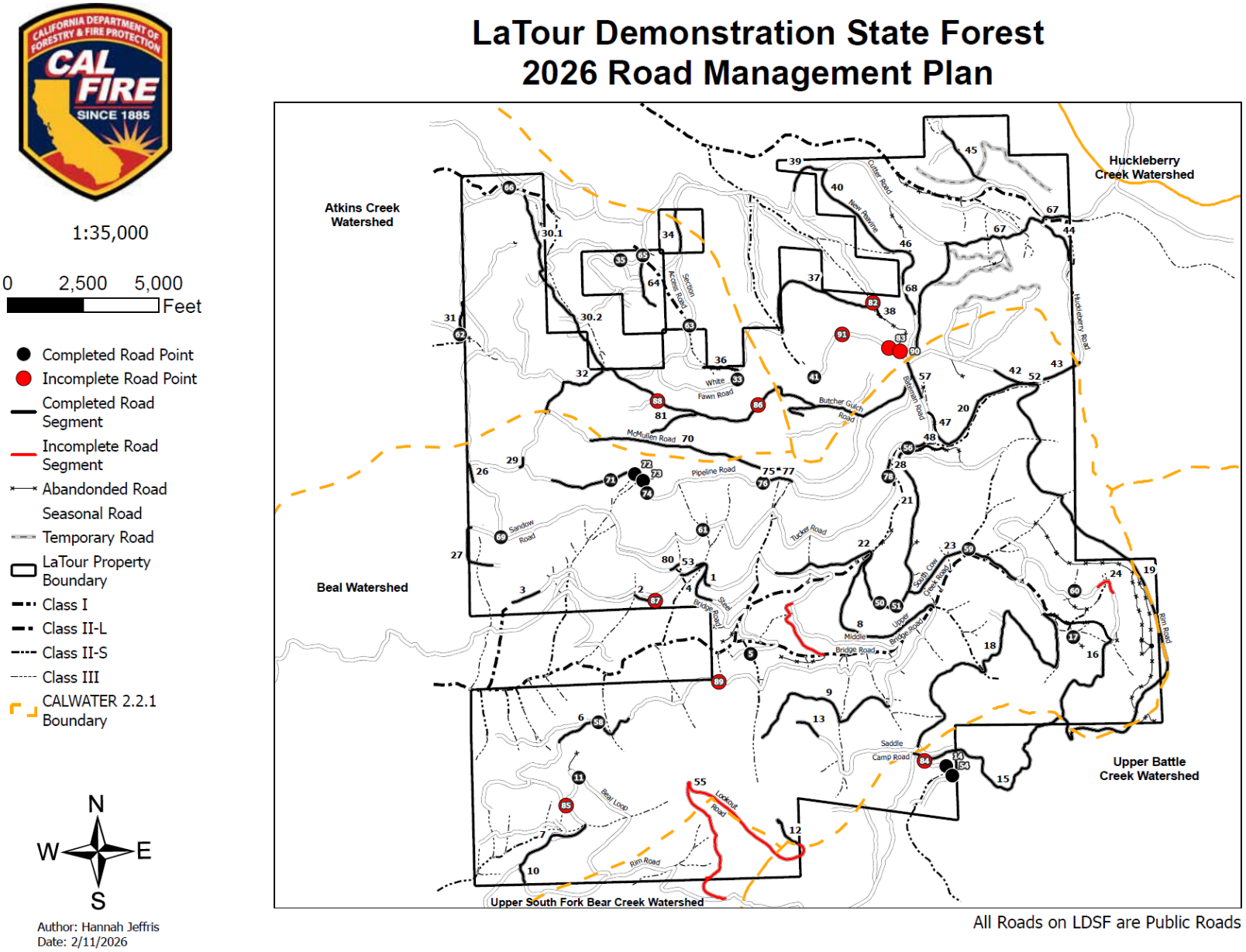
General road maintenance on LDSF has been accomplished in the past primarily through timber sale agreements.

Observations of the road network during implementation of LDSF's 2013 RMP allowed the road segments to be rated in relation to their risk to water quality from erosion. Soil type, gradient, location on the hillslope, surfacing, type of drainage, condition of drainage structures, frequency of drainage structures, amount of use, and current condition were all used to place road segments in the categories of high, moderate, and low risk for erosion.

SUMMARY

The intent of this RMP is to provide a systematic program to ensure that the design, construction, use, maintenance, and surfacing of LDSF's roads, road landings, and road crossings will avoid, minimize, or mitigate adverse impacts to the aquatic habitats supporting fish, amphibians, and other aquatic organisms. An additional benefit may be the long-term reduction in the costs of repairs resulting from problem avoidance.

Figure 1. LaTour DSF Road Management Plan Sites



1. THE ROAD AND STREAM CROSSING INVENTORY

The inventory of road and stream crossings provides the basis for maintaining and mitigating the road system at LDSF. It allows LDSF Forest Managers to: a) identify problems that need to be corrected through routine maintenance activities; b) assign maintenance and mitigation priorities to planning watersheds, road segments, and crossings; c) identify the most effective designs for roads, landings, and culvert problem sites; d) identify roads to be abandoned; and e) identify road segments needing deferred maintenance or reconstruction. The inventory included an intensive evaluation of all roads and crossings.

In 1995, LDSF inventoried and evaluated the entire road system and an initial RMP was developed. The road system was re inventoried and revaluated between 2000 and 2003 for the revised 2003 RMP. The inventory of crossings was again conducted in 2018. LDSF should continually reevaluate the road system and make repairs and improvements as needed. It is estimated there are approximately 64 miles of actively used roads on LDSF. The road network inventory includes both a general road segment component and a separate crossing component.

1.1. The Road Inventory Methodology

All roads on LDSF have been mapped and GIS layers exist for the road system and crossings. The basic components for the road inventory procedure for LDSF are the following: (see Weaver (1997) for a detailed description of these components):

1.1.1. Road inventory work should be implemented by evaluating each road segment.

1.1.2. Road segments should be inspected in the field and information should be recorded to identify significant road-related features. This part of the program should be a relatively rapid survey to determine where the problem sites are located on LDSF. Trained field crews should undertake this task and be supervised by LDSF staff.

1.1.3. Following this reconnaissance, RPFs (or qualified experts in soil science, hydrology, civil engineering, and geologic sciences) should develop site-specific mitigation measures for identified 1significant potential or existing problems.[1]

The basic unit for the LDSF road survey should be the “road segment”. Field inventories should require road segments to be easily mapped. Therefore, road segments should be chosen so that at least one end is easily identified on a map and on the ground. If possible, a road segment should be a length of road that is relatively uniform with respect to its attributes that influence sediment production. These may include drainage characteristics, roadbed characteristics, cuts and fills, geomorphic characteristics of underlying terrain, intensity of use, slope, etc. Segments will vary in length depending on the above attributes. Segments may be subdivided following the completion of the field reconnaissance.

[1] Certified Engineering Geologists (CEGs) or other appropriately licensed engineers or earth scientists will be used where evaluation of unstable areas requires geologic and/or other specialized expertise.

Each road segment should be given a unique identifier (three numbers). The identifier should be written on the map at the beginning and end of the road segment. As a convention, the marker adjacent to the easily identified end is underscored on the map. Information should be collected in the field, beginning at this end of the road segment. Field crews should document the location of important road features along a road segment.

1.2. The Field Data Sheets for Roads

Field Survey Sheets were filled out for each identified segment, (see attached form). The road survey and crossing survey (discussed below) were carried out simultaneously, and the roads and crossings were cross-referenced. For example, each culvert was identified by its associated road segment(s), and each road segment data sheet listed the culverts in (or at the end of) the segment. The field data sheets were entered into a database, which was linked to the GIS through the road segment numbering system.

The following explanations apply to the individual items in the data sheets for the road survey

(Note that the actual information collected in the field may change over time as the forms are field tested and improved):

Descriptive Information
"Road name and number", "planning watershed", and "segment identification number" can be determined from map information before going into the field. "Length of segment" should be determined in the field. Under usage category, high ("H") applies to roads used more than once per day during the summer; medium ("M") applies to roads used less than once per day, and light ("L") applies to roads used less than once per month.

1.2.1. Road Drainage
Culvert information is included here as well as in the culvert survey. "Water Breaks" include both waterbars and rolling dips, and the type should be indicated.

1.2.2. Road Bed
"Width of the Bed" refers to the shoulder-to-shoulder distance, not just the running surface. The "dominant and maximum road grades" will be measured in percent using a clinometer. Road segments are intended to have relatively uniform grade. If rills and/or gullies are numerous throughout the segment, their presence is documented. (Recent grading may eliminate evidence of rilling and gullying, in which case this potential sediment source will be recorded as none present at this time).

1.2.3. Cutslope/Fillslope
"Parent material" refers to the soil type as indicated by the Shasta County Soil survey. This information can be obtained in the office prior to field survey. Failures are noted under Mass Wasting Features.

1.2.4. Mass Wasting Features
Mass wasting features such as fillslope and cutslope failures, and indicators of potential failures such as tension cracks and excessive wood in fills, are noted as part of the road inventory.

1.2.5. Sediment Delivery Hazard Areas

Portions of roads or landings adjacent to watercourses that have steep slopes and/or little filter strip potential will be identified. These deserve special treatment during road closure and maintenance activities.

1.2.6. Access Control

The presence, operating condition, and maintenance needs of gates or other access-control facilities will be noted. Gating of the entire road system will occur when, in the opinion of the LDSF Manager, light vehicles have the potential to cause significant rutting of the road surface. Roads may be gated after the first significant precipitation occurs in the fall and until the snow melts off the road surface in the spring. The road surface must be dry enough to support vehicle traffic without rutting prior to allowing access.

1.3 The Crossing Survey

Inadequate and decaying culverts can be major causes of sediment problems. Poorly designed culverts can be blocked by woody debris, rocks, or sediment, which can cause the road to be overtopped and the fill to be eroded. Culverts, including cross drains, which drain onto unprotected fill or “shotgun” culverts with outlets elevated above grade, can initiate deep gullies. To function properly, culverts should be periodically inspected and maintained. The Crossing Survey developed a database with information on all crossings within LDSF, including culverts, bridges, fords, and ditch relief cross drains.

Drainage structures also include waterbars and rolling dips (collectively called “water breaks”). These structures are not included in the crossing survey since their locations may vary from year to year, depending on road grading and maintenance.

1.4 The Crossing Survey Form

The attached form shows the information collected at crossings. Each crossing was assigned a unique number and its location was noted on a map in the field. The field sheets were entered into a database, and the culvert locations, latitude and longitude, and ID numbers entered were used to update the GIS. The database allows the LDSF Forest Managers to sort by watershed, stream class, channel distance to Class I streams, severity of problems, etc. In addition, the field inspectors “red-flagged” data sheets for culverts that require immediate attention, so that treatment of problems will not have to await the completion of the survey.

Terms used in the Survey Form refer to the following:

Crossing Type

A correctly installed culvert is shown in Figure 3. Typical crossing types are abbreviated as follows:

CMPR	corrugated metal pipe (round)—specify if aluminum or galvanized steel
CMPO	corrugated metal pipe (open bottom)—specify if aluminum or galvanized steel
CMPV	corrugated metal pipe (oval) squash pipe – specifically aluminum or galvanized steel
CMPA	corrugated metal pipe (arch)
RCP	reinforced concrete pipe

RC Box	reinforced concrete box culvert
CPP	corrugated plastic pipe
Open	fill totally removed
BRD	bridge
FORD	ford – specify type

If more than one culvert of the same type is present, the number should be indicated.

Upstream Channel Dimensions
Active channel width above the crossing entrance (upstream of any backwater effects).[2] [3]

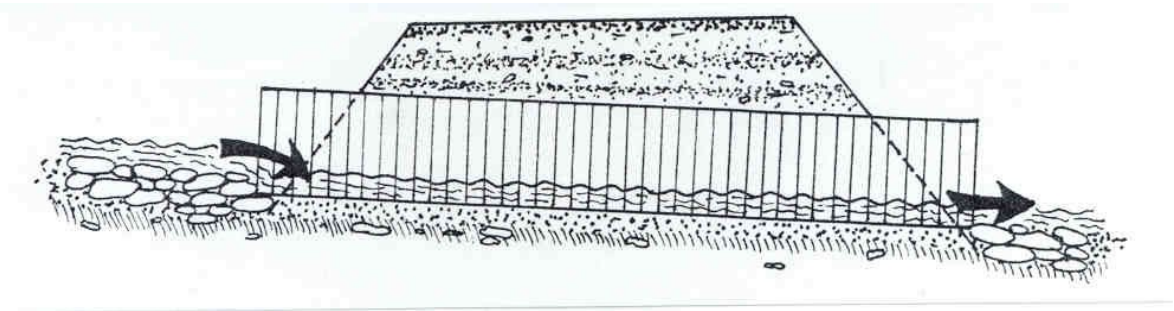


Figure 3. Correctly placed culvert, which is set slightly below the original stream grade and protected with armor at the inlet and outlet.

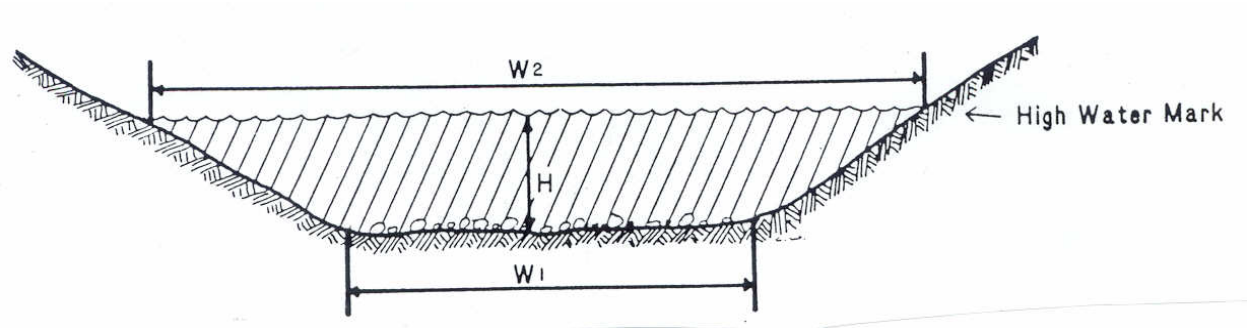


Figure 4. Watercourse channel measurements to determine watercourse cross-sectional area.

Entrance Type
Entrance type will be noted.

Maximum Head
Maximum head refers to the height (ft.) from the bottom of the culvert inlet to the overflow elevation at the road crest.

Rustline Depth
The rustline in a galvanized steel culvert indicates the approximate depth of winter baseflow

[3]Research in northwestern California suggests that culverts with diameters at least 0.7 times the active channel width will pass 95 percent of the woody debris greater than 30 cm long, as well as the 100-year discharge (Flanagan 1996). Generally some training is necessary to consistently recognize the bankfull and active channel widths.

(note that this does not work for plastic or aluminum culverts). [4]

Diversion Potential
Diversion of water from plugged culverts can be a major source of damage.
The path water would follow from the road to an active stream channel if the culvert were blocked is noted.

Outlet
The dissipation of energy of the water as it leaves the culvert is important in controlling erosion.

Percent Dented/Crushed and Percent Filled
Estimate the percentage of the culvert cross-sectional area lost due to mechanical damage or sediment filling.

Alignment and Grade
Inadequate culvert alignment or gradient is noted as part of the field inventory. (Figure 5)

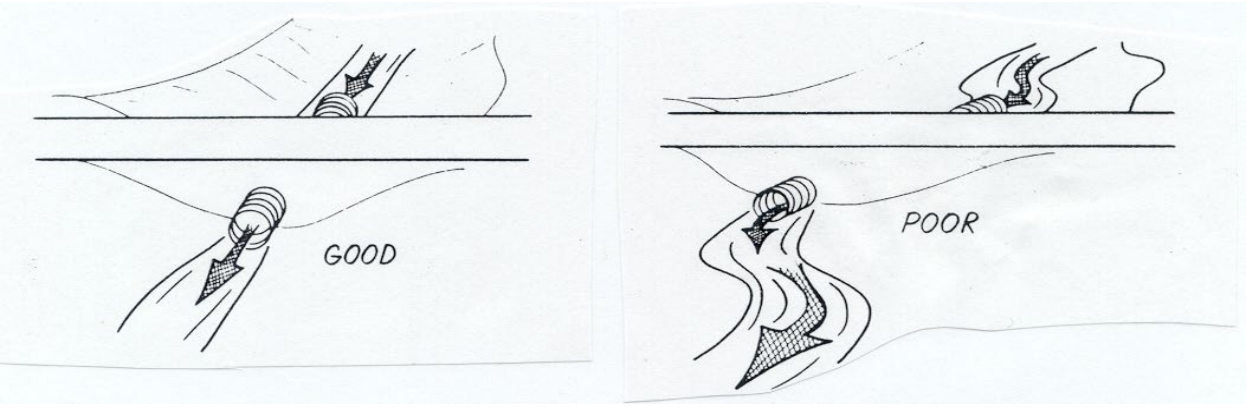


Figure 5. Good and poor culvert alignment.

Fish Passage
Obvious problems for fish passage is noted on the field forms. Examples of problem situations include: 1) too steep of gradient, creating excessive velocity, 2) too much drop from culvert outlet to pool below, creating a jump too high, 3) no resting pool below culvert, and 4) inadequate water height over pipe bottom.

A complete culvert and crossing inventory was conducted in 2018. The inventory was also conducted utilizing ESRI's Survey 123 App. The data collected and saved to the cloud on the various mobile devises now exists as a feature hosted layer in the GIS environment. The inventory was conducted utilizing the same fields identified in the Forest's approved Road Management Plan.

[4] The flow indicated by the rustline is equaled or exceeded about 10 percent of the time on an annual basis. If the rustline is higher than about one-third of the culvert diameter, the culvert is probably undersized (Flanagan and Furniss 1996); if it is less than 8 inches above the bottom, the culvert may not be passable for fish. The rustline should be measured at the culvert outlet.

2. STANDARDS AND GUIDELINES FOR DESIGN AND CONSTRUCTION OF FOREST ROADS, LANDINGS, AND CROSSINGS

Road, landing, and crossing design will follow the current state of the practice, such as is described in *The Handbook for Forest and Ranch Roads* by Weaver and Hagans (19943)[5] , or as suggested by the interagency Review Team where a timber harvesting plan (THP) has been submitted. Some of the fundamental considerations in planning, design, construction, and reconstruction from the Weaver and Hagans Handbook are described below. Over the life of the plan, improvements in road design, construction materials, surfacing materials, construction, and maintenance techniques are likely to continue.

The "demonstration" mandate of LDSF may lead to cases where an experimental design for roads, landings, and crossings do not match the specifications in this document or the current state of the practice.

2.1. Planning

Careful planning is essential for the development of an efficient and environmentally sound road system. Roads with the highest potential to adversely affect watercourses should be properly reconstructed or abandoned, if necessary. Existing and new roads needed to accommodate cable yarding on slopes steeper than 40 percent should generally be located on or near ridge lines (although many miles of mid-slope road will remain). The goal for planning the final transportation network should be to establish roads in low risk locations that will accommodate appropriate yarding and silvicultural systems. However, a specific road density target may not be used.

High risk areas under the 2013 Road Management Plan were prioritized for treatments, to reduce the potential of road generated sediment delivery to associated watercourses.

The road construction, maintenance, and rehabilitation standards specified in this Plan have helped prevent significant, adverse impacts to aquatic habitats. Measures included, but where not limited to: 1) monitoring all active roads on an annual basis, providing a feedback mechanism for road maintenance and improvements; and 2) updating the current GIS database to record data about road features collected during the monitoring efforts.

Planning for the LDSF road network is based on the following principles:

- The protection of aquatic resources is a major objective of the Road Management Plan.
- The total mileage of roads should not be significantly increased.
- Existing roads should be used wherever appropriate, in preference to building new roads. Substandard roads with drainage and sediment production problems should be reconstructed, regraded, re-aligned, resurfaced, or otherwise treated to prevent significant sediment delivery to watercourses. Exceptions to using existing roads in

[5] There are some minor exceptions. Road grades associated with new construction are typically slightly steeper than suggested. Also, backhoes are not used to construct inside ditches and bridges are not used as extensively as suggested in the Handbook.

preference to new roads include, but are not limited to, building new roads at ridgeline locations for cable yarding.

- Roads should be designed to the minimum width necessary to safely accommodate required traffic, with turnouts spaced appropriately for the road class. All roads should be classified according to expected use and maintained accordingly.

- Roads should generally be located to avoid unstable terrain, and to minimize ground disturbance and watercourse crossings. Roads in unstable areas, including inner gorge areas, should only be built if a reasoned assessment by a Certified Engineering Geologist (CEG) confirms that the proposed construction is unlikely to result in mass wasting that would contribute sediment to a Class III or higher watercourse.

- Maps showing mass wasting hazards, including shallow landslide instability, deep-seated instability, and inner gorge areas, should be used as a guide to avoid unstable ground and to indicate the need for input from an engineering geologist in the design and location of roads.

2.2. Design of Roads, Landings, and Crossings

Proper road, landing, and crossing design are the key to minimizing both the costs of construction and maintenance, as well as environmental damage. The following are the key design principles for roads, landings and watercourse crossings that should be followed by LDSF:

- On slopes over 50 percent, road design for hillslope stability should depend on site-specific conditions; detailed specifications for design and construction should be included in the THP.

- New and reconstructed roads and landings generally should be outsloped for surface drainage; inboard ditches should be avoided except where necessary. Where such ditches exist and are determined to be significant sediment sources, they should be eliminated over time, if possible. Inside ditches may be appropriate in certain situations such as where an existing road crosses an old or potential debris slide and water is routed past the feature in the ditchline.

- Compared to waterbars, rolling dips are more resistant to traffic induced failures and should be used where possible for surface drainage. Other road drainage structures should be used in some situations, such as existing main line crowned roads with acceptable numbers of cross drains. On temporary roads that are “put to bed” and will not be driven for several decades, rolling dips or waterbars and outsloping are more effective than culverts (self-maintaining drainage structures will be utilized on temporary roads were possible).

- Road fill should be protected from erosion by installing rock riprap or overside drains where necessary.

- Roads intended as main haul routes should be surfaced to reduce erosion potential as funding is available. Surfacing agents include but are not limited to rock or lignin.

- Watercourse crossings should be designed to accommodate a 100-year runoff event. Appropriate sizing techniques include USGS regional regression equations, the rational method, and flow frequency analysis.

- Watercourse crossings should be designed to minimize diversion potential. Fill volume should be minimized over crossings, while providing sufficient depth of fill to protect a culvert from crushing under truck traffic.

- Watercourse crossings utilizing culverts should have armored entrances and outflows as needed to avoid substantial loss of fill material.

- Temporary crossings involving fill on Class I and perennial Class II watercourses should be installed after May 1st and removed by October 15th. Temporary crossings involving fill should only use clean, washed rock in the watercourse channel (utilizing the CDFG Streambed Alteration Permit). When temporary crossings are removed, the channel should be restored to the approximate original configuration.

- Crossings of Class I streams should be designed to provide for fish passage, where not currently present.

- Rock-lined ford, cable concrete mat crossings or vented crossings should be used for Class II and III watercourse crossings where appropriate, since their failure rate is much lower than for culverts (Spittler 1992). Approaches to fords should be rocked to prevent sediment delivery to watercourse channels. The use of rock-reinforced fords or cable concrete mats is only possible in locations where channel gradients and slopes are moderate to low. These types of structures are most applicable to channels that flow only in direct response to rainfall. For each proposed dry ford, the THP should identify the construction design needed to minimize the potential for contributing sediment to watercourse channels. Information appropriate for proper design includes: 1) the channel geometry above the immediate zone of influence of the crossing site (Figure 4), 2) the size of the boulders that are stable within steep pitches of the channel, and 3) the thickness of fill needed for the crossing.

- Landings should be designed for minimum safe working size and care should be exercised in selecting stable sites for construction.

2.3 Construction and Reconstruction

Without proper planning and execution, construction activities may cause serious water quality and sediment problems. The following principles apply to road construction activities on LDSF lands:

- Construction activities that involve significant soil disturbance (such as excavation for roads and landings) should be conducted when soils are not saturated. Culverts and bridges should be installed between April 1st and November 15th, the dry period of the year. Material disturbed during construction should be stabilized to prevent movement into watercourses.

- Crossings should be installed in a manner that will avoid input of significant amounts of sediment to the stream.

- Bare mineral soil exposed during construction or reconstruction activities should be evaluated for surface erosion potential and sedimentation. Measures to reduce surface erosion should include but not be limited to: a) mulching or matting, b) seeding, c) planting vegetation, d) armoring, and e) combination of several measures.

- Disturbance to the bed and banks of streams should be avoided or minimized. Disturbance should only occur at watercourse crossings and should take place between April 1st and November 15th (see bullets above regarding installation and removal of temporary crossings).

- No new roads should be built in Watercourse and Lake Protection Zones, except for approved watercourse crossings.

- The organic layer of soil should not be incorporated within or beneath the road fill.

- The LDSF archaeological resources inventory should be reviewed to determine the location of known archaeological sites before construction and maintenance work is started. These sites should be protected and left undamaged. The specific procedures to protect archaeological sites will be addressed in the revised LDSF Management Plan.

3. ROAD USE RESTRICTIONS

Wet weather operations on LDSF should be minimized and typically only occur during late fall. In addition, the following guidelines should be considered to determine how dust abatement and water drafting for dust abatement is conducted on LDSF:

- Log hauling should not occur when “pumping” of fines from the road surface produces sediment that enters inside ditches and causes turbid water to flow in ditch lines with direct access to watercourses.

- Only surfaced roads should be considered for wet weather log truck traffic. If road rock begins to significantly break down, wet weather use of that road shall cease until the road is adequately repaired.

- Roads actively used for hauling during the dry period of the year should be treated to reduce the generation of road dust and maintain road stability. Generally this will mean watering the roads as needed; chemical treatments might also be employed in certain situations.

- Water drafting for dust abatement should occur in off-channel areas when practicable.

- Water drafting from Class I watercourses for dust abatement on LDSF roads, or for other uses, should require that the following measures are followed: 1) all water intakes are properly screened to prevent harming small fish; and 2) the rate of drafting will be modified or halted if necessary to assure no visible drop in the water surface of the waterbody downstream of the intake/diversion point.

- Water drafting from Class II watercourses for dust abatement on LDSF roads or for other uses should require that the rate of drafting be modified or halted if necessary to assure no visible drop in the water surface of the water body downstream of the intake/diversion point.

The LDSF Manager may modify these restrictions based on site specific operational circumstances.

4. ROAD INSPECTION AND MAINTENANCE PROGRAM

Proper maintenance is the key to reducing the long-term contribution of roads to stream sediment. The maintenance program at LDSF should be based on the road and culvert survey (described above) and the inspection program (described below), which provide the information base for determining maintenance priorities.

4.1 Principles of the Inspection Program

- Properly abandoned roads should be inspected at least twice following the completion of the decommissioning activities. The first inspection should follow the first winter after decommissioning. The second inspection should occur after five over-wintering periods. If significant problems are found, equipment should be used to rehabilitate the site properly, if feasible and practical to do so. Following this work, another inspection should be made after the first over-wintering period following equipment use to determine if the improvements are properly functioning.

- In addition to the detailed road and crossing inventory (see Section 2), active roads and crossings (i.e., roads that have not been properly abandoned) should be inspected once annually to ensure drainage facilities and structures are properly functioning. Two types of inspections may be used: 1) formal inspections, and 2) rapid ad hoc inspections. During formal inspections, all crossings and roads should be carefully observed every three years and problem sites should be recorded on road/crossing inventory forms. To cover the period between detailed inspections, a rapid ad hoc inspection may be made by LDSF Foresters and other staff during normal activities. Only obvious problems may be determined with the rapid ad hoc inspections. Information collected on road problems during either the detailed formal review or the rapid observation review should be entered into the road database developed for LDSF, and maintenance personnel should be advised immediately of significant hazards. Identified problems should be corrected before the onset of wet weather whenever possible and appropriate, depending on availability of personnel and equipment. Failed culverts should be evaluated to determine the cause of failure.

- Problem facilities (including currently known sites and those identified in road/culvert survey) should be monitored by LDSF Foresters more frequently. The Foresters should evaluate these sites to determine if immediate repairs are needed to prevent failure of a crossing or road damage.

4.2 Principles of the Maintenance Program

- Maintenance should be scheduled on an “as needed” basis (including sites located from the rapid ad hoc road inspection process), as well as determined by the formal road inspection that occurs on a three-year cycle.

- During normal road maintenance that does not relate to identified problem sites, excessive grading of running surfaces, inside ditches, and cutslopes should be avoided. Additionally, when possible, vegetation should be left on or above cutslopes to stabilize the slope. Vegetation may be removed on or above cutslopes when it is necessary to improve visibility, promote safe travel on the road or allow for effective grading.

- Hazard zones (e.g., where roads are adjacent to watercourses and there is a high sediment delivery potential) identified during the road inventory or the inspections should be highlighted and maintenance personnel should be advised to use alternative maintenance procedures that might be necessary to prevent further disturbance (e.g., carrying graded material farther down the road prism rather than side-casting into streamside areas).

5. ROAD ABANDONMENT PLAN

Temporary roads can be defined as roads that are used for one or two years, and then "put to bed" with proper road closure. They may be reopened and reused in the next entry***. Properly abandoned roads*** are defined as roads that have been permanently closed in a manner that prevents erosion, maintains hillslope stability, and re-establishes natural drainage patterns. In the California Forest Practice Rules (2021), Abandoned Road means "any Logging Road on which proactive measures have been applied to effectively remove it from the Permanent Road Network." Similarly, as defined in Weaver and Hagans (1994), *proper or proactive road abandonment* (i.e., closure or road decommissioning) is a method of closing a road so that regular maintenance is no longer needed and future erosion is largely prevented.

There are no known roads on LDSF that are ***improperly abandoned*** and which may continue to act as sediment sources. Pro-active road abandonment usually involves removing watercourse crossing fills, removing unstable road and landing fills, and providing for erosion resistant drainage. The focus of pro-active road abandonment is to aggressively treat road segments that have the greatest potential to erode and deliver sediment to stream channels.

All roads on LDSF that are no longer required for management and recreation purposes will be evaluated for pro-active abandonment, and closure treatments that do not result in increased, overall sediment production will be implemented. Sometimes, more damage will result from soil disturbance and destruction of vegetative cover already in place, when compared to the benefits of removing old crossings, etc. Therefore, varying levels of proactive road abandonment may be used on LDSF, ranging from full closure to installing water breaks by hand.

Identification and prioritization of LDSF roads for proactive abandonment come from the road inventory. Some of the criteria that may be used to identify roads to proactively abandon include:

1. Unstable inner gorge areas
2. Roads in close proximity to a watercourse
3. Roads not needed for management purposes
4. Roads with excessive amounts of perched fill.

For further discussion on this topic, see Handbook for Forest, Ranch & Rural Roads 2015

5.1 Principles of the Pro-active Road Abandonment Program

- Pro-active road abandonment means actively treating a road to reduce erosion potential, so it will not contribute significant amounts of sediment to the stream system, even in severe storms, and will not need long-term maintenance. Future vehicular use of these roads is not intended after closure.

- Proactive abandonment should include removing culverts and reestablishing channels to their original grade and, as possible, channel configuration. The road prism at crossings should be pulled back to a stable slope configuration. Where necessary, the regraded channel should be armored to prevent downcutting or erosion of the old fill material.

- Potentially unstable fills should be pulled back and graded to a stable configuration, mulched, and seeded.

- Where possible, drainage structures on temporary roads should be installed with features that will be self-maintaining, such as rolling dips, cross ditches with packed inside ditchlines, or outsloping. Waterbars should only be used where local topography prevents the installation of rolling dips. Temporary roads are intended to be reopened for future use. Landings should be outsloped and drained with appropriate drainage structures.

- Following completion of the road inventory (see section 2), a schedule should be developed for closure of temporary roads.

- Seasonal roads with gates may be locked during the wet season (LDSF staff discretion). Access to LDSF is generally eliminated during winter months due to snow. However, during late spring, roads can be saturated due to snowmelt.

6. SCHEDULE/FUNDING FOR ROAD NETWORK IMPROVEMENT ACTIVITIES

LDSF staff should conduct annual/spring windshield surveys of all roads and crossings as they become accessible following snow melt, to ensure functionality, sediment delivery minimization and insurance of public safety.

The focus of LDSF's road management program should be to minimize the volume of sediment that enters watercourses, rather than to maximize the number of miles of road treated per year.

Based upon variability in annual budgets, it is not possible to predict exactly the amount of work that can be completed or is necessary to be conducted per year. Road reconstruction, including outsloping and filling inside ditches, removing ditch relief culverts, and installing rolling dip cross drains can cost $5,000-$7,000 per mile. Surfacing roads with rock can also cost upwardly of $40,000 per mile.

Every effort should be made to maximize RMP work with the available funding provided.

REFERENCES, ROAD MANAGEMENT PLAN

California Department of Forestry and Fire Protection. 1995. LaTour Demonstration State Forest, Sustained Yield Plan. Unpubl. Report. 246p.

Flanagan, S.A. 1996. Woody debris transport through low order stream channels: implications for stream crossing failure. Unpubl. Draft masters thesis. Humboldt State Univ., Arcata, CA. 34 p.

Flanagan, S.A. and M.J. Furniss. 1996. Field indicators of stream crossing capacity. Unpubl. Draft rept. USFS Six Rivers National Forest. Eureka, CA. 4 p.

Furniss, M.J., T.D. Roelofs, and C.S. Yee. 1991. Road construction and maintenance. American Fisheries Society Special Publication 19: 297-323.

McNamara, D. 1989. LaTour Demonstration State Forest Management Plan. Unpubl. Rept. Approved by the State Board of Forestry on Nov. 7, 1989. 63p.

Rice, R.M. 1989. On-site effects: the necessary precursors of cumulative watershed effects. Unpubl. paper presented at the Cumulative Impacts Training session, Fort Bragg, CA. January 31-February 3, 1989. 12p.

Weaver, W.E. and D.K. Hagans. 1990. Techniques and costs for effective road closure. Pacific Watershed Associates Technical Paper No. 90-1. Pacific Watershed Associates, Arcata, CA. 7 p.

Weaver, W.E. and D.K. Hagans. 1994. Handbook for forest and ranch roads: a guide for planning, designing, constructing, reconstructing, maintaining and closing wildland roads. Prepared for the Mendocino County Resource Conservation District, Ukiah, CA. 161 p.

Weaver, W. E. 1997. Assessment and implementation techniques for controlling road related sediment sources. Unpubl. Rept. prepared for the Second Watershed Academy, Santa Cruz, CCA May 5-9, 1997. Pacific Watershed Associates, Arcata, CA. 29p.

Weaver, W.E 2015, Handbook for Forest, Ranch & Rural Roads: A Guide For Planning, Designing, Constructing, Reconstructing, Upgrading, Maintaining and Closing Wildland Roads. Rept. prepared for the Mendocino County Resource Conservation District, April 2015.

APPENDIX A of Road Management Plan:

Identified problem locations on LDSF's Road System. (See Figure 1,)

1. Bateman Road Near Steel Bridge Road Junction:
Steep gradient, insloped, shows recent extensive inside ditch erosion for about 1/8 mile. Solution: Increase number of cross drains and or add additional rock. A rolling dip was installed above the vista point in 2022 and a small sediment catch basin was installed above the culvert on the long in board ditch. Observations from 2022-2024 showed no evidence of accumulation of materal. The previous concerns of erosion, due to the absence of apparent fines in the in board ditch, failed to the consider the alluvial shale falling off the cut slope. Additionally the road fill slope above the crossing was armored with keyed in 24" + rock and the road width was increased with a berm for safety and preventing discharge to the fill. **CORRECTED 2024 under Senapol THP 2-22-0020 SHA.**

2. Bateman Spur No. 2:
Water flowing down road for 500 feet, partially due to failed waterbar. Significant surface erosion directly input into Class III channel. Solution: Outslope and install rolling dips. **CORRECTED 2000**

3. Roaring Springs Spur:
Landing at end of spur saturated by spring needs adequate drainage. Solution: If landing is to be used again, install filter fabric and rock, and perhaps subsurface drain. Additionally, it would be possible to install an inside ditch sufficient in depth to channel water away from the landing surface. **CORRECTED 2002, LANDING ABANDONED**

4. Steel Bridge Road from Junction with Bateman Rd. to Junction With First Spur Road:
Active gully erosion on the road surface, from the inside ditch that is mostly full of cut slope ravel. Solution: Outslope and install rolling dips. **CORRECTED 2002 BY INSTALLING ROLLING DIPS**

5. Steel Bridge Road South of South Cow Creek Bridge:
48-inch culvert entrance blocked by rock resulted in very large gully down road surface for approximately 60 feet. Solution: Reseat culvert and out slope with rolling dips. **CORRECTED 1995.**

6. Middle Bridge Road Southwest of South Cow Creek:
Inside ditch erosion, blocked inside ditchlines causing water to flow across the road prism and creating fill slope erosion problems. Two locations of approximately 0.4 miles each need improvement. Solution: Pull cross drain culverts and outslope with rolling dips. **CORRECTED 2006**

7. Middle Bridge Road from Beal Creek Crossing to Rim Road:
Inside ditch erosion, ditchline blockages causing water to flow across the road surface. Solution: Pull cross drain culverts and convert to outsloping with rolling dips. **CORRECTED** under the Cable Cow THP, 2014-2015

8. Upper Bridge Road from Junction With Bateman Rd to South Cow Creek Crossing: Large cut bank sluffage totally blocking inside ditchline forcing a large amount of water over the road surface. Solution: Remove cutbank sluffage and convert the road to outsloping with rolling dips. **CORRECTED 2003**

9. Upper Bridge Road from South of South Cow Creek Crossing:
In at least three locations, drainage problems exist that are delivering considerable amounts of sediment into tributaries of South Cow Creek. Problems include erosion from skid trail entrances to

the road that are totally blocking the inside ditch, fill slope erosion, and ditchline erosion. Approximately the last one mile of this road needs improvement. **CORRECTED 2006**

10. Rim Road to Beal Loop:
Significant inside ditch erosion for the first 0.1 mile. Solution: Convert the road to outsloping with rolling dips. **CORRECTED** under the Cable Cow THP, 2014-2015

11. Beal Loop Road:
Significant rill erosion at the entrance with Rim Road. Approximately 800 feet of severe inside ditch erosion on steeper gradient stretch of road. **CORRECTED 2006**

12. LaTour Butte Road:
While no threat to water quality, moderate rilling is occurring for the last 0.25 miles before the lookout, and a few other locations. Solution: Outslope with rolling dips where needed. **CORRECTED 2009**

13. Saddle Camp Road to the West of the Junction with Rim Road:
Last 0.15 miles has blocked inside ditchline with a steeper road gradient, creating rilling and gullying and moderate fill slope erosion. **CORRECTED 2006**

14. Spur to the South of Rim Road/Saddle Camp Road Junction:
First 0.1 mile has significant surface erosion and some fill slope erosion. The west fork of the spur has a considerable amount of rilling directly delivering sediment into the headwaters of North Fork Battle Creek. Fill at the culvert is eroding. Solution: Install rolling dips where needed. **CORRRECTED 2011**

15. Rim Road From Junction with Saddle Camp Road to Junction with South Cow Creek Road:
Severe inside ditch erosion, rilling and gullying, and fill slope erosion both on and off LDSF. Severe problem due to Jiggs soil type. Solution: Convert to outsloping with rolling dips. **PARTIALLY CORRECTED IN 2006 AND 2007 AND IN FALL 2017, Road is located on both on LDSF and USFS.**

16. South Cow Creek Road from Junction with Rim Road to Junction With Saddle Camp Road:
Very significant gullied road surface, very significant inside ditch erosion, causing a major sediment input into the headwaters of South Cow Creek. The channel shows large quantities of fresh fine sediment in storage. This erosion is particularly bad on the upper 0.3 mile stretch before the junction with Rim Road. Solution: Convert to outsloping with rolling dips. **CORRECTED 2001 Road Portion Abandoned**

17. South Cow Creek Road Spur:
Totally undrained spur allows water to flow down the road prism, directly entering the headwaters of South Cow Creek. Fill erosion noted around culvert. Solution: Outslope with rolling dips. **CORRECTED 2001 Road Portion Abandoned**

18. Saddle Camp Road from Junction with South Cow Creek Road to Junction With Rim Road:
First 0.75 miles has significant inside ditch erosion with very few cross drain culverts. Road is very near headwaters tributary of South Cow Creek and is exceedingly difficult to drain without direct sediment input to the channel. Channel shows fresh sediment input. The last 0.5 miles of road before junction with Rim Road shows inside ditch erosion and surface rilling due. Solution: Attempt to install rolling dips at strategic locations for lower portion of the road; convert to outsloping with rolling

dips for the upper portion. **CORRECTED 2001. Additionally, the road was rocked from the campground to top of the adjacent Class III watercourse, in 2017.**

19. Rim Road From Junction with South Cow Creek Road to Huckleberry Road:
For the southern 1.5 miles, both on and off LDSF, numerous road drainage problems exist. Inside ditchlines are blocked, causing water to flow over the road resulting in significant rilling. Other areas have eroding inside ditchlines, or no discernible drainage. Solution: Convert to outsloping with rolling dips. **CORRECTED 2005 & 2009**

20. Huckleberry Road from Junction with Rim Road to Junction with Bateman Road:
Very significant inside ditchline erosion due to very few cross drain culverts. High risk due to location near headwaters of Bullhock Creek. Solution: Either install additional cross drain culverts or convert to outsloping with dips. **CORRECTED 1999**

21. Bateman Road From Junction with South Cow Creek Road to Junction with Huckleberry Road:
Inside ditchline erosion for 0.6 miles north of junction with South Cow Creek Road. Few culverts and entrance to last culvert is damaged, causing water to flow for excessive distances in the ditchline. Slight through cut very difficult to properly drain. Solution: Repair existing culvert and attempt to install at least one more cross drain culvert. **CORRECTED 1999**

22. Bateman Road From Middle Bridge Road to South Cow Creek Road:
Cross drain culvert entrance damaged. Significant inside ditch erosion from Bullhock Creek crossing southeast for 0.5 miles. Solution: Install more cross drain culverts and fix existing ones.
CORRECTED 1999 - Rocked rolling dips were installed to supplement or replace cross drain culverts in 2009.

23. South Cow Creek Road from Junction with Bateman Road to Junction with Saddle Camp Road:
Massive gully where inside ditchline enters fill for culvert for South Cow Creek near campground. Inside ditchline erosion from junction with Saddle Camp Road to large culvert for South Cow Creek. Solution: Install additional cross drain culverts or convert to outsloping with rolling dips. **CORRECTED 2001 - ¼ mile abandoned**

24. Spur Roads Above South Cow Creek Meadows:
Temporary roads that appear to have been improperly abandoned, resulting in the loss of the road prism in one location. Solution: If reused in the future, properly abandon.; mitigated and consider realigning road in next THP
PORTION CORRECTED 2002, & 2006

25. Pipeline Road:
Approximately 0.25 miles has drainage problems. Water runs over the road prism causing fill slope erosion; inside ditch erosion also occurs. Also, short stretch with drainage problems at the junction with Sunset Loop Road. Solution: Outslope with rolling dips. **CORRECTED 2000**

26. Sandow Road From Junction with Pipeline Road to Junction with Tucker Road:
Significant rilling occurring the first 500 feet. Also, near the entrance with Tucker Road, skid trial erosion blocks inside ditchline, causing water to flow over the road. Solution: Install-rolling dips.
CORRECTED 2000

27. C-Shaped Spur at Western Edge of LDSF off Sandow Road:
Badly eroded surface due to total lack of drainage. Through cut in many locations that will be difficult to adequately drain. Solution: Attempt to drain with water bars or rolling dips. **CORRECTED 2002**

28. Tucker Road:
Approximately 0.1 miles near stream resulting from Grouse Spring with blocked inside ditchline and water flowing over the road surface. Approximately 0.5 miles near campground with significant inside ditch erosion, blocked ditchlines, causing water to flow over the road surface and resulting in rilling. Just above the entrance with Bateman Road, the inside ditchline is blocked, causing water to flow over the road and resulting in significant erosion. Solution: Convert to outsloping with rolling dips. **CORRECTED 2002**

29. Sunset Loop Road:
At entrance with Pipeline Road, first 300 feet has significant inside ditch erosion and discharge on to Pipeline Road. Solution: Drain with rolling dips. **CORRECTED 2000**

30. Butcher Gulch Road from Junction with Spur to Section Loop Road to Butcher Gulch Campground:
Significant inside ditch erosion down to the LDSF boundary. Off LDSF, no drainage structures and significant erosion for most of the stretch. The northern portion on LDSF is somewhat better but still needs drainage structures installed. Solution: Convert to outsloping with rolling dips. **CORRECTED 2000 (FOREST ROAD ONLY). Segment 30.1 was rocked in 2021 with segment 30.2 rocked in late summer of 2022.**

31. Sunset Gulch Spur off Sandow Road:
Recently graded but needs drainage structures installed; portions are throughcuts. Solution: Attempt to drain with rolling dips. **CORRECTED 2000**

32. Spur Located Between Sunset Loop and Butcher Gulch Road:
No drainage structures exist, and very active erosion is occurring on the steeper portions of this road. Solution: Drain with outsloping and rolling dips. **CORRECTED 2000**

33. Section Loop Road:
Eastern portion (0.25 miles) has both eroding inside ditchlines and blocked ditchlines causing water to actively rill the road surface down to White Fawn Road. Solution: Drain with outsloping and rolling dips. **CORRECTED under McMullen Mountain THP, 2-10-049SHA.**

34. Access Road:
The northern portion of the Access Road on the LDSF property needs drainage structures installed. Solution: Drain with outsloping and rolling dips. **CORRECTED 2000, Utilized and improved under the Boucher THP (2-17-054SHA), in 2019.**

35. Lee Marsh Gulch Road:
The fill for the culvert passing Lee Marsh Gulch is being exposed at each end and threatens the crossing. The first 1/8-mile is not drained and is causing erosion problems. Solution: Drain with outsloping and rolling dips. **CORRECTED 1999**

36. White Fawn Road Between the two Junctions with Section Loop:
Heavily eroding inside ditch for most of this stretch. Solution: Drain with outsloping and rolling dips. **CORRECTED under the McMullen Mountain THP, 2013 – 2014.**

37. White Fawn Road from Section Loop to Peavine Gulch Crossing:
To the east of White Fawn Gulch, very few culverts, and culverts that are present are generally blocked (this has not yet caused a serious erosion problem). Solution: Convert to outsloping and rolling dips. **CORRECTED under the McMullen Mountain THP, 2013 – 2014.**

38. Old Peavine Road Above White Fawn Road:
Improperly abandoned road. Peavine Gulch water diverted around a landing and erodes hillslope. Currently a bleeding sore. Solution: Reestablish the Class III drainage in its natural location, through the existing landing. **CORRECTED under the McMullen Mountain THP, 2013 – 2014.**

39. Cutter Road From Old Peavine Road to New Peavine Road:
Ditchline largely buried, water crosses road causing rilling. Solution: Convert to outsloping with rolling dips. **CORRECTED 1999**

40. New Peavine Road:
Lower 0.4 miles has heavily gullied inside ditchline. Insufficient number of culverts present, or those present are not working. Solution: Either install more cross drain culverts and repair existing ones or convert the road to outsloping with rolling dips (for the portion less than 8 percent gradient). **CORRECTED 1999, 2011**

41. Peavine Spur:
Last 0.1 mile has severe inside ditch erosion that enters the headwaters of White Fawn Gulch. Solution: Attempt to install either a culvert or rolling dip prior to the existing landing area. **CORRECTED 1999**

42. Rim Road From Junction with Bateman Road to Huckleberry Road:
Inside Ditch gully erosion last 0.1 mile before Huckleberry Road. Solution: Convert road to outsloping with rolling dips. **CORRECTED 1999, 2009**

43. Huckleberry Road from Junction with Rim Road to LDSF Boundary:
Severe inside ditch erosion for the 0.25 miles to the LDSF boundary. Solution: Convert road to outsloping with rolling dips. **CORRECTED 1999, 2011**

44. Huckleberry Road from LDSF Boundary to Old Cow Creek Campground:
Inside ditchline erosion for 0.4 miles south of the campground. Solution: Convert road to outsloping with rolling dips. **CORRECTED 1999. The road segment was further augmented in 2017 by the installation of a burrito crossing under the Mountain Cow THP 2-14-054-SHA.**

45. Old Cow Creek Road:
Just before fork, 0.1 miles undrained and actively rilling road surface immediately above Old Cow Creek. On the upper fork, west side, the road surface is severely gullied with direct access to a Class II tributary for about 0.25 miles. Portions of this road are a slight through cut. Solution: Either properly abandon this stretch of road, or make a serious effort to properly drain it, including possibly filling the through cut area and outsloping and installing rolling dips. **CORRECTED 1999**

Road system problems identified since 2003:

46. New Peavine Road
Between the intersection of the Bateman and the Cutter Road, there is gully erosion of the graveled surface and the gravel is being deposited at the outlet of the rolling dips. Solution: increase number of rolling dips and add larger rock within the rolling dips. **CORRECTED 2010 & 2011**

47. The Huckleberry tie-in Road There is gully erosion of the graveled surface and the gravel is being deposited at the outlet of the rolling dips and in a class III watercourse. Solution: Abandon the upper .25 miles of the road, install more rolling dips on the lower .25 miles and construct approximately 300 feet of new road tying the Huckleberry Road into the Bateman Road. **CORRECTED 2010**

48. Huckleberry Road
The segment of road located between the intersection of the Bateman Road and the intersection of the Huckleberry tie-in Road, has portions that are within the WLPZ of a Class II watercourse. Additionally, there is a failed Class II watercourse crossing on this road segment. Solution: Abandon the road construct the new road described above and approximately an additional 1600 feet of new road upslope connecting the Bateman Road to the Beaver Creek spur Road. **CORRECTED 2010**

49. Huckleberry Road (Duplicate of 20)
Between the intersection of the Huckleberry tie-in road and the Cutter Road, there is gully erosion of the graveled surface. The gravel is being deposited at the outlet of the rolling dips. Solution: increase number of rolling dips and add larger rock within the rolling dips. **CORRECTED 2011**

50. Bateman Road
An unclassified watercourse is intercepted by an inside road ditch and the water from snow melt it convey down the inside ditch to a cross drain culvert approximately 1000 feet away. The excess water is causing gully erosion and is the water is being discharged on to the Upper Bridge Road. Solution: Install a rock rolling dip where the unclassified watercourse naturally crossed the Bateman Road. **CORRECTED 2010**

51. Bateman Road
Approximately .25 miles of the Bateman Road, south of the intersection with South Cow Creek Road, is the low spot on the landscape and has no drainage off or across this road segment. This condition causes the ponding of snow melt on the Bateman Road and a prolonged saturation of the road, Solution: raise goad grade approximately 12 inches using crushed rock and install rock rolling dips excavate the outlets. **CORRECTED 2010**

52. Rim Road.
The first 600 feet of the Rim Road, starting at the intersection with the Huckleberry Road, is within the WLPZ of Bullhock Creek and remains saturated for a prolonged period during spring and early summer. The inside ditch of the road drains a meadow which is the head waters of Bullhock Creek. Solution: rock the segment of road with a minimum depth of six inches. **CORRECTED 2011**

53. Bateman Road
Inside ditch is draining spring water and conveying the water to a culvert at Grogan Gulch. Solution: Rock approximately 8000 feet of the Bateman Road to a minimum depth of 6 inches. **CORRECTED 2011.**

54. Section 24 Spur
A class III watercourse has been diverted into a roadside ditch to another class III watercourse crossing approximately 300 feet away. There has been significant deposition of eroded material within the roadside ditch causing potential diversion down the road. Solution: reestablish the class III watercourse into the original channel and install a rock ford watercourse crossing. **CORRECTED 2011**

55. LaTour Butte Road:
While no threat to water quality, moderate rilling has occurred from the southern property boundary of LDSF to the Beal Planning Watershed Boundary. Additionally, the brush has encroached onto road making passage difficult. Solution: remove the brush, outslope the road and install rolling dips where needed. **CORRECTED 2009 Additional work may be required this decade.; needs to be readdressed**

56. Bateman Road, Bullhock Creek crossing
The watercourse crossing consists of three round CMP culverts. Two culverts have a diameter of 30 inches, and one has a diameter of 24 inches. Solution: replace the existing three culverts with one arched CMP culvert with the equivalent size of a 72 inch diameter or greater round CMP culvert. **CORRECTED 2010. In 2017, the length of culvert installed in 2010 was deemed to be too short to maintain a safe road width for the snow groomer and was extended to maintain the necessary road width and mitigate the previous poor road alignment.**

57. Bateman Road from LDSF HQ to the Rim Road.
This segment of the Bateman Road has a flat to a crowned surface, with no effective drainage features. Storm runoff and snow melt is conveyed from the Rim Road south approximately 1600 feet and Is discharged into the headwaters of a Class III watercourse. Solution: Install rocked rolling dips where appropriate and excavate the outlets to allow for good drainage. **CORRECTED 2010**

Road system problems identified since 2016:

58. Winter Road Failure of segment of Middle Bridge and material transport to Lois Spur.
This segment of road had been evaluated in the fall, prior to the failure, in association with the completion of the Cable Cow THP. No concern of potential failure was apparent, and all drainage presented as functional prior to the 2016-2017 winter. A rain on snow event at the mid elevation band of forest resulted in a large quantity of water traveling down the surface of the road and discharging two feet prior to the roadside drain, resulting in a failure of the fill prism. The majority of the material was deposited onto the Lois Spur below. The road failure segment required moderate reconstruction for a linear distance of approximately 50 feet to make passable and an additional rolling drip was installed to avoid direct drainage to the previous failure site. **CORRECTED 2017**

59. Winter over topping of Beaver Creek Crossing (SC05)
This crossing over topped due to a debris blockage at the inlet. The over topping resulted in the erosion of approximately 25% of the downstream fill slope on creek's right. Repair required replacement of the fill and 12" plus rock armoring. **CORRECTED 2017.**

60. Winter plugging of Crossing (SC11) by debris and over topped.
This crossing over topped due to a debris blockage at the inlet. The over topping resulted in the water flowing down the road to the next hydrologic disconnection prior to flowing back into its original channel. Repair required the removal of the debris and installation of a critical drip. **CORRECTED 2017.** Long term solution will be to realign the road in the vicinity of the crossing.

61. Winter plugging of Crossing TU10.
This crossing over topped due to a debris blockage at the inlet. The over topping resulted in the water flowing down the road to the next hydrologic disconnection prior to flowing back into its original channel. Repair required the removal of the debris and installation of a critical drip. **CORRECTED 2017.** Long term solution will be upgrade the crossing on the next entry.

62. Light down cutting of existing landing. Solution is to increase the dip across the existing landing and armor the fill slope. **CORRECTED under the Boucher THP (2-17-054SHA), in 2019.**

63. Lee March Gulch Upper Crossing. Potential delivery from lack of adequate hydrologic disconnection. Solution: install hydrologic disconnection and critical dip.
CORRECTED under the Boucher THP (2-17-054SHA), in 2019.

64. Road abandonment, A small section of road approximately 500' of through cut design in located parallel to Lee March Gulch and drains to the crossing at point 65. Solution: abandon the road by improving the water bar at the top of the road segment and slash packing the through cut road prism down to the crossing.
CORRECTED 2019under the Boucher THP (2-17-054SHA).

65. Lee March Gulch Lower Crossing. Potential delivery from lack of adequate hydrologic disconnection. Solution: install hydrologic disconnection.
CORRECTED 2019under the Boucher THP (2-17-054SHA).

66. Atkins Creek Crossing. Potential scour and loss of road width on running surface over crossing. Solution is to install >12" rip rap in inlet and outlet fill slopes to return the running surface.
CORRECTED 2019 under the Boucher THP (2-17-054SHA).

67. Cutter Road, the native surface road was upgraded to install rolling dips and hydraulic disconnection and rolling dips. **CORRECTED 2017** The surface was additionally rocked.

68. Cutter Road Tie-through, the native surface road was upgraded to install rolling dips and additionally rocked. **CORRECTED in 2017.**

69. Sandow Spur Road, Crossing SDS2. The culvert was removed and upgraded to a 12" + rock ford with 4" rock surfacing on the approaches. **CORRECTED 2024 under Royston THP 2-19-0044 SHA.**

70. McMullen Mountain Road. The legacy through cut road design lacked sufficient drainage. 7 Rolling dips were installed, and the road was graded. **CORRECTED 2024 under Senapol THP 2-22-0020 SHA.**

71. Pipeline Road. Redundant In board ditch culvert PL-2, was removed and replaced with a rocked rolling dip. **CORRECTED 2024 under Senapol THP 2-22-0020 SHA.**

72. Pipeline Road. Crossing PL-03. The hydrologic disconnection was enhanced and a critical dip over the culvert was improved. **CORRECTED 2024 under Senapol THP 2-22-0020 SHA.**

73. Pipeline Road. Crossing PL-04. The existing culvert was upgraded to a 24" x 30' CMP with a mitered inlet. A critical dip installed immediately west of the crossing and the hydrologic disconnection was improved. **CORRECTED 2024 under Senapol THP 2-22-0020 SHA.**

74. Pipeline Road. Crossing PL-05. The existing culvert was removed and upgraded to a rolling dip. **CORRECTED 2024 under Senapol THP 2-22-0020 SHA.**

75. Pipeline Road. Three additional roading dips were installed west of Grouse springs to improve drainage. **CORRECTED 2024 under Senapol THP 2-22-0020 SHA.**

76. Pipeline Road. Crossing PL-12. Inboard ditch was cleared, and a critical dip was installed. **CORRECTED 2024 under Senapol THP 2-22-0020 SHA.**

77. Pipeline Road. Crossing PL-13. Installed critical dip and installed 12" + rock armor. Additionally, the road was rocked from PL-13 – PL-14. **CORRECTED 2024 under Senapol THP 2-22-0020 SHA.**

78. Tucker Road. Crossing TU-02. Vegetation on the crossing was removed the critical dip was improved by final grading. **CORRECTED 2024 under Senapol THP 2-22-0020 SHA.**

79. Sandow Road. Two additional roading dips were installed west of the intersection of Bateman to improve drainage. **CORRECTED 2024 under Senapol THP 2-22-0020 SHA.**

80. Sandow Road. The inside ditch between crossings 113 and 11-16 was reestablished. **CORRECTED 2024 under Senapol THP 2-22-0020 SHA.**

81. Butcher Gulch Road Spur. The road between Butcher Gulch Road and McMullen Road was rocked. **CORRECTED 2024 under Senapol THP 2-22-0020 SHA.**

82. Cutter Road. The native surface was upgraded to be rocked. **CORRECTED 2024 under Mountain Cow THP 2-14-054 SHA.**

82. White Fawn Road. WF05 "Install critical dip, needs hydrologic disconnect"

83. Peavine Spur. PS5 High diversion potential if plugged, no critical dip; "Install critical dip"

84. Rim Road Spur. SCS01 High diversion potential if plugged, no critical dip; "Install critical dip"

85. Middle Bridge Road. MB22 High diversion potential if plugged, no critical dip; "Install critical dip over crossing"

86. Butcher Gulch Road. BG7 High diversion potential if plugged, no critical dip; "Install critical dip"

87. Bateman Road Spur. 14-02 High diversion potential if plugged, no critical dip; "Install critical dip"; to be addressed under senapol

88. Butcher Gulch Road. BG03 High diversion potential if plugged, no critical dip; "Install critical dip"

89. Middle Bridge Road. MB16. High diversion potential if plugged, no critical dip

90. Peavine Spur. PS6 Immediate Action Needed; Install critical dip, clear debris in pipe

91. Peavine Spur. PS3 Clear inlet, clear outlet, install critical dip

92. Material build up in inside ditch, water cutting into road prism on downhill side. Excavate inside ditch/hill to widen road prism , key in 36"+ rock downslope, establish outside berm to prevent water from eroding fill slope and for public safety. **Completed under Senapol THP 2024**

93. Road Segment from intersection of McMullen and Pipeline rocked along pipeline to the east of PL-05 culvert(RP-11 in Senapol THP), which was removed and replaced with a rolling dip under the Senapol THP. **Completed 2025**

94. Road segment of butcher road from sunset loop to the Butch tie was reshaped and rocked to prevent riling. **Completed 2025**.

95. Crossing 15-06 had the inlet mitered, outlet rock armored and 4" clear rock added to the road surface of crossing under Senapol maintenance in **2025.**

96. Sec. 22 spur was rocked to the landing during the **2025** Drought mortality Exemption

97. Lower bridge road to be abandoned after Senapol THP harvesting has been completed.

The most immediate road-related water quality problems as identified by planning watershed are as follows (numbers correspond to the identified road issues described in this section), numbers in bold have been corrected:

Beal Planning Watershed

Highest-	**16**,**18**,**19**,**20**,**5**,**8**,**9**,**4**,**21**,**23**,**47, 58, 59, 60, 61**
Moderate-	**1**,**2**,**6**,**7**,**17**,**22, 25**, **27**, **28**,**43**,**48**,**50**,**51**,**52**
Least-	**3**,**4**,**5, 8, 9**,**10**, **11**,**12**,**13**,**21**,**23, 24, 26, 29**,**42**,**49**,**53**

Huckleberry Creek Planning Watershed

Highest-	**45**,**38**,**40**
Moderate-	**39**, **41**, **44**, **62**, **63**, **64**, **65**, **66**, **67, 68**
Least-	**37**,**46**

Atkins Creek Planning Watershed

Highest -	**35**,**36**,**30** (**30.1**, **30.2**)
Moderate-	33,**32**
Least-	**34**,**31**

Upper Battle Creek Planning Watershed

Highest-	15
Moderate-	**14, 54**
Least-	

Upper South Fork Bear Creek Planning Watershed

Highest-
Moderate-
Least- **55**

Implementation of the Road Management Plan since 2003 shows that most of the problems associated with the forest road system have been corrected or mitigated. The 2018 resurvey of the road system found that most crossings appear to be functioning as designed with little risk of sediment contribution to the watershed. The most common notations during the survey were to install critical dips and maintain/improve hydrologic disconnections.


LDSF Culvert Inventory
Collector *
(ie J. Poburko)
Poburko
Washburn
Rowe
Birkimer
Beers
Varga-Rosales
Rivera
Russel
Collection Date and Time
Friday, September 14, 2018
2:13 PM
Crossing ID *
(ALL CAPS)
Crossing Class *
Class I
Class II
Class III
Ditch Relief Culvert
Rocked Rolling Dip
Crossing Type *
CMPR (Round)
CMPV (Squashed)
CMPO (Open Bottom)
CMP ARCH
R Concrete Pipe
R Concrete Box
Corrugated Plastic Pipe
Previously Abandoned and Stablized
Bridge
Rocked Ford
Rocked Rolling Dip
Length in feet *
(round up to nearest 10')
Alignment *
Good
Poor
Entrance Type *
Projecting
Flush
Beleved Inlet
Trash Rack
Riser
Inlet Armour *
Is Inlet rock Armoured?
Yes
No
Outlet *
Flush
Shotguned
Downspout/overside drain
Outlet Armour *
Is Outfall slope Rock Armoured?

LDSF Culvert Inventory

Is Inlet rock Armoured?
- Yes
- No

Outlet *
- Flush
- Shotguned
- Downspout/overside drain

Outlet Armour *
Is Outfall slope Rock Armoured?
- Yes
- No

Outlet Surface Material *
- Rock
- Wood Debris
- Native Material

Erosion_Observed *
- Fill Erosion
- Gulleying
- None

Crushed Inlet *
Is the Inlet Crushed?
- Yes
- No

PipeRust *
Is rust line present?
- Yes
- No

Plugging Potential *
If blocked, conclude immediate action needed if you can't dig it out.
- None, (Clear)
- Dented > 5%
- Inlet blocked with material
- Outlet blocked with material

Diversion Potential if Plugged *
- High, no critical dip
- Medium
- Low (hydrologicly diconnected)

Rating *
- Acceptable
- Immediate Action Needed
- Annual Maintainence Pass Required
- Reevalaute in 5 years

Location *