LaTour Demonstration State Forest Management Plan

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California Department of Forestry and Fire Protection
The Resources Agency

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CERTIFICATION by REGISTERED PROFESSIONAL FORESTER

pursuant to
California Code of Regulations
Title 14, §1602.1

I, David J. Loveless, am responsible for the preparation of this Forest Management Plan for LaTour Demonstration State Forest.

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August 16, 2013
Date

APPROVAL of FOREST MANAGEMENT PLAN
for
LATOUR DEMONSTRATION STATE FOREST

Approved by vote of the Board of Forestry and Fire Protection

George Gentry, Executive Officer

Date

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I. INTRODUCTION

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

The California Department of Forestry and Fire Protection (Department or CAL FIRE) manages approximately 71,000 acres of Demonstration State Forests (DSFs), on behalf of the public. LaTour Demonstration State Forest (LDSF), a 9,033-acre mixed conifer forest located in the northern Sierra Nevada/southern Cascades, in Shasta County, 45 miles east of Redding, is the second largest DSF.

The majority of public wildlands in California are set aside as reserves and parks to preserve rare ecosystems. Demonstration State Forests, by contrast, are public lands that by legislative mandate have a unique and distinctly different purpose from parks and wilderness areas. Demonstration State Forests are mandated to conduct research, demonstration, and education on sustainable forestry practices. Demonstration State Forests are required to balance periodic timber harvest with public trust resource values such as recreation, watershed, wildlife, range and forage, fisheries, and aesthetic enjoyment.

While still one of the leading timber-producing States, California is also home to a very large population with strong interests in environmental protection. The Demonstration State Forests meet an important need to advance research and demonstration into sustainable forestry practices, in a State with a rapidly growing population that is placing increasing demands on forest lands for recreation, environmental protection and conversion to residential use. Given the often controversial role of timber production in California, the State Forests fill an important role in helping maintain California's leading role as an innovator in creating solutions to difficult and controversial environmental issues related to forest management.

This document contains a management plan for LDSF. The management plan describes the on-the-ground management activities planned on the Forest for the next five to ten years. It serves as a guide to Forest managers as well as a public disclosure of the management goals and direction on LDSF. It refers to, and should be interpreted in combination with the 2013 Option A Plan for the Forest, which contains a large landscape level strategic analysis of sustainable forest management on LDSF. Using a planning interval of 100 years, the Option A Plan establishes the long-term sustained yield for the Forest, taking into account biological and economic factors that may limit productivity due to constraints imposed from consideration of other forest values, including but not limited to, recreation, watershed, wildlife, range and forage, fisheries, regional economic vitality, employment and aesthetic enjoyment, as described in the Forest Practice Rules (FPRs), Title 14 California Code of Regulations (CCR) § 933.11(a).

A. Authority and Statutes

The legislative authority for the State Forest System is contained in Public Resources Code (PRC) §4631-4658. Guided by the statutes, the California Board of Forestry and Fire Protection (Board) establishes policy which governs LDSF and other state forests, and CAL FIRE is responsible for the management of all Demonstration State Forests. As per Board oversight policy, the LDSF staff operates under a management plan, which describes general goals and objectives, and provides guidance and direction for the managed use of forest resources with an emphasis on forest demonstration, research, recreation, maintenance of wildlife habitat, and water quality protection. The management plan is required pursuant to Public Resources Code (PRC) §4645 and Article 8 of Board policy.

Board policy states that the primary purpose of the state forest program is to conduct innovative demonstrations, experiments, and education in forest management. Many such projects are integrated into the production and harvesting of forest products. Timber harvesting is one of the mechanisms used to implement

and achieve the forest management goals and to aid and support the maintenance and enhancement of other non-timber resources.

In addition, the California Environmental Quality Act (CEQA) requires analysis of the potential environmental impacts of a forest management plan. This requirement is fulfilled by a Negative Declaration CEQA document prepared for and included with the LDSF management plan.

B. History of LDSF

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 it was essentially an unmanaged forest with very little previous harvesting and no management activities. Christmas tree sales were initiated on the Forest in 1946, the year of acquisition. The first manager was assigned in 1948 and forest management activities began with the first timber sale in 1951.

C. Management Goals

The following is a list of management goals for LDSF. Each project on LDSF shall 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, wildlife habitat requirements for various species that inhabit LDSF, and road management practices that result in reduced sediment. This information should be made available to the general 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, sensitive plants, 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 Best Management Practices (BMPs) 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, as per PRC 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 contamination of watercourses from road water runoff.

6. Continue an aggressive pest management program to decrease the spread of insects and disease in order to maintain tree mortality at a minimal level. 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 and to lessen the damage from wildfires, should they occur. Continue an aggressive vegetation management program using prescribed burns or other non-fire treatments to help reduce the hazard associated with dense vegetation wildfires.

8 Work toward maintaining the widest possible diversity of managed forest stands in different successional stages, in order to foster ecosystem resiliency and adaptability to climate change, and develop a laboratory of representative forest conditions across the landscape for research. Seek opportunities to maintain or increase functional wildlife habitat 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.

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 lands are managed primarily for timber production. Lands to the north are administered by W.M. Beaty and Associates (Beaty) with Sierra Pacific Industries (SPI) owning a portion of the land. Properties to the east are administered by LNF and Beaty. LNF and SPI own and administer lands to the south. Lands to the west are administered by Beaty and SPI (SPI lands previously owned by Roseburg Resources Company (RRC)).

C. Climate

LDSF has a Mediterranean type 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, Lyonsville, and Windy variant have lower timber site classifications, with Jiggs soils being the least productive.

Jiggs, Lyonsville, 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 drain small portions of the south side of LDSF. See Appendix for watershed map.

Old Cow Creek arises from Old Cow Creek and 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 acreage 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 Permanent 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, mixed conifer and true fir, found on LDSF. 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 include pit toilets, tables 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, and 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 late May through October. 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/office also used as a guest facility. 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 227,511 MBF (net 210,603 MBF) according to the Continuous Forest Inventory (CFI) plot re-measurements conducted in 2010. 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 169,430 MBF have been harvested from 1946 through 2012.

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 plots were installed per lot using a systematic grid. 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 are 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 will be reduced to eight (8) plots per 40-acre lot with re-measurement efforts prioritized and focused on those areas that have been altered through management activities, such as harvesting activities, 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, in order to maintain a current inventory database. By implementing a post-harvest inventory LDSF will be able to verify that we are accomplishing management objectives, such as retention of desired residual stocking levels that we are intending to achieve. Table 4 is a summary of current timber inventory conditions and Table 5 is a stand table, each reported on a per acre basis for the entire Forest.

While white fir has always been the dominant species on LDSF, it is becoming more dominant, both in terms of stems and merchantable volume, over time 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. And 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 valuable 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 this wildlife habitat element on LDSF.

The red fir species component is still showing signs of decline due to an on-going infestation of cytospora abietus (fir canker) along with sanitation-salvage harvesting of infected trees and poor regeneration success by both natural and artificial means. Those areas most heavily infected with cytospora fungus will be treated to eliminate the source and re-planted, where appropriate, with white fir and/or other species to halt the cycle of

infection. Fall planting trials will be conducted in the future followed by stocking surveys to evaluate survival rates.

Table 4. LDSF Current Inventory Conditions (Stock Table)*

Species	TPA	BA/acre	QMD	Volume BF/ac	Volume CF/ac
Bigleaf Maple	0.16	0.04	6.53	-	0.55
Black Oak	4.13	0.97	6.56	-	7.32
Canyon Live Oak	1.40	0.21	5.24	-	1.30
Douglas-fir	10.48	7.14	11.18	1,423	-
Incense Cedar	14.27	6.40	6.80	508	-
Jeffrey Pine	11.51	8.72	10.87	902	-
Lodgepole Pine	6.06	1.28	6.24	77	-
Mountain Hemlock	0.42	0.13	7.46	11	-
Other Conifers	0.06	0.00	3.07	-	-
Other Hardwoods	2.36	0.20	3.90	-	0.10
Ponderosa Pine	6.77	5.06	10.03	920	-
Pacific Yew	0.06	0.04	11.94	2	-
Red Fir	19.38	12.94	9.46	1,810	-
Sugar Pine	10.36	16.80	15.50	3,235	-
White Fir	194.37	112.40	9.01	16,310	-
Western White Pine	5.11	2.97	8.30	372	-
All Conifers	274.30	173.90	9.33	25,570	-
All Hardwoods	8.04	1.41	5.67	-	9.27
Total	**282.34**	**175.31**	**9.26**	**25,570**	**18.54**

*Based on 2010 TAI Plot Data, all trees > 1" DBH, 9,033 Total Acres

Table 5. LDSF Stand Table*

DBH	WF	RF	SP	DF	IC	PP	JP	WP	LP	OC	BO	OH
2	82.36	6.07	3.15	2.98	5.19	1.42	2.07	2.34	2.46	2.46	0.07	0.35
4	14.87	2.21	1.08	0.59	3.41	1.14	1.01	0.56	0.06	0.12	0.76	0.97
6	19.15	2.10	0.45	0.82	1.54	0.77	1.58	0.49	0.63	0.75	1.28	1.03
8	16.78	1.87	0.44	0.54	1.06	1.11	1.36	0.24	0.42	0.44	0.70	0.12
10	13.49	1.54	0.50	0.59	0.96	0.69	1.53	0.18	0.40	0.46	0.28	0.05
12	10.68	1.32	0.41	0.28	0.56	0.51	1.20	0.29	0.25	0.27	0.10	0.04
14	8.35	1.03	0.48	0.25	0.39	0.26	0.80	0.25	0.20	0.21	0.05	0.03
16	6.76	0.85	0.47	0.23	0.25	0.15	0.48	0.18	0.07	0.10	0.01	0.01
18	5.93	0.59	0.29	0.25	0.19	0.15	0.47	0.14	0.05	0.06	0.01	0.01
20	4.65	0.46	0.47	0.17	0.16	0.07	0.32	0.14	0.02	0.02	0.01	0.00
22	3.61	0.37	0.44	0.21	0.13	0.07	0.22	0.08	0.00	0.01	0.01	0.00
24	2.67	0.31	0.39	0.12	0.10	0.08	0.14	0.09	0.00	0.00	0.00	0.00
26	1.80	0.22	0.41	0.10	0.07	0.05	0.10	0.05	0.00	0.00	0.00	0.00
28	1.23	0.16	0.28	0.10	0.05	0.05	0.06	0.03	0.00	0.00	0.00	0.00
30	0.75	0.10	0.27	0.07	0.05	0.04	0.06	0.03	0.00	0.00	0.00	0.00
32	0.48	0.07	0.18	0.05	0.04	0.04	0.03	0.01	0.00	0.00	0.00	0.00
34	0.32	0.04	0.16	0.05	0.04	0.04	0.02	0.01	0.00	0.00	0.00	0.00
36	0.19	0.03	0.12	0.03	0.04	0.04	0.02	0.01	0.00	0.00	0.00	0.00
38	0.12	0.03	0.08	0.03	0.02	0.01	0.02	0.01	0.00	0.00	0.00	0.00
40	0.07	0.01	0.08	0.02	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00
42	0.05	0.00	0.06	0.02	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00
44	0.03	0.00	0.05	0.02	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00
46	0.02	0.00	0.04	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
48	0.01	0.00	0.03	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
50	0.01	0.00	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
52	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
54	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
62	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**194.37**	**19.38**	**10.36**	**7.59**	**14.27**	**6.77**	**11.51**	**5.11**	**4.56**	**4.90**	**3.28**	**2.61**

* Based on 2010 TAI Plot Data

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. Table 6 is a summary of acreage by site class by Section.

Table 6. LDSF Acreage by Site Class by Section

Section	I	II	III	IV	V	Non-Productive	Acreage
1	53	452	329	6			840
2	57	264	37				358
3	65	207	328				600
10	74	228	265	78			645
11	99	249	219	73			640
12	54	172	330	54		30	640
13	238	225	86	126			675
14	199	93	58	76		14	440
15	184	87	34	6		9	320
22	169	328	71	9		38	615
23	21	88	177	208	55	61	610
24		112	183	32	11	6	344
6		284	516	80			880
7		62	308	122	19	2	513
17	32	7	231	50			320
18	36	58	215	134	24	46	513
31		60	20				80
Total	1281	2976	3407	1054	109	206	9033
	14.2%	32.9%	37.7%	11.7%	1.2%	2.3%	100%

C. Growth

Annual growth rates are determined by computing the difference between two Continuous Forest Inventory measurement periods, for example 2005 and 2010, and dividing by the number of years between measurements. The gross growth includes both ingrowth and survivor growth (5 year growth on trees). Gross growth was 429 board feet per acre in 1970, and the 2005-2010 re-measurements indicate that the current annual gross growth rate is 614 board feet per productive acre (8,968 acres). The net growth between 1970 and 2010 increased significantly from 320 to 499 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 planned management on LDSF over the next five to ten years. The management goals for the Forest are described in terms of desired forest structural conditions. LDSF balances 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 program under this plan is expected to generate a moderate, perpetually sustainable harvest level. Harvest levels will support a financially viable timber management program in order to remain relevant as a research laboratory for sustainable forestry on private timberlands. Planned harvest levels are somewhat lower than that 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 the widest possible range of forest conditions in order to 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 and late seral stands 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 legislated mandate for the Forest emphasizes that of a working forest property for demonstration and research purposes, and directed towards serving a clientele of small to medium size landowners.

In order to remain relevant as a research forest, LDSF aims 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, we anticipate that the oldest trees on the Forest 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. We will also attempt to recruit large diameter snags (greater than 30 inches dbh) in stands if they are available and lacking. This will 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-successional forest definition. No stands meeting all criteria of the definition were found on LDSF. However, there are stands that contain all 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 components, snags and large down logs. Many areas throughout the Forest exhibit some of these functional characteristics. These attributes will continue to be retained and recruited wherever feasible. Forest stands currently considered late successional but less than 20 acres in size provide a valuable foundation for the recruitment of additional adjacent acreage into late successional forest conditions through management. In addition, the biological resources associated with late successional forests can also be enhanced and serve as is a demonstration opportunity by providing important habitat elements in other forest types as well.

Table 7 details the projected forest structure in size classes 5 and 6[(1)] based on the California Wildlife Habitat Relationships (CWHR) classification system (Mayer and Laudenslayer, 1988). These WHR classes have the potential to develop late successional characteristics, which can provide important habitat values. Table 8 illustrates the projected development of all CWHR forest structure classes over the 100-year planning horizon used in the Option A maximum sustained production (MSP) analysis for LDSF. Currently LDSF has about six percent of the Forest in CWHR size classes 5 and 6. Our projections indicate that within the next two decades, a large number of acres will move into CWHR size classes 5 and 6. At the end of the 100-year planning horizon, almost half of the acreage on LDSF will be in CWHR size classes 5 and 6. According to the model, it is reasonable to expect that a significant portion of this acreage may meet the BOF late successional definition.

It then follows that, even though late successional forest may be a modest portion of LDSF in the near term, the current forest structure distribution on LDSF is one that may produce a large number of acres of late successional forest over the next few decades. The management challenge on LDSF is not going to be one of cultivating late successional forest structure for the future. On 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 as well, in addition to the late successional forest stands that are predicted to develop and emerge over time. Management strategies for balancing the forests

[1]: CWHR 6 refers to multi-storied stands that contain a component of greater than 24 inches DBH trees, must contribute at least 25 percent to the canopy closure over CWHR size class 3 (6-11 inches DBH) trees and/or CWHR size class 4 (11-24 inches DBH) trees, with a canopy closure total of 60 percent or greater. CWHR size class 5 stands have a greater than 24 inches DBH on average (including all stems greater than 5 inches DBH, including hardwoods). CWHR “M” and “D” refers to moderate (40-59 percent) and dense (greater than 60 percent) canopy closure, respectively.

stand structure distribution will 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.

In the near term, late successional forest stands may be consolidated in discrete areas over time on LDSF by expanding the small stands that currently exhibit some late successional characteristics in order to develop stands that contain all of the functional characteristics necessary to meet the BOF definition for late succession forest stands. These late successional forest stands will fill an important research and demonstration role and will expand and complete the range of successional stages found on LDSF.

Table 7. Current and Projected Acreage of CWHR Size Classes 5 and 6

WHR	2005	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
BO6D	0	0	0	38	0	0	0	0	0	0	0
DF5D	0	0	0	0	0	0	0	9	118	46	52
DF5M	0	0	0	0	0	0	7	516	437	118	366
DF6D	0	0	0	0	0	0	116	7	57	57	57
IC6D	0	0	0	0	0	0	5	5	0	0	0
KM5D	0	0	0	0	10	47	122	395	335	157	107
KM5M	0	5	5	20	20	51	166	194	248	514	642
KM6D	218	111	343	465	863	498	500	190	138	58	7
LP5D	0	0	0	0	0	0	0	2	13	3	0
LP5M	0	0	0	0	0	9	9	9	9	31	51
MH5D	0	0	0	0	0	0	0	38	38	38	24
MH5M	0	0	0	0	0	0	0	0	16	16	54
MH6D	0	0	0	0	38	38	24	0	0	0	0
PP5D	0	0	0	0	0	0	24	40	24	97	86
PP5M	0	0	0	0	0	0	12	54	165	255	735
PP6D	0	12	0	81	114	96	140	323	718	689	682
RF5D	0	0	0	0	0	6	10	10	8	7	13
RF5M	0	0	0	5	20	17	17	17	63	70	66
RF6D	5	0	5	18	29	23	17	17	8	8	0
SP5D	0	0	0	0	0	0	1	1	0	10	0
SP5M	0	0	0	0	0	0	0	5	9	26	19
SP6D	0	0	0	0	0	1	11	0	13	0	0
WF5D	0	0	0	10	49	72	890	1,013	670	365	262
WF5M	11	12	23	48	85	377	314	418	752	1,075	911
WF6D	322	511	1,539	1,964	2,112	1,916	953	524	314	181	108
WP5M	0	0	0	0	0	0	0	5	5	8	8
WP6D	7	0	0	0	0	0	4	4	8	0	0
Total	564	651	1,915	2,647	3,340	3,149	3,342	3,796	4,162	3,826	4,248
Total, % of Forested Acreage([2])	6%	7%	21%	30%	37%	35%	37%	42%	46%	43%	47%

[2]: The total forested acreage currently on LaTour DSF is 8,968 acres.

Table 8. Projected CWHR Forest Structure Classes over the 100-Year Planning Interval

WHR	2005	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
BO3D	24	0	0	0	0	0	0	0	0	0	0
BO3S	16	16	0	0	0	0	0	0	0	0	0
BO4D	14	38	38	0	0	0	0	0	0	0	0
BO4P	0	0	16	16	0	0	0	0	0	0	0
BO6D	0	0	0	38	0	0	0	0	0	0	0
DF2D	0	0	0	407	0	0	0	0	0	0	0
DF2M	0	0	0	32	49	0	0	0	0	0	0
DF2P	0	0	439	49	0	0	0	0	0	0	0
DF3D	0	0	0	0	541	97	97	8	0	0	0
DF4D	0	0	0	0	0	541	434	81	72	0	0
DF4M	0	0	0	0	0	0	0	40	0	0	0
DF5D	0	0	0	0	0	0	0	9	118	46	52
DF5M	0	0	0	0	0	0	7	516	437	118	366
DF5P	0	0	0	0	0	0	0	8	15	477	230
DF5S	0	58	0	0	0	0	0	0	0	0	0
DF6D	0	0	0	0	0	0	116	7	57	57	57
IC3M	5	0	0	0	0	0	0	0	0	0	0
IC4D	0	0	5	5	5	5	0	0	0	0	0
IC4M	0	5	0	0	0	0	0	0	0	0	0
IC4P	7	7	0	0	0	14	14	14	14	0	0
IC5P	0	0	0	0	0	0	0	0	0	14	14
IC6D	0	0	0	0	0	0	5	5	0	0	0
KM2D	0	0	22	0	0	0	0	0	0	0	0
KM2M	0	0	0	17	0	0	0	0	0	0	0
KM2P	0	22	28	25	8	0	0	0	0	0	0
KM2S	0	0	25	0	0	0	0	0	0	0	0
KM3D	19	18	7	368	47	0	0	0	0	0	0
KM3M	35	10	0	11	0	0	0	0	0	0	0
KM4D	249	342	186	98	52	39	43	0	0	0	0
KM4M	257	228	291	159	166	119	27	165	136	136	0
KM4P	227	227	105	187	165	89	12	3	3	0	0
KM4S	40	73	66	34	0	66	66	0	0	0	0
KM5D	0	0	0	0	10	47	122	395	335	157	107
KM5M	0	5	5	20	20	51	166	194	248	514	642
KM5P	8	5	5	0	14	39	105	78	82	212	159
KM5S	0	0	0	0	0	50	55	112	97	88	158
KM6D	218	111	343	465	863	498	500	190	138	58	7
LP3P	2	0	0	0	0	0	0	0	0	0	0
LP3S	9	0	0	0	0	0	0	0	0	0	0
LP4D	0	0	0	0	11	2	2	0	0	0	0
LP4M	0	0	11	11	3	0	0	0	0	0	0
LP4P	0	2	0	0	0	2	2	0	0	0	0
LP4S	9	17	0	0	0	0	0	0	0	0	0
LP5D	0	0	0	0	0	0	0	2	13	3	0
LP5M	0	0	0	0	0	9	9	9	9	31	51
LP5P	0	0	0	0	0	5	5	8	8	4	4
LP5S	0	0	9	9	9	9	9	5	5	5	5
MH4M	0	0	0	0	22	0	31	23	8	0	0

Table 8. Projected CWHR Forest Structure Classes over the 100-Year Planning Interval (cont..)

WHR	2005	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
MH4P	0	0	0	22	16	31	0	0	0	0	0
MH5D	0	0	0	0	0	0	0	38	38	38	24
MH5M	0	0	0	0	0	0	0	0	16	16	54
MH6D	0	0	0	0	38	38	24	0	0	0	0
PP1S	0	0	3	12	3	15	3	7	3	8	3
PP2D	0	0	0	232	481	220	314	215	326	216	159
PP2M	0	12	27	60	49	31	55	31	26	32	37
PP2P	0	483	36	6	33	6	33	2	31	4	27
PP2S	0	0	343	591	329	422	323	358	319	237	294
PP3D	0	0	368	160	480	789	526	606	444	542	455
PP3M	0	6	155	152	0	16	0	5	0	0	0
PP3P	22	16	0	0	0	0	0	0	0	0	0
PP3S	369	0	0	0	0	0	0	0	0	0	0
PP4D	58	52	65	45	182	335	885	753	811	690	779
PP4M	48	84	53	17	30	187	11	250	165	322	238
PP4P	32	11	0	13	0	10	0	5	0	78	0
PP4S	152	0	9	9	0	0	0	0	0	0	0
PP5D	0	0	0	0	0	0	24	40	24	97	86
PP5M	0	0	0	0	0	0	12	54	165	255	735
PP5P	0	0	0	0	0	356	361	72	35	103	102
PP5S	0	0	0	0	9	9	9	348	350	373	373
PP6D	0	12	0	81	114	96	140	323	718	689	682
RF3M	24	0	0	0	0	0	0	0	0	0	0
RF3P	0	19	0	0	0	0	0	0	0	0	0
RF3S	17	6	0	0	0	0	0	0	0	0	0
RF4D	22	26	31	18	0	1	0	0	0	0	0
RF4M	24	25	23	21	22	8	16	12	8	0	0
RF4P	24	38	50	141	95	32	26	4	0	8	0
RF4S	102	100	77	9	0	29	0	33	20	16	0
RF5D	0	0	0	0	0	6	10	10	8	7	13
RF5M	0	0	0	5	20	17	17	17	63	70	66
RF5P	0	0	0	2	15	88	83	70	84	72	130
RF5S	0	0	13	13	11	5	13	61	72	87	117
RF6D	5	0	5	18	29	23	17	17	8	8	0
SP4D	0	0	0	1	1	0	0	0	0	0	0
SP4M	0	0	0	0	0	0	0	11	0	11	11
SP4P	0	0	0	4	0	0	0	0	0	0	0
SP5D	0	0	0	0	0	0	1	1	0	10	0
SP5M	0	0	0	0	0	0	0	5	9	26	19
SP5P	0	0	0	8	12	6	11	1	22	0	30
SP5S	0	2	2	2	2	7	2	7	2	13	9
SP6D	0	0	0	0	0	1	11	0	13	0	0
WF2D	0	0	21	16	0	0	0	0	0	0	0
WF2M	0	0	0	85	16	0	0	0	0	0	0
WF2P	0	3	3	16	0	0	0	0	0	0	0
WF2S	0	5	121	11	0	0	0	0	0	0	3
WF3D	108	80	43	21	37	6	0	0	0	0	0

Table 8. Projected CWHR Forest Structure Classes over the 100-Year Planning Interval (cont..)

WHR	2005	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100
WF3M	53	63	25	6	0	0	0	0	0	0	0
WF3P	10	16	0	5	0	0	0	0	0	0	0
WF3S	17	0	5	3	0	0	0	0	0	0	0
WF4D	3,000	1,976	1,279	631	95	103	36	3	0	0	4
WF4M	1,996	2,058	1,397	1,106	1,020	319	416	191	88	84	48
WF4P	480	541	366	478	421	596	149	249	38	28	34
WF4S	283	178	93	5	0	20	0	0	0	4	4
WF5D	0	0	0	10	49	72	890	1,013	670	365	262
WF5M	11	12	23	48	85	377	314	418	752	1,075	911
WF5P	23	34	83	187	318	357	721	592	862	558	452
WF5S	15	26	43	86	95	113	113	194	227	216	380
WF6D	322	511	1,539	1,964	2,112	1,916	953	524	314	181	108
WP3D	4	0	0	0	0	0	0	0	0	0	0
WP3P	0	3	0	0	0	0	0	0	0	0	0
WP3S	3	0	0	0	0	0	0	0	0	0	0
WP4D	0	4	4	4	4	4	3	3	0	0	0
WP4M	0	7	7	15	15	8	12	0	0	0	0
WP4P	5	5	8	0	0	7	0	7	7	0	0
WP4S	0	7	7	15	7	7	7	0	0	0	0
WP5M	0	0	0	0	0	0	0	5	5	8	8
WP5P	0	0	0	0	0	0	0	0	0	7	13
WP5S	0	0	0	0	9	9	9	15	15	15	9
WP6D	7	0	0	0	0	0	4	4	8	0	0
XX4S	32	0	0	0	0	0	0	0	0	0	0
XX5P	0	0	0	0	0	0	0	0	4	0	0
XX5S	11	9	9	7	7	5	0	2	2	0	4
< 10%[(3)]	553	1,357	1,035	660	728	588	592	522	409	486	437
Total	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968	8,968

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. As a result, LDSF has returned to a

[3]: These are areas that have less than 10 percent canopy cover, and as such do not fit into any standard CWHR category.

primarily uneven-aged management approach. Even-aged management will be used as needed for research, demonstrations, insects and disease mortality areas, and in unforeseen situations such as stand rehabilitation following wildfires.

Uneven-aged management will be utilized for the mixed conifer stands, which are generally comprised of a wide range of age and size classes. The silvicultural systems to be utilized in these stand types will primarily include selection and group selection regeneration methods. Openings created by harvesting will use natural regeneration or artificial regeneration if necessary, to ensure that they are successfully regenerated. To maintain species diversity within the mixed conifer stands, larger openings will be created to promote pine regeneration rather than the more shade tolerant true fir species. During timber marking activities for harvest, pine species will be favored to leave as a seed source in order to recruit more pine regeneration. Artificial regeneration may be necessary at times due to poor cone crops or a lack of viable seed or preferred pine seed source.

Uneven-aged management, primarily group selection with some commercial thinning will be utilized in the true fir stands. Many of these stands consist of dense young-growth that primarily occurs naturally above 5,500 feet. These stands are, for the most part, 75 to 95 years old with diameter's ranging from 12 to 20 inches. The intent of these silvicultural systems is to improve individual tree growth and stand health, and to promote regeneration. This management strategy began in 1982. Most stands of this type and of commercial size have been thinned by the completion of the third cutting cycle in 2010.

Clearcutting will be utilized in a few instances where chronic disease or insect infestations have severely damaged stands or for research purposes. As described previously, red fir on LDSF is very susceptible to infection by dwarf mistletoe and cytospora. 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 will be clearcut over a period of time, taking into consideration adjacency constraints, and artificially regenerated with white fir or other appropriate species in order to reduce the prevalence and impact from these diseases.

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

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

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

Sanitation-Salvage (Intermediate): Sanitation is the removal of insect attacked or diseased trees in order to maintain or improve the health of the stand. Salvage is the removal of only those trees which are dead, dying, or deteriorating, because of damage from fire, wind, insects, disease, flood, or other injurious agent. Salvage provides for the economic recovery of trees prior to a total loss of their wood product value. These methods will 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 will be used for the purposes of restoring and enhancing the productivity of any forest land on LDSF which do not meet the stocking standards as defined in the California Forest Practice Rules.

Fuelbreak/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.

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.

Clearcutting (even-aged): This prescription will only be utilized in connection with natural catastrophic events such as fire, severe disease or insect damaged areas, windthrow, or for research purposes such as regeneration treatments under even-aged silvicultural systems. Red fir on LDSF is very susceptible to infection by dwarf mistletoe and *cytospora*. There are a few scattered pockets of dense young red fir stands heavily damaged by these diseases and exhibiting high mortality rates. In order to control the repeated cycle of infection, these stands will be clearcut and artificially regenerated with appropriate species that are less susceptible to these diseases.

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.

Alternative Prescriptions: An alternative prescription will 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 will also take place for research and demonstration purposes, to allow for experimentation with alternative means of forest regeneration. Ponderosa pine and Douglas-fir nursery stock are the most commonly planted conifer species on LDSF. 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.

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 will be entered approximately 15-20 years after the previous entry. The shorter cutting cycle is 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. Stands will not be harvested more frequently than 10 years after the previous entry, except in the case of emergencies and salvage operations.

Table 9. Modeled Acres by Silvicultural Prescription for the 100-Year Planning Interval

	Decade									
Prescription	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**	**2080**	**2090**	**2100**
Group sel. (openings)	377	598	376	432	377	364	379	251	332	266
Selection	1381	266	686	393	761	393	752	454	768	511
Commercial Thin	590	100	1509	122	1468	122	1470	122	1781	122
Sanitation/salvage	302	24	214	24	213	13	219	24	213	65
Rehabilitation	40									
Fuelbreak	83		35	70	35	73	35	77	35	69
Shelterwood	202	0	0	0	0	0	0	0	0	0
Seed Tree	140									
Clearcut	15	0	29	0	32	0	27	0	22	0
Variable Retention	80	61	0	0	0	0	0	0	0	0
Total	3210	1049	2849	1040	2886	965	2882	927	3152	1033

Table 9 describes the results of the computer model projections for calculating the long term sustained yield. Computer models, by necessity, are abstractions of reality that capture average trends but have limited ability to represent the variations around these averages that occur on individual sites. The results in the table do not represent site-specific commitments to silvicultural treatments for implementation. Rather, they are included here to allow reviewers to validate the reasonableness of the computer model projections.

Given the mature and over-mature forest conditions found on most of the Forest with respect to the culmination of mean annual increment, the LTSY constraint was a binding restriction on decadal harvests.

The result of the modeling is a conservative harvest schedule. Harvest is less than growth in every 10-year period. Going forward, the intent is to adjust growth projections and silviculture as we implement and monitor the plan through time.

G. Sustainable Harvest Levels

Based on the approves Option A, the long-term sustained yield (LTSY) is 5.51 million board feet per year, or 615 board feet per acre per year . The corresponding near-term sustainable harvest level through 2014 is 4.1 million board feet per year, or 467 board feet per acre per year. Based on the inventory derived from the 2010 CFI plot remeasurements, this constitutes a harvest intensity of about 1.9 percent of the current inventory. Comparatively, the theoretical LTSY for LDSF if it were managed for maximum sustainable fiber production would be approximately 7 million board feet per year, or 800 board feet per acre per year. Current measured growth on the Forest is 499 net board feet per acre per year, based on the 2010 CFI plot remeasurements.

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 annual timber sale agreements. When areas are harvested, the operator is required to grade the roads they use. 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 will continue to maintain all roads in serviceable condition and to prevent road related erosion and sediment transport. This will be accomplished by adhering to LDSF Road Management Plan and maintaining and updating the road system database (See LDSF Road Management Plan in Appendix).

I. Harvest Methods

The primary logging system utilized on LDSF has been tractor logging. Other systems include cable logging, helicopter and animal logging. Generally cable logging and helicopter logging will be utilized on slopes in excess of 50 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 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 will be utilized for future harvests. When skid trails are laid out and constructed in area not previously logged they are 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 Resource Company, or Collins Pine Company.

Table 10. Forest Product Mills Near LDSF

Name	Location	Production (mmbf)
Colllins Pine Company	Chester	77
Roseburg Resource Company	Weed	75
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. To date, through 2012, over 104,224 Christmas trees have been harvested.

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 low 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 today for Christmas tree harvesting will also eventually become productive mature timber stands. These areas largely consist of dense stands of natural regeneration in which selected trees are removed in order 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 will 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 2013 and 2018 will be no greater than the sustainable harvest levels established in the Option A plan, approximately 21 million board feet. Timber harvesting activities will 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 demonstrations needs.

M. Plantation Management

LDSF currently has approximately 620 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. The management of these plantations will vary, depending upon the plantation age, stocking level, and health of the trees. Management activities will include pre-commercial thinning, 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, improve regeneration and biological diversity. Selection and group selection will be the primary silvicultural methods used.

2. Manage mixed conifer stands to increase growth on residual trees, improve regeneration and biological diversity. Pine species will be the preferred leave species to help increase pine regeneration.

3. Uneven-aged management will be the primary management strategy. Even-aged management will be used as needed for research, demonstrations, insects 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 below the allowable decadal harvest levels in the 2007 LDSF Option A plan. Timber harvesting activities will occur primarily in the Beal, Upper Battle Creek, and Huckleberry Watersheds, but they may also occur elsewhere on the Forest.

6. Maintain all roads in serviceable conditions and adhere to 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. We anticipate that riparian areas will be a fertile area for future research on the Forest. Management in and near these areas will 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 “Threatened and Impaired Watersheds” 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 will 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 general guidelines for watershed and fisheries resources will be adhered to on LDSF:

1) Maintain conifer and hardwood trees in buffer zones along all watercourses and around all springs in order to lower water temperature, or prevent increases in water temperature.
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 levels described in the Option A document. Commonly used estimates of sedimentation rates attributable to timber operations do not take into account 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 to be implemented over the next several years include rocking main roads as needed, replacing culverts at risk of failure with larger culverts and outsloping road segments with rolling dips. Where necessary, the existing road system will be upgraded.

   Each timber harvesting operation will be evaluated with regard to 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 are no known threatened or endangered species inhabiting LDSF. Peregrine falcons and bald eagles have been occasionally observed. Mountain lions are occasionally observed as well.

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 the Forest. The primary species hunted is deer with the occasional hunting of gray squirrels, mountain quail, turkey, blue grouse, and black bear.

Although no threatened or endangered terrestrial species have been confirmed to occur on LDSF, ongoing monitoring and research will be performed to detect special-status species. Monitoring will include keeping current with state and federal lists as well as conducting periodic floral and faunal surveys. Inventories will emphasize special status species expected to be present but not yet observed as well as those currently known to exist or occur on LDSF.

We will work to restore, maintain, or enhance occurrence of special habitat elements and unique habitats to promote species diversity and habitat quality. Measures to achieve this 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 of natural ponds and springs,
4) Riparian zone protection and restoration,

5) Retention of late-successional forest conditions in the near term, and consolidation of late successional forest conditions in the long 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.

We will incorporate control or eradication of exotic plant species into management activities, as opportunities are identified.

C. Prescribed Burning

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

The primary brush species comprising the brush fields on the better timber sites is chinquapin (*Castanopsis sempervirens*). Once the brush has been treated the areas will then be planted with conifer seedlings. Conifer species selection 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. These stands should be underburned to reduce the fire hazard.

Underburning will be designed to reduce the fuel loading by disposing of fuels. 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 can then be adjusted as necessary and then prescribed on a larger scale if proven successful.

Management Objectives

1. Reduce the fire hazard on LDSF.

2. Improve the 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. Archaeological Resources

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 are reminded to remain alert for potential archaeological finds while performing regular tasks.

It is believed that the 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. Whenever any artifacts are found they will be collected or protected, noted on a map, and a CAL FIRE archaeologist will be notified.

If an archaeological site is found, it will be protected as required by the Forest Practice Rules. Any significant sites will be mapped, recorded and, if needed, studied. The CAL FIRE archaeologists will be notified of any finds. All permanent LDSF personnel will be given archaeological training and be alert for potential archaeological resources.

E. Range Resources

The range resource on LDSF is essentially transitory due to timber operations with the exception of meadow areas. Timber operations create holes in which grasses and forbs may increase for a short time until the tree canopy closes again. Meadow areas with grasses and forbs are decreasing due to tree encroachment. This trend is being reversed with meadow restoration work by removing the encroaching trees.

The primary user of the range resource is wildlife. While grazing by livestock is discouraged, Shasta County is an open range county. To keep livestock out, fences would have to be built. While casual use by livestock that drift in from adjacent lands does occur on the Forest, this use is minor. However, it does create problems such as degradation of stream banks in certain areas along Atkins Creek, South Cow Creek and South Cow Creek Meadow, and Old Cow Creek.

F. 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. The California Air Resources Board was tasked with obtaining compliance with the cap through regulatory and market approaches. Planning is currently underway and definitive decisions by the Board have not yet been taken, however, it appears that forests will play a significant role in non-regulated strategies to meet targets. This is anticipated to occur both as offsets within a cap and trade system and through voluntary measures.

Recognized strategies to mitigate GHG emissions and enhance terrestrial sequestration include reforestation, forest management and fuels treatments to avoid catastrophic losses. LDSF will contribute to the targets of AB32 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 Forest are anticipated to increase over time. For example, the Option A Plan indicates that the gross timber inventory on the Forest will increase from about 22.7 MBF per acre in 2005 to 34.4 MBF per acre in 2105. Given the current gross timber inventory of 25.2 MBF per acre, based on the 2010 CFI data, the Forest is well on the way to meeting this projected target.

Forest products produced from LDSF will sequester carbon during their life cycle. Biomass fuels produced on the Forest also provide an opportunity to replace fossil fuels with an alternative energy source that is considered carbon neutral.

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 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 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 is the fir canker (*Cytospora abietis*). *Cytospora* infects red fir on LDSF and has caused substantial degradation and mortality in some stands. The clearcuts that have been conducted and are planned for the future focus primarily on stands of red fir heavily infected and dying. Stands that have not become heavily infected are those that have been thinned and/or are isolated from the disease and growing well.

Another disease causing problems primarily in sapling size trees is blister rust (*Cronartium ribicola*). Blister rust infections have been on the increase the last five years 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. 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 in order to capture the mortality and to prevent further spread of the 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 have to be protected from deer or they sustain heavy browse damage and mortality. Vexar tubing is currently used to protect the seedlings from deer browse however 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 safe and defense 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 easily available for fire control as well. Fuel breaks have also been constructed and maintained in critical and strategic areas.

The Shasta-Trinity Unit Chief is responsible for fire protection on LDSF. The LDSF staff responds to fires on LDSF and assists unit personnel. In addition, the staff regularly contacts campers and other people using LDSF for recreational purposes and reminds them to be cautious with fire.

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

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 fuelbreaks are planned along McMullin Mountain, the Cutter Tie-in, and the Rim Roads.

VI. RESEARCH AND DEMONSTRATION

A. Background

Section 5061 of the Resource Management Procedures Handbook states that "State forests have been established to furnish land for needed investigation, demonstrations, and education in such things as the economic feasibility of artificial reforestation, good forest practices, maintenance of forestland in a productive condition, study of effects of improved cutting methods, proper management and harvesting methods, and economical forest management".

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 personnel.

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. The most recent silvicultural 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. Future harvests will include helicopter, cable logging, tractor and mechanized systems for biomass thinning when economically viable.

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. 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:

Carbon Sequestration Project – LDSF, in cooperation with WESTCARB, are 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, is conducting an annual survey of avain 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. The results are to be published in Tree Notes, Cal Fire publication.

Continuous Forest Inventory (CFI) – Two hundred and twenty-one (221) permanent CFI plots were established in 1965 with re-measurement every 5 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.

Blister Rust Study - Sapling size western white pine trees infected with blister rust are being monitored to evaluate the effects of blister rust infections on western white pine. The intent of the cooperative (CAL FIRE/USFS) blister rust program is to identify mature resistant sugar pine and western white pine. Western white pine was subsequently dropped from the study; therefore the monitoring of western white pine at LDSF was suspended.

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

Blister Rust Resistance in Sugar and Western White Pine – This is a genetic study, testing sugar pine and western white pine seedlings to find blister rust resistant parent trees. This is an on-going project with out-plantings at the Happy Camp Disease Garden. Paul Stover, USFS. Note: this long term study did not include western white pine.

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.

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 will be monitored for sediment transport by the installation of silt fences.

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 was completed in 2012, with piles burned the fall of that year. The prescription covered approximately 50 acres. The area will be 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.

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.

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, 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.

Planned Future Research Projects

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

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

Watershed Monitoring Project – This project was carried out by the Sacramento Watersheds Action Group in 2001. A follow-up project is proposed to re-evaluate all watercourses on LDSF as funds allow. The results shall be compared to the 2001 baseline information.

Revise the "Annotated Species List of Terrestrial Vertebrates on LDSF", conducted by Barrett in 1995. The results shall be compared to the 2001 baseline information.

Small Mammal Study – This study, initially proposed to be conducted in conjunction with the CDF&W, is intended to evaluate the effects of Group Selection timber harvest silvicultural practices on biological diversity of small bird and mammal populations in forested systems; and to support forest managers and policy makers in assessing cumulative effects of this silvicultural practice. The research project is currently on-hold due to CDF&W funding and personnel issues. A replacement principle research partner is being sought.

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.

Economical 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.

C. Management Objectives

1. All ongoing studies should be carried out to completion. Final reports will 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. Follow up with researchers to ensure publication of results.

2. Encourage the permanent staff to be alert for potential studies and initiate studies whenever possible. Seek advice from research institutions and forest managers on potential studies that could be conducted.

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

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

D. Five-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 five years and resource requirements.

Research 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 available barracks, including bunks and kitchen facilities, at LDSF headquarters.

This will be an ongoing function of LDSF staff that will include routine maintenance, materials for minor building repairs, necessary supplies including propane, diesel, and cleaning supplies. Estimated cost is $5,000 annually.

Objective: Collect, organize, and store data on tree and plant inventories; wildlife and fish inventories; and soil, geologic, meteorological, and watershed data so that 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 of these will be updated on a schedule such that the CFI is re-measured every 5 years and a portion of the TAI data is collected each year, with the goal of a complete TAI every 10 years. Significant LDSF staff time is allocated to collecting and managing this data. Both of these inventories will be periodically reviewed for appropriateness and efficiency by LDSF staff and State Forests Biometrician and Research Coordinator.

A water monitoring station is proposed for installation on South Cow Creek to monitor water quality and quantity as part of the proposed VTAC project described under “Ongoing Research Projects” above. The groundwork (foundation) has also been prepared and equipment purchased for the installation of a weather station to be located on Table Mountain in 2013.

Documents relating to historical inventories of any of the above elements will be scanned so that they are available via either CD or the state forests web site. Raw data sets (Access database files) will 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 will be maintained. Both the CFI and the TAI databases will retain historical data as well as current data. The CFI database will contain all measurements back to its inception in 1965. User’s guides and cruise procedures will be made available for these databases as a key to the database fields.

GIS data layers will 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 will be available by request on CD or on the state forests web site.

A key to all of these resources will be maintained. This list will be searchable by keyword, title, and author.

Research Infrastructure Costs: The TAI and CFI data collection is part of the ongoing operational cost of LDSF. The water monitoring and weather stations will be funded from research funds from Sacramento and are estimated to be no more than $80,000 total. Ongoing maintenance and data collection will be the responsibility of LDSF; estimated annual costs are $3,000 plus LDSF staff time.

The State Forests Publications Coordinator in Sacramento will scan research documents. Data set organization and key definitions will be the responsibility of the Research Coordinator in Sacramento in cooperation with the LDSF staff.

The CFI and TAI database development, maintenance and support will be the responsibility of Sacramento. Data entry is the responsibility of LDSF. LDSF will maintain a key to all of these resources with assistance from Sacramento 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 single tree selection so that practical implementation issues and multi-resource implications may be examined.

Demonstration areas that may also be used for research will be installed on LDSF. Two or more levels of residual stocking, for each silvicultural method, will be demonstrated. Unit sizes will be selected so as to maximize the multi-disciplinary research opportunities. But this must be balanced against the fact that this is a long-term study and we wish to minimize the impact on future research opportunities for other studies. Control unit(s) will also be identified. Records will 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. Depending on the applicability, costs for multi-disciplinary investigations could cost the Sacramento research fund up to $100,000 per decade.

Research targeted at regeneration units within group selection areas, or even-aged management areas where they occur, will be encouraged. This research will 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 will be retained, as will 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 will increase due to information tracking requirements. Road improvement funds from Sacramento must be fully funded.

The late seral study will require both LDSF and Sacramento staff's time to initiate and track. Additional inventory work may be necessary to ensure habitat elements are sampled intensively enough for proper analysis. This would require additional LDSF staff time. Depending on the applicability, costs for multi-disciplinary investigations could cost the Sacramento research fund up to $50,000 per decade.

These projects will 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 is accomplished through papers, articles, presentations, tours and the web.

Objective: Research results from LDSF are provided to customers.

Each project will be evaluated as to the most appropriate outlet for dissemination. The following table provides some guidance.

Table 11. Guidelines for Publications

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

The CAL FIRE publications will be distributed to appropriate libraries in the State. Relevant abstract publishers will be asked to include references to these publications. Search engines will be contacted with the link to the web site and it will be advertised in applicable publications.

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

This will be facilitated by the California Demonstration State Forests web site, which will be linked to the CAL FIRE web site. Past and current project reports and publications will be available, as will data sets. This will encourage building on past projects and using multidisciplinary approaches when researchers are developing proposals.

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

Many of the outreach costs are borne over the entire Demonstration State Forests system, such as the web site or newsletter. This assumes that the biometrician, research coordinator and publications coordinator positions in Sacramento are fully staffed and that operating funds are available. At least $10,000 per year will be needed in Sacramento to fund publishing costs.

Conclusion

This five-year research and demonstration plan for LDSF provides a direction for the continued success of LDSF. Added interest and growth in demonstrations and experiments will result from the attention given to research infrastructure and outreach. The specific demonstration projects outlined above will 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 eight camping sites located near streams on LDSF. See Appendix Page 69 for a map showing campground locations. The only developments currently in the campsites are tables, pit toilets and fire pits. In the summer of 2002 potable water will be piped into 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 June 1 to November 15. During the remaining portions of the year, access is restricted due to snow conditions.

The Lassen National Forest (LNF) grooms approximately 30 miles of roads on LDSF and an additional 30+ miles of road 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 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.

The location and the 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. As the burn area becomes less attractive for hunting, the demand for campsites in this area may diminish.

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 can be developed. Additional campsites can 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 can also be evaluated for feasibility and construction cost for development when funds become available.

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. 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.

C. Management Objectives

1. Existing facilities will be maintained and any hazards identified.

2. Evaluate the usage of campsites annually. Expand 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.

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.

CDF, 2007. LaTour Demonstration State Forest Option A plan. California Department of Forestry and Fire Protection, Redding, California. 246 p.

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.

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.

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.

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, Calilfornia. 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

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

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
	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 gentilis*	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

	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
	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

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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

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CARNIVORIDAE (Carnivores)

FAMILY	*GENERIC NAME*	*COMMON NAME*	*REMARKS*
Canidae (Coyote, Foxes)	*Canis latrans*	Coyote	r
	Urocyon cinereoargenteus	Grey fox	r
	Vulpes vulpes	Red fox	r
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

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BOVIDAE

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

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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

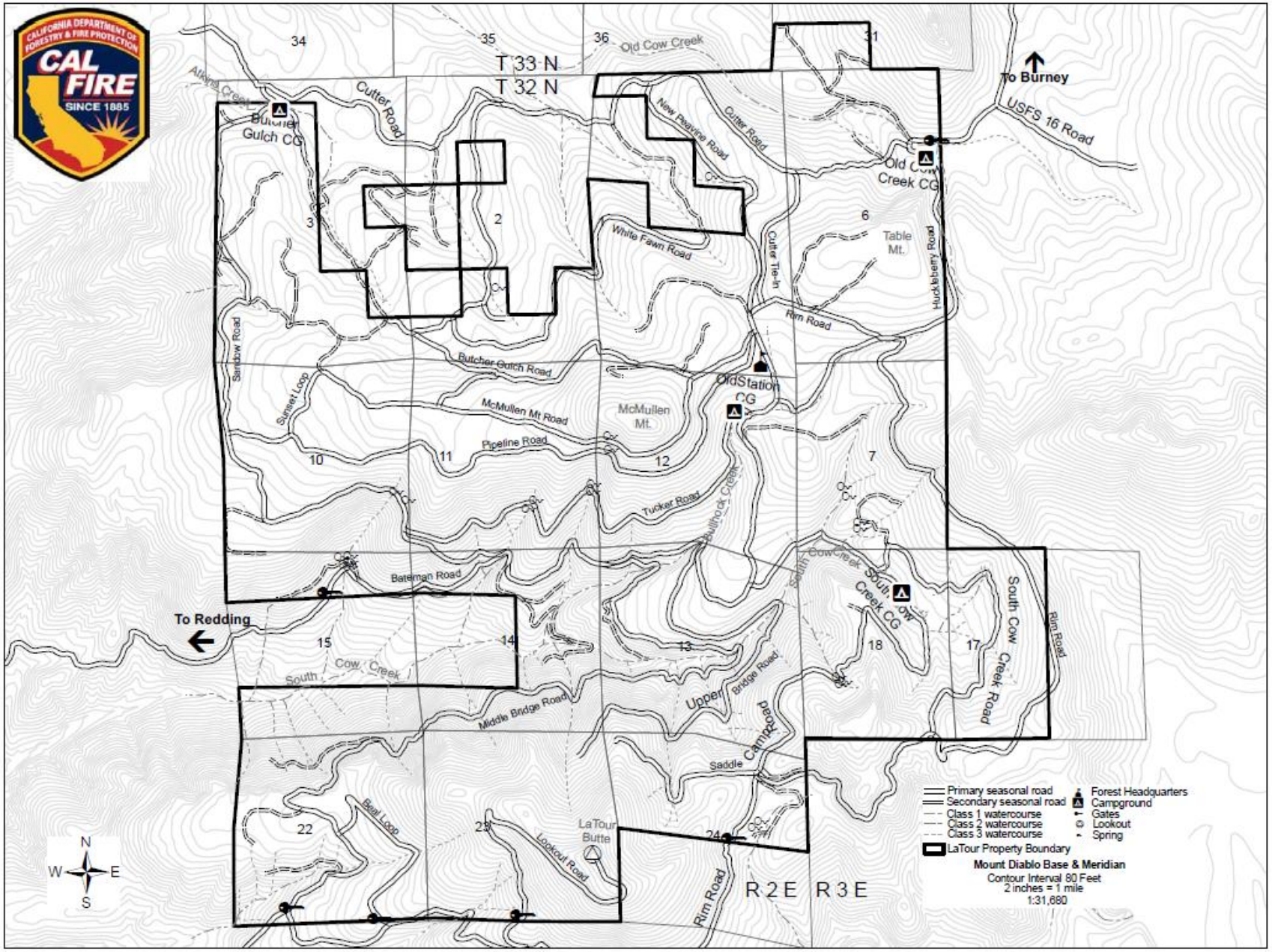
MISTLETOES

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. califorincium	Sugar pine dwarf mistletoe
	A. americanum	Lodgepole pine dwarf mistletoe
	A. douglasii	Douglas-fir dwarf mistletoe
	Phoradendron juniperinum ssp libocedri	Incense cedar mistletoe

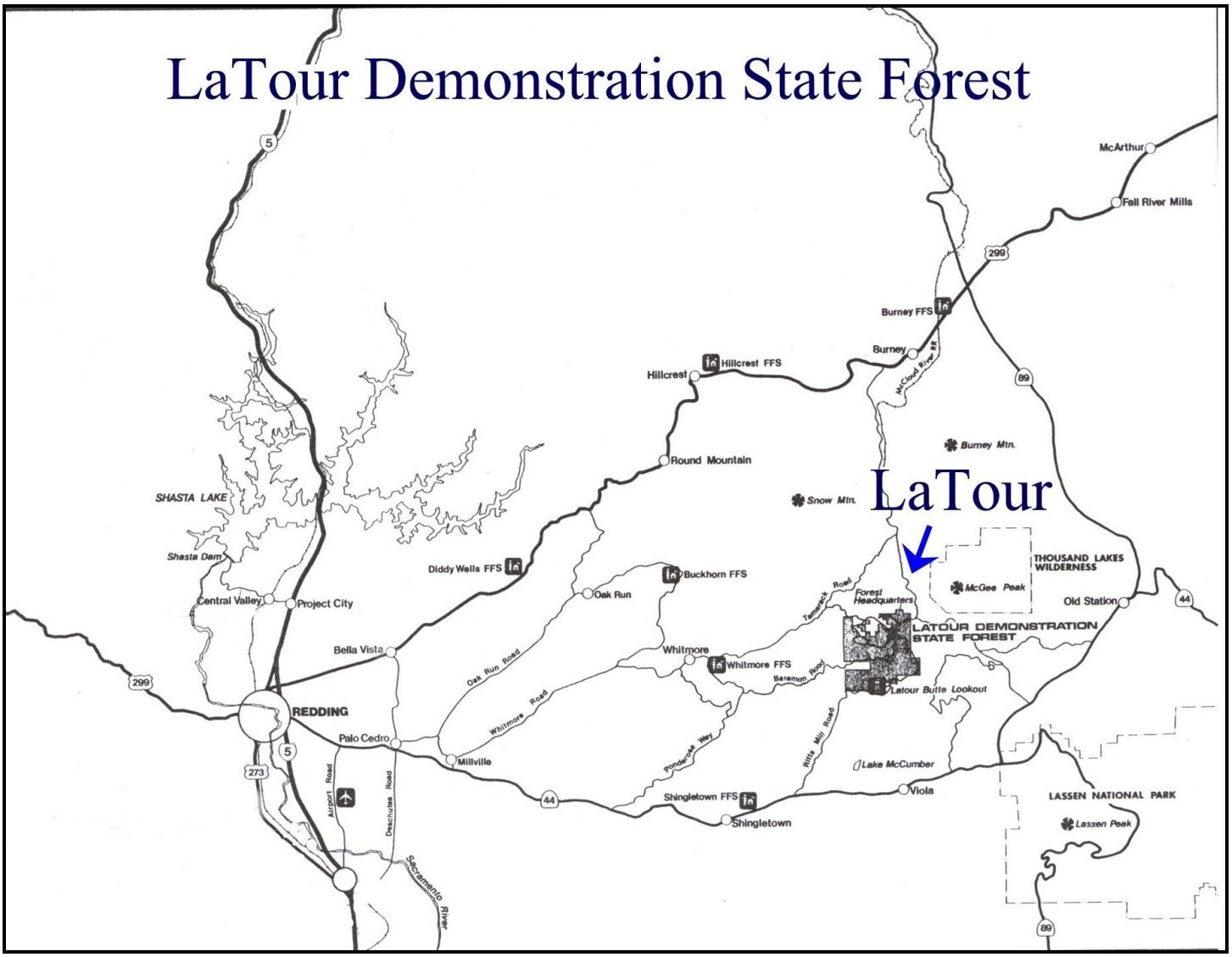
FUNGI

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

LaTour Demonstration State Forest



LDSF Vicinity Map



Road Management Plan
For
Latour Demonstration State Forest

Revised April 26, 2013

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. The 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.

Inventorying and improving LDSF's roads to reduce sediment yield is needed. 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, relatively low 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 serious erosion observed on LDSF is associated with the inside ditch network draining the roads. Inside ditch erosion has been shown to be a significant 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. Rain-on-snow and snowmelt events have caused several of the 18 inch pipes to plug. 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, in numerous locations, the ditchlines have filled with cutslope ravel and water has been forced over the road surface, sometimes eroding fill slopes.

The 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 seems very appropriate for LDSF, due to its lack of a full-time equipment operator and a limited road maintenance program. Additionally, the soils on LDSF are especially prone to: 1) cutslope ravel with input of large quantities of cobbles into the ditchline, and 2) active downcutting and gullying in the ditchline when cross drain spacing is inadequate. These facts indicate that most of the seasonal insloped roads with inside ditchlines should be converted to outsloped roads with rolling dips.

LDSF has begun this conversion process. Usually this work is required of the timber sale purchaser. 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. Gates are being installed to restrict vehicle access on wet roads in the winter, which will reduce damage to road surfaces and decrease erosion problems.

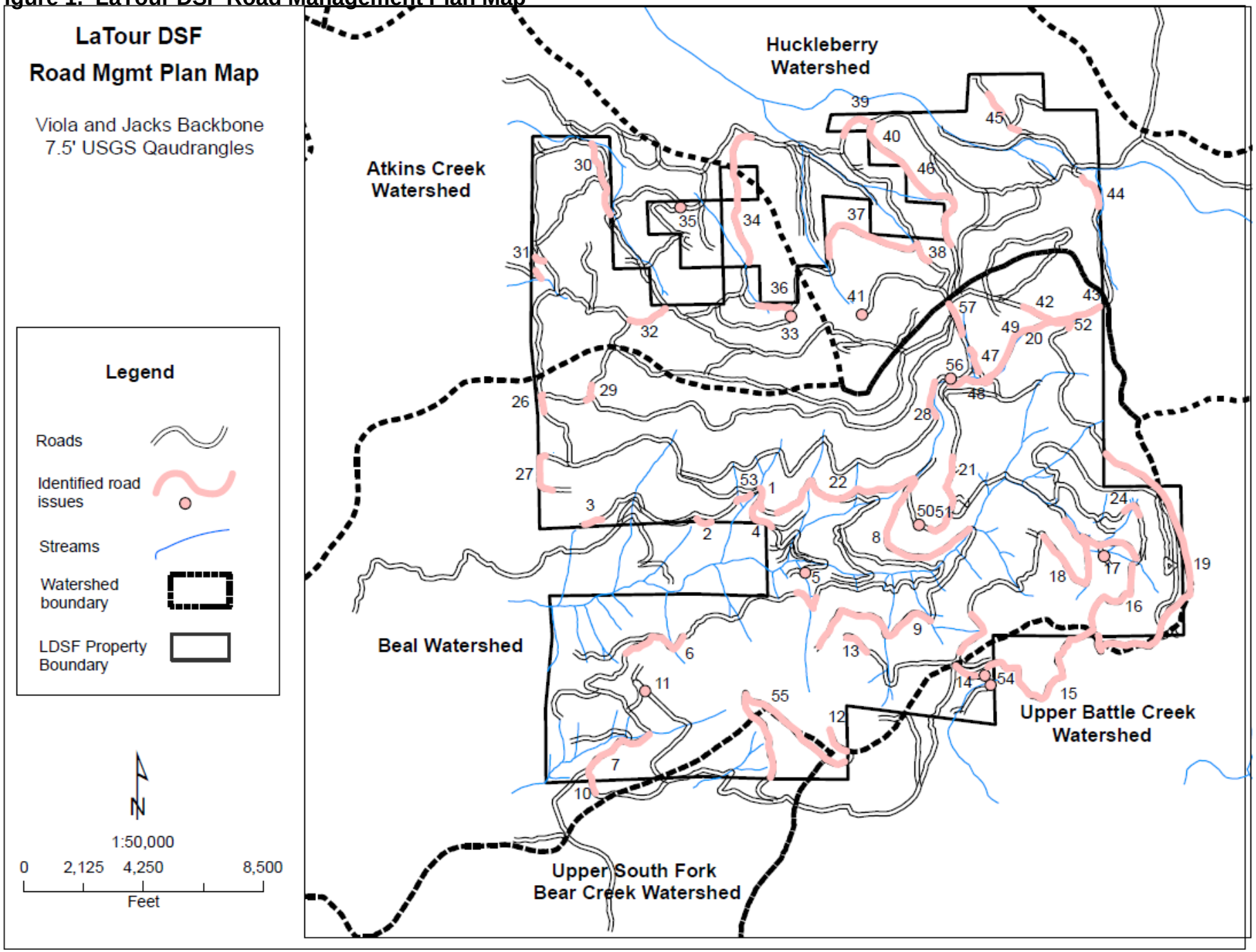
Observation of the road network during preparation of LDSF's RMP allowed the road segments to be rated in relation to their risk to water quality from erosion. Soil type, gradient, location on the hillslope, surfacing, type of drainage, condition of drainage

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 as a result of problem avoidance.

Figure 1. LaTour DSF Road Management Plan Map



1. THE ROAD AND STREAM CROSSING INVENTORY

The inventory of road and stream crossings will provide the basis for maintaining and mitigating the road system at LDSF. It will allow the managers to: a) identify problems that can 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 will include 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. LDSF will 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. CAL FIRE or a qualified contractor will re-inventory all roads currently or formerly used for truck traffic. The road network inventory includes both a general road segment component and a separate stream 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 crossing layer needs updating due to improvements that have been accomplished over the last five years. 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 will be implemented by evaluating each road segment.

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

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

The basic unit for the LDSF road survey will be the “road segment”. Field inventories will require road segments to be easily mapped. Therefore, road segments will 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 will be given a unique identifier (three numbers). The identifier will 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 is collected in the field beginning at this end of the road segment. Field crews will document the location of important road features along a road segment.

1.2. The Field Data Sheets for Roads

Field Survey Sheet will be filled out for each identified segment, (see attached form). The road survey and crossing survey (discussed below) will be carried out simultaneously, and the roads and crossings will be cross-referenced. For example, each culvert will be identified by its associated road segment(s), and each road segment data sheet will list the culverts in (or at the end of) the segment. The field data sheets will be entered into a database, which will be 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 will 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 will be 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 will be 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, will be 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 must be periodically inspected and maintained. The Crossing Survey will develop 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 upon road grading and maintenance. Instead, their location in a road segment will be noted in the road survey.

1.4 The Crossing Survey Form

The attached form shows the information that will be collected at crossings. Each crossing will be assigned a unique number and its location will be noted on a map in the field. The field sheets will be entered into a database, and the culvert locations, latitude and longitude, and ID numbers entered will be used to update the GIS. The database will allow the managers to sort by watershed, stream class, channel distance to Class I streams, severity of problems, etc. In addition, the field inspectors will “red-flag” 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). [3]

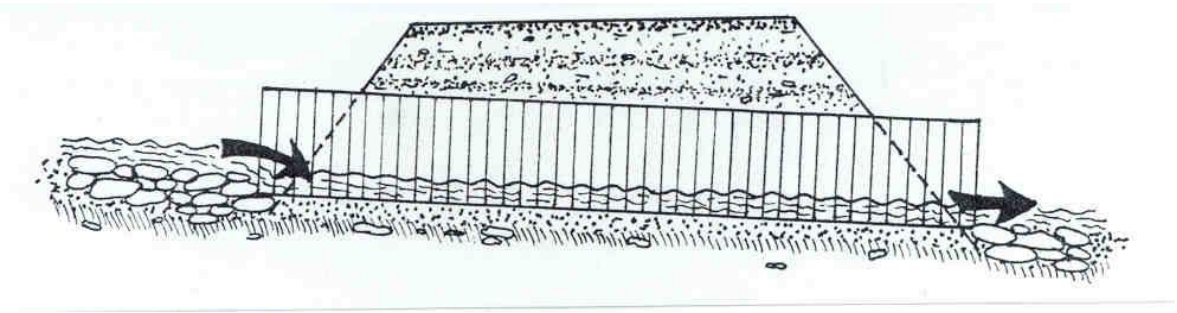


Figure 3. Correctly placed culvert, which is set slightly below the original stream grade and protected with armor at the inlet and outlet.

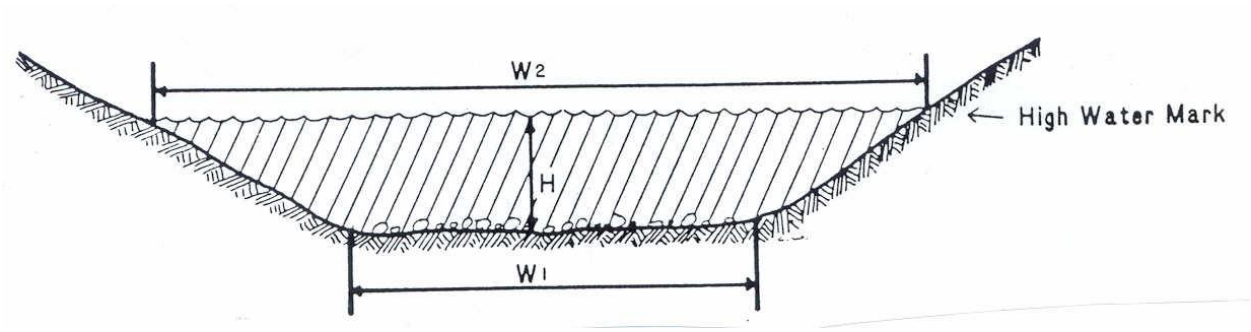


Figure 4. Watercourse channel measurements to determine watercourse cross-sectional area.

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 should be 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 will be noted as part of the field inventory. (Figure 5)

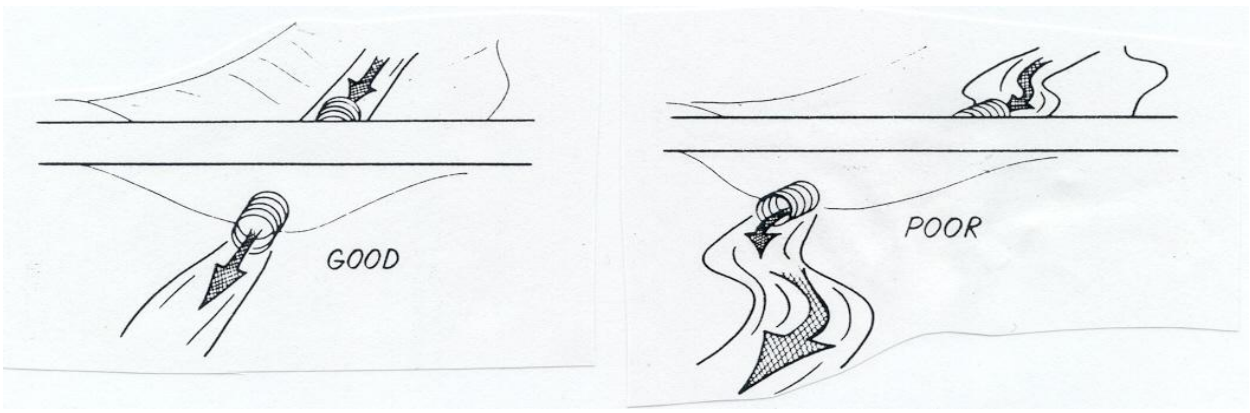


Figure 5. Good and poor culvert alignment.

Fish Passage
Obvious problems for fish passage will be 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.

[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 (1994)[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 will be properly reconstructed or abandoned if necessary. Existing and new roads needed to accommodate cable yarding on slopes steeper than 40 percent will 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 will be to establish roads in low risk locations that will accommodate appropriate yarding and silvicultural systems. However, a specific road density target will not be used.

High-risk areas will have the highest priority for road improvement projects on road segments that will remain in the permanent road transportation network.

The road construction, maintenance, and rehabilitation standards specified in this Plan will help prevent significant, adverse impacts to aquatic habitats. Measures include, but are 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 will not be significantly increased.
- Existing roads will be used wherever appropriate, in preference to building new roads. Substandard roads with drainage and sediment production problems will 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 will be designed to the minimum width necessary to safely accommodate required traffic, with turnouts spaced appropriately for the road class. All roads will be classified according to expected use, and maintained accordingly.

- Roads will generally be located to avoid unstable terrain, and to minimize ground disturbance and watercourse crossings. Roads in unstable areas, including inner gorge areas, will 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, will 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 will be followed by LDSF:

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

- New and reconstructed roads and landings will be generally outsloped for surface drainage; inboard ditches will be avoided except where necessary. Where such ditches exist and are determined to be significant sediment sources, they will 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 will be used where possible for surface drainage. Other road drainage structures will 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 will be protected from erosion by installing rock riprap or overside drains where necessary.

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

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

- Watercourse crossings utilizing culverts will 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 will be installed after May 1st and removed by October 15$^{th.}$ Temporary crossings involving fill will only use clean, washed rock in the watercourse channel (utilizing the CDFG Streambed Alteration Permit). When temporary crossings are removed, the channel will be restored to the approximate original configuration.

- Crossings of Class I streams will be designed to provide for fish passage.

- Rock-lined ford, cable concrete mat crossings or vented crossings will 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 will 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 will 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 will be designed for minimum safe working size and care will 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) will be conducted when soils are not saturated. Culverts and bridges will be installed between April 1st and November 15th, the dry period of the year. Material disturbed during construction will be stabilized to prevent movement into watercourses.

- Crossings will 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 will be evaluated for surface erosion potential and sedimentation. Measures to reduce surface erosion will include but will 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 will be avoided or minimized. Disturbance will only occur at watercourse crossings and will take place between April 1st and November 15th (see bullets above regarding installation and removal of temporary crossings).

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

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

- The LDSF archaeological resources inventory will be reviewed to determine the location of known archaeological sites before construction and maintenance work is started. These sites will 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 will be minimized and typically only occur during late fall. In addition, the following guidelines will dictate how dust abatement and water drafting for dust abatement is conducted on LDSF. The following techniques will be used:

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

- Only surfaced roads will 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 will 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 will occur in off-channel areas when practicable.

- Water drafting from Class I watercourses for dust abatement on LDSF roads, or for other uses, will 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 will require that the rate of drafting be modified or halted if necessary to assure no visible drop in the water surface of the waterbody 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 will be based on the road and culvert survey (described above) and the inspection program (described below), which will provide the information base for determining maintenance priorities.

4.1 Principles of the Inspection Program

- Properly abandoned roads will be inspected at least twice following the completion of the decommissioning activities. The first inspection will follow the first winter after decommissioning. The second inspection will occur after five over-wintering periods. If significant problems are found, equipment will be used to rehabilitate the site properly, if feasible and practical to do so. Following this work, another inspection will 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) will be inspected once annually to ensure that drainage facilities and structures are properly functioning. Two types of inspections will be used: 1) formal inspections, and 2) rapid ad hoc inspections. During formal inspections, all crossings and roads will be carefully observed every three years and problem sites will be recorded on road/crossing inventory forms. To cover the period between detailed inspections, a rapid ad hoc inspection will be made by LDSF Foresters and other staff during normal activities. Only obvious problems will be determined with the rapid ad hoc inspections. Information collected on road problems during either the detailed formal review or the rapid observation review will be entered into the road database that will be developed for LDSF, and maintenance personnel will be advised immediately of significant hazards. Identified problems will be corrected before the onset of wet weather whenever possible and appropriate, depending on availability of personnel and equipment. Failed culverts will be evaluated to determine the cause of failure.

- Problem facilities (including currently known sites and those identified in road/culvert survey) will be monitored by LDSF Foresters more frequently. The Foresters will 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 will 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 will be avoided. Additionally, when possible, vegetation will be left on or above cutslopes to stabilize the slope. Vegetation might be removed on or above cutslopes when it is necessary to improve visibility and promote safe travel on the road.

- 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 will be highlighted and maintenance personnel will 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 (1998), abandonment means "leaving a logging road reasonably impassable to standard production four wheel drive highway vehicles, and leaving a logging road and landings in a condition which provides for long-term functioning of erosion controls with little or no continuing maintenance." 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 will be used on LDSF, ranging from full closure to installing water breaks by hand.

Identification and prioritization of LDSF roads for proactive abandonment will come from the road inventory. Some of the criteria that will 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 Weaver and Hagans (1990, 1994).

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

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

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

- Following completion of the road inventory (see section 2), a schedule will 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 will make arrangements for the road inventory work to be completed. A LDSF Forester will directly oversee any contractors hired for this work. It is likely this survey will be performed by LDSF staff.

The focus of LDSF's road management program will 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 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 will be taken 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.

APPENDIX A of Road Management Plan: Identified problem locations on LDSF's Road System. (See Figure 1, page 74)

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.

2. Bateman Spur No. 2:
Water currently 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 cutslope 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 outslope 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. To be 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. To be 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 fillslope 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, 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**

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

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**

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 throughcut 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.
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 of Sandow Road:
Badly eroded surface due to total lack of drainage. Throughcut in many locations that will be difficult to adequately drain. Solution: Attempt to drain with waterbars 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)**

31. Sunset Gulch Spur off of 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. **TO BE CORRECTED under the McMullen Mountain THP, 2013 – 2014.**

34. Access Road:
Off of LDSF, several drainage problems exist, including blocked culvert entrances, blocked inside ditchlines, and generally a lack of drainage structures. The northern portion on LDSF is generally better but needs drainage structures installed. Solution: Drain with outsloping and rolling dips. **CORRECTED 2000**

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. **TO BE 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. **TO BE 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. **TO BE 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**

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 throughcut. Solution: Either properly abandon this stretch of road, or make a serious effort to properly drain it, including possibly filling the throughcut area and outsloping and installing rolling dips. **CORRECTED 1999**

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**
Moderate-	1,**2**,**6**,7,**17**,**22**,**25**,**27**,**28**,**43**,**48**,**50**,**51**,**52**
Least-	**3**,10,**11**,**12**,**13**,**24**,**26**,**29**,**42**,**49**,53

Huckleberry Creek Planning Watershed

Highest-	**45**,38,**40**
Moderate-	**44**,**41**,**39**
Least-	37,**46**

Atkins Creek Planning Watershed

Highest -	**35**,36,**30**
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**

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
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. **To Be Corrected 2014-2015.**

54. Section 24 Spur
A class III watercourse has been diverted into a road side 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**

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**

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**

LaTour DSF ROAD SURVEY FORM

Road Name/Number _____ Planning Watershed: ☐SC ☐OC ☐A ☐NFB ☐SFB
Collected by: _____ Date of Survey _____
Begin: Lat/Long: 121:____:____E/40:____:____N End: Lat/Long: 121:____:____E/40:____:____N
Segment ID# __ __ __ Length of Segment _____(ft) Usage Category: ☐ L ☐ M ☐ H

I. ROAD DRAINAGE

☐ Outsloped ☐ Crowned ☐ Insloped ☐ Inside Ditch – rocked, native material, vegetated (circle)

Berms: ☐ Yes ☐ No Vegetated: ☐ Yes ☐ No

Waterbreaks: ☐ None ☐ Bars Spacing _____ (ft) ☐ Rolling Dips Spacing _____ (ft)

Culverts: No. Culverts in segment: _____ No. Culverts draining into channels: _____
List culvert ID from crossing survey form: _____/ _____/ _____/ _____/ _____/ _____/
_____/ _____/ _____/ _____/ _____/ _____/

II. ROAD BED

Average width of roadbed _____ (ft) Surface: ☐ Native Soil ☐ Gravel ☐ Other _____

Road Grade: Avg. Slope _____(%) Max. Slope _____(%)
☐ Grade >8%: Slope _____ (%) from _____mile to _____ mile
Slope _____ (%) from _____mile to _____ mile
Slope _____ (%) from _____mile to _____ mile
Slope _____ (%) from _____mile to _____ mile

III. CUTSLOPE/FILLSLOPE

Parent Material-Soil Type: _____ from _____mile to _____mile
_____ from _____mile to _____mile
_____ from _____mile to _____mile
_____ from _____mile to _____mile

IV. MASS WASTING FEATURES ☐ Immediate repair needed ☐ Photo(s) taken: _____

Description _____ Mile _____
Description _____ Mile _____
Description _____ Mile _____
Description _____ Mile _____

V. SEDIMENT DELIVERY HAZARD AREAS

Description _____ Mile _____
Description _____ Mile _____

VI. ACCESS CONTROL

☐ Yes ☐ No ☐ Needed Type _____ Latitude _____ Longitude _____
Description/comments _____

LATOUR DSF CROSSING/CULVERT SURVEY FORM

Road Name/Number _____ Planning Watershed: ☐SC ☐OC ☐A ☐NFB ☐SFB
Collected by: _____ Date of Survey _____

Segment ID# __ __ __ Crossing ID# __ __ __ Mile _____(10ths) Lat/Long:
121:____:____E/40:____:____N

CROSSING TYPE: ☐ Watercourse crossing: ☐ Class I ☐ Class II ☐ Class III ☐ Ditch relief

☐ CMPR ☐ CMPV ☐ CMPO ☐ CMP ARCH ☐ RCP ☐ RC BOX ☐ CPP ☐ OPEN

☐ BRIDGE describe_____ ☐ FORD describe
_____

CULVERT:

Dimensions: dia: _____(in) width: _____(in) length _____(ft) slope _____(%)

Alignment: ☐ Good ☐ Poor describe _____

Entrance Type: ☐ Projecting ☐ Flush ☐ Beveled inlet
☐ Trash rack ☐ Rock armored ☐ Riser ht. _____(ft)

Outlet: ☐ Projecting Energy Dissipater: ☐ Rock ☐ Woody debris ☐ Downspout/overside drain
☐ Fill erosion ☐ Downstream gullying – describe below in comments/maintenance

Pipe condition: ☐ Dented/Crushed _____(%) ☐ Culvert filling capacity _____(%) rust line depth
_____(ft)

Plugging Potential: ☐ H ☐ M ☐ L Sediment Transport Capacity: ☐ H ☐ M ☐ L

RATING: ☐ Replace Immediately ☐ Replace w/n 5 years ☐ Reevaluate 5 years ☐ Acceptable

WATERCOURSE:

Upstream Channel: Slope_____(%) Bankfull Width(W2) _____(ft) Depth(H) _____(ft)
Active Bed Width(W1) _____(ft)

Drainage area: _____ (acres) culvert watercourse crossings only (Done in the office)

Water diverted from: _____ to _____

COMMENTS/MAINTENANCE: ☐ Maintenance needed ☐ Photo(s) taken _____ (amount)

Describe any maintenance needs, photo(s) description or general comments: