

LASSEN VOLCANIC NATIONAL PARK

A SUMMARY OF MONITORING ACTIVITIES FOR 2007

Division of Natural Resources Management
Lassen Volcanic National Park



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BUFFLEHEAD DUCK MONITORING

INTRODUCTION

The Bufflehead Duck (*Bucephala albeola*) is California's rarest boreal duck species. The Bufflehead nests almost exclusively in cavities excavated by Northern Flickers (*Colaptes auratus*) and occasionally in those excavated by Pileated Woodpeckers (*Dryocopus pileatus*) (Cornell Laboratory of Ornithology 2008). A small, isolated breeding population occurs in Northeastern California, the majority of which is located within Lassen Volcanic National Park (LVNP) and Lassen National Forest (LNF). The nearest breeding population occurs a substantial distance away in central Oregon, Idaho, and Wyoming. The largest concentration of breeding buffleheads worldwide is found in Central British Columbia.

In an eight-year study of the distribution, density, population trends, and habitat usage of buffleheads in California, Airola (1987) raised concerns over the viability of the Lassen population because of its small size, remoteness from other breeding populations and several land-use factors which may lead to loss or degradation of habitat. These land-use factors were fish stocking, loss of nest snags near lake shorelines, and high recreation use. Of the 151 lakes surveyed within the study area, 21 broods and 82 adults were found. Airola developed models that estimated the total California breeding population at 59-65 pairs, with McCoy Flat reservoir in LNF contributing 20% of the state's population.

PROJECT HISTORY

In 1997, LVNP and LNF biologists agreed to establish an interagency monitoring effort to survey buffleheads over park and forest lands to determine if any changes had occurred in the population over the 11-year period since Airola completed his study. In addition, both agencies were interested in long-term monitoring of Bufflehead Duck population trends. These efforts are important because: 1) these two land holdings contain the vast majority of the breeding habitat for this species in California, and 2) much of this land, at least on LNF, is subject to land-use practices which may jeopardize the breeding success of the species.

During the first year of monitoring in 1997, twenty-six lakes were surveyed within LVNP. Broods were found on eight of these lakes, and another seven lakes had adult ducks but no broods. Combining all 218 ponds and lakes surveyed over the study area (LVNP and LNF lands) a total of 71 broods and 374 young were observed. Preliminary analysis of first year data seem to corroborate the findings of Airola that fish stocking and lakeshore disturbance can result in decreased bufflehead use and productivity on otherwise useable lakes (Rickman 1997). Using the 1997 data and estimation models developed by Airola, a total of 119-130 pairs and 95-104 broods were estimated to occur within the state. During a nine year period of surveys on LNF, Hog and McCoy Reservoirs have contributed 46% of the observed adults, 39% of the broods and 45% of the young, despite having been dry or nearly dry for two of the survey years (Rickman 2006).

OBJECTIVES

The objective of this survey effort is to track population trends by monitoring Bufflehead Duck adults and young at lakes within LVNP. Additionally, data is being collected that will help describe site conditions at each lake, including the presence of fish and identification of potential human-caused disturbances.

METHODS

As many lakes as possible are surveyed each year. However, priority is given to fifty baseline lakes selected for long-term monitoring in 2003. These lakes have been prioritized for survey, in case limits on staff time preclude more extensive surveys. Forty of the fifty lakes were selected because brood production had been observed at these sites one or more times during the first six years of survey (1997-2002). Ten additional lakes were randomly selected, to detect potential increases in the number of breeding sites.

In 2007, Bufflehead Duck brood surveys were conducted between June 26 and August 4. Surveys were conducted by walking the perimeter of the lakes and recording numbers of adults with and without broods and the number of young in each brood. Sex of adult birds was noted. Because males in full basic plumage, adult females, and first-year birds of both sexes usually cannot be distinguished, birds greater than age 1 year were recorded as “age and sex unknown”, except females with broods and a few males in adult alternate plumage. Clutches with more than 12 young are thought to represent either the results of dump nesting or brood amalgamation (Rickman 2001). Therefore, the total number of young within an observed group is divided by 12 to estimate the number of contributing broods. Other data collected at each lake included: presence of fish, type and extent of recreational use, and a notation of other disturbances. Field data were recorded on standard survey forms and archived in the Resource Management office. Data were entered into an Excel spreadsheet.

Volunteers contribute significantly to the survey efforts on both park lands and national forest lands. Volunteers from the California Waterfowl Association (CWA) surveyed numerous lakes on LNF in 2007.

RESULTS IN LASSEN VOLCANIC NATIONAL PARK

One hundred and two lakes were surveyed in LVNP during 2007. Adult buffleheads were found on 41 of the lakes surveyed. Nineteen of the lakes supported broods and a total of 20 broods were observed (Figure 1). A total of 78 adults and 89 young were observed.

RESULTS OF INTERAGENCY SURVEYS

Two of the three ranger districts within Lassen National Forest are surveyed for Bufflehead Ducks: Eagle Lake Ranger District (ELRD) and Almanor Ranger District (ALRD). A total of 385 lakes and ponds were surveyed on LVNP and LNP lands in 2007. Broods were observed at 50 of the 385 site surveyed, and a total of 434 young counted.

Totals by agency in 2007 were:

LVNP: 102 lakes surveyed, 19 lakes with broods, 20 broods and 89 young

ELRD: 55 lakes surveyed, 6 lakes with broods, 32 broods and 244 young

CWA: 179 lakes surveyed, 17 lakes with broods, 18 broods and 75 young

ALRD: 49 lakes surveyed, 8 lakes with a broods, 15 broods and 26 young.

Refer to Table 1 for a summary of the interagency survey results.

Table 1: Bufflehead Duck Brood Surveys, 1997 – 2007, Lassen Volcanic National Park and Lassen National Forest.

Year	Number of Lakes Surveyed	# of Lakes with Broods	Number of Broods	Number of Young
1997	218	43	71	374
1998	179	36	79	510
1999	198	46	105	651
2000	181	36	82	506
2001	348	43	46	203
2002	309	47	78	437
2003	351	42	76	297
2004	350	60	101	521
2005	399	57	110	490
2006	472	54	110	620
2007	385	50	85	434

FUTURE DIRECTION

The park will continue this joint project with Lassen National Forest as part of the park's long-term monitoring program.

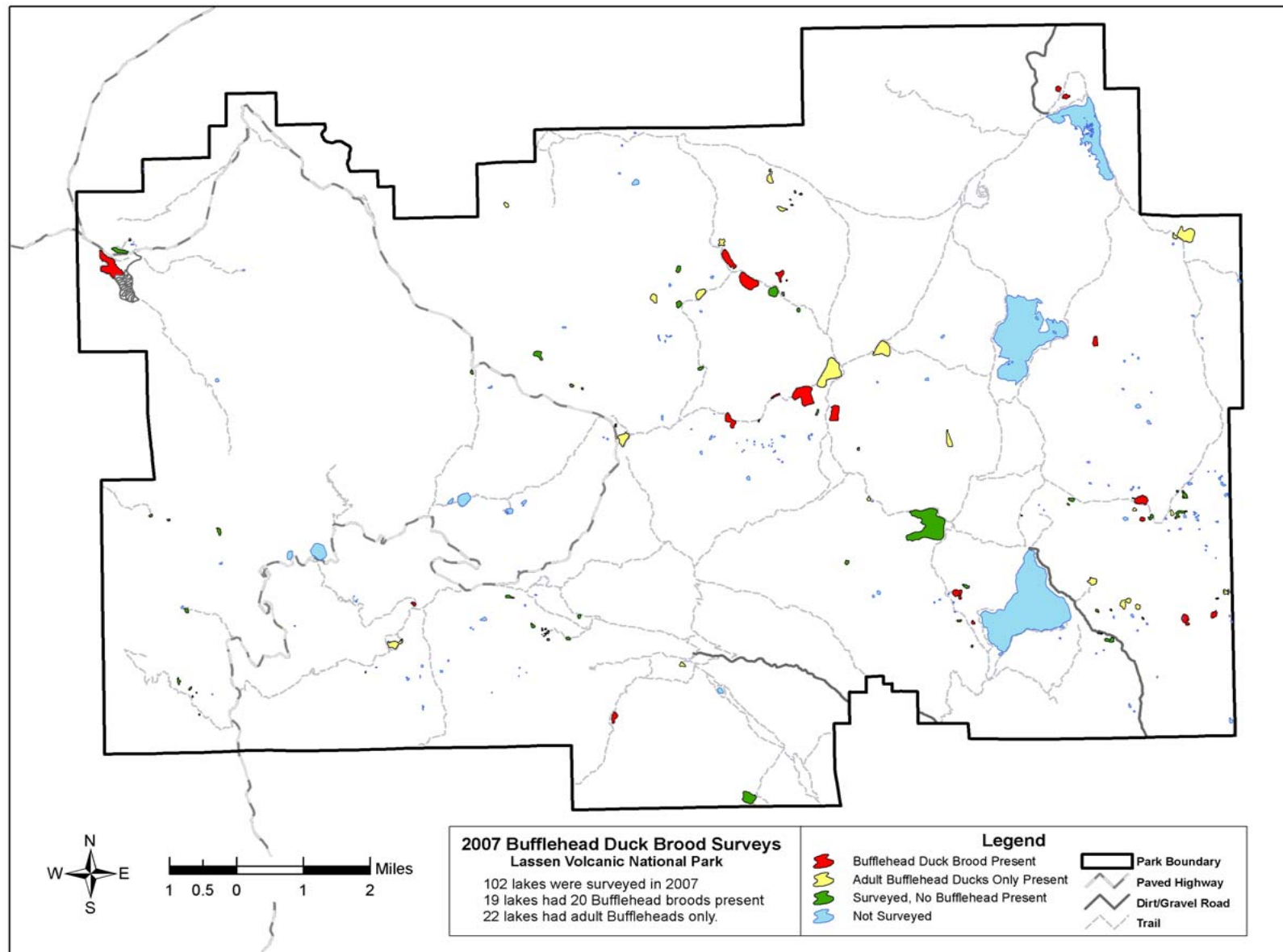


Figure 1. Map of 2007 Bufflehead Surveys

PEREGRINE FALCON MONITORING

INTRODUCTION

The American Peregrine Falcon (*Falco peregrinus anatum*), once a common resident throughout much of California, began rapidly declining about the mid-part of the 20th century. The chief factor responsible for this decline was the biochemical impact of organochlorine pesticide residues (primarily DDT), but habitat degradation throughout the falcon's range also played a large role. Documentation of these alarming trends not only in California populations but throughout the species range prompted the United States Fish and Wildlife Service (USFWS) in 1970 to list the American Peregrine Falcon as Federally endangered.

Once a species is federally listed, the Endangered Species Act strives not only to prevent the species from becoming extinct, but ultimately to restore these species to the point where they no longer require legal protection. To this end, the USFWS is required to develop and implement formal Recovery Plans to help guide restoration efforts. The fundamental components of a recovery plan include range-wide inventories of species abundance and distribution, and monitoring to track population trends.

In 1999, due to population recovery criteria being met, the American Peregrine Falcon was removed from the Federal list of Endangered and Threatened Wildlife. It currently retains endangered status by the State of California.

Though periodic sightings of this species in the park have been made over the past few decades (LVNP Species Observations Database), and nesting has been confirmed outside the park boundary (Grinnell and Miller 1944), the park's scant records have never shown peregrine falcons to nest inside the park. A scientific study conducted in the park (Baldridge et al. 1980), though not successful in detecting nesting Peregrine Falcons, identified potential nesting sites and recommended a strategy for monitoring these sites.

PROJECT HISTORY

In 1980, a study was initiated by the Cooperative Park Studies Unit in Davis to determine the extent of the use of the park by endangered raptors, including Peregrine Falcon (Baldridge et al. 1980). Thirty-six priority cliff sites were located, described, photographed, and mapped for their potential to support Peregrine Falcon nesting. Data analysis showed that none of the 36 cliff sites held excellent potential as a Peregrine Falcon nesting location. However, two sites were rated as having good potential, three sites were rated as suitable, and four sites were rated as having marginal potential. The remaining 27 potential sites, after closer examination, were considered unsuitable for nesting.

Though no Peregrine Falcon nesting was observed at any of these locations during subsequent surveys in summer 1980, one Peregrine Falcon was observed near Lassen Peak well after the nesting season. Results led the authors to believe that 1) potential Peregrine Falcon nest sites in the park are below optimum, and that most are generally unsuitable, and

2) presence of Peregrine Falcon in the park is probably mostly due to upslope post-breeding movement in response of prey availability.

Nevertheless, because five sites (those rated as having good or suitable potential) could conceivably support nesting Peregrine Falcons in some years, the report recommended that the park annually monitor these sites using methods similar to those employed in this study. Nest site monitoring began in 1997 and has continued annually at high priority sites.

METHODS

An observer experienced in Peregrine Falcon monitoring conducted all surveys from designated (and mapped) observation posts. A spotting scope and binoculars were used to scan potential nesting sites. Survey results, including falcon sightings and any indications of nesting activities were recorded in detailed journal format, and are stored in Resource Management Division files. Timing and duration of surveys was based on knowledge of the species' nesting habits, local climate conditions, and consultation with biologists conducting Peregrine Falcon surveys on lower elevation lands surrounding the park.

RESULTS

From fieldwork accomplished during 1999 and 2000, it was determined that: 1) 2007 field efforts would be concentrated on two priority sites that appeared to promise the best results, and 2) locating Peregrine Falcons while they were still on the nest would require beginning the surveys in mid to late May. The two sites chosen were Northwest Blue Lake Canyon, and Raker Peak.

Northwest Blue Lake Canyon

This nest was first surveyed on May 16th of 2007. No activity was observed upon arrival at 11:15. At 11:30 one adult flew into the cliff area and landed on a ledge west of all previously known nest locations. The peregrine stayed only for a minute or two before flying out of the area. The ledge where the peregrine landed was surveyed for two hours with no young observed and no adult peregrine falcons returned.

This area was surveyed again on June 1st 2007. No activity was observed upon arrival at 10:30. At 11:00 one adult came off of the ledge that was found on May 16th 2007 and flew away from the cliff to the east. At 12:30 one peregrine falcon flew in and landed towards the bottom of the cliff on a ledge. This peregrine appeared to have some juvenile feathers and streaking on the breast. After an hour, two adult peregrine falcons were seen and heard over the cliffs and then they both disappeared to the backside of the cliff. The suspected juvenile also got up and flew over the backside of the cliff. It is assumed that this was a juvenile and that the two adult peregrine falcons were the parents of this juvenile.

It is assumed that one young was fledged in 2007 due to the June 1st sighting.

Raker Peak

This area was surveyed by using a spotting scope and binoculars to view the cliff and surrounding areas. The area was surveyed twice in 2007, on May 16 and June 01. No indication of Peregrine Falcon presence was observed on either of these visits.

Visitor Reports

There were no observations of Peregrine Falcons reported by park visitors or staff in 2007.

FUTURE DIRECTION

We plan to continue implementing Peregrine Falcon monitoring at the high priority sites in Blue Lake Canyon and Raker Peak for 2008. We will continue to collaborate and share information with Forest Service biologists conducting falcon monitoring on properties adjacent to LVNP.

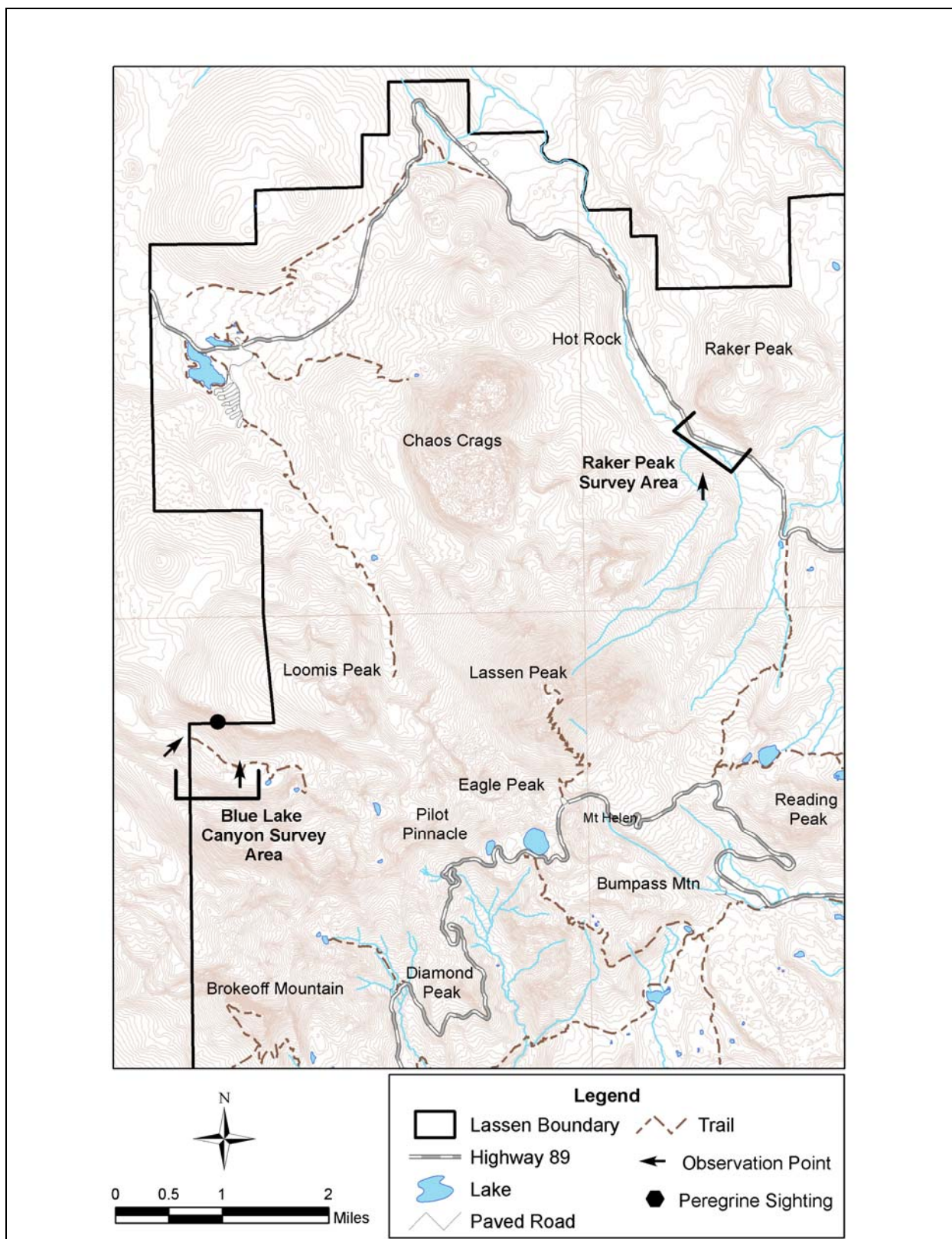


Figure 2. Peregrine Falcon Survey Sites

BALD EAGLE NEST MONITORING

INTRODUCTION

Though no historical information exists on Bald Eagle (*Haliaeetus leucocephalus*) population size in California, it is widely thought that this species formerly occupied a widespread range and was quite abundant throughout the western states. After World War II, the Bald Eagle population declined rapidly in California and throughout all other parts of its range. This was caused primarily by DDT contamination which caused severe nesting failure in this species. Another factor contributing to its decline was degradation of breeding and wintering habitats. In 1967 the United States Fish and Wildlife Service (USFWS) listed the Bald Eagle as Federally endangered, followed by the State of California which listed the species as endangered in 1971. By the late 1960s and early 1970s, fewer than 30 nesting pairs remained in California, all in the northern part of the state (Jurek 1990).

Fortunately, the last 30 years have seen a remarkable turnaround in population numbers and occupied sites for the Bald Eagle. Protection of nesting areas, restrictions on use of DDT and other pesticides, and wildlife management projects designed to enhance bald eagle populations have all played significant roles. By 1994, the number of occupied territories in California had increased from 30 to 116. Likewise, the wintering population had stabilized to around 1,000 birds. Annual productivity for the species has been considered good during the last decade, with slightly more than one young being produced per occupied territory. Partly because much progress has been made toward meeting most of the population recovery criteria specified in the Pacific Bald Eagle Recovery Plan (Jurek 1995), the USFWS recently officially reclassified the Bald Eagle to threatened.

Since 1980, Lassen Volcanic National Park (LVNP) has actively participated in a multi-agency program of annual breeding season surveys. This program, which is managed by the California Department of Fish and Game (CDFG), has provided a relatively thorough statewide coverage of the status of breeding Bald Eagles.

PROJECT HISTORY

The current Bald Eagle monitoring effort has been in place for more than 20 years and stems from written management recommendations provided by a 1980 study of endangered raptors in the park (Baldrige et al. 1980). The purpose of that study was to document the distribution of endangered raptors (Bald Eagle and Peregrine Falcon) in LVNP, determine if these species nested in the park, and implement a monitoring system for these species which could be continued by park personnel. Significant findings of Baldrige's study were: 1) the discovery of the first active Bald Eagle nest in the park, at Snag Lake, 2) the recognition that the Snag Lake nest is probably the highest in elevation of any in the state, and 3) the acknowledgment that LVNP has extremely marginal Bald Eagle nesting habitat because of scarce food supplies and relatively harsh climates during the nesting season. Therefore, the park can support at most one resident breeding pair, in addition to one other foraging pair which nests outside the park, and a few wandering juveniles.

The nest that was used in 2000 blew down during the winter or spring of 2001. No new nest has been located since 2000. Adult Bald Eagles have been observed in the Butte Lake, Snag Lake, and Cluster Lake areas since 2000.

METHODS

Two observation posts are used to make on-ground surveys of the nest tree during the breeding/fledging season. The principal post is located one half mile west/northwest of the nest, and the secondary post is located east/northeast near the southwest edge of Snag Lake. Observation posts and nest trees have been mapped using a GPS device. Observations generally occur approximately once per week from early June until young Bald Eagles fledge (sometimes as late as early August), or until it is determined that no young are present. Observations are taken using a 20-45 power spotting scope and binoculars. In addition to time spent at the observation posts, observations are made of the entire Snag Lake region from trails along the lakeshore and prominent points affording adequate views of the lake. In years of nesting success, detailed records are kept of adult foraging behavior, foods obtained, adult and nestling interactions, and alternate nest building and nest repairing activities. Data are recorded on standard CDFG eagle monitoring forms and submitted to State offices in Sacramento.

RESULTS

In 2007, Resource Management staff searched for bald eagles in the Snag and Butte Lake areas and did observe adult bald eagles at Snag Lake and one juvenile bald eagle at Butte Lake. The juvenile appeared to be $\frac{1}{2}$ to $1\frac{1}{2}$ years old by plumage characteristics (McCollough, 1989). No nest was found in 2007. Visitor and staff sighting reports also confirmed adult bald eagles at Snag Lake and Butte Lake and one juvenile bald eagle at Butte Lake. Due to the close proximity of Snag Lake and Butte Lake it is believed these are the same bald eagles which utilize both lakes for foraging.

Bald eagles were also observed by park staff and visitors at Manzanita Lake in 2007. These eagles nest outside the park but use Manzanita Lake for foraging. Only adult bald eagles were observed at Manzanita Lake in 2007.

Bald Eagle nesting success at the Snag Lake site has occurred in eleven of the 29 years of nest monitoring (Table 2).

FUTURE DIRECTION

Nest site monitoring will continue indefinitely at the Snag Lake nest site. Any additional nest sites located within the park will be monitored using established protocol.

Table 2. Snag Lake Bald Eagle Nest History

Year	Hatched, (Fledged)	Mode of Survey	Comment
1979	unknown, (1)	Foot	No nest located
1980	No	Aircraft, foot	1 nest located
1981	No	Aircraft	No nest located
1982	No	Foot	No nest located, late thaw
1983	2, (1)	Foot	1 nest located, late thaw
1984	2, (1)	Foot	Same tree as previous year
1985	?	---	Not surveyed
1986	?, (1)	Foot	2 nests found, 1 gone by end of year
1987	2, (1)	Foot	Alternate nest rebuilt, then collapsed; Remains of eaglet found; Snag Fire in Aug-Sept.
1988	No	Foot	Evidence of spring nest-building
1989	No	Foot	Nest used in '83 and '84 fully intact
1990	No	Foot	No evidence of nesting or territorial behavior
1991	No	Foot	No evidence of nesting or territorial behavior
1992	1, (1)	Foot	Same nest as used in '83 and '84
1993	1, (1)	Foot	Same nest as used in '83 and '84
1994	?	--	Not surveyed
1995	No	Foot	Heavy winter snow, late thaw
1996	1, (1)	Foot	
1997	1, (1)	Foot	
1998	No	Foot	El Nino winter; evidence of spring nest- building
1999	1,(1)	Foot	Probably same nest as used in 1995
2000	1,(1)	Foot	Same nest as used in 1999
2001	No	Foot	No nest located
2002	Unknown	Foot	No nest located
2003	Unknown	Foot	One nest located (historic nest)
2004	Unknown	Foot	One historic nest located - no activity
2005	Unknown	Foot	One historic nest located - no activity
2006	Unknown	Foot	Status unknown
2007	Unknown	Foot	Status unknown (1 young suspected)

SONGBIRD MONITORING – DRAKESBAD MIST-NETTING

INTRODUCTION

In the past few decades, much concern has been raised about the sharp and widespread population declines of songbirds. In the early 1990s, the Partners in Flight (PIF) program began an attempt to enlist a concerted effort among academic, government, and private sector scientists and managers to understand the causes of, and then reverse, songbird declines. Through this program, many important underlying causes of declines have been identified, followed by successful strategies to protect songbirds and their habitats. The National Park Service has contributed an active role in the PIF program since its inception.

The Lassen region is critical to efforts to protect declining songbirds. The area supports diverse bird communities including half of the PIF-listed Species of Conservation Priority and all the species listed by the Sierra Nevada Ecosystem Project Report as declining or likely declining (Graber 1996). Neotropical migrants are an especially important avian group which are presently well-represented in the Lassen region, but continue to show alarming declines elsewhere.

Constant-effort mist-netting data collected during the breeding season provides an annual index of abundance, productivity, and survivorship (DeSante and Geupel 1987). Data can indicate whether populations are sources (reproductive success is sufficient to balance mortality) or sinks (mortality exceeds local production of young), and whether existing conditions are capable of supporting breeding populations (Nur and Geupel 1993).

PROJECT HISTORY

From 1997-1999, Lassen Volcanic National Park (LVNP), Lassen National Forest (LNF), and the Point Reyes Bird Observatory (PRBO) conducted a 3-year study of the songbird communities in selected areas of the park and the forest. The purpose of this project was to evaluate the health of existing bird populations, identify areas important to sensitive and declining species, and provide recommendations to enhance declining populations. All data collected during these efforts were done so in accordance with standard methodologies and were contributed to national monitoring programs including Monitoring Avian Productivity and Survivorship (MAPS) and Breeding Biology Research and Monitoring Database (BBIRD).

During all years of the project, intensive training in standard methodologies (especially constant-effort mist-netting and point-counting) was provided to LVNP and LNF field staff by PRBO ornithologists to facilitate continuation of the project beyond the 3-year pilot period. At the conclusion of the study in 1999, the Drakesbad mist-netting station was converted to a permanent MAPS station as part of the park's long-term monitoring program. This year marked the tenth consecutive year of constant-effort mist-netting at Drakesbad.

METHODS

Mist-netting procedures were conducted according to the protocols described in Ralph et al. (1993). See Table 3 for a summary of days of operation. Nets were located approximately 50 meters apart and were operated during the breeding season approximately once every 10 days (Figure 4). Nets were opened 15 minutes after local sunrise, checked every 30 to 40 minutes, and operated for five hours. Birds captured were removed from the nets and processed immediately on-site. Each bird captured (except hummingbirds and game birds) received a U.S. Fish and Wildlife Service band for permanent identification and to allow estimates of survival from subsequent recaptures. Age, sex, skull ossification, breeding condition, fat score, molt, flight feather wear and fade, wing length and weight of each bird were recorded as described by Pyle (1997). All data are stored in FOXPRO databases and analysis programs developed by PRBO.

Table 3. Summary of breeding season net results from 1997-2007 at Drakesbad

YEAR	DAYS OF OPERATION		NO. OF CAPTURES ¹				BIRDS/ 100 NET HRS.	NUMBER OF SPECIES
	TOTAL	RANGE	TOTAL NET HRS.	B	U	R		
1997	6	6/16-8/1	315	169	39	39	78.41	20
1998	4	7/7-8/4	200	127	23	37	93.5	24
1999	7	6/8-8/5	336	147	38	72	76.5	23
2000	7	6/5-8/3	247	143	39	46	92.3	27
2001	7	6/7-8/9	313.5	190	59	56	97.4	27
2002	7	6/4-8/6	350	217	21	71	88.3	24
2003	7	6/5-8/7	349.5	199	25	66	83.0	31
2004	7	6/3-8/5	350	217	43	58	90.8	30
2005	7	6/10-8/4	335	171	13	64	74.0	26
2006	7	6/7-8/3	350	301	50	53	115.4	31
2007	7	6/7-8/2	350	240	52	70	103.4	30

¹ B = BANDED, U = UNBANDED, R = RECAPTURE

RESULTS

The national average for number of individuals captured per 100 net hours, from 410 MAPS stations, was 37.2 in 1996 (DeSante et al. 1998). Drakesbad consistently has capture rates well above the national average. Productivity indices (juvenile to adult ratio) by species are presented in Table 4. These results indicate high productivity (defined here as ratios ≥ 0.30) for many breeding species, in particular several riparian species such as Neotropical migrants MacGillivray's Warbler (*Oporornis tolmiei*) and Wilson's Warbler (*Wilsonia pusilla*), in addition to Song Sparrow (*Melospiza melodia*) (Figure 3). This is noteworthy because two of these species, Wilson's Warbler (*W. pusilla*) and Song Sparrow (*M. melodia*), are showing marked declines throughout their ranges and are both listed by PIF as Species of Concern.

Survivorship analysis for Drakesbad was conducted in 2004 by PRBO. For Wilson's Warbler (*W. pusilla*) the survival rate was 33% for females and 68% for males (Gardali et al. 2004). The MAPS N.W. region estimate for this species was 45% (Gardali et al. 2004). For Song Sparrow (*M. melodia*) the survival rate was 49% for females and 57% for males (Gardali et al. 2004). The MAPS N.W. region estimate for this species was 47% (Gardali et al. 2004). MacGillivray's Warbler (*O. tolmiei*) had a survival rate of 42% for females and 48% for males (Gardali et al. 2004). The MAPS Northwest Region estimate for this species is 49%. It is interesting to note the difference between male and female survival rates for all three species. Female survival rates are lower than male survival rates for all three species. It is hypothesized that this is due to the stress levels endured by females that take on the majority of the effort during the breeding season in terms of egg production and incubation (Gardali et al. 2004). This data suggests that with the relatively high survival rates for these species, Drakesbad is high quality habitat.

Data continue to show the importance of the Drakesbad area for dispersing hatch year birds, such as Orange-crowned Warbler (*Vermivora celata*) and Rufous Hummingbird (*Selasphorus rufus*). Neither of these species breeds at Drakesbad but dispersing juveniles use the area to forage. In 2007, 49 hatch year Rufous Hummingbirds and 65 hatch-year Orange-crowned Warblers were captured. Sixteen after-hatch-year Orange-crowned Warblers were also captured in 2007 as well as three after-hatch-year Rufous Hummingbirds. There were also two Orange-crowned Warblers that were of unknown age and sex captured in 2007.

Between-year recapture has revealed important data on site fidelity and longevity. Two female Wilson's Warblers and one male Song Sparrow were recaptured in 2007 that were originally banded in 2003 and were all aged as after-second-year birds when originally banded. This would mean these birds are at least five years old. One Orange-crowned Warbler was recaptured in 2007 that was originally banded in 2004 as an after-hatch-year, indicating that this bird was three years old. All other birds that were recaptured in 2007 were originally banded in 2005 or 2006.

No new species were recorded this year. Of interest this year was the capture of two Wilson's Warblers at Drakesbad that were originally banded as hatch year birds at the Gurnsey Creek banding site on the Lassen National Forest in 2005. Gurnsey Creek is located in the Deer Creek drainage and is approximately 9 air miles from Drakesbad. This is the first time a bird originally banded at Gurnsey Creek has been recaptured at Drakesbad.

FUTURE DIRECTION

Long-term data collection from the Drakesbad station will continue indefinitely as a part of the park's developing inventory and monitoring program. Implementation of the Monitoring Concept Plan that was developed in 2000 will guide the park in planning comprehensive, long-term programs for monitoring bird populations (Humble et al. 2001). This plan recommended that the park combine mist-net data collection with relative abundance monitoring — using Variable Circular Plot (VCP) point counts — of bird populations in other areas of the park. In addition, recommendations were made to

consider the establishment of 1 to 2 more mist-netting stations. This approach is in accordance with direction from the NPS Inventory and Monitoring program which states “the most effective and useful avian monitoring programs will be those that incorporate multiple, complementary approaches — population distribution and trend monitoring through Variable Circular Plot Points Counts, and determination of vital rates through constant-effort mist-netting” (Fancy and Sauer 2000).

The Lassen National Forest plans to continue operating the Gurnsey Creek mist-net station, companion station to Drakesbad. Resulting datasets will add greater resolution and value to Drakesbad data.

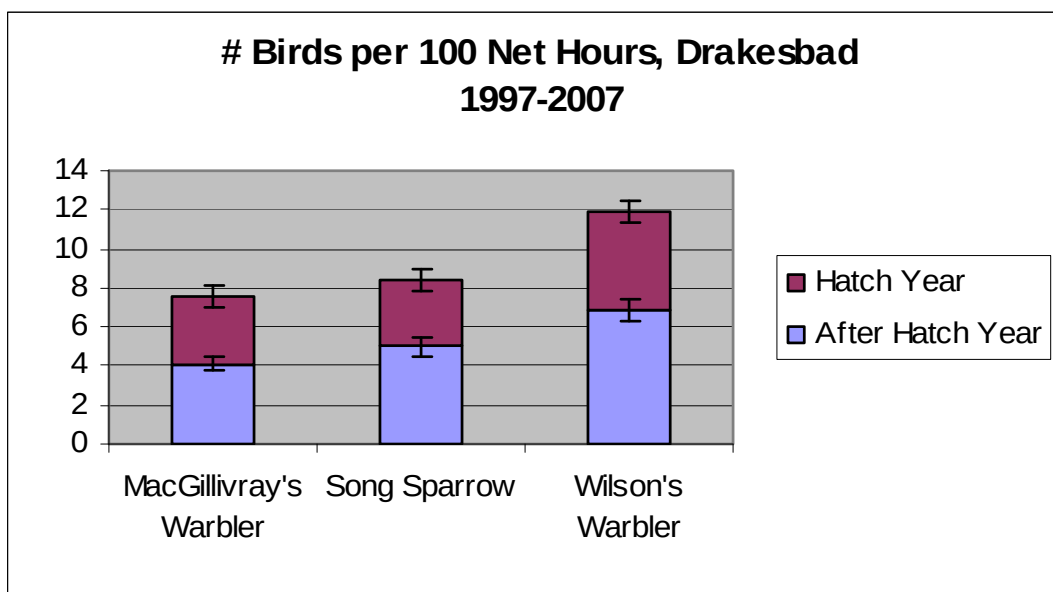


Figure 3. Average Productivity ($\pm$ Standard Error) as Expressed in Ratios of Hatch Year to After Hatch-Year Birds for Three Species at Drakesbad.

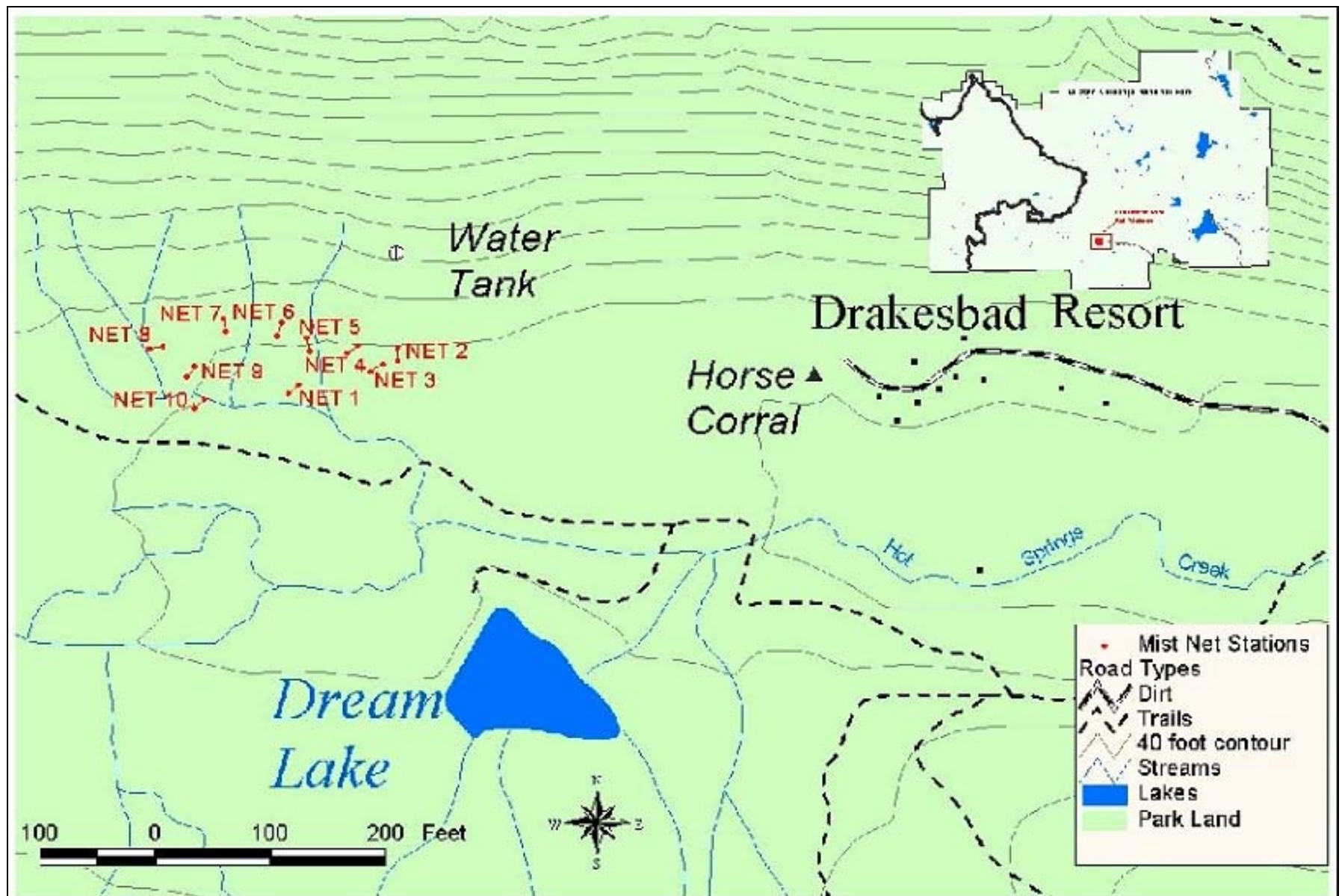


Figure 4. Drakesbad Permanent Mist Net Stations

Table 4. Species and Age Class of Birds Banded at Drakesbad During Constant-Effort Mist-Netting, 1997-2007.

Species	1997			1998			1999			2000			2001			2002			2003		
	HY	AHY	Ratio	HY	AHY	Ratio	HY	AHY	Ratio	HY	AHY	Ratio	HY	AHY	Ratio	HY	AHY	Ratio	HY	AHY	Ratio
American Dipper	0	0		0	0		0	0		1	0		0	0		0	0		0	0	
American Robin	0	1	0.00	0	3	0.00	2	5	0.40	0	5	0.00	0	1	0.00	0	2	0.00	0	4	0.00
Allen's Hummingbird	0	0		0	0		0	0		1	0		0	0		0	0		0	1	0.00
Anna's Hummingbird	2	1	2.00	2	0		0	0		0	0		1	0		0	0				
Audubon's Warbler	0	1	0.00	0	3	0.00	0	7	0.00	0	4	0.00	3	8	0.37	0	5	0.00	0	4	0.00
Brewer's Blackbird	0	0		0	1	0.00	0	0		0	0		0	0		0	0		0	0	
Brewer's Sparrow	0	0		0	0		0	0		1	0		0	0		0	0		0	0	
Brown Creeper	0	0		0	0		0	0		0	1	0.00	3	0		0	0		0	3	0.00
Calliope Hummingbird	0	0		0	0		0	0		3	0		2	1	2.00	0	0		0	0	
Cassin's Finch	0	0		0	1	0.00	0	4	0.00	0	1	0.00	0	0		0	1	1.00	1	12	0.08
Cassin's Vireo	2	0		0	0		1	0		0	0		0	0		1	1	1.0	2	0	
Common Snipe	0	0		0	0		0	0		0	0		0	0		0	0		U	U	
Dusky Flycatcher	0	0		0	0		0	0		1	0		3	0		0	0		0	1	0.00
Evening Grosbeak	0	11	0.00	0	8	0.00	0	3	0.00	1	0		0	4	0.00	0	13	0.00	0	9	0.00
Golden-crowned Kinglet	0	0		0	0		0	0		0	0		1	1	1.0	0	0		0	0	
Hairy Woodpecker	0	0		0	1	0.00	0	1	0.00	0	0		0	0		0	1	0.00	0	0	
Hammond's Flycatcher	2	0		0	0		4	0		1	0		1	0		1	0		1	0	
Hermit Thrush	0	0		0	1	0.00	0	0		0	0		0	0		0	0		0	0	
Hermit Warbler	0	0		0	0		0	2	0.00	2	0		0	0		2	0		0	1	0.00
House Wren	0	0		0	0		2	0		1	0		0	0		0	0		0	0	
Lazuli Bunting	0	0		0	0		0	0		0	0		0	2	0.00	0	0		0	0	
Lincoln's Sparrow	2	3	0.67	2	3	.067	1	4	0.25	2	2	1.0	0	1	0.00	2	6	0.33	0	5	0.00
MacGillivray's Warbler	14	11	1.27	3	9	0.33	5	16	0.31	14	8	1.75	17	12	1.42	12	21	0.57	10	8	1.25
Mountain Chickadee	0	0		0	1	0.00	0	2	0.00	0	1	0.00	2	0		0	0		0	2	0.00
Nashville Warbler	1	0		3	0		0	2	0.00	1	1	1.00	0	0		1	2	0.50	0	2	0.00
Olive-sided Flycatcher	0	0		0	0		0	0		0	0		0	0		0	0		0	1	0.00
Orange-crowned Warbler	39	2	19.5	25	2	12.5	28	1	28.0	28	6	4.67	37	9	4.11	35	11	3.18	27	11	2.45
Oregon Junco	1	0		0	3	0.00	0	4	0.00	1	4	0.25	3	0		0	2	0.00	0	0	
Pine Siskin	0	0		0	1	0.00	0	1	0.00	0	2	0.00	0	2	0.00	0	0		0	1	0.00
Purple Finch	0	0		0	0		0	0		0	0		2	1	2.00	0	0		0	0	
Red-breasted Nuthatch	0	0		0	0		0	0		0	0		0	0		0	0		0	1	0.00
Red-breasted Sapsucker	0	0		1	0		2	1	2.00	0	0		1	2	0.50	3	2	1.5	0	2	0.000
Red-shafted Flicker	0	1	0.00	0	0		0	0		0	0		0	0		0	0		0	0	
Red-winged Blackbird	0	1	0.00	0	1	0.00	0	0		0	2	0.00	0	2	0.00	0	1	0.00	0	1	0.00
Rufous Hummingbird	27	9	3.00	19	1	19.0	37	1	37.0	29	6	4.83	39	16	2.44	20	1	20.0	22	0	
Song Sparrow	17	12	1.42	4	17	0.24	5	18	0.28	16	13	1.23	13	16	0.81	8	22	0.36	6	19	0.31
Tree Swallow	0	0		0	0		0	0		0	0		0	0		0	0		0	1	0.00
Warbling Vireo	1	8	0.13	0	1	0.00	0	7	0.00	1	4	0.25	1	10	0.10	0	8	0.00	0	3	0.00
Western Tanager	0	0		0	3	0.00	1	4	0.25	0	2	0.00	0	6	0.00	0	3	0.00	0	3	0.00
Western Wood-Pee wee	0	2	0.00	0	3	0.00	0	6	0.00	0	0		0	4	0.00	1	1	1.0	0	6	0.00
Willow Flycatcher	0	1	0.00	0	1	0.00	0	0		0	0		0	3	0.00	0	1	0.00	0	0	
Wilson's Warbler	22	13	1.69	12	21	0.57	9	19	0.47	16	17	0.94	20	16	1.25	6	28	0.21	22	21	1.05
Yellow Warbler	1	0		0	0		0	0		2	0		1	3	0.33	1	4	0.25	1	6	0.17
Totals	131	77		71	85		97	108		122	79		150	120		93	136		92	128	

U=unknown age.

Table 4 (cont). Species and Age Class of Birds Banded at Drakesbad During Constant-Effort Mist-Netting, 1997-2007.

Species	2004			2005			2006			2007					
	HY	AHY	Ratio	HY	AHY	Ratio	HY	AHY	Ratio	HY	AHY	Ratio			
American Dipper	0	0	0	0	0		0	0	0	0	0	0			
American Robin	0	3	0.00	0	1	0.00	1	2	0.50	0	2	0			
Allen's Hummingbird	0	0		0	0		0	0		0	0	0			
Anna's Hummingbird	1	0	0.00	0	0		11	2	5.50	0	0	0			
Audubon's Warbler	4	6	0.67	0	2	0.00	0	1	0.00	3	1	3.00			
Black-headed Grosbeak	0	0		1	0		1	3	0.33	0	2	0			
Brewer's Blackbird	0	0		0	0		0	1	0.00	0	0	0			
Brewer's Sparrow	0	0		0	0		0	0		0	0	0			
Brown-headed Cowbird	0	0		0	0		0	1	0.00	0	0	0			
Brown Creeper	0	0		0	0		2	1	2.00	1	0	0.00			
Calliope Hummingbird	5	0	0.00	1	0		0	1	0.00	1	0	0.00			
Cassin's Finch	2	4	0.50	0	0		0	8	0.00	0	4	0.00			
Cassin's Vireo	1	0	0.00	0	1	0.00	0	0		0	0	0			
Dusky Flycatcher	0	1	0.00	0	0		0	1	0.00	1	0	0.00			
Evening Grosbeak	6	13	0.46	0	1	0.00	0	15	0.00	1	7	0.14			
Golden-crowned Kinglet	0	0		0	0		0	0		1	0	0.00			
Hairy Woodpecker	0	1	0.00	0	0		0	0		0	1	0.00			
Hammond's Flycatcher	0	0		2	0		3	1	3.00	2	0	0.00			
Hermit Thrush	0	0		0	0		0	0		0	0	0.00			
Hermit Warbler	1	1	1.00	0	0		1	0	0.00	3	0	0.00			
House Wren	0	0		0	0		1	0	0.00	1	0	0.00			
Lawrence's Goldfinch	1	0	0.00	0	0		0	0		0	0	0.00			
Lazuli Bunting	5	1	5.00	0	1	0.00	0	3	0.00	0	2	0.00			
Lincoln's Sparrow	2	4	0.50	4	8	0.50	4	2	2.00	3	2	1.50			
MacGillivray's Warbler	12	19	0.63	6	14	0.50	20	18	1.11	7	9	0.78			
Mountain Chickadee	0	0		1	1	1.00	0	1	0.00	1	0	0.00			
Nashville Warbler	5	2	2.50	2	1	2.00	9	2	4.50	0	1	0.00			
Olive-sided Flycatcher	0	0		0	2	0.00	0	1	0.00	0	1	0.00			
Orange-crowned Warbler	43	7	6.14	31	6	5.17	102	6	17.0	57	16	3.56			
Oregon Junco	0	1	0.00	1	1	1.00	4	4	1.00	4	6	0.67			
Pine Siskin	2	8	0.25	0	0		0	0		0	3	0.00			
Purple Finch	0	0		1	1	1.00	0	0		0	0				
Red-breasted Nuthatch	1	0	0.00	0	0		0	0		1	0	0.00			
Red-breasted Sapsucker	1	6	0.17	0	1	0.00	0	1	0.00	0	2	0.00			
Red-shafted Flicker	0	0	0.00	0	0		0	0		0	0				
Red-winged Blackbird	0	0	0.00	0	0		0	0		0	0				
Rufous Hummingbird	36	0	0.00	8	4	2.00	36	0	0.00	48	3	16.0			
Song Sparrow	12	9	1.33	5	12	.417	9	13	0.69	21	18	1.67			
Spotted Sandpiper	U	U	0	0	0		0	0		0	0				
Swainson's Thrush	0	0		0	1	0.00	0	0		0	0				
Townsend's Solitaire	0	0		0	1	0.00	0	0		0	0				
Warbling Vireo	2	2	1.00	0	12	0.00	0	4	0.00	1	6	0.17			
Western Tanager	0	0		0	7	0.00	1	5	0.20	1	4	0.25			
Western-Wood Peewee	0	5	0.00	0	6	0.00	1	10	0.10	1	3	0.33			
Willow Flycatcher	0	3	0.00	0	0		0	2	0.00	0	4	0.00			
Wilson's Warbler	14	22	0.64	13	29	.448	20	21	0.95	22	27	0.81			
Yellow Warbler	4	6	0.67	3	10	0.300	1	1	1.00	2	8	0.25			
Totals	160	124		79	122		227	131		183	132				

SONGBIRD MONITORING – BREEDING BIRD SURVEY

INTRODUCTION

In the 1960s concern began to be raised about the harmful effects of habitat degradation on the nation's songbird populations (Carson 1962). Unfortunately, because no long-term regional or continental data were available for most bird species, ornithologists were unable to accurately quantify these perceived declines. Consequently, in the mid-1960s the Patuxent Environmental Science Center (now a part of the USGS, Biological Resource Division) developed the Breeding Bird Survey (BBS) program, a volunteer-staffed effort to obtain continental population data on breeding birds. Today, the BBS has nearly 4000 established survey transects in the US and Canada and has become an important source of long-term population data for all birds at continental, regional and local scales.

As with any sound ecological monitoring program, the main strengths of the program are that it is systematic, range wide, and has been in operation for multiple decades. However, one drawback of BBS data is that it provides no explanation for cause of population trends. Other techniques such as constant-effort mist-netting or nest searches must be used to assist in identifying the cause of trends.

Despite the program's shortcomings, the BBS is still recognized as a valuable source of information for scientific research and is used by government agencies to establish management priorities. In recent years, the Sierra Nevada Ecosystems Project (SNEP) relied heavily upon BBS data to provide Congress with a status report of Sierra Nevada ecosystems (Graber 1996). During the course of SNEP, 17 BBS transects were analyzed. Among other findings, 18 species of landbirds were discovered to be declining or likely declining. The report also concluded that because of the many years of systematic data derived from Sierra Nevada routes, breeding landbirds were the most useful group of vertebrates to monitor as an indicator of vertebrate health in the Sierra Nevada.

New analysis techniques have increased the value of the BBS program to a wider range of resource managers and researchers. Because individual BBS routes have been recently linked by computer to specific geographic points, relative abundance data can be used to show temporal and geographical patterns of songbird decline (Figure 5). Because of the natural variation of bird populations and sampling error from imperfect BBS methods, the most precise estimates resulting from these data are those covering large spatial scales (continental or regional). These new analysis techniques more readily identify at-risk species to avian researchers who can then undertake studies to determine causes for declines.

PROJECT HISTORY

In 1972, the "Lassen Park" transect (Route 008) was established. Twenty-seven observation stations were located within the park's boundaries and 23 stations were located within Lassen National Forest (LNF). In 1990, the route was modified because highway noise from

State Highway 44 was unacceptably influencing bird detection rates at several observation stations along the highway. The new transect — renamed “Chaos Crater” (Route 308) — maintained the identical 27 observation stations as Route 008 within the park, but observation stations formerly occurring along the highway on LNF were redistributed to quieter locations (Figure 6).

Biologist Ron Schlorff of the California Department of Fish and Game conducted censuses on Route 008 from 1972 to 1989 and on Route 308 from 1990 to 1998. In 1999, park Resources Management assumed responsibility for managing Route 308.

Route 308 was not run in 1992, 1995, and 1998 because of inclement weather.

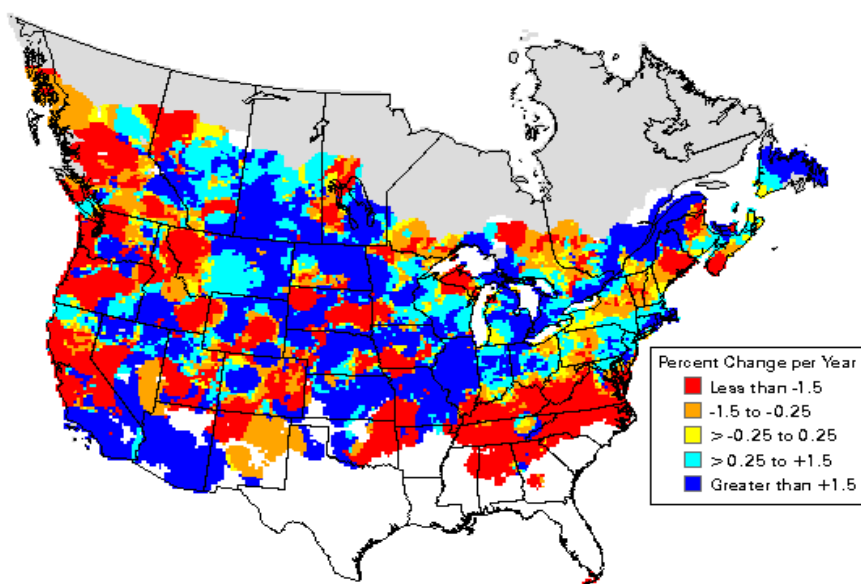


Figure 5. BBS Trend Map for Yellow Warbler, 1966-2003.

METHODS

Following national protocols, Breeding Bird Surveys are conducted in the park once annually during the peak of the nesting season, primarily during June. The transect is 24.5 miles long, with 50 observation stations located at ½ mile intervals along the route. A three-minute point count is conducted at each station, during which the observer records all birds heard or seen within a quarter mile of the station. A single observer collects the data, although other observers may be present to record data or provide transportation between stations. Observers must be able to identify all birds breeding in their area by sight and sound.

RESULTS

In 2007, the route was run on June 21. A total of 249 individuals representing 36 species were observed in 2007. Audubon’s Warbler (*Dendroica coronata*) was the most numerous

species followed by Mountain Chickadee (*Parus gambeli*), with 38 and 24 individuals observed, respectively (Table 5). Oregon Junco was the third highest count with 23 individuals observed. There were no new species observed in 2007 although there were six unidentified flycatchers and two unidentified woodpeckers. The unidentified flycatchers were either Hammond's or Dusky Flycatchers which have similar plumage and song and are difficult to tell apart. If there was a question about the species it was marked down as unknown. The two unidentified woodpeckers were both flying through the forest and could not be reliably identified to species.

FUTURE DIRECTION

The park will continue to operate the Chaos Crater Route (#308) indefinitely to contribute data to this long-term national monitoring effort. Data from the BBS will help support and corroborate data collected from other avian monitoring programs within the park and surrounding National Forest lands.

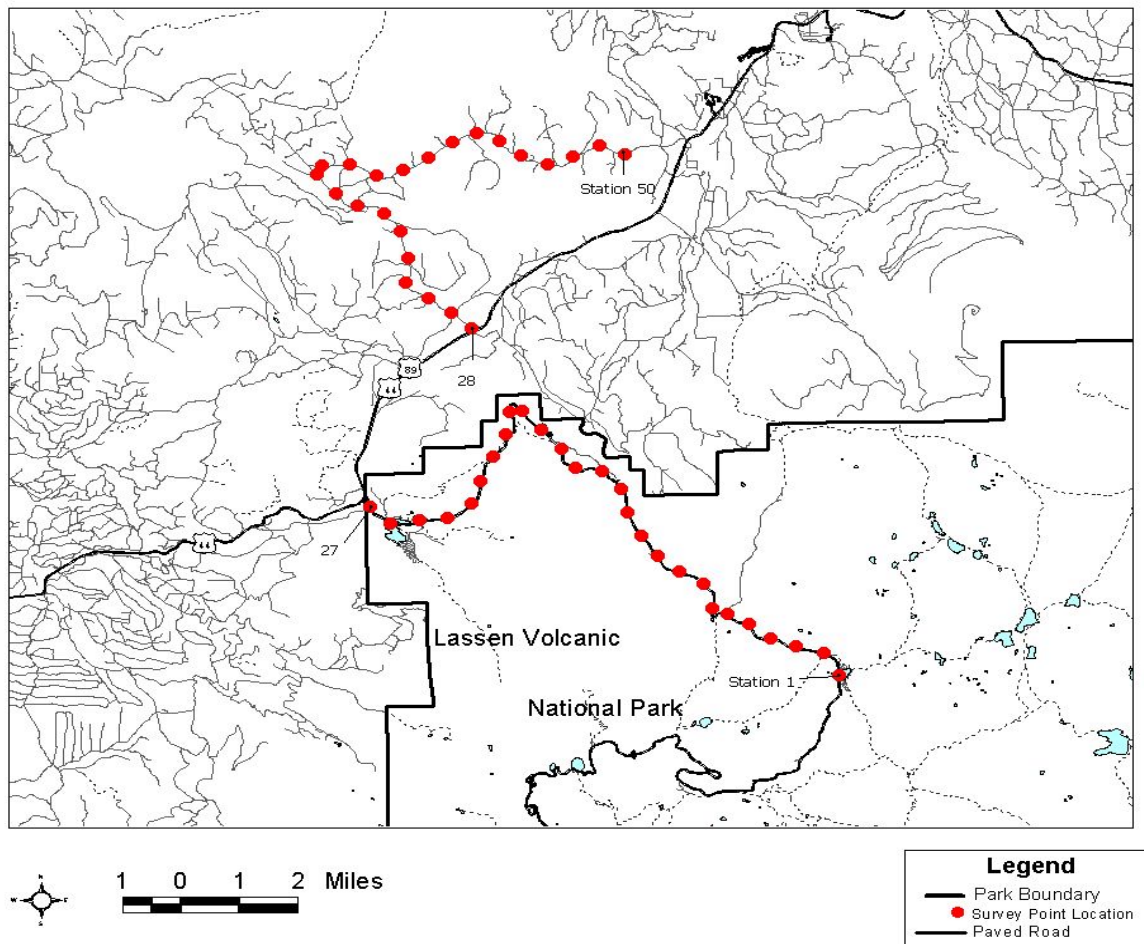


Figure 6. Breeding Bird Survey Route #308

Table 5. Breeding Bird Survey – Route Summary

RTE: 308 NAME: CHAOS CRATER STRATUM: 66 LAT-LONG: 4035-12133

STATE: CA

SPECIES	1990	1991	1993	1994	1996	1997	1999	2000	2001	2002	2003	2004	2005
American Coot	0	0	3	0	0	0	0	0	0	0	0	0	0
American Dipper	0	0	0	0	0	0	1	0	0	0	0	0	0
American Robin	46	30	40	28	28	37	12	13	10	10	6	7	14
Anna's Hummingbird	1	0	0	0	2	0	0	0	0	0	0	0	0
Audubon's Warbler	26	28	41	24	52	50	58	49	56	61	51	44	43
Band-tailed Pigeon	0	0	0	0	0	0	0	2	0	0	1	1	1
Bewick's Wren	0	0	0	2	1	0	0	0	0	0	0	0	0
Black-backed Woodpecker	0	3	0	0	3	0	1	0	2	0	0	0	0
Black-headed Grosbeak	1	1	0	4	0	0	0	0	0	0	0	0	0
Brewer's Blackbird	0	0	1	0	2	0	0	0	2	4	3	0	0
Brown Creeper	13	14	15	18	19	8	9	8	5	6	2	9	6
Brown-headed Cowbird	0	1	0	1	0	0	1	0	0	0	0	0	0
Canada Goose	0	0	0	0	0	0	0	0	0	0	0	0	2
Cassin's Finch	8	8	5	3	16	5	11	3	5	0	2	2	7
Chipping Sparrow	0	0	8	6	5	0	1	23	14	10	8	13	23
Clark's Nutcracker	13	4	2	0	2	0	3	0	0	3	0	0	0
Common Nighthawk	2	1	0	0	1	2	0	0	1	0	0	1	2
Common Raven	0	0	0	0	4	3	0	1	3	1	1	3	1
Dusky Flycatcher	5	3	8	6	2	0	21	9	7	5	8	9	7
Evening Grosbeak	1	0	1	1	0	2	1	13	11	9	15	19	3
Fox Sparrow	15	12	9	3	10	9	7	15	13	11	10	11	11
Golden-crowned Kinglet	5	3	2	2	13	13	9	17	21	15	5	9	11
Gray Flycatcher	0	0	0	2	0	0	0	0	0	0	0	0	0
Great Blue Heron	0	0	1	0	0	0	0	0	0	0	0	0	0
Green-tailed Towhee	0	1	9	1	0	1	2	1	1	0	0	0	0
Hairy Woodpecker	1	6	9	5	5	2	5	0	0	6	0	3	1
Hammond's Flycatcher	17	42	17	18	28	31	9	5	5	6	11	9	8
Hermit Thrush	12	15	17	12	22	12	9	4	5	5	8	2	9
Hermit Warbler	0	1	4	7	13	0	19	7	2	2	5	3	4
House Wren	0	0	0	1	0	0	0	0	0	0	0	0	0
Lincoln Sparrow	0	0	0	0	0	0	1	1	1	2	0	1	2
Macgillivray's Warbler	0	0	3	0	0	0	1	0	0	2	0	2	1
Mallard	0	0	2	3	0	1	0	0	1	0	0	0	1
Mountain Chickadee	67	74	75	79	95	87	55	38	32	38	46	35	46
Mountain Quail	0	3	4	3	3	2	0	0	0	0	3	0	1

TABLE 5 (continued)	1990	1991	1993	1994	1996	1997	1999	2000	2001	2002	2003	2004	2005
Mourning Dove	0	0	1	0	0	2	0	0	0	0	0	0	0
Nashville Warbler	0	0	0	0	0	0	5	0	3	0	5	0	6
Northern Goshawk	1	0	0	0	0	0	0	1	0	0	0	0	0
Olive-sided Flycatcher	16	12	10	9	27	20	7	8	4	4	3	2	4
Orange-crowned Warbler	1	1	0	0	0	0	0	1	0	0	2	0	0
Oregon Junco	36	32	37	42	67	41	26	26	21	31	22	32	23
Pacific-slope Flycatcher	0	0	0	0	0	0	0	0	0	0	0	0	1
Pied-billed Grebe	0	0	0	1	0	0	0	0	0	0	0	0	0
Pileated Woodpecker	0	0	0	0	0	0	0	0	0	1	0	1	0
Pine Siskin	0	0	1	0	0	0	4	1	2	0	0	1	0
Pygmy Nuthatch	0	0	0	0	0	0	0	0	2	0	0	0	0
Red Crossbill	0	0	1	0	0	0	2	1	0	0	3	2	0
Red-breasted Nuthatch	50	43	23	39	59	50	49	11	12	17	17	22	14
Red-breasted Sapsucker	0	0	0	0	1	2	3	1	2	1	2	0	0
Red-shafted Flicker	4	3	8	1	4	8	1	6	7	3	1	1	3
Red-tailed Hawk	0	0	1	1	1	1	0	0	0	0	0	0	0
Red-winged Blackbird	0	0	0	1	3	1	0	1	1	0	0	2	0
Cassin's (Solitary) Vireo	0	0	0	4	4	1	3	0	4	0	0	1	1
Song Sparrow	0	0	2	1	0	0	0	0	0	0	2	1	1
Spotted Sandpiper	0	0	0	0	0	0	0	0	0	0	1	1	0
Spotted Towhee	0	3	2	1	0	0	3	0	2	0	0	1	5
Steller's Jay	13	8	14	5	37	17	13	7	7	12	10	18	9
Townsend's Solitaire	0	0	0	0	0	0	9	4	3	3	1	3	1
Tree Swallow	0	1	0	0	2	1	4	0	0	2	1	0	1
Turkey Vulture	0	0	1	0	0	1	2	0	0	0	0	0	0
Unidentified Hummingbird	0	0	0	0	0	1	0	1	0	0	0	0	0
Warbling Vireo	1	5	3	8	1	2	15	7	7	11	10	8	12
Western Screech-Owl	1	0	0	0	0	0	0	0	0	0	0	0	0
Western Tanager	3	6	1	3	4	3	17	21	18	27	25	20	19
Western Wood-Pewee	28	26	29	24	43	19	19	29	21	26	26	24	33
White-breasted Nuthatch	1	1	0	1	0	0	0	0	0	0	1	0	0
White-headed Woodpecker	0	0	2	2	1	1	4	1	6	1	2	6	1
White-throated Swift	0	0	0	0	0	1	0	0	0	0	0	0	0
Willow Flycatcher	0	0	0	0	1	0	0	0	0	0	0	0	0
Wilson's Warbler	0	0	0	0	0	0	2	1	0	0	0	0	0
Winter Wren	0	0	0	0	0	0	0	1	0	0	0	0	0
Wrentit	0	0	0	0	0	0	3	1	1	2	0	1	0
Yellow Warbler	1	8	2	3	5	5	1	3	2	1	2	1	1
TOTAL INDIV.	389	399	414	375	586	442	428	342	322	338	321	331	339
TOTAL SPECIES	29	32	39	39	37	35	42	38	39	33	36	39	39
DATE ROUTE RUN	06/23	06/15	07/03	06/25	06/21	06/19	06/19	06/26	06/25	06/27	6/28	6/29	7/02

TABLE 5 (continued) BREEDING BIRD SURVEY - ROUTE SUMMARY REPORT

SPECIES	2006	2007
American Coot	0	0
American Dipper	0	0
American Robin	6	9
Anna's Hummingbird	0	0
Audubon's Warbler	36	38
Band-tailed Pigeon	1	1
Bewick's Wren	0	0
Black-backed Woodpecker	1	1
Black-headed Grosbeak	1	0
Brewer's Blackbird	0	0
Brown Creeper	1	3
Brown-headed Cowbird	0	0
Canada Goose	13	1
Cassin's Finch	4	6
Chipping Sparrow	10	12
Clark's Nutcracker	0	2
Common Nighthawk	0	0
Common Raven	4	0
Dusky Flycatcher	2	5
Evening Grosbeak	19	8
Fox Sparrow	5	8
Golden-crowned Kinglet	16	9
Gray Flycatcher	0	0
Great Blue Heron	0	0
Green-tailed Towhee	0	0
Hairy Woodpecker	2	5
Hammond's Flycatcher	6	5
Hermit Thrush	4	8
Hermit Warbler	0	5
House Wren	0	0
Lincoln Sparrow	2	2
Macgillivray's Warbler	0	0
Mallard	0	0
Mountain Chickadee	42	24
Mountain Quail	0	0
Mourning Dove	0	1
Nashville Warbler	0	1

TABLE 5 (continued) BREEDING BIRD SURVEY - ROUTE SUMMARY REPORT

Northern Goshawk	0	0
Olive-sided Flycatcher	0	0
Orange-crowned Warbler	0	0
Oregon Junco	27	23
Pacific-slope Flycatcher	0	0
Pied-billed Grebe	0	0
Pileated Woodpecker	0	0
Pine Siskin	0	1
Pygmy Nuthatch	0	0
Red Crossbill	0	2
Red-breasted Nuthatch	16	13
Red-breasted Sapsucker	1	1
Red-shafted Flicker	1	1
Red-tailed Hawk	0	0
Red-winged Blackbird	1	1
Cassin's (Solitary) Vireo	0	2
Song Sparrow	3	0
Spotted Sandpiper	1	0
Spotted Towhee	2	0
Steller's Jay	7	5
Townsend's Solitaire	2	4
Tree Swallow	0	0
Turkey Vulture	0	0
Unidentified Flycatcher	3	6
Unidentified Woodpecker	0	2
Warbling Vireo	4	8
Western Screech-Owl	0	0
Western Tanager	15	19
Western Wood-Pewee	20	12
White-breasted Nuthatch	0	0
White-headed Woodpecker	1	1
White-throated Swift	0	0
Willow Flycatcher	0	0
Wilson's Warbler	0	0
Winter Wren	0	0
Wrentit	0	0
Yellow Warbler	1	4
TOTAL INDIV.	281	249
TOTAL SPECIES	36	36
DATE ROUTE RUN	7/11	6/21

SPOTTED OWL MONITORING

INTRODUCTION

The California Spotted Owl (*Strix occidentalis occidentalis*) is one of three subspecies of Spotted Owl occurring within the United States. The Mexican Spotted Owl (*Strix occidentalis lucida*) is found in the southwestern states and Mexico. The Northern Spotted Owl (*Strix occidentalis caurina*) occupies western Washington, Oregon and the coastal ranges of northern California, from the Oregon border to the San Francisco Bay area. The range of the California Spotted Owl includes the Cascade and Sierra Nevada mountains and portions of the Southern California Coast Range. Lassen Volcanic National Park (LVNP) is within the range of the California Spotted Owl, but not within the range of the Northern or Mexican Spotted Owls.

All three subspecies are associated with late seral habitat (Thomas et al. 1990). The California Spotted Owl occurs in habitat that has a mixture of tree sizes and usually at least two canopy layers, with some very large, old trees present (Verner et al. 1992). These old trees provide cavities which are used by the owls for nesting (Verner et al. 1992). Suitable California Spotted Owl habitat exists within LVNP.

The California Spotted Owl was petitioned for listing under the Endangered Species Act on October 12, 2000. The reason stated for the petition was habitat destruction due to logging, urban development, livestock grazing, mining, recreation, and road construction (USFWS 2000). The U.S. Fish and Wildlife Service (USFWS) made a determination on February 10, 2003 that the California Spotted Owl does not warrant protection under the Endangered Species Act at this time. This decision was based on the belief that current land management direction on Federal lands and commercial timberlands will increase nesting, roosting and foraging habitats for the California Spotted Owl. The California Spotted Owl is listed as a Sensitive species by the U.S. Forest Service and Bureau of Land Management (BLM).

PROJECT HISTORY

In 1988, a partial survey of suitable habitat within LVNP detected one pair and two individual California Spotted Owls (Fowler 1988). The pair was located near Kings Creek Falls. The two individuals were a female found near Grassy Swale and a male found near Snag Lake. In 1995, a formal survey of the entire park was attempted; however, the park-wide survey was not completed because heavy snow delayed the beginning of the monitoring period (DuBrau and Evasick 1995). Areas that were surveyed in 1995 included the Warner Valley and Butte Lake prescribed burn units. A new pair of Spotted Owls was located near Butte Lake. The Butte Lake pair was determined to be non-nesting in 1995. In 2002, the Forest Service's Pacific Southwest Forest and Range Experimental Station (PSW) located two new nests within the park while surveying national forest lands adjacent to the park boundary. One nest was located in the vicinity of Willow Lake and the other north of Prospect Peak. Both nests are monitored annually. Also in 2002, park staff initiated surveys

in areas with scheduled fire management activities. FIREPRO funding is used for these inventories to protect Spotted Owl nest sites from fire management activities such as prescribed burning and mechanical thinning projects. One new pair and nest was found in 2002 during these surveys on the south side of Prospect Peak.

In 2005, LVNP received funding from the NPS Biological Resource Management Division (BRMD) to conduct a two year inventory of all suitable Spotted Owl habitat within the park in 2005 and 2006. Potential suitable habitat was delineated by vegetation mapping and Geographic Information System (GIS) analysis. Survey points were established in suitable habitat along roads and trails. Surveys were conducted in accordance with a protocol developed by the US Forest Service. Two new pairs of Spotted Owls were located during this two year survey in 2005 and both determined to be non-nesting that year. One is located near Craggs Campground and the other in Warner Valley. In 2006, the Craggs pair was located and determined to be non-nesting but the Warner Valley pair was not located during 4 survey visits to the area they inhabited in 2005. Since FIREPRO funding was not available in 2005 and 2006, proposed burn areas were incorporated into the park wide survey. No new pairs or nests were located in areas proposed for fire management activities.

METHODS

The surveys were conducted using protocols established by the U.S. Forest Service for Spotted Owl surveys within the Sierra Nevada. This allows for consistency in survey methods between agencies. According to the protocol, all suitable habitat must be surveyed six times. The surveys may be conducted in one year, or three times per year over a two year period (preferred). Most surveys were conducted at night, however, some cross-country surveys, considered too hazardous to walk at night, were surveyed during the day. Call points were established every one-quarter to one-half mile along roads and trails. An amplified caller was used to play Spotted Owl calls to elicit responses from territorial Spotted Owls. Each call point was surveyed for ten minutes.

If a Spotted Owl was detected during a survey, a daytime follow-up visit was conducted within 48 hours. The follow-up visit is a visual search of the area to locate an owl detected at night. If a Spotted Owl was found during the follow-up visit, a technique called mousing was used to determine nesting status. Mousing consists of placing a live mouse on the forest floor in plain sight of the owl. An owl will normally fly down and take the mouse. The owl will either eat the mouse or take it to a mate or nest. If an owl eats four or more mice it is determined to be non-nesting. If an owl takes at least one mouse to a nest or mate, pair status is confirmed. If the owl ignores the mouse for an hour the follow-up visit is complete with the results being inconclusive. Nesting status is confirmed if a female is detected on the nest, either member of the pair takes prey into the nest, or young are detected in the presence of one or both adults. If nesting was confirmed, a reproductive visit was conducted after June 1st to determine number of fledged young. All nests, non-nesting pairs and individual Spotted Owl locations were mapped using global positioning system (GPS).

Great Horned Owls (*Bubo virginianus*) and Northern Goshawks (*Accipiter gentilis*) are known predators of spotted owls, particularly young Spotted Owls. If a Great Horned Owl or Northern Goshawk is heard or seen during the survey, the survey point and adjacent call points are aborted for that survey visit. Surveyors move to the next call point out of hearing distance (approximately 1 mile) of the predator and continued to survey. If a Great Horned Owl or Northern Goshawk is seen or heard during a follow-up visit the visit is aborted immediately to reduce the chance of attracting potential predators to responding Spotted Owls.

RESULTS

FIREPRO funding was not received in 2007 for Spotted Owl surveys in fire management areas. The Lava Spring and Hole burn units were scheduled to be burned in 2007 so these units were surveyed in 2007. Personnel from the Resource Management Division conducted surveys in these burn units in 2007 and did not have any responses from Spotted Owls. No new Spotted Owls were discovered in 2007. Visits to historical pairs are listed below.

Devil's Kitchen Pair: This pair was discovered and confirmed to be non-nesting in 2005. No nest was found in 2005. The area where the pair resided in 2005 was surveyed four times in 2006 with no spotted owls being located. This area was surveyed again in 2007 two times and no spotted owls were detected.

Lost Creek Pair: This pair was also discovered in 2005. The pair was determined to be non-nesting in 2005 and non-nesting in 2006 as well. In 2007 a nest was found and the pair successfully fledged one young although 2 young were seen on the initial reproductive visit. The fate of the second juvenile is unknown. Personnel from PSW came into the park and banded the juvenile and the female from this pair. It was discovered that the female was banded as a juvenile in 2002 near Willow Lake on the Lassen National Forest. This site is approximately 15 miles southeast from the Lost Creek nest. PSW has not located this spotted owl since its initial capture in 2002. They removed the juvenile band from the female and replaced it with a color coded leg band for monitoring purposes. The male was not located on the day of the banding of the female and juvenile and was not banded in 2007.

Willow Lake pair: This pair was monitored by PSW in 2007 and successfully fledged one young. PSW banded the juvenile and also determined that the female of this pair was a new female that had a juvenile band. The female was recaptured and the juvenile band replaced with a new color coded band. It was determined that this female was banded as a juvenile in 1999 near Fredonyer Pass on Highway 36 just east of the town of Westwood California approximately 25 air miles east of the current nest. PSW has not located this female since 1999. The original female from the Willow Lake pair was not located in 2007 and her fate is unknown

Bathtub West Pair (North Prospect): This pair of owls used a nest that is inside the park near the park boundary on the north side of Prospect Peak in 2002. This pair moved outside

of the park to Forest Service lands in 2003. The two known nest sites for this pair were surveyed twice in 2007 with no response.

Fantastic Pair (South Prospect): This pair's nesting territory lies within the Prospect Peak prescribed fire burn unit. In the fall of 2005 this area was burned using helicopter ignition methods. An area approximately 50 meters around the nest tree was lightly thinned of ladder fuels and the duff layer removed from around the nest tree to protect it prior to burning. These measures were successful in protecting the nest tree and the nest grove. The nest grove and the area where the male was located in 2006 were surveyed twice in 2007. No Spotted Owls were detected at either location during these surveys.

Other owl species detected: There were no other owl species detected during the 2007 Spotted Owl surveys.

None of the surveys had to be aborted for any reason in 2007.

FUTURE DIRECTION

Lassen Volcanic National Park will continue to monitor known nests and pairs annually. FIREPRO funding was received for surveys in 2008 of fuel treatment areas (prescribed fire, mechanical thinning, and pile burning). Surveys will be conducted in these areas in 2008 following the current Forest Service protocol prior to project initiation.

BLACK-TAILED DEER MONITORING

INTRODUCTION

The East Tehama Deer Herd (ETDH) of Columbian black-tailed deer (*Odocoileus hemionus columbianus*) is the largest migratory herd in California and occupies a range that is considered the most extensive in the state. It has a migration route of up to 150 km, and during the summer, occurs throughout the park and surrounding national forest lands. Based on 50-year datasets maintained by the California Department of Fish and Game (CDFG), the ETDH population reached a high of around 100,000 animals in the late 50s and early 60s. Later, due to the droughts of the 70s, numbers drastically fell off to about 35,000, then climbed back up to about 70,000 by the mid-1980s. Though large fluctuations in populations have been recorded in the 50 years of CDFG record-keeping, today's record low populations of around 25,000-30,000 animals appear not to be sufficiently rebounding. This has generated some concern among wildlife biologists and ecologists, as the ecological impact of this large deer herd on the Lassen region, both as a dominant herbivore and as prey for cougars and coyotes, is substantial. Changes in vegetation structure and composition through fire suppression may be the most important factor reducing the deer condition (Walker 1997).

PROJECT HISTORY

In 1996, Lassen Volcanic National Park (LVNP), in cooperation with the Lassen National Forest (LNF) and CDFG, assisted in the establishment of two spotlight trend survey routes in the Almanor Basin to complement a route which had been run yearly by CDFG biologists since 1992. Another route was established on LNF in 1997 to make a total of four routes that were surveyed annually from 1997 through 1999. The original route run by CDFG was eliminated after the 1999 count due to a change in policy, leaving a total of three routes that are currently surveyed annually. The purpose of these routes is to provide additional trend data to complement several other methods used by CDFG (including triplicate surveys of deer winter range in early winter and early spring) to census and develop accurate population trends and estimates for the ETDH.

METHODS

Fixed spotlight trend surveys are conducted according to protocols established by CDFG. In summary, 25-mile-long permanent road transects are surveyed for total deer numbers for three consecutive nights during the first two weeks of August. Routes are begun one hour before local sunset, and conclude around three hours after local sunset. Two observers, a driver and a passenger, conduct independent surveys on either side of the road while keeping vehicle travel speed at about eight miles per hour except for brief stops to record count information. Spotlights used in the surveys are 1 million candle power. Data is recorded on standardized data sheets and include weather information, deer observation times, and vehicle mileage at each observation. Total deer count is the most important data obtained, with sex and age classes being secondary information only recorded when there is absolutely no doubt about the accuracy of these judgments.

RESULTS

Fixed spotlight trend surveys were conducted on permanent transects in LVNP and LNF from August 6-August 8, 2007. All three transects (Juniper Lake, Swain Mountain, and Hay Meadows) were surveyed. This was the twelfth year for Juniper Lake and Hay Meadows, and the eleventh year for Swain Mountain. Refer to Figure 7 and Table 6 for 2007 results. In 2007, on the Swain Mountain route, both spotlights malfunctioned after 10 miles (roughly half of the route) on survey night one which caused half the survey to be aborted for that night. This was the only technical problem in 2007.

FUTURE DIRECTION

Fixed spotlight trend surveys will continue because they are an efficient method to obtain trend data while deer are on their summer range. These datasets have been important in corroborating the findings of other methods used by CDFG to monitor ETDH demographics.

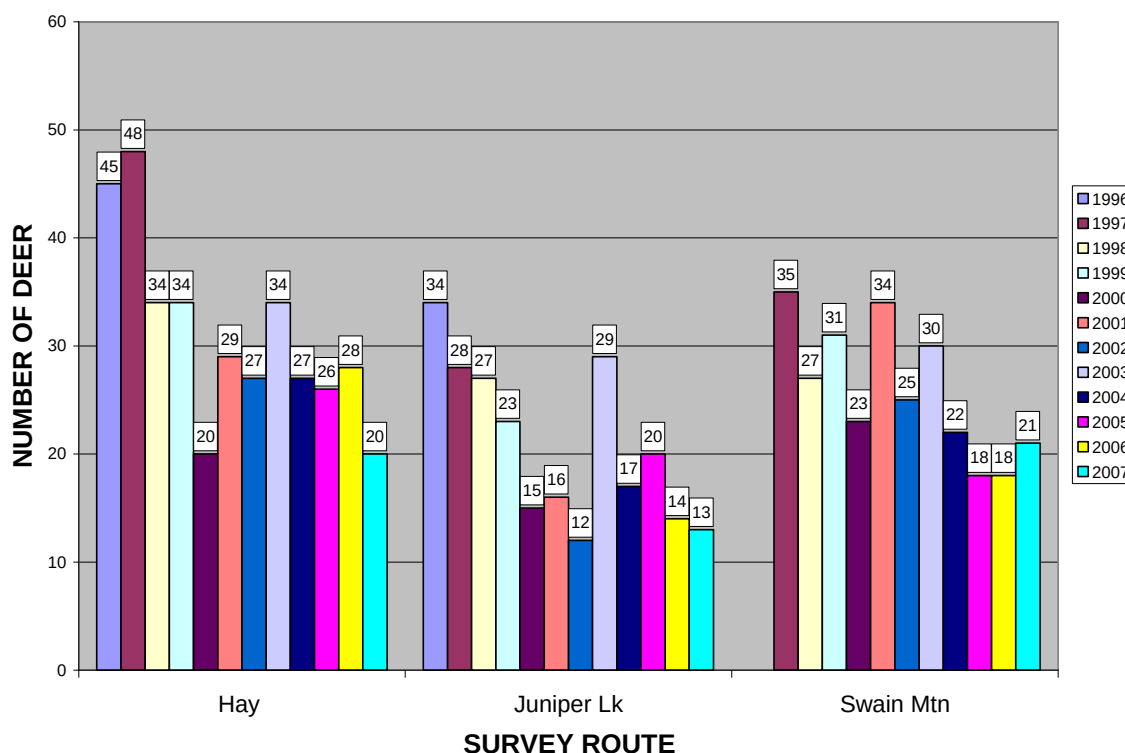


Figure 7. Average Annual Count from Three Fixed Spotlight Deer Trend Surveys on Lassen Volcanic National Park and Lassen National Forest, 1996-2007.

Table 6. 2007 Results from Three Fixed Spotlight Deer Trend Survey Routes in Lassen Volcanic National Park and Lassen National Forest.

HAY MEADOWS ROUTE

Survey Night	No. of Bucks	No. of Does	No. of Fawns	Unknown	Total
1	1 (1)	13 (12)	0 (0)	7 (10)	21 (23)
2	0 (1)	14 (9)	1 (5)	7 (10)	22 (25)
3	1 (2)	13 (14)	0 (1)	3 (18)	17 (35)
Route Totals	2 (4)	40 (35)	1 (6)	17 (38)	60 (83)
Nightly Avg.	0.7 (1.3)	13.3 (11.7)	0.3 (2)	5.7 (12.7)	20.0 (27.7)

JUNIPER LAKE ROUTE

Survey Night	No. of Bucks	No. of Does	No. of Fawns	Unknown	Total
1	1 (2)	8 (9)	1 (0)	0 (0)	10 (11)
2	2 (1)	5 (8)	0 (6)	1 (2)	8 (17)
3	1 (3)	15(9)	0 (2)	4 (0)	20 (14)
Route Totals	4 (6)	28 (26)	1 (8)	5 (2)	38 (42)
Nightly Avg.	1.3(2)	9.3 (8.7)	0.3 (2.7)	1.7 (0.7)	12.7 (14.0)

SWAIN MOUNTAIN ROUTE

Survey Night	No. of Bucks	No. of Does	No. of Fawns	Unknown	Total
1	0 (2)	4 (8)	1 (0)	2 (6)	7 (16)
2	0 (2)	13 (9)	2 (0)	4 (4)	19 (15)
3	1 (4)	17 (5)	5 (3)	15 (10)	38 (22)
Route Totals	1 (8)	34 (22)	8 (3)	21 (20)	64 (53)
Nightly Avg.	0.3 (2.7)	11.3 (7.3)	2.7 (1.0)	7.0 (6.7)	21.3 (17.7)

Note: The numbers of mule deer counted during 2006 surveys are listed in parentheses.

WILDLIFE SIGHTINGS

INTRODUCTION

A new system for recording wildlife observations from park staff and visitors at Lassen Volcanic National Park was initiated in 1999. This new system was needed to help park resource manager's accurately record wildlife observation data. There have been at least five different sighting report forms used at Lassen Volcanic National Park (Perrine and Arnold 2001). These forms ranged from the National Park Service's official Natural History Field Observation Form 10-257, to separate forms for reporting black bears and red foxes. The Interpretation Division also had its own form. Each form collected different information with an inconsistent level of detail. These forms did not have adequate space to describe the animal's physical attributes, location or behavior. Observer information was also incomplete which made it impossible to contact the observer if follow-up was needed. The data was stored in a dBase III+ electronic database that was familiar to only one person in the Resource Management Division. Because of the lack of familiarity with this database, the forms were filed without being entered into the electronic database. Without being entered into a user friendly database the query of the data was a long tedious process that yielded incomplete data. A new system was needed that would be user friendly to visitors and staff.

METHODS

A new system was developed that consisted of a new form with a map of Lassen Volcanic National Park on the back. The front of the form has short spaces for observer name, phone number and address, as well as date, time and location of the sighting. Longer spaces are provided to describe the animal and document behavior, the presence of offspring, and other information such as whether the animal is collared or tagged or injured. The back of the form has a map of the park showing roads, trails, campgrounds and other landmarks such as lakes and mountain peaks. The person completing the form fills out the front of the form and then marks the location on the map. The visitor gives the form to a park service employee who then forwards it to the Natural Resource Management Division.

The Resources Management staff has an overlay that divides the park into a grid of 1 square mile (mi^2) sections. Each section has a code associated with it. One mi^2 was chosen because it was an acceptable compromise between accuracy and confidence. The overlay is used to determine in which grid square the sighting was located, and consequently what location code should be recorded in the database for the sighting.

After the location code is determined, all the sighting information is entered into a Microsoft Access database using a computerized data entry form. Basic queries can be run in this program to determine a wide variety of information. Some examples include the total number of sightings for a particular time period and the number of a given species between any given dates. The results can then be imported into ArcGIS to generate maps of sighting occurrences for particular species. These maps can illustrate either the number of reports

received or the number of animals sighted, since several individuals of the same species may be reported as one sighting.

RESULTS

There were a total of 190 sighting reports turned in to the Resource Management Division in 2007. A total of 300 animals were reported representing 41 species (Table 7). In 2006, an article was published in the park newspaper asking visitors to report sightings of wildlife they thought were worthy of reporting. Although the numbers of reports turned in were not substantially different than 2005 (134 in 2005 and 153 in 2006), the number of species reported jumped from 37 in 2005 to 59 species in 2006. In 2007 the number of species reported declined to 41. The same article asking visitors to report wildlife sightings was also published in 2007. Black bears were the most reported animal within the park with 101 sighting reports recording 110 animals. This is up almost 50% from 2006 sighting reports. There were multiple sightings of the same bears in the Kings Creek and Summit Lake areas which contributed to the increase in 2007. Bald Eagle had the second most sighting reports with 13 sighting reports recording 13 individuals. American marten had the third highest sighting report numbers with 6 sighting reports recording 6 animals. Canada goose only had 2 sighting reports turned in but 60 individuals were observed (52 on Snag Lake and 8 on Butte Lake).

The new sighting reports emphasize filling out a report for significant or unusual wildlife (such as cougars, bears, foxes, coyotes, marten, eagles, falcons, etc) or any animal that is injured or acting strangely. The result is that most of the animals actually seen by visitors and staff go undocumented.

FUTURE DIRECTION

Lassen Volcanic National Park will continue to use this system to record wildlife sightings.

Table 7. Wildlife Observation Form Results, Lassen Volcanic National Park, 2007.
(The total number of reports submitted is in parentheses)

Species	Total # of animals	
Carnivores		
Badger	3	(3)
Bear, black	110	(101)
Bobcat	1	(1)
Coyote	1	(1)
Fox, red	3	(3)
Mountain lion	3	(3)
Marten, American	6	(6)
Mink	1	(1)
Otter, river	5	(4)
Unknown mustelid	1	(1)
Other Mammals		
Beaver, mountain	2	(2)
Deer, mule	6	(4)
Pika	3	(3)
Muskrat	2	(2)
Raptors		
Eagle, Bald	13	(13)
Eagle, Golden	3	(3)
Falcon, Prairie	1	(1)
Hawk, Cooper's	2	(2)
Hawk, Sharp-shinned	1	(1)
Hawk, Unidentified	1	(1)
Kestrel	1	(1)
Osprey	2	(2)
Vulture, Turkey	2	(1)

Table 7 (continued).

Other Birds

Bufflehead	6	(1)
Duck, Ring-necked	12	(2)
Goose, Canada	60	(2)
Great Blue Heron	6	(3)
Grebe, Eared	3	(2)
Grouse, Blue	2	(2)
Jay, Gray	4	(3)
Merganser, Common	1	(1)
Nightjar, Unidentified	3	(1)
Nuthatch, Unidentified	8	(1)
Pigeon, Band-tailed	8	(1)
Robin, American	1	(1)
Swift, Vaux's	1	(1)
Tanager, Western	2	(2)
Woodpecker, Lewis	1	(1)
Woodpecker, Black-backed	6	(4)

Reptiles

Turtle, western-pond	1	(1)
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Amphibians

Toad, western	2	(2)
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Total Observations	300	(191)
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NONNATIVE PLANT TREATMENT AND MONITORING

INTRODUCTION

The nonnative invasive plant program in Lassen Volcanic National Park (LVNP) consists of five primary management strategies. These strategies are:

1. **Prevent** the introduction and spread of invasive nonnative plants through public education and proactive management.
2. **Survey** and map nonnative vegetation and prioritize its potential for invasiveness and ecological displacement as an early-detection tool.
3. **Treat** infested areas using minimum tool requirements according to LVNP Weed Management Plan guidelines.
4. **Monitor** populations and treatment areas to gauge program effectiveness.
5. **Adapt** management strategies based on monitoring results and LVNP Weed Management Plan guidelines.

There are several invasive species targeted for management in the park. Bull thistle (*Cirsium vulgare*) and woolly mullein (*Verbascum thapsus*) are the two most invasive and widespread weeds in the park. Intermediate wheatgrass (*Elytrigia intermedia ssp. intermedia*) and smooth brome (*Bromus inermis*) are found in the southwest corner of the park near the old ski slope. These 4 species are the main targets of the park's weed treatment activities. In addition, oxeye daisy (*Leucanthemum vulgare*), dalmation toadflax (*Linaria genistifolia ssp. dalmatica*), Klamathweed (*Hypericum perforatum*), foxglove (*Digitalis purpurea*), and chicory (*Chicorium intybus*) are targets of treatment efforts at the park headquarters in Mineral. The entire population (less than 6 individuals) of Klamathweed was removed from the Summertown Burn Unit/ Leachfield area. Yellow salsify (*Tragopogon dubium*) is widely distributed but not abundant in disturbed areas. Other exotic species such as dandelion (*Taraxacum officinale*) and self-heal (*Prunella vulgaris*) are found in moist or disturbed areas of the park, but are not currently targeted for treatment. Surveys in 2003 found a population of five Canada thistle (*Cirsium arvense*) on the west shore of Snag Lake, but a repeat survey this year found no plants. Canada thistle is also found in the sewage mounds area near the southwest park entrance. About 50 Himalayan Blackberry (*Rubus discolor*) shoots were removed at Terminal Geyser. Reed canary grass (*Phalaris arundinacea*) and tall wheatgrass (*Elytrigia elongata*) were removed from the Warner Valley horse corral site. Their status as weeds in California remains unclear; however, multiple academic opinions agree that its location suggests this population is invasive and non-native. Cheatgrass (*Bromus tectorum*) was treated on the edge of Butte Lake and at Manzanita Lake.

PROJECT HISTORY

The nonnative invasive plant program is implemented through a joint effort by the Natural Resource Management Division and the Fire Management Division. Public education consists of species-specific “alert” flyers and visitor contacts. In 2002, the California Exotic Plant Management Team (CaEPMT) crew began assisting in surveying and treatment. Two biological technicians funded by the Bluff Wildland Fire Use Fire Burned Area Emergency Restoration project began surveying and treating for nonnative species within the Snag Lake watershed in 2005 and will continue in 2006. Biological Technicians assigned to the Federal Lands Highway Project survey and treat areas along the main Park road to prevent further spread of exotics related to construction projects. Volunteers from the local area, Golden Gate National Recreation Area, and the national chapter of the Sierra Club have contributed over 1000 hours since 2002.

METHODS

Surveys to determine the distribution and abundance of nonnative species are focused on developed areas, road corridors, the park boundary and within the watersheds of existing and proposed prescribed burn units. A survey is performed by walking in a regular grid pattern over an area such that any weed species will be noticed. The distance at which two members of a survey crew are separated from each other varies from about 5m to 50m depending on the visibility through the vegetation. Extra care is taken when surveying potential habitat such as areas that are moist or disturbed. When an infestation is found, the species, number of plants and percentage of reproductive plants are noted. The location and extent of each infestation is recorded by a global positioning system (GPS) unit. All data is entered in the Weed Information Management System (WIMS). Please see LVNP WIMS Protocol and LVNP Weed Protocol for more information (LVNP 2006). Photographs are taken of certain weeds and look-alikes to aid in training for identification.

Manual removal of target plant species is currently the only treatment practiced. Because the park would like to consider the use other treatments, we will have to complete an Environmental Assessment (EA) and determine whether there would be any significant impacts from those proposed treatments, in order to be in compliance with the National Environmental Policy Act (NEPA). Many areas have a relatively low density infestation and the disturbance to the surrounding vegetation will be minimal. The roots of the plants are loosened with a pick or hoe before the plants are pulled out of the ground. Care is taken to remove roots of plants because some species, particularly bull thistle, have the potential to sprout vegetatively. If the plants are flowering, the reproductive heads are removed from the plant so that they do not set seed. If the flowers are mature enough to show color, they are bagged and carried out of the field. Seedlings are scraped with the flat part of a pick unless they are too abundant to warrant complete treatment. If possible, a revisit to an infestation is performed about four weeks after the first visit to treat any reproductive plants that were missed.

RESULTS

The 2007 season was focused on entering and verifying historical data and preparing for the Weed Management Plan and Environmental Assessment (WMP/EA)(LVNP 2008). Two Student Conservation Association interns (Rosalind Vara and Alex Lawton) were funded by the Lassen Park Foundation to compile and organize data into WIMS and field-verify historical locations. They entered over 600 occurrences, assessments, and treatments in 10 weeks. Two Biological Science Technicians (Zeph Friedman-Sowder and Jenn Tiehm) were also instrumental in documenting our activities throughout the summer and in leading group efforts.

In addition, the Redding East Noxious Weed District Biologist from the California Department of Food and Agriculture (CDFA) surveyed Highway 44 and Forest Service and Private land north of the park for spotted knapweed (*Centaurea stoebe*). Point locations for spotted knapweed were recorded. They also assisted in surveying local quarries proposed for construction material.

The Lassen County Special Weeds Action Team spent 40 hours in the park treating weeds in Lassen County. The team is based out of the Bureau of Land Management Eagle Lake Field Office in Susanville, CA. They are funded by the Lassen Weed Management Area and a small grant from resource management funds.

The Exotic Plant Management Team came out for their annual visit from July 11-18. They were based at Lost Creek and treated Manzanita Lake and Mineral Headquarters. Another crew came out in September and treated additional areas in the Manzanita and Butte Lakes areas.

Eighteen Sierra Club members participated in a work trip July 23-29. They were based out of Warner Valley and treated Drakesbad, Terminal Geyser, and the lower valley.

Lastly, LVNP employees assisted in locating new weed populations by submitting WIMS-based forms to the plant crew. Two new populations of bull thistle were located by park employees.

The two most pervasive invasive species in the park are woolly mullein (*Verbascum thapsus*) and bull thistle (*Cirsium vulgare*). Intermediate wheatgrass (*Elytrigia intermedia*) and smooth brome (*Bromus inermis*) are mainly a problem in the old ski slope area and along the main park road and at Mineral Headquarters. Yellow Salsify (*Tragopogon dubium*) is widespread, but sparse throughout the park. Cheatgrass (*Bromus tectorum*) was treated at Butte and Manzanita Lakes and mapped at Terminal Geyser.

A more formal early detection program was implemented this year. A new population of Klamathweed (*Hypericum perforatum*) was discovered at Dersch Meadow after construction work on the new culverts was completed. No other road construction-related populations have been recorded. New populations at Mineral Headquarters were also recorded. A new population of Hoary cress (*Cardaria draba*) was recorded at the Lost

Creek Campground. New populations of bull thistle were found in two drainages near Snag Lake and along Lost Creek.

The area around park headquarters is the most diversely infested area with mainly oxeye daisy (*Leucanthemum vulgare*), dalmation toadflax (*Linaria genistifolia* ssp. *dalmatica*), Klamathweed (*Hypericum perforatum*), foxglove (*Digitalis purpurea*) and chicory (*Cichorium intybus*). Plans for treating this area are still being developed.

Periwinkle (*Vinca major*) was pulled by staff and EPMT. Some areas were covered with weed cloth and others were seeded with locally collected mountain brome (*Bromus carinatus*) and blue wildrye (*Elymus glaucus*).

Himalayan blackberry was treated at Terminal Geyser. Two new populations were found; one population in the housing area in Mineral Headquarters and one plant between Loomis Museum and the entrance station along the Manzanita Lake Trail.

On a positive note, a historical population (2003) of five Canada thistle (*Cirsium arvense*) on the west shore of Snag Lake was monitored for the third year in a row. No plants were found. This location should continue to be checked, however, as Canada thistle is a persistent weed that needs to be prevented from spreading. The reed canary grass (*Phalaris arundinacea*) at the Warner Valley horse corral was treated by the Sierra Club and new weed cloth installed. The population cover was reduced by 80% with most of the cover around the edge of the weed cloth.

FUTURE PLANNING

Given that the invasive plant management program has limited resources, clearly focused priorities must be established before the growing season. The WMP/EA that will be released for public review during the winter of 2008 will guide future management strategies.

Surveying and mapping will begin with the proposed prescribed burn units and revisits of previous infestations. Surveying burn units before ignition is a priority because it is required by the Fire Management Plan Environmental Assessment. Continued intensive survey and treatment of the headquarters area will continue to prevent the introduction of new species to the park interior by management activities. Intensive treatment efforts will begin on cheatgrass and Klamathweed and a plan developed for oxeye daisy.

Data collected will be entered into the Weed Information System (WIMS) database. New data will be entered directly into a Trimble GeoXT using ESRI ArcPad (ESRI 2002) software then downloaded directly into the WIMS database. Individual plant counts will be kept for some species as anecdotal information but all species-infested cover and gross cover will be recorded. This will assist in tracking Government Performance and Results Act (GPRA) goals and cover species that cannot be counted individually (e.g., rhizomatous species such as reed canary grass).

The short summer season allows a small window of time for treatment. Therefore, survey and treatment work must be prioritized carefully to maximize effectiveness. Both bull thistle and woolly mullein can produce large numbers of propagules from few adults; the best management strategy is to first target small, isolated infestations, then large diffuse infestations, followed by large dense infestations. Typically, previously treated infestations take precedence over infestations that have never been treated.

Public education will be conducted via the park newspaper and website. Park employees will also receive training on distinguishing nonnative and look-alike native species and reporting nonnative sightings.

The Natural Resources Management Division will continue to host volunteer groups and solicit interest in collecting mullein and Klamathweed for medicinal use. Ohlone School of Herbal Studies, Sierra Club, and the Weed Management Area crew will assist park staff with treatments in 2008.

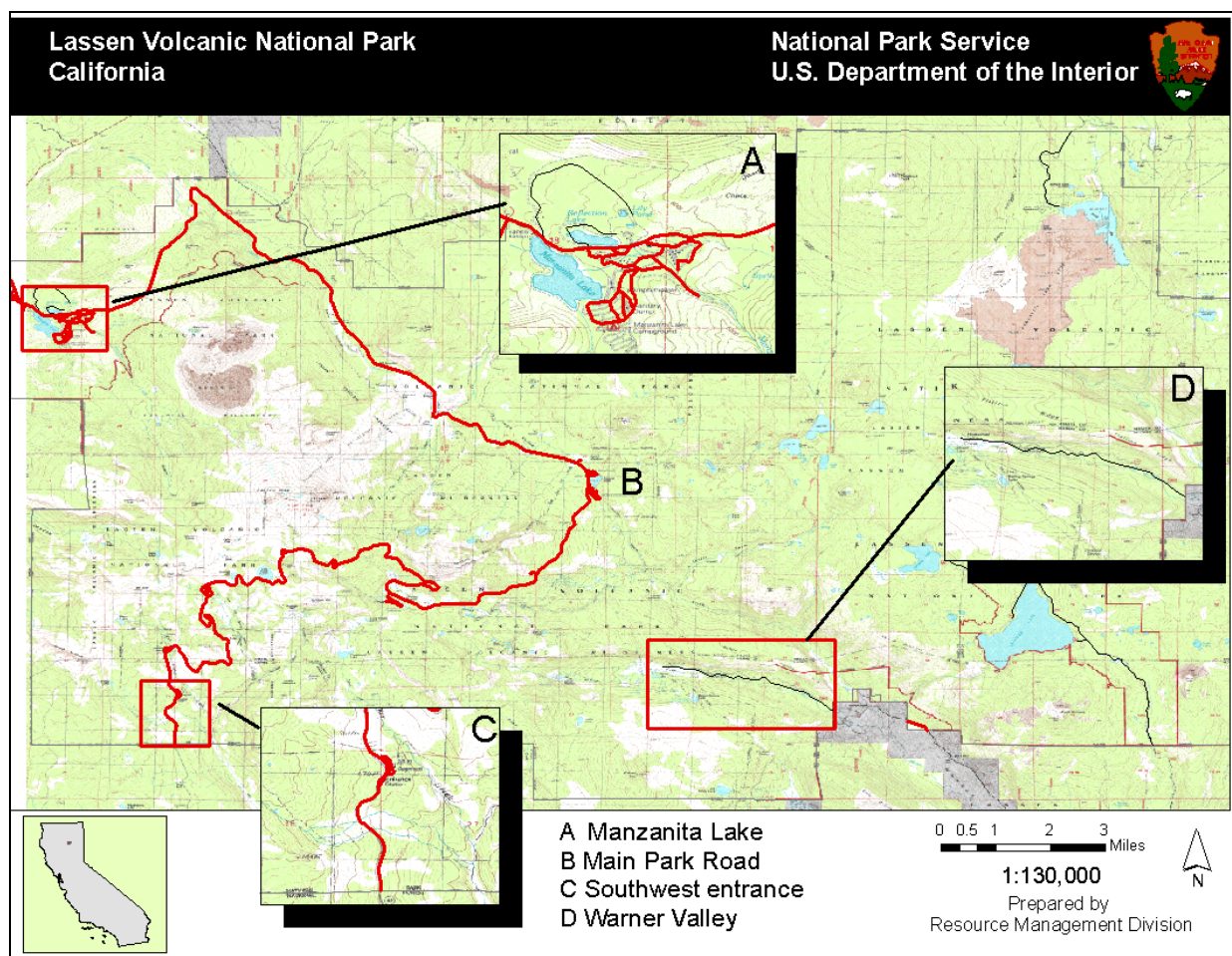


Figure 8. Locations Targeted for Survey and Treatment of Weeds in 2007, Lassen Volcanic National Park.

DISTURBED LANDS RESTORATION

INTRODUCTION

Two projects were undertaken by the park in 2007 that required restoration of ground disturbance by the Natural Resources Management staff.

PROJECT HISTORY

Summer 2007 was the first season of on-the-ground disturbance for the current Federal Lands Highway Program (FLHP) road repaving project and the Southwest Visitor Center construction. From 2005-2007, mapping the proposed restoration sites, plant propagation and seed collection were initiated. The program was organized into 3 categories: seed and cuttings collection and plant salvage, disturbed ground restoration, and data tracking/monitoring. Each was tracked using an Excel spreadsheet and/or Access database.

OBJECTIVES

The objectives of the project are to facilitate the growth of native plants on disturbed sites and also to monitor disturbed sites for potential invasion by exotic species.

METHODS

Seed and cuttings collection and plant salvage

Main Park Road

Seed collection was based on work sites determined in previous years. This season was an excellent Lupine seed production year, particularly Satin Lupine (*Lupinus obtusilobus*). Terrace Lake Trailhead and Lake Helen were two collection sites that produced large amounts of seed. Seed was collected in five sub-basin watersheds in the park. A base map of sub-basin watersheds was created with ESRI ArcMap 9.

Since the majority of highway construction occurred between Lake Helen and Summit Lake (with the exception of the Southwest Visitor Center), these most seed was collected from these areas. All collected seed was tracked in the Excel database under the “Seed Collection” tab (Figure 9). The seed was dried and stored in breathable mesh bags. Seed was either dispersed at sites later in the season when precipitation was expected, or given to the Corvallis Plant Materials Center, National Resources and Conservation Service (NRCS) for propagation. NRCS propagated and grew 1340 individual plants. Most of these plants were picked up on September 11th, 2007 and transported to the park. They were staged at the Horse Corral by Summit Lake to acclimate until they were planted in September/October 2007.

In addition, plants were salvaged at several sites before construction began and left on site in water or brought to Park Headquarters in Mineral. The plants were set in a plastic tarp, which allowed water to sit at the bottom and give the plants adequate moisture to survive.

The plants were transplanted to their corresponding sites when construction was completed and sufficient precipitation was expected. Some sites were watered by construction water trucks. These sites are:

- Dersh Meadows
- Lost Creek
- Kings Creek Picnic Area
- Lake Helen Picnic Area
- Lassen Peak Parking Lot
- Pike Slope

Common Name	Scientific Name	Site Location	Watershed	Sub-Watershed	# of Bags	Lat_DD	Long_DD
Narrow-flowered Lupine	Lupinus angustiflorus	Near Hot Rock	Hat Creek	Upper Lost Creek	1	40.42691	-121.53423
Narrow-flowered Lupine	Lupinus angustiflorus	Summit Lake South	Upper North Fork Feather River	Kings Creek	1	40.49271	-121.42934
Squirrel Tail	Elymus elymoides	SW Visitor Center Campground	Mill Creek	Lassen Peak	1	40.43684	-121.53284
Swamp Thistle	Cirsium douglasii var. breweri	Drakesbad Meadow	Upper North Fork Feather River	Drakesbad	9	40.44136	-121.406733
Dwarf Thistle	Cirsium scariosum	SW Visitor Center Meadow	Mill Creek	Lassen Peak	1	40.43624	-121.53362
Baltic Rush	Juncus baltic	Kings Creek Meadow	Upper North Fork Feather River	Kings Creek	1	40.46683	-121.47598
Baltic Rush	Juncus baltic	SW Fee Both Creek	Mill Creek	Lassen Peak	1	40.43528	-121.53467
Bolander's Yampah	Perideridia bolanderi	Lower Ski Slope	Mill Creek	Lassen Peak	1	40.43881	-121.53537
Bolander's Yampah	Perideridia bolanderi	Drakesbad Meadow	Upper North Fork Feather River	Drakesbad	1	40.44136	-121.406733
Black-Alpine Sedge	Carex nigricans	Diamond Peak Overlook	Mill Creek	Lassen Peak	1	40.46683	-121.47598
Black-Alpine Sedge	Carex nigricans	SW Visitor Center Campground	Mill Creek	Lassen Peak	1	40.43684	-121.53284
Whitethorn Ceanothus	Ceanothus sempervirens	1/4 Mile before SW Fee Booth	Mill Creek	Lassen Peak	1	40.42691	-121.53423
Brewer's Mountain Heather	Phyllodoce breweri	Kings Creek Picnic Area	Upper North Fork Feather River	Kings Creek	1	40.4638	-121.47784
Showy Sedge	Carex spectabilis	Kings Creek Meadow	Upper North Fork Feather River	Kings Creek	1	40.46683	-121.47598
Abrupt-Beaked Sedge	Carex abrupta	SW Fee Both Creek	Mill Creek	Lassen Peak	1	40.43528	-121.53467
Sierra Stickseed	Hackelia nervosa	Jones Cut	Mill Creek	Lassen Peak	1	40.45968	-121.5266
Coyote Mint	Mondardella odoratissima	Sulphur Works	Mill Creek	Lassen Peak	1	40.48441	-121.53584
Coyote Mint	Mondardella odoratissima	SW Visitor Center Meadow	Mill Creek	Lassen Peak	2	40.43624	-121.53362
Slender Hairgrass	Deschampsia elongata	Dersh Meadow	Hat Creek	Upper Hat Creek	1	40.50291	-121.44975
Turfed Hairgrass	Deschampsia cespitosa	Diamond Peak Overlook	Mill Creek	Lassen Peak	1	40.46683	-121.47598
Small-Flowered Stickseed	Hackelia micrantha	Sewage Mounds	Mill Creek	Lassen Peak	2	40.41726	-121.53235
California Stickseed	Hackelia californica	Drakesbad Meadow	Upper North Fork Feather River	Drakesbad	1	40.44136	-121.406733
Wintergreen-Leaved Buckwheat	Eriogonum pyrolifolium	Emerald Lake	Mill Creek	Lassen Peak	1	40.45563	-121.51775
Spurry Buckwheat	Eriogonum spargulifolium	Drakesbad Meadow	Upper North Fork Feather River	Drakesbad	1	40.44136	-121.406733
Ample-Leaved Sedge	Carex amplifolia	Drakesbad Meadow	Upper North Fork Feather River	Drakesbad	1	40.44136	-121.406733
Ragless Ragwort	Senecio aronicoides	Emerald Lake	Mill Creek	Lassen Peak	2	40.45563	-121.51775
Mule's Ear	Balsamorhiza sagittata	Lower Ski Slope	Mill Creek	Lassen Peak	2	40.43981	-121.53537
Leemon's Needlegrass	Achnatherum lemmonii	Drakesbad Meadow	Upper North Fork Feather River	Drakesbad	1	40.44136	-121.406733
Corn Lily	Veratrum californicum var. californicum	Lower Ski Slope	Mill Creek	Lassen Peak	1	40.43981	-121.53537
Dwarf Thistle	Cirsium scariosum	Drakesbad Meadow	Upper North Fork Feather River	Drakesbad	1	40.44136	-121.406733
Mountain Hemlock	Tsuga mertensiana	Emerald Lake	Mill Creek	Lassen Peak	3	40.45563	-121.51775
Satin Lupine	Lupinus obtusilobus	Terrace Lake Trailhead	Upper North Fork Feather River	Kings Creek	not bagged yet	40.47631	-121.47913
Pealy Everlasting	Anaphalis margaritacea	1/4 Mile before SW Fee Booth	Mill Creek	Lassen Peak	3	40.42926	-121.53439
Satin Lupine	Lupinus obtusilobus	Lake Helen	Mill Creek	Lassen Peak	not bagged yet		

Figure 9. Spreadsheet of Seed Tracking for Restoration Projects in Lassen Volcanic National Park.

At Dersh Meadows *Deschampsia caespitosa* was collected in two 2' x 2' plastic trays. The trays were left in a shallow pond on site. The grass was inspected throughout the summer and is surviving quite well on site.

Twenty-four *Salix boothii* (booth's willow) and sixteen *Alnus incana* (mountain alder) cuttings were taken at Lost Creek. The species were bundled separately, placed in Lost Creek, and attached to a rebar post on the bank. Monitoring of the cuttings determined that the cuttings looked healthy; they were transplanted in late September. At Kings Creek Picnic Area, willow cuttings were salvaged and also left on site. They did not produce roots

and were transplanted in October after the first snow. Survivorship may be different at the two sites due to time of cutting, storage, and length of storage. The hypothesis is that the cuttings at Lost Creek were taken when the plant was near dormancy, which adds to the survivorship of new plants. However, the Lost Creek cuttings have been left on site and unplanted for a longer time than the Kings Creek Picnic Area cuttings will be, so cuttings from both sites should have roughly equal survivorship. Data will be collected next spring and summer.

For Lake Helen Picnic Site and Lassen Peak Parking Lot, *Polygonum davisiae* (davis' knotweed), *Carex abrupta* (abrupt-beaked sedge), *Carex stramineiformis* (straw-like sedge), *Carex brewerii* (brewer's sedge), *Carex nigricans* (black-alpine sedge), *Erigonum nudum* (hairy-flowered buckwheat), and *Tsuga mertensiana* (mountain hemlock) were salvaged primarily by the construction contractor. The plants (except for *T. Mertensiana*) were transported to the water catch basin at park headquarters in Mineral until September and transplanted to Lake Helen Picnic Area (the same sub basin watershed as Lassen Peak Parking Lot). *T. Mertensiana* was used as vertical mulch to create microsites for natural seed recruitment and salvage plants.

At the Pika Slope, two clumps of *Phyllodoce breweri* (brewer's mountain heather) approximately 2' by 4' were salvaged while construction occurred at the site. The plants were watered and then placed back in the ground when the construction was finished.

Southwest Visitor Center

At the Southwest Visitor center, several target species were collected:

- Elymus Glaucus* (blue wildrye)
- Bromus carinatus* (California brome grass)
- Abies magnifica* (red fir)
- Tsuga mertensiana* (mountain hemlock)
- Chrysolepis sempervirens* (bush chinquapin)
- Holodiscus microphyllus* (rock spirea)
- Ceanothus cordulatus* (whitethorn ceanothus)
- Artostaphylos nevadensis* (pinemat manzanita)
- *Wyethia amplexicaulis* (mule's ear)

These are the species that will be planted at the new Southwest Visitor Center in the fall of 2008, when construction is complete. Cuttings of *A. nevadenis* and *C. cordulatus* were collected this year by NRCS.

Through an interagency agreement between Lassen Volcanic National Park and Russ Haas (NRCS Revegetation Technical Advisor) a plan was drafted for NRCS to grow plants from collected seed or cuttings for revegetation at the Southwest Visitor Center. *Ceanothus cordulatus* produced quite well this year, as did *W. amplexicaulis*. *T. mertensiana* also produced well this year, but because of an early summer, it went to seed early, and the park staffs were able to collect only a small amount of seed. *A. magnifica* did not produce

sufficient seed for NRCS propagation. Seeds found in small mammal caches were not viable.

Other sites

Seed was collected throughout the park and either stored or redistributed in the late fall. *Cirsium douglasii* (swamp thistle) was collected in July and spread on the lift station restoration site near Drakesbad in November. At the Sewage Mounds, manual removal of the invasive *Elytrigia intermedia* (intermediate wheatgrass) was followed by seeding with *Elymus elymoides* (squirrel tail) and *Bromus carinatus* (California brome) in July.

Disturbed ground restoration sites

Berm and Boulder Sites

Berm and Boulder sites (old pullouts, road widening, etc.) were by far the most numerous construction-type sites this year. There were 38 total berm and boulder sites. Several of the sites are previous unofficial vehicle pullouts. The majority of the sites were between Lake Helen and Summit Lake. At several sites scarifying and boulder placement occurred. Scarifying is a mechanical treatment to the soil that makes the ground uneven and jugged. The rough surface mimics the adjacent undisturbed area and will hold more water and trap more seed than a flat surface. The process of scarifying and boulder placement closes these sites to vehicle use. Other sites, that will remain open to vehicle use, had boulders placed around the outer edge of the pullout. The boulders prohibit vehicles from driving over the boundaries of the pullout and damaging native vegetation. They also act as vertical mulch (similar to planting dead trees or shrubs) creating microsites for water and seed collection to promote natural seed recruitment. Boulders were sourced from the Lake Helen Rock Quarry or along the road.

RESULTS

Data tracking/monitoring

The FLHP database was broken down into these categories: Official Photo monitoring Sites (10)2, Revegetation Sites, Restored Sites, Berm and Boulder Sites, 2007 Construction Sites, Highway 89 Weed Monitoring, Disturbed Lands Sites, and Seed Collection.

Official Photo monitoring Sites

Several sites were chosen to be photo-card monitored (Figure 10) based on the location and extent of construction and restoration. This allows us to determine the success rate of restoration efforts at each site, by comparing before and after photos. There are four sites; they are:

- Dersh Meadows
- Lost Creek
- King Creek Meadow & Picnic Area
- Lake Helen Picnic Area

Construction at these sites included new culvert installation, repaving, boulder placement, and berm scarification.

Phase	Site name	LAT_DD	LONG_DD	Accuracy	Photo name	Photo Direction	File Location	Field Notes
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadow Culvert 1 (N)	West	FLHP-10(2)Dersch Meadow Culvert 1 (North).JPG	Dersch Meadows Field Notes
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadow Culvert 1 (S)	West	FLHP-10(2)Dersch Meadow Culvert 1 (South).JPG	
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadow Culvert 2 (N)	West	FLHP-10(2)Dersch Meadow Culvert 2 (North).JPG	
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadow Culvert 2 (S)	West	FLHP-10(2)Dersch Meadow Culvert 2 (South).JPG	
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadow Culvert 3 (N)	West	FLHP-10(2)Dersch Meadow Culvert 3 (North).JPG	
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadow Culvert 3 (S)	West	FLHP-10(2)Dersch Meadow Culvert 3 (South).JPG	
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadow Culvert 4 (N)	West	FLHP-10(2)Dersch Meadow Culvert 4 (North).JPG	
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadow Culvert 4 (S)	West	FLHP-10(2)Dersch Meadow Culvert 4 (South).JPG	
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadow Culvert 5 (N)	West	FLHP-10(2)Dersch Meadow Culvert 5 (North).JPG	
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadow Culvert 5 (S)	West	FLHP-10(2)Dersch Meadow Culvert 5 (South).JPG	
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadow Culvert 6 (N)	West	FLHP-10(2)Dersch Meadow Culvert 6 (North).JPG	
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadow Culvert 6 (S)	West	FLHP-10(2)Dersch Meadow Culvert 6 (South).JPG	
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadows Culvert (S)	West	R:\Natural Res Management\Vegetation\Federal Highways\veg	
2	Dersch Meadow*	40.50081667	-121.4421	26 feet	Dersch Meadows (E)	East	R:\Natural Res Management\Vegetation\Federal Highways\veg	
2	Lost Creek*	40.53983333	-121.4929667	19 feet	Lost Creek Culvert Photo 1	Northeast	Lost Creek\5-17-07\Lost Creek Culvert Photo 1.jpg	Lost Creek Field Notes
2	Lost Creek*	40.53983333	-121.4929667	19 feet	Lost Creek Culvert Photo 2	Northeast	Lost Creek\5-17-07\Lost Creek Culvert Photo 2.jpg	
2	Lost Creek*	40.53983333	-121.4271	19 feet	Lost Creek Culvert (N/A)	Northwest	R:\Natural Res Management\Vegetation\Federal Highways\veg	
2	Lost Creek*	40.53983333	-121.4271	19 feet	Lost Creek Culvert (SE)	Southeast	R:\Natural Res Management\Vegetation\Federal Highways\veg	
2	Lost Creek*	40.53983333	-121.4271	19 feet	Lost Creek Willow & Alder Cuttings	N/A	R:\Natural Res Management\Vegetation\Federal Highways\veg	
2	Kings Creek Meadow*	40.46161667	-121.4674833	22 feet	Kings Creek Meadow (N)	North	Kings Creek Meadow 10(2)07-5-07\Kings Creek Meadow (N).JPG	Kings Creek Meadow Field Notes
2	Kings Creek Meadow*	40.46161667	-121.4674833	22 feet	Kings Creek Meadow Erosion Control	East	R:\Natural Res Management\Vegetation\Federal Highways\veg	
2	Kings Creek Picnic Area*	40.46048	-121.47521	21 feet	Kings Creek Picnic Area	Southeast	Official Photo Monitoring Sites 10(2)Kings Creek Picnic Area	
2	Lake Helen Picnic Area*	40.46665	-121.5082667	18 feet	Lake Helen Picnic Area	Northwest	Official Photo Monitoring Sites 10(2)Lake Helen Picnic Area 1	Lake Helen Field Notes
2	Lake Helen Picnic Area*	40.46665	-121.5082667	18 feet	Lake Helen Parking Area	North	Official Photo Monitoring Sites 10(2)Lake Helen Picnic Area 1	
2	Lake Helen Picnic Area*	40.46665	-121.5082667	18 feet	Lake Helen Roundabout	South	Official Photo Monitoring Sites 10(2)Lake Helen Picnic Area 1	
2	Lake Helen Picnic Area*	40.46665	-121.5082667	18 feet	Lake Helen No Berm	Southwest	Official Photo Monitoring Sites 10(2)Lake Helen Picnic Area 1	
2	Lake Helen Picnic Area*	40.46665	-121.5082667	18 feet	Lake Helen Scariffing	N/A	Official Photo Monitoring Sites 10(2)Lake Helen Picnic Area 1	

Figure 10. Photo-monitoring Sites for the Federal Highways Project in Lassen Volcanic National Park.

Revegetation Sites

See “Seed and cuttings collection and plant salvage” section above.

Restored Sites

All restoration sites along the highway are tracked in this spreadsheet. Basic information, such as location, photo label, and a link to the report location are noted.

Berm and Boulder Sites

All sites that had more than 2 boulders placed or significant ground disturbance are noted in this spreadsheet. Sites with nursery or salvaged plants will be denoted and tracked in the Plant Tracking database.

2007 Construction Sites

These sites had major construction; primarily culvert installation and new headwalls. They were monitored throughout the season for disturbance from construction equipment.

None of these sites were designated to be restored. However, evaluation will be completed late 2007 and early 2008. If the sites are identified as having high restoration potential (i.e. area will require extensive years to restore to a natural state), then the sites will be restored by park staff and denoted in the database.

Highway 89 Weed Monitoring

Sites were designated for weed removal and/or monitoring along Highway 89. Sites were targeted because of material storage, degree of disturbance, and/or existing weed populations. For example, fill taken from the Burney Materials Company was primarily stored at the Lost Creek site and will be monitored for yellow star thistle. The materials origin site at the Burney Materials Company had yellow star thistle blooming and cheatgrass. The company treated the existing populations and followed protocol of washing and immediate transport of fill. Due to early detection monitoring at the Dersch Meadow culverts, a new population of *Hypericum perforatum* (Klamathweed) was discovered and immediately removed.

Disturbed Lands Sites

All of these sites have been restored in previous years. Many are old non-FLHP construction sites that fall under the Lassen Disturbed Lands Program. Each site was evaluated on plant growth, ground cover percent, and species diversity. Several sites fell below established guidelines for successful restoration sites. They were denoted as needing further restoration efforts in the Excel database. Several sites, however, meet the criteria for successful restoration and were listed accordingly in the database.

Seed Collection

See “Seed and cuttings collection and plant salvage” section above.

Plant tracking database

The Plant tracking database was tested for the first time in the fall of 2007. The database tracks basic plant, salvage (if applicable), transplant, and monitoring information (Figure 11).

On September 24, 2007, 46 *L. obtusilobus* were transplanted at the Terrace Lake Trailhead. The plants were propagated from local seed by NRCS but were an “experimental batch” grown without supplements. They were not vigorous plants and are not expected to survive the winter. All 46 plants are being tracked as #100.

ECOLOGICAL ASSESSMENT OF ASPEN COMMUNITIES

INTRODUCTION

Aspen stands are an important source of understory plant diversity in the conifer dominated forests of Lassen Volcanic National Park (LVNP). The presence of aspen supports and maintains levels of biodiversity that would otherwise not be present (Manley and Schlesinger 2001; Potter 1998). Aspen also provide important ecological services such as forage, habitat for many plant and animal species, and increased soil water availability (Sheppard et al. 2006). Studies indicate aspen are declining in the region and throughout the West (Bartos and Campbell 1998). In California, DiOrio et al. (2005) found a 24% decline in aspen stand area over a 48 year period in the Warner Mountains. A similar pattern was observed adjacent to LVNP on the Lassen National Forest, Eagle Lake Ranger District, where 77% of stands were found to be in decline, defined as an almost complete loss of mature aspen with little or no regeneration (Jones et al. 2005).

Aspen utilizes a clonal lifestyle, and needs an established disturbance regime to periodically trigger vegetative reproduction. Mature trees produce large numbers of seeds, but the seeds have a very narrow range of conditions that must exist for successful establishment. As a result, aspen relies on vegetative suckering from the root system to maintain clones over the long periods between successful seed establishment events. New shoots are released when a disturbance such as fire kills or stresses aspen stems. Fire suppression reduces the frequency of events that trigger vegetative regeneration. Aspen is a shade intolerant species, and mature stems die if they are overtopped by other tree species (Sheppard et al 2006). Thus, another consequence of fire suppression has been the successful seed establishment and survival of shade-tolerant conifer species such as white fir (*Abies albicaulis*) within aspen stands and across the landscape. Taylor (2000) showed that conifer encroachment has affected forest composition and structure in mid- and upper montane forests at Lassen. Heavy deer browsing on aspen suckers is also occurring in the majority of aspen stands (N. Nordensten, personal communication). An aging or overtopped aspen stand will produce new shoots annually, but without a release from the double pressure of conifer shading and herbivory on new growth, a clone will die as the carbohydrate stores of the root system become depleted. The death of the clone results in the loss of the ecological services provided by aspen.

The implication is that as aspen stands decline, the understory plant diversity harbored beneath them is lost. Few studies have sought to measure loss of biodiversity from aspen stands in decline. This study is measuring the amount and rate of conifer encroachment in aspen stands at LVNP over the period from 1952 to 2005, as well as current levels of understory plant diversity in these aspen stands. The goal of this project is to estimate the amount of plant diversity that is at risk of loss due to conifer encroachment as a function of the rate of conifer encroachment over the past half century. This information will assist management decisions about the need for monitoring and restoration activities in aspen stands.

OBJECTIVES

The first objective is to measure the amount and overall rate of conifer encroachment in aspen stands from 1952-2005 using remote sensing methods. The hypothesis is that conifer cover has increased in aspen stands over the period 1952-2005.

The second objective is to compare the degree of conifer encroachment over the past 50 years to the current level of understory plant diversity over a range of encroachment from stands of nearly pure aspen to highly encroached stands. We hypothesize that understory diversity will decrease as encroachment rate and amount increases.

PROJECT HISTORY

The project was initiated by the Klamath Network Inventory and Monitoring Program in 2006 to assess the need for long-term monitoring of aspen. During the Network's Vital Signs process, aspen were initially identified as a "keystone" species that could be used to gauge overall ecosystem health. The Klamath Network established a cooperative agreement with Dr. Ken Tate of UC Davis, due to his involvement with aspen research on the Lassen National Forest. The study was then developed to evaluate the condition of aspen in the park and the trends affecting aspen health and integrity, using understory plant diversity and species richness measures to represent the biodiversity resource in aspen stands. A detailed work plan was developed and approved by the Klamath Network, and a pre-season field meeting of Network and Park staff was held in June 2007.

METHODS

Objective 1: Change detection analysis. Black and white aerial photos from 1952 are currently being georectified using a local rectification methodology, and the reference image is 2005 NAIP imagery. For a sample of the aspen stands selected for the field-based component of the study, change in conifer cover between 1952 and 2005 will be estimated. The analysis is based on Digital Mylar, an ArcGIS extension tool developed by the U.S. Forest Service.

Objective 2: Field-based data collection. In the 2007 field season, we used preliminary stand surveys to build a pool of potential study stands. A sample of 30 stands was selected from the preliminary pool with randomization. Twenty two stands were sampled in field season 2007. In each plot, the overstory was evaluated by tree species with forest structure measures including cover, basal area, and stem density, and understory cover measurements were recorded by species. Other environmental metrics that might contribute to understory differences were also measured, including site solar availability, elevation, aspect, a qualitative measure of relative soil moisture, leaf litter depth and quality, and herbivory levels on suckers.

RESULTS

Twenty two aspen stands were sampled in the first field season. Regression-based modeling shows an association between increases in conifer cover, basal area, and density and decreases in understory species richness and diversity. Soil moisture is also associated with understory species richness and diversity. The results suggest that the decrease in species richness occurs more slowly in stands with high soil moisture compared to low soil moisture. The stand location (Hat Creek Drainage, Warner Valley, or Snag/Butte Lake) was not a significant variable in the model. The average species richness per stand was similar in Warner Valley (36 species), Hat Creek Drainage (32) and Snag/Butte Lake (33). A total of 202 species were identified in the understory surveys.

FUTURE DIRECTION

The field sampling will be finished during the 2008 field season, for a total of 30 sampled stands. Data analysis and report writing will be concluded during the fall and winter of 2008, to contribute to the park's development of an aspen monitoring strategy.

HAZARDOUS TREE INVENTORIES AND MITIGATION

INTRODUCTION

Hazardous tree management is the process of reducing exposure to risks from known (i.e. observed and rated) tree hazards. Generally, known hazards are isolated from public use by either 1) closing or relocating facilities or restricting use, or 2) directly mitigating the hazard by removing the tree or pruning a defective limb or top. While equal analysis of both options must be undertaken, usually facilities of a moveable nature or those temporarily used -- such as picnic tables or individual campsites -- can be relocated or temporarily closed. Permanent facilities, except those targeted for replacement, will probably entail a direct mitigation option.

Natural Resources Management staff has identified and delineated portions of the park's designated developed zone subject to hazardous tree management. These include campgrounds, visitor contact stations, utilities, residential areas, ranger stations, concession facilities, administrative offices and facilities, roadside exhibits, road systems, and backcountry structures.

DETECTION OF HAZARDOUS TREES

Detection of hazardous trees is a process of locating and marking individual problem trees within developed areas. This is a two part process combining surveillance and examination. Surveillance is the rapid overall inspection of developed areas for hazardous trees. It is somewhat analogous to a hasty search in a search and rescue. General surveillance is done at all development zone locations — except roadside units — every year before the visitor season. These may also occur on an unplanned basis during or following any conditions that are known to generate tree hazards e.g. severe windstorms, floods, wet snow, insect or disease outbreaks. Examination entails thorough, individual evaluation of hazardous conditions indicated by surveillance work and includes tree identification and measurement, defect assessment, hazard rating, mapping, and tagging. Complete examinations are scheduled for every two years at all front country and back country locations. Road corridors are subject to surveillance as a secondary priority. Roadside surveys are conducted within 100' of the road centerline.

RATING SYSTEM

Evaluating and rating tree hazards is based on assessing 1) the possibility of a “target” being hit due to its location and its significance, and 2) severity of the defect, the apparent likelihood of failure, and the damage potential due to size, length or weight of the hazard. The basic hazard rating system analyzes these factors, which are added as points in a two-part equation to give a final hazard rating.

The combined value for each rated tree is the basis for assigning priorities for taking management action; selecting either abatement (restricting use or isolating the risk) or mitigation (removal or pruning). The highest priority for management action is seven,

indicating a high value target with great exposure potential for extensive damage, injury, or death. The lowest priority that can be assessed is a 2. Hazardous conditions rated 4 and above entail monitoring or observation to determine when defective conditions increase. Hazard ratings of 5 (with a 3 defect), 6, and 7 entail additional management response. This will be in priority order with actions taken to address 7 ratings first. Where known 7-rated hazardous conditions exist, affected area closure —with signing, barriers, or other suitable means – should be promptly undertaken. This may be on a temporary basis until direct mitigation can be accomplished, if that is the selected management action. A permanent closure should be established if the affected facilities are not essential, or where affected cultural or natural resources take precedence.

MARKING AND MAPPING TREES

During all examinations, hazardous tree conditions with ratings of 4, 5, 6 or 7 are individually tagged and mapped. Tagging consists of nailing a pre-numbered surveyor's tag on the north side of the tree bole approximately 6 feet above the ground. All vital information about the tree is recorded onto a standard field form and its location is mapped. Presently, hand drawn — and highly inaccurate — maps of the developed areas are used to plot the general location of hazardous trees. For the time being, this seems to adequately serve the purpose of relocating marked trees. Better mapping of hazardous trees will require the development of accurate (and possibly geo-referenced) base maps.

MITIGATION

Mitigation is usually completed early in the summer by Roads and Trails staff. In the rare cases where trees must be climbed for limbing or complete tree removal, mitigation is either contracted or performed by tree crews from Yosemite or Sequoia and Kings Canyon National Parks. Mitigation is sometimes accomplished by contractors (usually Licensed Timber Operators) simultaneous with other projects conducted within developed areas such as tree thinning or other silvicultural projects.

RESULTS

Hazardous trees identified and rated during systematic surveys in 2005, 2006 and 2007 were mitigated in 2007 by in-house staff from Roads and Trails or by a Licensed Timber Operator under contract on a separate thinning project. A few tree hazards were mitigated by the Fuels crew. Of the 349 trees recommended for removal in 2007, 316 trees were removed, 29 were rescheduled for removal in 2008, and four were abated by removing the “target”.

Table 8. Results of Hazard Tree Surveys and Mitigation, 2007

	Trees Recommended for Removal by Diameter Class					Actually Removed	Resched Removal	"Abated" Hazards
	<12"	12-24"	25-36"	>36"	TOTAL			
Manzanita Lake Campground	15	88	20	7	130	130		4
Manz. Lk: Boat Launch/Loomis	0	3	2	0	5	1		
Manz. Lk: Amphitheater/Store	0	0	0	1	1	1		
Manz. Lk: Entr. Sta./Recycling	0	3	0	0	3	3		
Manz. Lk: Lassen Crossroads	2	2	0	0	4	4		
Manz. Lk (Housing)	0	1	0	0	1	1		
Crags and Lost Creek Cmpgrnd	2	31	18	13	64	64		
Summit Ranger Station/Corrals	0	4	1	0	5	5		
Summit Lake Cmpgrnd -North	2	15	5	0	22	22		
Summit Lake Cmpgrnd -South	3	8	1	0	12	12		
Headquarters	4	11	6	2	23	23		
Warner Valley - Drakesbad	0	5	2	1	8	8		
Warner Valley - Cmpgrnd North	0	7	2	0	9		9	
Warner Valley - Cmpgrnd - South	0	4	1	0	5		5	
Warner Valley - Picnic Area	3	2	0	0	5		5	
Warner Valley - Ranger Station	1	4	1	0	6		6	
Butte Lake Campgrounds	0	1	2	0	3	3		
Butte Lake Horse Corrals	0	2	1	2	5	5		
Butte Lake Water Treatment	0	2	0	0	2	2		
Butte Lake Picnic	0	0	1	0	1	1		
Southwest Entrance and Cmpgrnd	0	1	2	3	6	2	4	
Juniper Lk – inholdings/Cmpgrnd	6	17	5	1	29	29		
Totals	38	211	70	30				
Grand Total					349	316	29	4

AIR QUALITY MONITORING

INTRODUCTION

In a national park, air pollution affects natural resources as well as the health of residents and visitors. The National Park Service (NPS) has established an air pollutant monitoring program to determine the status of each park unit's air quality and to determine if a park is exceeding the National Ambient Air Quality Standards (NAAQS) established by the Environmental Protection Agency (EPA). The program is designed to detect trends in pollution levels over time. Monitoring may also be linked with studies of the biological impacts of air pollution.

PROJECT HISTORY

In 1977, Lassen Volcanic National Park (LVNP) was one of many parks designated as a Class I area under the Clean Air Act Amendments. The act gives park managers responsibility to protect air quality and related values, such as visibility, from the adverse effects of air pollution.

In 1988, LVNP became part of the NPS gaseous pollutant (ozone) monitoring program and the Improving Protected Visual Environments (IMPROVE) visibility monitoring network. Initially, the park intended to collect about five years of baseline air quality data. A monitoring station was established in an existing building near the helicopter landing at Manzanita Lake. A visibility camera was set up on the ski lifts just inside the southwest entrance.

In 1995, LVNP was designated as a trend site for the Northern California Mountain area, and, as a result, year-round air quality monitoring began. Although the visibility camera was removed in 1995 after collection of baseline information, additional equipment was installed at the Manzanita air quality station to measure dry deposition (primarily sulfates and nitrates in gaseous or particulate form) for the Clean Air Status and Trends Network (CASTNet).

In the summer of 2000, LVNP became a participant in the National Atmospheric Deposition Program/National Trends Network (NADP/NTN). The NADP/NTN program monitors long-term spatial and temporal trends in atmospheric deposition (i.e. wet deposition in the form of acid rain).

METHODS

Four primary types of air quality data are collected at the air quality station within LVNP.

First, ambient ozone is measured 24 hours a day, 365 days a year. Exposure to ozone affects human health and may trigger a variety of respiratory problems, as well as impair the body's immune system. Ozone also affects vegetation. Research shows that some plants are more sensitive than humans to ozone and that effects on plants may occur well below the EPA

NAAQS (NPS 2004). Along with the ozone, several meteorological parameters are measured including wind speed, wind direction, temperature, relative humidity, rainfall, and solar radiation. The equipment is checked once a week by the air quality station operator and twice a year by a contractor who completes a detailed site calibration. In fall 2000, the DataView system of recording these parameters was introduced to LVNP, which replaced the old strip chart and paper recording forms. Recording and submitting results via computer saves time during station checks and makes the results more accessible for review.

Second, the amount and type of particulate matter in the air is monitored for the IMPROVE visibility network. The IMPROVE monitoring system is comprised of five particulate sampler modules and one control module. Three of the modules collect fine particles (called PM₂₅ which are 0-2.5 microns in diameter) and one collects larger particles that are 0-10 microns in diameter (PM₁₀). The fifth module was installed for 'quality assurance' in 2003; it is a duplicate of one of the PM₂₅ modules. Different materials used in each PM₂₅ filter capture particles of different chemical compositions. A controller runs the modules for a 24-hour period every three days. The filters are changed weekly by the station operator and returned to the Crocker Nuclear Lab at UC Davis for chemical analysis. The five samples obtained are analyzed for composition, concentration of fine particles that produce light extinction, and for tracers that can identify emission sources (Crocker Nuclear Lab 1995).

Third, dry deposition monitoring is done by continuously pumping air through a CASTNET filter for one week. The station operator changes the filter and sends it to an EPA contractor for analysis. These filters are analyzed to obtain: 1) weekly concentrations of particulate sulfate, particulate nitrate, particulate ammonium, sulfur dioxide, and nitric acid; 2) hourly concentrations of ambient ozone levels; 3) meteorological conditions required for calculating dry deposition rates.

Fourth, wet deposition monitoring for NADP/NTN provides data on the chemistry of the rain and snow that falls at the air quality station. The station operator changes a precipitation collection bucket once a week. The operator decants any rainwater collected into a sample bottle and sends the sample to the Central Analytical Laboratory (CAL) which measures pH, conductivity and also analyzes the sample for sulfate, nitrate, ammonium, chloride and base cations. In August 2007, the platform for the collector equipment was replaced to adhere to NADP/NTN specifications.

RESULTS

The following results summarize 2006 data, which are the most current annual summaries available for air quality data.

Ozone Levels

In 2006, the NAAQS primary standard for ozone was 0.08 parts per million (ppm) over an 8-hour period. The standard was exceeded when an 8-hour average ozone concentration was greater than or equal to 85 parts per billion (ppb). (Note that the EPA strengthened the NAAQS in March 2008; the new 8-hour primary standard is 0.075 ppm over an eight hour

period). Ambient ozone measured at LVNP is near background (natural) levels for most of the year. The most recent annual data summary (2006) reveals that the mean daily ozone concentration at the Manzanita Lake Air Quality Station was 43 ppb. The highest daily 8-hour average ozone concentration in 2006 was 77 ppb, and the park did not exceed the EPA's primary ozone standard (ARS 2008). However, ozone levels are increasing. Jaffe and Ray (2007) evaluated ozone data from 1987-2004 and found a statistically significant increase in ozone at seven out of nine sites in the western U. S. LVNP data analyzed in their study showed an increase of 0.32-0.33 parts per billion by volume per year (ppbv/year) ($P < 0.01$), or a total increase of 5-6 ppbv over the 18 year period.

Visibility

Aerosol bext measures light extinction resulting from the presence of liquid or solid particles suspended in the atmosphere (atmospheric aerosols). These particles can be generated naturally (i.e. forest fires, plant transpiration) or from human activities (industrial manufacturing, vehicle emissions). A higher aerosol bext measurement indicates a greater amount of haze resulting in poorer visibility. The most recent summary (2004) of annual aerosol bext across the United States is shown in Figure 12 (CIRA 2008). LVNP's visibility is very good relative to much of the United States.

Dry Deposition

Dry acid deposition is a significant problem in the eastern United States. Concentrations of sulfur dioxide (SO_2) and particulate nitrate (NO_3) emissions observed at western CASTNET sites are significantly lower than in the East with only a few sites measuring levels above 1.0 ug/m^3 (Harding ESE 2002). LVNP's 2004-2006 3-year average concentration of SO_2 was 0.6 ug/m^3 (EPA 2008a). The 2004-2006 3-year average concentration of NO_3 was 1.4 ug/m^3 (EPA 2008b). Both concentrations are well below the national annual averages.

Wet Deposition

The 2006 Annual Data Summary provides the most current annual data for the park. In 2006, annual average pH of the samples collected at the site was 5.38. Average annual deposition for a variety of compounds is shown in Table 9 (NADP 2007).

Table 9. Statistical Summary of Precipitation Chemistry for Valid LVNP Samples, 2006

Annual Deposition (kg/ha)							
Ca	Mg	K	Na	NH4	NO3	Cl	SO4
0.306	0.047	0.059	0.318	0.459	2.154	0.565	1.377

FUTURE DIRECTION

Air quality monitoring at LVNP will continue. The Park is also implementing operating practices to reduce its own pollution emissions, which include the use of electric vehicles within the headquarters and Manzanita Lake areas, installation of solar panels at remote ranger stations to decrease generator usage, and implementation of dust abatement measures during project work.

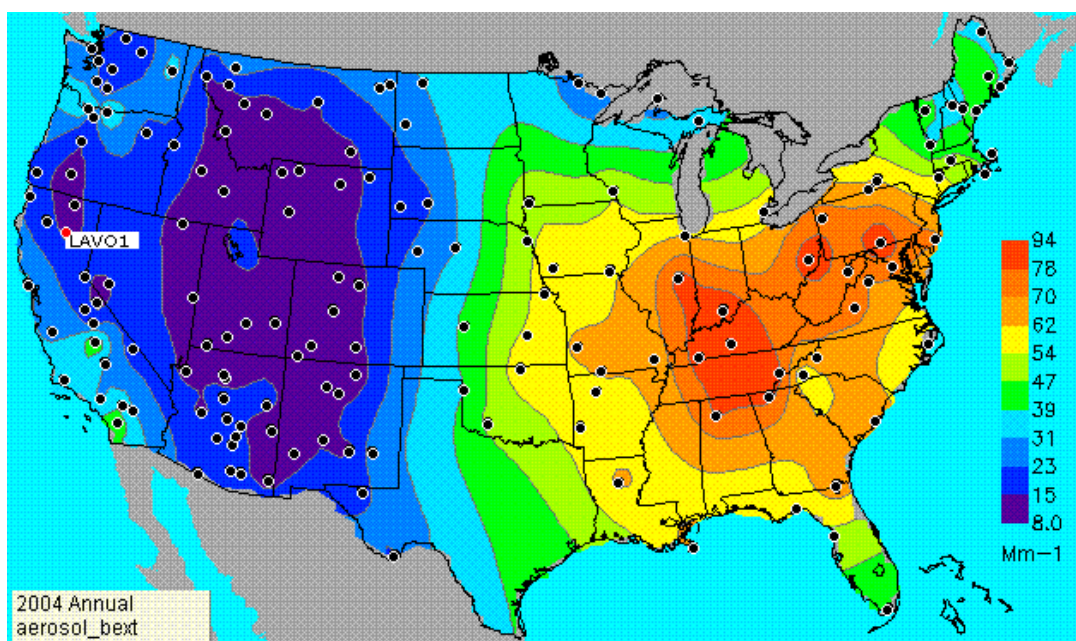


Figure 12. 2004 Annual Aerosol Bext

LAVO1 is the site code for the air quality station at Manzanita Lake, Lassen Volcanic National Park. Source: CIRA 2008.

SOILS INVENTORY AND MAPPING PROJECT

INTRODUCTION

As part of the National Park Service (NPS) Servicewide Inventory and Monitoring Program, a Soils Inventory and Mapping project was initiated at Lassen Volcanic National Park in 2006, under the direction of the NPS Natural Resource Program Center (NRPC) Geologic Resource Division in cooperation with the Natural Resources Conservation Service (NRCS). The soils of Lassen have not been previously surveyed, except for one approximately 4000-acre portion of the park in Tehama County. This mapping was performed in the period from 1952 to 1959 at a map scale of 1:31680. This area will be reassessed and likely updated and integrated into the current project.

The Soils Inventory and Mapping Project will include a parkwide soil survey, which will provide an orderly, on-the-ground, scientific inventory of soil resources. The project includes the creation of maps showing the locations and extent of soils, the collection of data about the physical and chemical properties of those soils, and the analysis of that data which will provide information about potentialities and problems of use on each kind of soil. This information will be in sufficient enough detail for park managers, planners, engineers, and scientists to apply sound management principles specific to land areas of concern. The soil survey will provide the basic information needed to manage soil sustainability, and to protect water quality, wetlands, vegetation communities, and wildlife habitat. Soil surveys are the basis for predicting the behavior of a soil under alternative uses, an area's potential erosion hazard, the potential for groundwater contamination, and the suitability and productivity potential for native vegetation.

Products of the Lassen soils survey included an in-park soils scoping session in 2005, and when completed in 2008, will include a digital soils layer, a corresponding set of soil attributes and interpretations in a National Soil Survey Information System (NASIS) format, a soil survey manuscript, and a metadata file. The project goal is to map soils at a scale of 1:24,000. This soil survey will take approximately 2-3 years to complete with anticipated fieldwork being completed by October 2008.

METHODS

Specifications of the work to be accomplished will follow the National Cooperative Soil Survey (NCSS) standards. The soil survey at Lassen involves two stages: fieldwork and manuscript development. The fieldwork involves several activities dealing with observations and investigations of the landforms and soils of the area. These are listed below in order from most common to least common activities:

- 1) Performing soil observations. Hand dug holes will be used to describe, photograph and sample soil profiles. These holes will be approximately 2 feet by 2 feet to a depth of 60 inches or to bedrock. The estimated number of holes will be 200 to 275. Excavated soil will be placed on tarps and put back in the hole. These observations are necessary to ascertain what types of soils exist within specific map units.

- 2) Hand-augering of soils with bucket augers. Augered holes are about 3 inches wide and 72 inches deep. Augering will likely be done in meadows to verify observations made from hand dug holes and to observe water table depths. Excavated soil will be placed on tarps and put back in the hole. The estimated number of auger holes is 30 to 50.
- 3) Digging a slightly larger pit to typify the central concept of the representative soil for each map unit and to collect samples for lab characterization. These pits will be hand dug or backhoe dug if approved and will be about 2 feet wide by 4 feet long and 80 inches deep or to bedrock. They will also be carefully back filled after the review and sampling process is complete. The information obtained from these pits is used to characterize the soil series and the map unit descriptions. The information is written out in the taxonomic unit descriptions, and is the basis for the information in the interpretative tables. The estimated number of pits needed to meet the quality assurance standards of the National Cooperative Soil Survey ranges from thirty to fifty.

RESULTS

Fieldwork began in May 2007 and concluded in mid-October. Fieldwork was completed by four NRCS soil scientists and a plant ecologist. A progress field review was held in the park the week of September 24 where the field crew relayed their observations and mapping concepts to NRCS staff.

NRCS described and sampled 150 soil profiles and photographed each profile and site. They have arranged each profile in a profile box to display the horizon sequences for subsequent understanding and as a tool to illustrate the soils to others. Seven profiles were selected for soil survey lab characterization and approximately 70,000 acres of mapping has been digitized this winter. Two soil monoliths were prepared for educational display.

The soil survey identification legend was developed for areas where NRCS have made field observations. This legend is the framework that links their field observations to map unit concepts and the mapping.

NRCS Soil Survey Staff:

Andrew Conlin – Soil Scientist, Project Leader

Jennifer Anderson - Soil Scientist

Garrett Liles - Soil Scientist

Julie Baker - Soil Scientist

Erin Hourihan - Plant ecologist

FUTURE DIRECTION

NRCS staff will finish field work on this project in 2008.

RESEARCH PERMIT TRACKING

INTRODUCTION

The National Park Service (NPS) welcomes public and private institutions to conduct scientific research within park boundaries. In order to protect park resources from potential impacts that may result from research being conducted, a scientific research and collecting permit is required. This permit is required for scientific activities pertaining to natural resources or social science studies in National Park System areas that involve fieldwork, specimen collection, and/or have the potential to disturb resources or visitors (NPS 2006). The knowledge gained from outside researchers is used to better protect and understand natural processes that occur within National Park units.

METHODS

Researchers wishing to conduct biological or social science studies within Lassen Volcanic National Park (LVNP) must submit a research permit application. This is done electronically through the National Park Service Research Permit and Reporting System (RPRS) website. Once the application has been submitted, the park's research permit coordinator receives an electronic message notifying them of a new research permit application that needs to be processed. The research permit coordinator reviews the permit to determine if the project falls within the parameters of the programmatic categorical exclusion established for research permits. If the permit falls within those parameters, the research permit coordinator can issue the permit. If the scope of research does not fall within the parameters of the programmatic, the permit must be sent to the LVNP Compliance Council for review. The research permit coordinator enters the information into the Planning, Environment and Public Comment (PEPC) database for the park's Compliance Council review. The Compliance Council reviews the application and provides comments and concerns on the research. The researcher is then contacted by the research permit coordinator to respond to concerns the park has. Once the concerns have been addressed adequately to satisfy the Compliance Council, the research permit is issued. If the concerns cannot be adequately addressed, the permit will be denied. Each permit is issued for the calendar year. At the end of the calendar year the researcher is required to submit an Investigators Annual Report (IAR). The IAR is a short summary of accomplishments made by the researcher during the year. This is required so the NPS can track the progress of research being conducted. A permit will not be granted for a second year of research if an IAR was not completed for the previous year. Two copies of a final report are required to be given to the park at the completion of the research.

RESULTS

A total of 35 permits were issued for scientific research and collecting in LVNP in 2007. Vegetation studies had the most permits with eleven, and geothermal studies had the second most permits with nine. Wildlife studies had four permits issued. All permits issued in 2007 are divided into the following eleven categories.

Vegetation: 11 permits issued

- Forest Inventory and Analysis.
- Re-measure James P. Heath conifer succession plots.
- Lassen Volcanic National Park comparative vegetation mapping project.
- *Utricularia* studies in Lassen Volcanic National Park.
- *Verbascum* removal and reuse.
- Inocubes of Central and Northern California.
- A phylogeographic and taxonomic study of *Oxypolis occidentalis* (Apiaceae).
- Moss as an ecosystem restoration tool.
- Systematic study of Polygonaceae Subfamily Eriogonoideae using molecular, anatomical, and morphological evidence.
- Conifer colonization of a flood-deposited stream cobble surface.
- Ecological assessment of aspen communities in the Klamath Network.

Geothermal: 9 permits issued

- A global microbial biodiversity study of high temperature mud pots.
- Microeukaryotic (protist) genetic diversity in Mt. Lassen's hydrothermal features.
- Investigation of microbial diversity in high temperature/low pH geothermal features.
- Discovery, characterization and diversity of viruses of extreme thermophiles.
- The evolution of sex in extreme environments: genetic diversity and sexual reproduction.
- Surveying and sampling Boiling Springs Lake with a remotely operated vessel.
- Hydrothermal systems in Cascades volcanoes.
- Discovery of new microbial life living at low pH and high temperatures.
- Monitoring the hydrothermal lakes, springs and gas at Lassen Volcanic National Park.

Wildlife: 4 permits issued

- Demographic parameters of the California Spotted Owl.
- A re-survey of terrestrial vertebrates.
- Habitat and wildlife monitoring project.
- Lassen National Forest carnivore survey.

Geology: 2 permits issued

- Plate Boundary Observatory (PBO) component in Lassen Volcanic National Park to monitor tectonic and magmatic process using high precision GPS.
- Caught between two tectonic environments: A geochemical study of source and magma modification processes in Lassen Volcanic National Park, California.

Amphibians: 2 permits issued

- Investigations of amphibian deformities in the western United States.
- Amphibians and invertebrates in the Lassen region.

Soil: 2 permits issued

- Soil survey of Lassen Volcanic National Park.
- Soil survey of Lassen Volcanic National Park-Ecological Site Development.

Air Quality: 1 permit issued

- Forest Inventory and Analysis Biomonitoring Program.

Water: 1 permit issued

- Stream condition inventory of Kings Creek.

Wetlands: 1 permit issued

- A community classification and gradient analysis of the wetlands of Lassen Volcanic National Park, CA and Crater Lake National Park, Oregon

Geochemistry: 1 permit issued

- Investigation of the occurrence and distribution of naturally-produced perchlorate in areas of minimal anthropogenic impact

Microbiota: 1 permit issued

- Fluorescence spectroscopy as a tool for finding biomolecules in extraterrestrial, subsurface missions

FUTURE DIRECTION

Lassen Volcanic National Park will continue to issue scientific research and collecting permits for research that is appropriate and beneficial to the park.

NEPA COMPLIANCE

INTRODUCTION

The National Environmental Policy Act (NEPA) was passed by Congress in 1969. This landmark legislation established this country's environmental policies, including the goal of achieving productive harmony between human beings and the physical environment for present and future generations. It provided the tools to carry out these goals by mandating that every federal agency prepare an in-depth study of the impacts of "major federal actions having a significant effect on the environment" and alternatives to those actions, and requiring that each agency make that information an integral part of its decisions. NPS Director's Order 12 and its correlating handbook guide very specifically how NEPA is to be implemented in National Park units.

OBJECTIVES

The objective of NEPA is to make sure that agencies fully consider the environmental costs and benefits of their proposed actions before they make any decision to undertake those actions.

METHODS

LVNP has a Compliance Council that is an interdisciplinary team made up of one staff member from each park division as well as the following staff members in the Natural Resources Division: Wildlife Biologist, Plant Ecologist, Forester, Chief, and the Compliance Specialist. All park projects are presented at the Lassen Operations Team meeting for internal scoping of issues related to the project. After any necessary changes are made to the project as a result of that meeting, the Compliance Council reviews the projects to determine if they can be Categorical Excluded from NEPA or if they need an Environmental Assessment or an Environmental Impact Statement completed. Most projects are determined to be categorically excluded, but there is still a specific NPS process that must be followed to document that decision making process.

RESULTS

The Natural Resource Management Division completed one Environmental Assessment (EA) in 2007. The Commercial Services Plan EA was completed on April 17, 2007 when the Regional Director signed the Finding of No Significant Impact (FONSI).

The Weed Management Plan EA was started in 2007. Internal and public scoping for issues that would need to be addressed was initiated. The writing of several draft sections was begun.

The Natural Resource Management Division also completed 18 Categorical Exclusions in 2007. The following is a list of all the completed Categorical Exclusions and their Planning, Environment and Public Comment (PEPC) numbers:

20871 - Install Safety and Security Lighting in Developed Work Areas
20193 - Install Network Cable in Conference Room and HQ Office
19608 - Replace the Automated Snow Sensor at Lake Helen
19192 - Install Photovoltaic Array at Mineral Headquarters
18768 - Boundary Adjustment and Acquisition of Spencer Meadows
18475 - Special Use Permit Programmatic
18474 - Ancestral Run Special Use Permit Programmatic
18389 - Remove Non-Historic Garage from Historic House #13
18358 - Repair Building #2 Enclosed Porch
18250 - Replace Fire Grates & Campsite Markers
18247 - Lighting Replacement - Bldg # 27
17988 - Programmatic for Research Permits
17886 - Research Proposal - Monitoring the Hydrothermal Lakes and Springs
17885 - Systematic Study of Polygonaceae Subfamily Eriogonoideae
17486 - Research Proposal - Plate Boundary Observatory (PBO)
17300 - Programmatic For Common Commercial Use Authorizations
17043 - Wiring, Timers and Valve Replacement of Showers at Manzanita Lake Camper Store
17042 - Refurbishing of Pool and Decking at Drakesbad Guest Ranch

FUTURE DIRECTION

The Weed Management Plan EA is currently on track to be completed in 2008. The park will continue implementing NEPA utilizing NPS Director's Order 12.

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