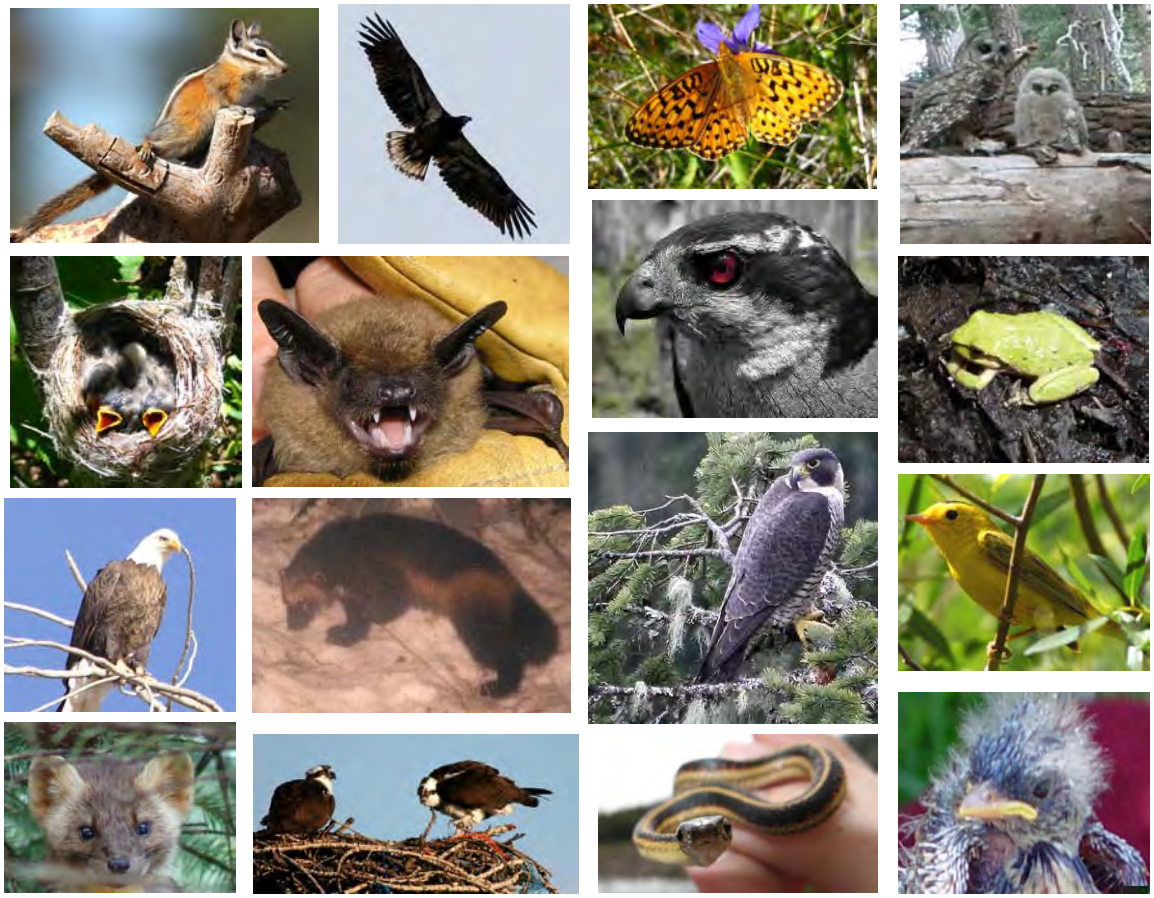
2009 Wildlife Program Annual Report

Ecosystem Conservation Department

Lake Tahoe Basin Management Unit



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The Ecosystem Conservation Department of the Lake Tahoe Basin Management Unit (LTBMU) and its partners conducted surveys to assess presence/absence, reproductive activity and success, and spatial distribution of several prominent wildlife species of special interest for the Lake Tahoe Basin in 2009. There are three primary needs for surveys being conducted on wildlife species on the LTBMU:

- Population Monitoring
- Project Inventories
- Restoration Monitoring

Population monitoring occurred for the first time on the LTBMU this season following the establishment of a 10-year monitoring plan for American marten, northern goshawk, osprey, willow flycatcher, bald eagle, and California spotted owl. Two of these species will be monitored each year during implementation of the 10-year plan with all species being monitored at least twice over the next ten years (2009 – 2018). The goal of the population monitoring effort is to provide a statistically valid representation of changes for specific wildlife populations on the LTBMU. In 2009, northern goshawk and bald eagle (Section 1.0, 2.2, and 2.4) population monitoring was implemented.

Project level monitoring included California spotted owl (*Strix occidentalis occidentalis*), northern goshawk (*Accipiter gentili*s), osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), peregrine falcon (*Falco peregrinus*), willow flycatcher (*Empidonax traillii*), and wolverine (*Gulo gulo*). Small mammal and bat surveys were also performed at both project and historic occupancy sites in order to provide baseline data. Due to fluctuations in effort and observer expertise, results of these surveys are not a statistically valid representation of populations over time and should not be interpreted as true trends (Section 1.0) – however they do provide an overall assessment for forest and project level reporting needs for environmental documentation.

Restoration monitoring continued in 2009 at two restoration sites (Cookhouse Meadow and the Sunset Reach of the Upper Truckee River) and two control sites (Big Meadow and Trout March, respectively) on the south shore of the LTBMU. In previous years, restoration monitoring was conducted under contract by Mike Morrison, PhD (Professor and Caesar Kleberg Chair in Wildlife Ecology and Conservation, Texas A&M University) and his graduate student Kathi Borgmann from Texas A&M University. However, in 2009 the LTBMU conducted restoration monitoring in-house. Restoration monitoring data was collected for butterflies, herpetofauna, songbird nest sites, songbird point counts, bats, small mammals and meadow wetness (Section 3.0).

1.0 POPULATION MONITORING

1.1 NORTHERN GOSHAWK

The 2009 season was the initial year of population monitoring for northern goshawk (Northern Goshawk Population Monitoring Plan (K. Slauson and W. Zielinski, in development)). This monitoring program is capable of detecting biologically meaningful levels of change in the goshawk population. It also attempts to clarify to what extent human activities affect nesting productivity either directly or indirectly (e.g. ski areas, urbanization, vegetation management). Linking human-caused stressors to trends in goshawk behaviors will be an effective tool for prescribing goshawk management. The plan selected 35 monitoring areas of 600ha each using historic detections, nest data and habitat. Twenty of these sites will be monitored four times during the 10-year period. The remaining fifteen sites will be surveyed once over the 10-year period. A total of 24 sample units were surveyed as part of the 2009 monitoring plan (MP) surveys.

Many of the monitoring plan sample units overlap or entirely incorporate project inventory areas. For this reason it is difficult to separate the surveys and the resulting data. Further discussion of these surveys is presented in section 2.2. Due to the large size of the monitoring plan sample units several of the route names do not align with previous year's data, survey areas, or territories. For example, the Carnelian Bay nest is actually in the Watson Creek territory. The McKinney Creek nest is the Sugar Pine Point SP territory.

1.2 BALD EAGLE

As with northern goshawk, 2009 was the initial year of population monitoring for bald eagle (Bald Eagle Population Monitoring Plan (K. Slauson and W. Zielinski, in development)). In an effort to assess the precision of previous single-day mid-winter bald eagle counts and to evaluate the ability of single-day counts to detect biologically meaningful changes in local population numbers, three counts were planned in 2009 using the Santa Cruz Predatory Bird Group Annual Mid-Winter Bald Eagle survey protocol. Only two counts were conducted in 2009 because too few volunteers were available to survey from all 26 count locations simultaneously on three separate dates and because of the frequency and timing of predicted poor weather conditions in January. Further discussion of these counts will occur in section 2.4.

2.0 PROJECT INVENTORIES

2009 Project Inventory and Population Monitoring Survey Summary

- **Spotted Owl:** 34 survey areas, 16 spotted owls (4 pairs, 2 individual adult males, 2 individual females, and 4 juveniles), 4 territories, and 4 nests.
- **Northern goshawk:** 57 survey areas, 34 individuals detected (8 pairs, 4 individual adults, and 14 juveniles), 14 territories, 11 territories with reproductive activity and 9 nests.
- **Osprey:** 45 nest sites surveyed; 24 active nests.
- **Bald eagle:** 16 bald eagles (13 adults and 3 juveniles) during the mid-winter survey; one active nest that failed.
- **Golden eagle:** 1 survey area, 1 adult golden eagle with 1 associated nest (failed).
- **Peregrine falcon:** 3 survey areas, 1 active nest with 4 associated peregrine falcons (2 adults; 2 juveniles fledged).
- **Willow flycatcher:** 11 sites, 7 adult flycatchers, 5 territories, 3 nests, and 8 fledglings with no known re-nests.
- **Small mammals:** 2 survey areas, 14 species and 654 individuals trapped.
- **Bats:** 1 new roost discovered, 4 sites surveyed for bats, and 4 sites determined to have some bat presence.
- **Wolverine:** 1 unconfirmed incidental detection, 11 areas surveyed, no survey detections.
- **American Marten:** 3 incidental detections (1 adult, 2 juveniles) and 1 associated maternal den.

2.1 CALIFORNIA SPOTTED OWL

2.1.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

The Lake Tahoe Basin Management Unit conducted surveys for California spotted owl (*Strix occidentalis occidentalis*) in cooperation with California Department of Parks and Recreation (CDPR), Nevada Department of Wildlife (NDOW), Hauge Brueck Associates (contractor for Heavenly Mountain Resort), and Insignia Environmental (contractor for Sierra Pacific Power Company) in 2009. These surveys for California spotted owl followed Forest Service, Region 5, 'Protocol for Surveying for Spotted Owls in Proposed Management Activity Areas and Habitat Conservation Areas' (USDA, revised 1993). CDPR was not able to conduct the annual spotted owl surveys at Sugar Pine Point State Park and Burton State Park due to a shortage of available surveyors in 2009.

Adult male spotted owl at the Burton nest taking a mouse. Photo by LTBMU wildlife crew.

Owl call stations were located along established routes on roads or trails, spaced approximately ¼ to ½ mile apart, and situated on the landscape to maximize acoustic coverage (e.g. located on high ground). Portion(s) of any survey route(s) within a one-mile radius of an active spotted owl nest

were not surveyed for the remainder of the season to prevent unnecessary harassment of the reproductive owl pair. Survey efforts within a one-mile radius of an active nest focused directly on the nest stand.

All surveys were conducted by a team of trained biologists beginning at sunset. If an owl was detected a follow-up visit was performed within 48 hours to attempt to locate the owl and determine its status. Spotted owl surveys determined survey area occupancy, individual and pair status, nesting status, and reproductive success. Owl pairs were identified based on whether the detections occurred within ¼ mile of each other as described in the regional protocol. A territory is determined to be 'reproductive' if nesting activity was observed or if juveniles were detected during the field season. Fledging is verified when juveniles are detected outside the nest cavity.

The LTBMU and its partners surveyed 34 areas within the Lake Tahoe Basin for California spotted owl in 2009 (Appendix 1). Survey areas were established in highly suitable to marginally suitable habitats within ¼ mile of Forest Service project sites; including fuels treatment, habitat restoration, new bike trails, new equine riding trails and trail reroute projects (Table 1). LTBMU routes were surveyed three times, with the first two visits occurring prior to 30 June, per standard 2-year survey protocol.

Table 1. Areas within the Lake Tahoe Basin surveyed for California spotted owl by the Lake Tahoe Basin Management Unit, Nevada Department of Wildlife, Hauge Brueck Associates, and Insignia Environmental in 2009. Occurrence of historical spotted owl detections near survey areas, number of visits in 2009, and LTBMU projects associated with survey area are also presented for reference.

Route Name	Historical Detections	2009 visits	Associated USFS Projects
Angora Creek	Yes	3	NEPA Resource Inventory (NRI)
Angora Ridge	No	3	NRI and Fallen Leaf Lake Bike Trail,
Bliss Creek	No	3	Lake Tahoe Ecosystem Underburn Project
Burton FS	Yes	6	NRI
Carnelian Bay	Yes	3	NRI, Lake Tahoe Ecosystem Underburn Project, and Carnelian Hazardous Fuels Reduction
Cold Creek Nest	Yes	6	NRI
Fallen Leaf Lake	No	3	Fallen Leaf Lake Bike Trail
Fiberboard Freeway (Insignia Environmental)	Yes	3	Sierra Pacific 625 & 650 Power line Projects
Genoa Peak	No	3	Aspen Community Restoration Project
Grass Lake	No	3	Aspen Community Restoration Project
Griff Creek	Yes	6	Lake Tahoe Ecosystem Underburn Project, and Incline Hazardous Fuels Reduction
Heavenly Ski Resort (Hauge Brueck Assoc.)	No	3	Heavenly Mountain Resort Master Agreement
Incline Creek	No	3	Incline Hazardous Fuels Reduction, Aspen Community Restoration Project
Incline Lake[1]	No	3	Incline Hazardous Fuels Reduction and Incline Lake Management Plan
Logan House Creek	No	3	Lake Tahoe Ecosystem Underburn Project
Marlette Basin (NDOW)	No	1	N/A
Martis Peak	No	3	Lake Tahoe Ecosystem Underburn Project, Carnelian Hazardous Fuels Reduction
North Canyon (NDOW)	Yes	1	N/A
Page Meadows	Yes	3	Lake Tahoe Ecosystem Underburn Project
Round Hill	No	3	Zephyr Cove Corrals
Saxon Creek	Yes	7	NRI and Lake Tahoe Ecosystem Underburn Project
Second Creek	No	3	Incline Hazardous Fuels Reduction

Route Name	Historical Detections	2009 visits	Associated USFS Projects
Spring Creek[2]	No	3	Fallen Leaf Lake Bike Trail
Stanford Rock	Yes	3	NRI
Tahoe Meadow	No	3	Incline Hazardous Fuels Reduction, Incline Lake Management Plan, and Aspen Community Restoration Project
Tahoe Mountain[2]	No	3	Fallen Leaf Lake Bike Trail
Tamarack Peak	No	3	Incline Hazardous Fuels Reduction
Taylor Creek	No	3	Fallen Leaf Lake Bike Trail
Third Creek	No	3	Incline Hazardous Fuels Reduction
Trout Creek	Yes	3	NRI
Tunnel Creek	No	3	Incline Hazardous Fuels Reduction
Twin Peaks	Yes	3	NRI
Ward Timber	Yes	3	Lake Tahoe Ecosystem Underburn Project
Watson Creek	Yes	3	NRI

[1]The third survey at Incline Lake was completed by Hauge Brueck Associates.
[2] The Spring Creek and Tahoe Mountain survey areas do not include the locations where there have been historical detections.

Spot-calling surveys were conducted by LTBMU crews per protocol for California spotted owl from 28 April through 18 August 2009. A nest check was conducted prior to the first survey at the historic Cold Creek nest.

Insignia Environmental conducted surveys for spotted owls for Sierra Pacific Power line 625 and 650 Project. The study area roughly followed FS road 73 from Tahoe city to Kings Beach. Thirty-seven call stations were surveyed 3 times along the "Fiberboard Freeway". Hauge Brueck Associates conducted surveys at Heavenly Ski Resort as well as the final survey at Incline Lake; the first two surveys were performed by LTBMU. NDOW performed spotted owl surveys at 14 call stations in North Canyon, between Spooner and Marlette Lakes, and at Marlette Basin.

Currently, there are 21 Protected Activity Centers (PACs) within the LTBMU; 12 of the 21 PACs were surveyed this year for spotted owl due to the proximity of LTBMU projects or as NEPA Resource Inventory (NRI) surveys. The Painted Rock, Echo Lake, Round Lake, Twin Crags, Hawley Grade, Tahoe Mountain, Spring Creek, General Creek, and Blackwood Creek PACs were not surveyed as projects are not scheduled currently or in the near future to take place within the boundaries of the PACs or within close proximity (0.25 miles). Spotted owls were detected at six of the PACs (Burton Creek, Carnelian, Cold Creek, Griff Creek, Lower Saxon Creek, and Stanford Rock) three of which included nests (Burton Creek, Cold Creek and Lower Saxon Creek) The Griff Creek nest was found on California Tahoe Conservancy land and therefore outside of the PAC (by less than 100 meters).

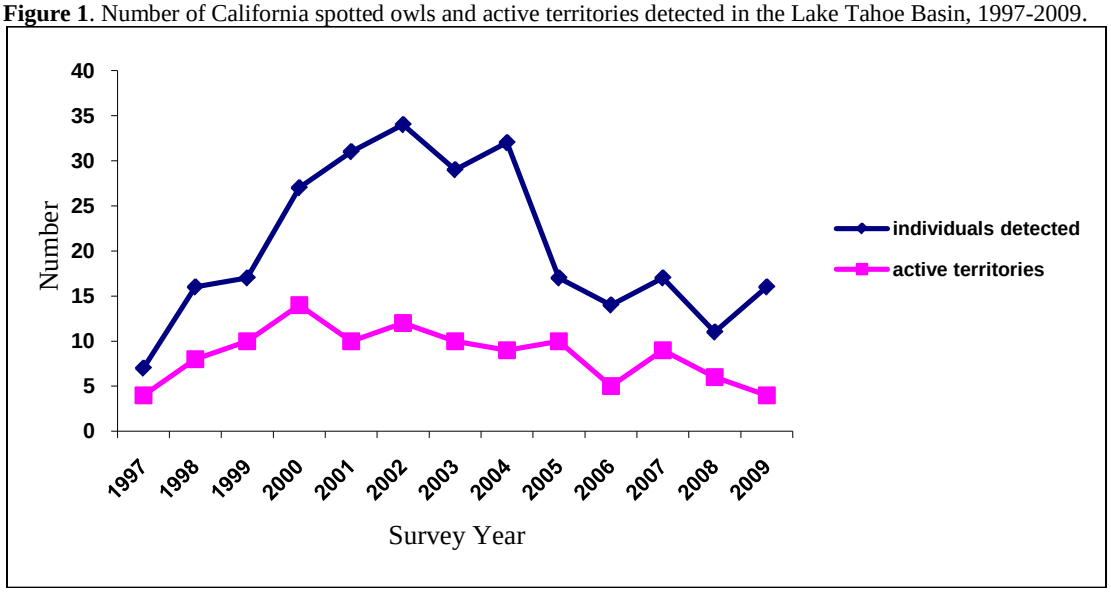
2.1.2 SURVEY RESULTS

Approximately 33,262 acres (13,460 hectares) were surveyed for California spotted owl by the LTBMU and its partners in the Lake Tahoe Basin in 2009. Acreage was calculated based the average area effectively surveyed (0.25 mile radius) from call stations during spot-calling surveys and a one mile radius around active nests. LTBMU wildlife crews surveyed 25,328 acres (10,450 hectares). Hauge Brueck Associates surveyed 3,422 acres (1,385 hectares) at Heavenly Ski Resort, Insignia Environmental surveyed 3,980 acres (1,610 hectares) along power lines north of Tahoe City and Kings Beach, and NDOW surveyed approximately 1,215 acres (492 hectares) between two survey routes along the east shore area of the Tahoe Basin. Sixteen individual spotted owls were detected in the Lake Tahoe Basin in 2009 (an increase of over 45% from 11 in 2008).

Sixteen individual spotted owls were detected by LTBMU in 2009 (Figure 1): 4 pairs, 2 individual males, 2 individual females, and 4 juveniles. All detections, except of the juveniles, were followed up within 48 hours to ascertain nesting status.

Female adult spotted owl at Cold Creek nest. Photo courtesy of Jon Paul, 2009.

Figure 1. Number of California spotted owls and active territories detected in the Lake Tahoe Basin, 1997-2009.



Seven territories were active with four territories determined to be reproductively active (i.e. Cold Creek, Saxon Creek, Griff Creek, and Burton FS) in 2009. Pairs were observed directly together at Cold Creek, Saxon Creek, Griff Creek, and Burton FS and at all nests, except at Griff Creek, where the male owl delivered one or more mice to the female or the nest cavity. Reproductively active territories increased from zero in 2008 to four in 2009 (Figure 2). Three of the four 2009 territories successfully fledged juveniles compared to zero fledglings found in 2008. Breeding activity comparisons are shown in Figure 2 and, breeding and territory status for 2009 is summarized in Table 2 (see below).

Figure 2. California spotted owl reproductive activity in the Lake Tahoe Basin, 1997-2009.

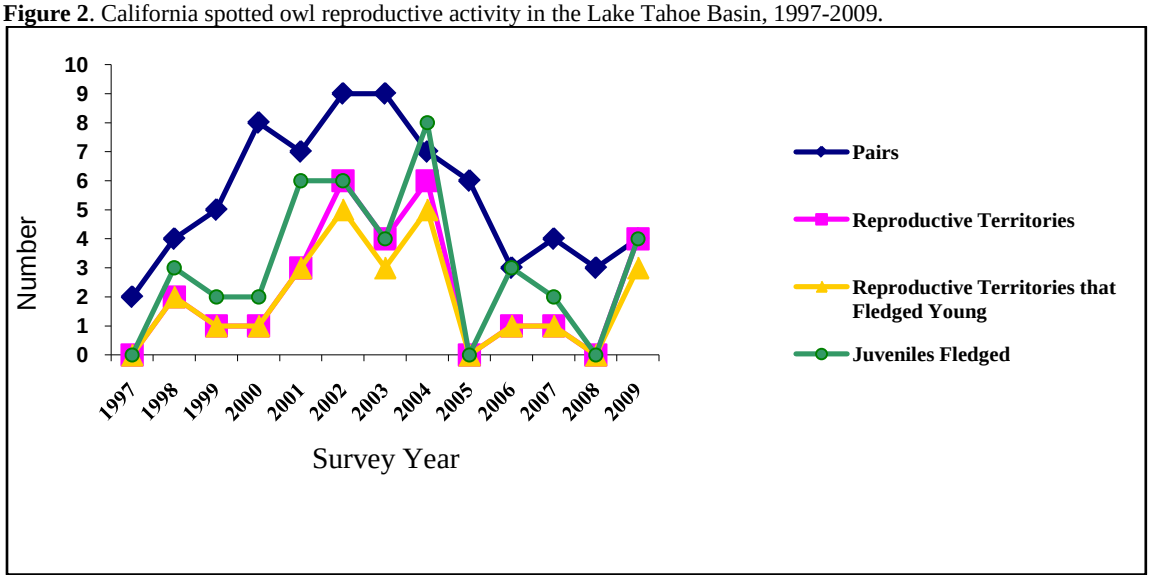


Table 2. Status of territories, pairs, reproductive activity and success for California spotted owl in areas surveyed by the Lake Tahoe Basin Management Unit, Nevada Department of Wildlife, Hauge Brueck Associates and Insignia Environmental in 2009.

Survey Area	Individuals Detected	Territory Active	Pair	Territory Reproductive	Juveniles Fledged
Angora Creek	0	no	-	-	-
Angora Ridge	0	no	-	-	-
Bliss Creek	0	no	-	-	-
Burton FS	3	yes	yes	nesting confirmed	1
Carnelian Bay	1	yes	unknown	unknown	-
Cold Creek	2	yes	yes	nesting confirmed	-
Fallen Leaf Lake	0	no	-	-	-
Fiberboard Freeway (Insignia Environmental)	0	no	no	-	-
Genoa Peak	0	no	-	-	-
Grass Lake	0	no	-	-	-
Griff Creek	4	yes	yes	nesting confirmed	2
Heavenly Ski Resort (Hauge Brueck Assoc.)	0	no	-	-	-
Incline Creek	0	no	-	-	-
Incline Lake	0	no	-	-	-
Logan House Creek	0	no	-	-	-
Marlette Basin (NDOW)	0	no	-	-	-
Martis Peak	0	no	-	-	-
North Canyon (NDOW)	0	no	-	-	-
Page Meadow	0	no	-	-	-
Round Hill	0	no	-	-	-
Saxon Creek	3	yes	yes	nesting confirmed	1
Second Creek	0	no	-	-	-
Spring Creek	0	no	-	-	-
Stanford Rock	1	yes	unknown	unknown	-

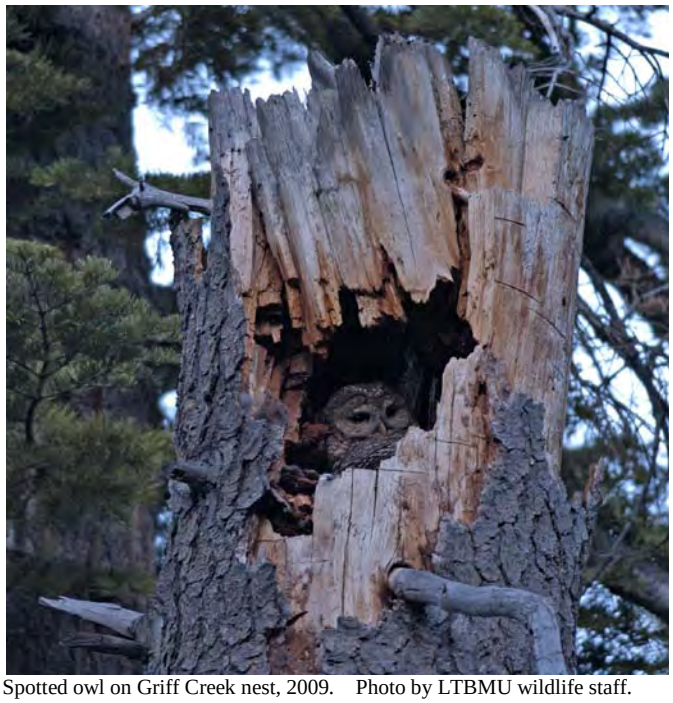
Survey Area	Individuals Detected	Territory Active	Pair	Territory Reproductive	Juveniles Fledged
Tahoe Meadow	0	no	-	-	-
Tahoe Mountain	0	no	-	-	-
Tamarack Peak	0	no	-	-	-
Taylor Creek	0	no	-	-	-
Third Creek	0	no	-	-	-
Trout Creek	1	yes	unknown	unknown	-
Tunnel Creek	0	no	-	-	-
Twin Peaks	0	no	-	-	-
Ward Timber	1	yes	unknown	unknown	-
Watson Creek	0	no	-	-	-
Total	**16**	**7**	**4**	**4**	**4**

2.1.3 DISCUSSION OF SURVEY RESULTS

Nests found at Griff Creek and Saxon Creek were in new nest trees. The nests found at Cold Creek and Burton FS were in trees that had been used for nesting in prior years. Fledglings confirmed nest success at Griff, Saxon and Burton. The nest located at Cold Creek was confirmed to be active on 27 April. This site has been inhabited by nesting owls in 2002, 2003, 2004 and 2006. On 8 June, a survey crew was inspecting the Cold Creek nest for activity when an adult northern goshawk flew onto a branch near the nest tree. The goshawk was chased away by both adult spotted owls, only to return later. No evidence of nesting owls, adults or juveniles, were discovered at the site during subsequent nest checks. It is likely that the northern goshawk caused this nest to fail.

The nest at Saxon Creek was discovered on 6 May during the follow up to audio and visual detections on a routine survey. Both male and female owls had responded to calls during the survey. Nesting owls have been found in the Saxon Creek drainage in five of the past eight years. On July 1st a single fledged juvenile was located with its parents approximately 200 meters down slope from the nest.

The nest at Griff Creek was discovered incidentally on 9 May by an independent wildlife consultant who forwarded the information to LTBMU. Surprisingly, this nest was within 10 meters of a popular mountain bike trail. On 17 June the nest was found empty and two fledged juveniles were discovered with the parent owls 30m down slope of the nest.

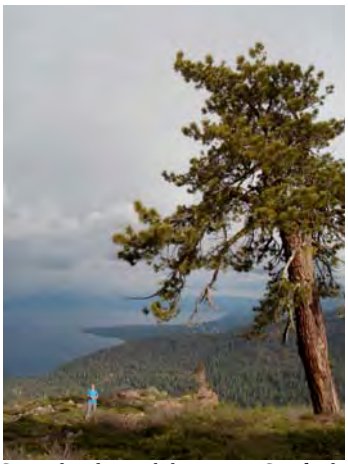


Spotted owl on Griff Creek nest, 2009. Photo by LTBMU wildlife staff.

On 12 May an unusual spotted owl vocalization was heard at Burton FS but was not identified correctly as a spotted owl by the surveyors and not followed-up until further research caused them to reconsider the detection. An additional visit on 2 June revealed a nest in an existing nest tree

that was previously used in 2001, 2002 and 2004. Two adults and a single juvenile were seen on 15 July near the nest tree. Since the pair was located on the forest service side of the property line, CDPR did not conduct protocol surveys at Burton State Park in 2009.

At the Carnelian Bay site, spotted owls were detected on all three surveys. Although gender could not be positively determined, surveyors recorded the first detection as a female and the last detection as a male which may indicate a pair resides in the area and hold a territory. Two follow-up visits the following morning located an owl but no mice were taken and no nest sites were found resulting in unknown pair status.


Spotted owl crew hiking up to Stanford Rock. Photo by LTBMU wildlife staff.

A barking call was detected by surveyors at Stanford Rock and 3 to 4 four-note calls were heard at Ward Creek. Neither follow-up visit found spotted owls. Late in the season (18 August) a single four-note call was heard at Trout Creek and upon follow-up was not found. Due to its proximity to other sites it may have been a dispersing adult or juvenile from the Saxon or Cold Creek nests.

Insignia Environmental detected possible spotted owl vocalizations on three occasions. Upon follow-up surveys no owls were located. These detections were in close proximity to owls already detected by LTBMU survey crews and were not counted as additional individuals. On 19 August an Insignia Environmental crew that was surveying for northern goshawks found a spotted owl roost. A follow up survey that evening found an individual owl at the site. Given the late date and proximity to a nest previously discovered by LTBMU at Griff Creek, this owl was not recorded as an individual sighting. Hauge Brueck Associates and NDOW had no detections.

2.1.4 RECOMMENDATIONS FOR SPOTTED OWL SURVEYS

Spotted owl calls were heard by biologists during spot-calling surveys at Burton FS but were not identified as such by biologists in both 2008 and 2009. Spotted owls employ a variety of vocalizations that are heard less often than the familiar 4-note call. Owl biologists should be capable of recognizing calls made by both adult and juvenile spotted owls. In addition to providing owl recordings to new field crews, vocalizations should be reviewed with the crew several times throughout the season to re-familiarize them with an assortment of spotted owl calls.

Surveyors have detected spotted owls on the Carnelian Bay route in seven of the last nine survey years. During five of those years detections were recorded multiple times on separate survey occasions, but only in 2004 was a nesting pair discovered. Spotted owls have likely formed pairs or nested there since the last reproductive territory was found. In order to search for nesting sites, in 2010 supplementary call points could be inserted into the Carnelian Bay route. Other routes where numerous detections have yielded nothing could be examined for alternate call stations.

All 2009 detections and nests were located near previously active territories. However not all PACs were surveyed. If time and resources permit in 2010, PACs that have not been surveyed in the prior 2 years (i.e. Echo Lake and Hawley Grade) should be examined again for spotted owl activity. PACs surveyed in 2008, but not 2009, include Twin Crags, General Creek, Blackwood Creek, Spring Creek, Tahoe Mountain, and Round Lake. PACs with known nests should also continue to be surveyed in 2010.

In 2011, the LTBMU will begin implementation of a population Monitoring Plan (MP) for spotted owls. This program is designed to detect biologically meaningful levels of change in the spotted owl population and identify relationships between stressors and population responses. The survey

area is expected to cover a large percentage of the basin. Wildlife personnel should mark MP routes at the end of the 2010 field season.

2.2 NORTHERN GOSHAWK

2.2.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

The LTBMU conducted northern goshawk (*Accipiter gentilis*) surveys in collaboration with Insignia Environmental (contractor for Sierra Pacific Power Company), NDOW, and Hauge Brueck Associates (contractor for Heavenly Ski Resort) in 2009 (Table 3). Due to a staff shortage CDPR did not conduct their own goshawk surveys in 2009 however they did assist forest surveys with the monitoring plan surveys that overlapped CDPR property. NDOW conducted goshawk surveys in 2009 however survey information was not available at the time of this writing. The Forest Service wildlife crew conducted dawn acoustic, broadcast acoustic, and stand search surveys for northern goshawks following the "Northern goshawk inventory and monitoring technical guide." (USDA 2006). Dawn acoustic surveys were conducted 11 March through 2 April. Broadcast acoustic surveys began 1 June and ended 31 August (Appendix 2). Stand search surveys followed goshawk detections during broadcast acoustic surveys as necessary. Suitable habitat was surveyed in proximity to USFS projects, in selected areas with a history of goshawk activity and within Monitoring Plan units (see below).

Dawn acoustic surveys for goshawk were conducted starting 45 minutes before sunrise and ending 1½ hours after sunrise, in cooperation with our partners. For each survey, observers were distributed approximately 300 meters apart around focal areas (e.g. nest stands) where, historically, goshawk activity occurred. The number of surveyors participating varied between 2 and 4 dependent upon the size of the area to be surveyed and the availability of qualified observers to assist. These surveys were intended to be non-invasive: surveyors avoided approaching nests and did not broadcast calls. Surveyors left the area if detected individuals responded to observer presence with agitation.

LTBMU wildlife crew member, Cate Brown, broadcasts calls during a northern goshawk survey, 2009. Photo by LTBMU wildlife staff.

Broadcast acoustic surveys were conducted in cooperation with our partners. Surveys were primarily conducted by 2 person crews. Per regional direction, surveys conducted by a single highly qualified observer were completed only outside of Protected Activity Centers (PACs) and monitoring plan units. Alarm calls were broadcast during the nestling period (early June through mid-July) and a combination of juvenile begging, food delivery, adult wail, and alarm calls were broadcast during the post-fledgling period (early July through late August). Goshawk calls were broadcast every 250 meters or less along transects within the survey polygon using a FoxPro broadcast system. Approximate locations of all broadcast locations, transects, and detections were plotted on site maps. Given this species' high degree of territory and nest stand fidelity, historic nest sites were surveyed first in an attempt to improve the assessment of nesting activity within the Basin.

Table 3. Areas within the Lake Tahoe Basin surveyed for northern goshawk by the LTBMU, Hauge Brueck Associates, and Insignia Environmental in 2009. MP designates the goshawk monitoring plan sample unit. Do to the large size of the MP sample units some route names do not align with previous year's data, survey areas, or territories.

Route	Historic Nesting Area	Project
Alpine Ridge (MP9d)	No	Northern Goshawk Monitoring Plan
Angora Creek	Yes	Fallen Leaf Lake Bike Trail, Aspen Community Restoration and NEPA Resource Inventory (NRI)
Angora Creek (MP33c)	Yes	Northern Goshawk Monitoring Plan, Fallen Leaf Lake Bike Trail and Aspen Community Restoration
Big Meadow	Yes	Big Meadow Fire Regime
Big Meadow (MP43c)	Yes	Northern Goshawk Monitoring Plan
Blackwood Ridge	No	Barker Pass
Blackwood Canyon (MP16a)	Yes	Northern Goshawk Monitoring Plan and Aspen Community Restoration
Bliss Creek	Yes	Lake Tahoe Ecosystem Underburn
Bliss Creek (MP17b)	Yes	Northern Goshawk Monitoring Plan and Lake Tahoe Ecosystem Underburn
Brockway Summit	No	Carnelian Hazardous Fuels Reduction
Burke Creek (MP27d)	Yes	Northern Goshawk Monitoring Plan
Burton FS (MP6c)	Yes	Northern Goshawk Monitoring Plan
Camp Richardson	No	Fallen Leaf Lake Bike Trail
Carnelian Bay (MP7b)	Yes	Northern Goshawk Monitoring Plan, Lake Tahoe Ecosystem Underburn and Carnelian Hazardous Fuels Reduction
Cold Creek (MP35c)	Yes	Northern Goshawk Monitoring Plan
First Creek	Yes	Incline Hazardous Fuels Reduction and Lake Tahoe Ecosystem Underburn
Fiberboard Freeway (Insignia Environmental)	No	Sierra Pacific 625 & 650 Power line Projects
Fountain Place	Yes	Aspen Community Restoration
General Creek (MP22b)	Yes	Northern Goshawk Monitoring Plan
Genoa Peak	Yes	Aspen Community Restoration
Genoa Peak (MP21c)	Yes	Northern Goshawk Monitoring Plan
Grass Lake	No	Aspen Community Restoration
Griff Creek	Yes	Carnelian Hazardous Fuels Reduction
Griff Creek (MP3d)	Yes	Northern Goshawk Monitoring Plan and Lake Tahoe Ecosystem Underburn
Hawley Grade (MP43b)	No	Northern Goshawk Monitoring Plan

Route	Historic Nesting Area	Project
Heavenly Ski Resort (Hauge Brueck Assoc.)	No	Heavenly Ski Resort Master Plan
Hellhole (MP39c)	Yes	Northern Goshawk Monitoring Plan
High Meadow (MP36d)	Yes	Northern Goshawk Monitoring Plan
Incline Creek	Yes	Incline Hazardous Fuels Reduction and Aspen Community Restoration
Incline Lake (Hauge Brueck Assoc.)	No	Incline Lake Management Plan
King	No	Carnelian Hazardous Fuels Reduction
Logan House Creek	No	Lake Tahoe Ecosystem Underburn
Marlette Cr.	Yes	NRI
Marlette/Hobart (NDOW)	No	NDOW Wildlife Surveys
Martis Peak	Yes	NRI
Martis Peak (MP3a)	Yes	Northern Goshawk Monitoring Plan and Lake Tahoe Ecosystem Underburn
McKinney Creek (MP20d)	Yes	Northern Goshawk Monitoring Plan
Meeks Bay	No	Meeks Meadow Washoe Restoration
Meeks Bay (MP20c)	Yes	Northern Goshawk Monitoring Plan
Memorial Point (NDOW)	No	NDOW Wildlife Surveys
Mount Baldy	No	Incline Hazardous Fuels Reduction
North Canyon (NDOW)	No	NDOW Wildlife Surveys
Page Meadows	No	Lake Tahoe Ecosystem Underburn
Round Lake	No	NRI
Saint's Rest (NDOW)	No	NDOW Wildlife Surveys
Saxon Creek (MP41b)	Yes	Northern Goshawk Monitoring Plan
Second Creek	No	Incline Hazardous Fuels Underburn
Secret Harbor	No	Lake Tahoe Ecosystem Underburn
Secret Harbor Creek (NDOW)	Yes	NDOW Wildlife Surveys
Sierra Creek (MP23d)	Yes	Northern Goshawk Monitoring Plan
Spring Creek	Yes	Fallen Leaf Lake Bike Trail and Aspen Community Restoration
Spring Creek (MP33a)	Yes	Northern Goshawk Monitoring Plan
Spring Creek (MP33b)	Yes	Northern Goshawk Monitoring Plan and Fallen Leaf Lake Bike Trail
Tahoe City (MP10a)	No	Northern Goshawk Monitoring Plan

Route	Historic Nesting Area	Project
Tahoe Mountain	Yes	NRI
Taylor Creek	No	Fallen Leaf Lake Bike Trail
Trout Creek	Yes	Lake Tahoe Ecosystem Underburn
Tunnel Creek	No	Incline Hazardous Fuels Reduction
Upland (NDOW)	No	NDOW Wildlife Surveys
Ward Canyon	Yes	Lake Tahoe Ecosystem Underburn
Ward Canyon (MP12b)	Yes	Northern Goshawk Monitoring Plan and Lake Tahoe Ecosystem Underburn
Watson Creek	No	Carnelian Hazardous Fuels Reduction
Zephyr Cove	No	Zephyr Corral

A survey area was considered occupied during dawn acoustic surveys if there was a visual or aural detection. Similarly, an area was considered occupied during broadcast surveys if there were visual or aural detections or if plucking posts with typical goshawk prey species remains, such as northern flicker, Steller's jay, etc., were found. Survey areas were considered reproductively active if: 1) an adult bird or nestling(s) were observed on a nest; 2) there was fresh whitewash and goshawk feathers under a nest; or 3) fledglings along with other evidence of nesting were detected within an area. Survey areas were considered reproductively successful if fledgling(s) were detected either outside a nest in an area where an active nest was found or where evidence of nesting was found.

2.2.2 SURVEY RESULTS

The LTBMU and partner agencies conducted broadcast surveys within 65 survey areas for a total of 54,045 acres (21,871 hectares) in 2009 (Table 4). Acreage was calculated based on the area of survey polygons plus (in the case of survey points provided by Insignia Environmental) the effective area encompassed within a 200 meter radius of call points. The LTBMU surveyed a total of 45,597 acres (18,857 hectares). Hauge Brueck Associates surveyed 1,800 acres (728 hectares). Insignia Environmental surveyed 5121 acres (2072 hectares). NDOW surveyed 527 acres (213 hectares).

Goshawks were detected within 30% (19 of 57) of the areas where broadcast surveys were conducted and within 80% (4 of 5) of the areas where dawn acoustic surveys were conducted in 2009. Nine nests were discovered in the Basin this year: six new nests and three previously detected nest sites. The Carnelian Bay MP7b nest (2008b) was found active during the first round of broadcast surveys. It was later determined to be on private property. A single nest check was conducted in conjunction with EDAW biologists who currently have permission from the land owner to conduct surveys. The Carnelian Bay nest fledged three juveniles. Similarly, there were 3 juveniles fledged at High Meadows with the nest (2009e) being found in early September during an extra-protocol intensive stand search. The Spring Creek goshawks used nest 2003d (also used in 2005) and fledged 2 juveniles. A new nest was found within Sugarpine State Park at the McKinney Creek MP20d survey area, 2009d (near Lily Pond) that fledged 2 juveniles. One fledgling was observed at Martis Peak (2009f) during broadcast surveys and a new nest was found during a stand search. The Tahoe City MP10a survey site fledged one juvenile with no nest found. Two fledglings where found in the Ward Canyon MP12b survey area but the nest was not found. Nest failure occurred at Big Meadow MP43c (2009a), Sierra Creek MP23d (2002h) and Hellhole MP39c (2009b) after nests were found active during early survey efforts. Including incidental sightings, there were goshawk detections within 19 survey areas in 2009.

Table 4. Survey Areas and results of northern goshawk surveys conducted by Lake Tahoe Basin Management Unit (LTBMU), Hauge Brueck Associates, and Insignia Environmental within the Lake Tahoe Basin in 2009.

Area	Dawn Acoustic Survey	Dawn Acoustic Detection	Broadcast Survey	Broadcast Detection	Nest Found	Nest Outcome
Alpine Ridge (MP9d)	No	N/A	Yes	No	No	N/A
Angora Creek	No	N/A	Yes	Yes	No	N/A
Angora Creek (MP33c)	No	N/A	Yes	No	No	N/A
Big Meadow	No	N/A	Yes	No	No	N/A
Big Meadow MP43c	Yes	Yes	Yes	Yes	Yes	Failed
Blackwood Canyon MP16a	No	N/A	Yes	No	No	N/A
Blackwood Ridge	No	N/A	Yes	No	No	N/A
Bliss Creek	Yes	N/A	Yes	No	No	N/A
Bliss Creek MP17b	Yes (NDOW)	No	Yes	No	No	N/A
Brockway Summit	No	N/A	Yes	No	No	N/A
Burke Creek MP27d	No	N/A	Yes	No	No	N/A
Burton FS MP6c	No	N/A	Yes	No	No	N/A
Camp Richardson[1]	No	N/A	Yes	Yes	No	N/A
Carnelian Bay MP7b	Yes	Yes	Yes	Yes	Yes	3 Fledged
Cold Creek MP35c[1]	No	N/A	Yes	Yes	No	N/A
Fiberboard Freeway (Insignia Environmental)	No	N/A	Yes	Yes	No	N/A
First Creek	No	N/A	Yes	No	No	N/A
Fountain Place	No	N/A	Yes	No	No	N/A
General Creek MP22b	No	N/A	Yes	No	No	N/A
Genoa Peak	No	N/A	Yes	No	No	N/A
Genoa Peak MP21c	No	N/A	Yes	No	No	N/A
Grass Lake	No	N/A	Yes	No	No	N/A
Griff Creek[1]	No	N/A	Yes	No	No	N/A
Griff Creek MP3b	No	N/A	Yes	No	No	N/A
Hawley Grade MP43b[1]	No	N/A	Yes	Yes	No	N/A
Heavenly Ski Resort (Hauge Brueck Associates)	Yes	No	Yes	No	No	N/A
Hellhole MP39c	No	N/A	Yes	Yes	Yes	Failed

Area	Dawn Acoustic Survey	Dawn Acoustic Detection	Broadcast Survey	Broadcast Detection	Nest Found	Nest Outcome
High Meadow MP36d	No	N/A	Yes	Yes	Yes	3 Fledged
Incline Creek	No	N/A	Yes	No	No	N/A
Incline Lake (Hauge Brueck Assoc.)	No	N/A	Yes	No	No	N/A
King	No	N/A	Yes	No	No	N/A
Logan House Creek	No	N/A	Yes	No	No	N/A
Marlette/Hobart (NDOW)	No	N/A	Yes	No	No	N/A
Martis Peak MP3a	No	N/A	Yes	Yes	Yes	1 Fledged
McKinney Creek MP20d	Yes	Yes	Yes	Yes	Yes	2 Fledged
Meeks Bay	No	N/A	Yes	No	No	N/A
Meeks Bay MP20c	No	N/A	Yes	No	No	N/A
Memorial Point (NDOW)	Yes	Yes	Yes	No	No	N/A
Mount Baldy	No	N/A	Yes	No	No	N/A
Marlette Creek	No	N/A	Yes	No	No	N/A
Martis Peak	No	N/A	Yes	No	No	N/A
North Canyon (NDOW)	Yes	No	No	N/A	No	N/A
Page Meadows	No	N/A	Yes	No	No	N/A
Round Lake	No	N/A	Yes	No	No	N/A
Saint's Rest (NDOW)	Yes	No	Yes	No	No	N/A
Saxon Creek MP41b	Yes	Yes	Yes	Yes	No	N/A
Second Creek	No	N/A	Yes	No	No	N/A
Secret Harbor	No	N/A	Yes	No	No	N/A
Secret Harbor Creek (NDOW)	Yes	No	No	N/A	No	N/A
Sierra Creek MP23d	No	N/A	Yes	Yes	Yes	Failed
Spring Creek	No	N/A	Yes	No	No	N/A
Spring Creek MP33a	No	N/A	Yes	No	No	N/A
Spring Creek MP33b	No	N/A	Yes	Yes	Yes	2 Fledged
Tahoe City MP10a	No	N/A	Yes	Yes	No	1 Fledged
Tahoe Mountain	No	N/A	Yes	No	No	N/A
Taylor Creek	No	N/A	Yes	No	No	N/A
Trout Creek	No	N/A	Yes	Yes	Yes	Unknown

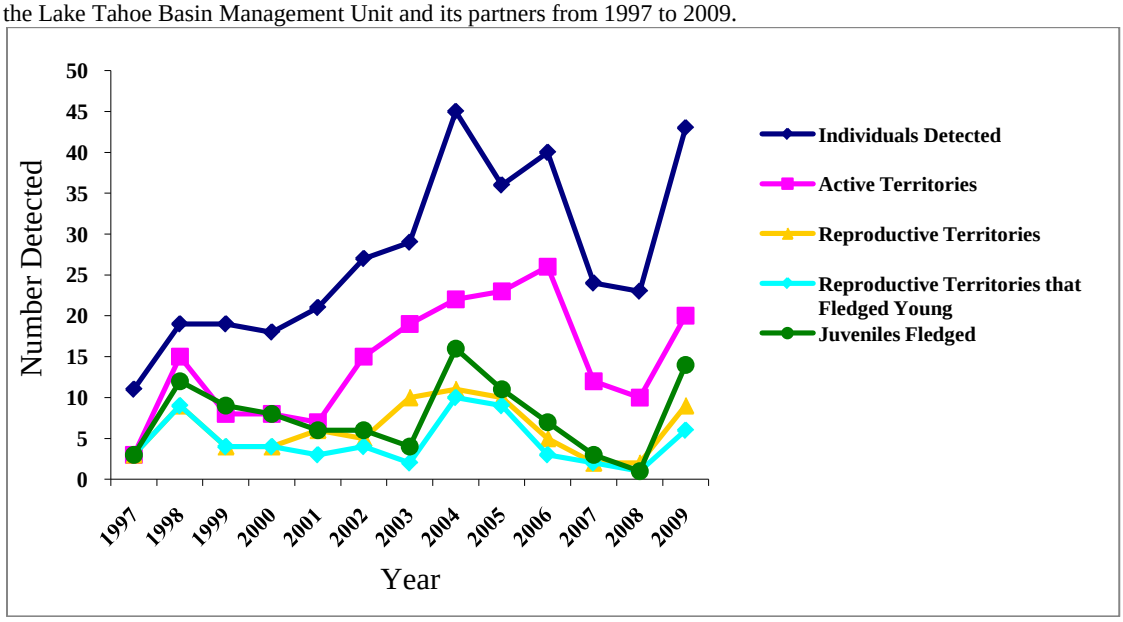
Area	Dawn Acoustic Survey	Dawn Acoustic Detection	Broadcast Survey	Broadcast Detection	Nest Found	Nest Outcome
Tunnel Creek	No	N/A	Yes	No	No	N/A
Upland (NDOW)	No	N/A	Yes	No	No	N/A
Ward Canyon	No	N/A	Yes	No	No	N/A
Ward Canyon MP12b	No	N/A	Yes	Yes	No	2 Fledged
Watson Creek	No	N/A	Yes	No	No	N/A
Zephyr Cove	No	N/A	Yes	No	No	N/A

[1] No detections during broadcast surveys but one or more incidental sightings in the area.

Survey areas were established in highly suitable to marginally suitable habitats within ¼ mile of agency project-implementation sites including fuels treatment, habitat restoration, and trail reroute projects. These surveys are conducted to determine presence/absence within or near a project area. The following tentative representation of northern goshawk individuals, active territories, and reproductive success (for 2009 project survey areas) is included for the sake of continuity between annual reports. The LTBMU and its partners recorded 57 goshawk detections (up 40% from 23 in 2008), 14 active territories (up 28% from 10 in 2008), 11 reproductively active territories (up 550% from 2 in 2008), 7 known reproductively active territories that fledged young (up 350% from 2 in 2008), and 14 known juveniles fledged (up 700% from 2 in 2008) in 2009 (Figure 3).

The goshawk population monitoring plan called for 24 sample units to be surveyed in 2009. Several difficulties were encountered during the season that prohibited many of these surveys from being completed to monitoring plan protocol. Originally there were 26 sample units planned for survey. Clear Creek MP18a and Spring Creek MP28c did not receive a second round of surveys prior to August 31. These two sample units were subsequently removed from 2009 data and reporting. Both of these sample units were strata two sample units (need to be surveyed once in the ten year period), so they can be surveyed in a future sampling effort. The monitoring plan differs from the standard protocol by requiring that surveys be complete by August 15 rather than August 31. Only 22% of monitoring plan surveys met this requirement, although all (except MP18a and MP28c) were surveyed by August 31. In addition, Angora Creek MP33c overlapped an area that was severely burned during the Angora fire in 2007. The field crew made the decision to omit the burned areas from the survey therefore the sample unit was inadequately surveyed. The Bliss Creek MP17b sample unit should have been surveyed jointly by LTBMU and NDOW. Coordination on this survey was inadequate and the NDOW portion was not completely surveyed.

Figure 3. Graph of number of northern goshawk individuals, active territories, and reproductive success detected by the Lake Tahoe Basin Management Unit and its partners from 1997 to 2009.



2.2.3 DISCUSSION OF SURVEY RESULTS

The USFS focused survey efforts largely in the monitoring plan areas in 2009. Crews also surveyed project sites that involved thinning which should move the existing forest structure toward more sustainable and resilient forest conditions, reducing the likelihood of stand replacing wildland fires, and contributing to the long-term suitability of goshawk habitats where possible. Other projects include trail re-alignment to reduce erosion, underburn, meadow restoration and stream channel restoration.

Northern goshawk adult on its nest at Hellhole site, 2009.
Photo by LTBMU wildlife staff.

In terms of area surveyed during broadcast surveys, goshawk search effort by LTBMU field crews increased 412% in 2009 over the previous field season. Goshawk detections exhibited a strong upward trend (248% more than in 2008) and individual goshawks detected increased 226% from 2008. A spike in goshawk detections in 2009 may be correlated to the increased survey effort of historical goshawk territory and suitable goshawk habitat.

The Seneca Pond goshawk PAC was moved in late 2007 following elimination of suitable habitats by the 2007 Angora Fire. The new PAC was relocated to nearby suitable habitats though there was only one historical goshawk record in that location. Two detections occurred in the new PAC in 2008 and single auditory

goshawk detection occurred within the PAC in 2009. Goshawks were not detected in the Tahoe Mountain PAC (also moved to accommodate habitat alteration due to the 2007 Angora Fire) in 2009.
Spring Creek MP33B was found to be reproductively active; goshawks used the 2003 nest (2003d) and fledged two young.

Dawn acoustic surveys at Big Meadow detected goshawks near the historic nesting area. Broadcast surveys and follow-up stand searches found a new nest (2009a) within the historic nest stand. Both male and female goshawks were detected during the surveys and the female was seen incubating during the first nest check, but neither adult was present on later surveys. It was determined that the Big Meadow nest failed.

There were multiple goshawk detections at Saxon Creek during dawn acoustic surveys but only one during broadcast surveys. No nest or reproductive activity was found.

Surveys at Trout Creek found a plucking post and a nest (2009c) that was not in use, but showed signs of recent use. These feature detections suggest that the territory was reproductively active but had failed early in the season.

A new nest (2009b) was found early in the season at Hellhole, but subsequent nest checks observed the female off the nest. The nesting attempt at Hellhole was ultimately determined to have failed.

Several visual and auditory detections occurred at High Meadows during broadcast surveys and led surveyors to three fledgling goshawks. A restoration project at High Meadows was scheduled to proceed starting fall 2009 and, due to its proximity to the juvenile goshawks, made finding the nest, nest stand and breeding territory a priority. An intensive stand search of the area post season discovered a new nest (2009e) and five plucking posts. These will now be protected during implementation of the restoration project, which was delayed until 2010 (for other reasons).

Signs of goshawks were found near Griff Creek. A crew member found a goshawk primary flight feather, which indicates goshawk presence in the area. Surveys of the surrounding area did not detect goshawk activity.

The Martis Peak territory was found to be reproductively active. Visual and auditory detections of both adults and one juvenile were made during broadcast surveys in August. The juvenile had already fledged but was still in the area of the nest. With persistence, the nest (2009f) was found during an intensive stand search effort.

The Watson Creek (within the Carnelian Bay MP7b survey area) dawn acoustic survey detected activity at the 2008 nest site (2008b), which is located on private property. A male goshawk was detected during the first broadcast survey within the survey polygon on Forest Service property and the active nest was ultimately located with three nestlings. Three fledglings were observed on and around the Watson Creek nest tree during a single nest check conducted in conjunction with EDAW.

Broadcast surveys in Ward Canyon and Tahoe City elicited begging responses from juvenile goshawks though no nests were found. Two fledglings were detected at Ward and one at Tahoe City. Stand search efforts were unable to discover the nest locations. Evidence, such as plucking post, whitewash, proximity to the historic territory, and an unwillingness to leave the area, displayed by the juveniles convinced surveyors they were within the current nest territory.

The Sugar Pine Point State Park territory, within the McKinney Creek MP20d survey area, was found to be reproductively active and successful. Early surveys detected an adult female goshawk whose behavior was not typical for a breeding female in a nesting territory; she was not aggressive and did not defend a territory. However, this behavior has been observed in the Sugar Pine Point territory in previous years. Joint agency crews searched the old nest territory several times but were unable to locate a nest until the second round of surveys. Two juvenile goshawks fledged from the Sugar Pine Point SP nest (2009d).

A female goshawk was observed on a historic Sierra Creek nest (2002h) early in the breeding season. However, follow-up nest checks observed decreasing activity until there were no detections and it was determined that the nest failed.

There were several incidental goshawk detections that occurred during other wildlife surveys. During a spotted owl nest check at Cold Creek a goshawk flew directly to the spotted owl nest. The owls tried to chase the goshawk away but the goshawk returned. Attempts were made to find the goshawks territory, but no further detections were made.

A goshawk was visually detected during a bat survey at the Tahoe Treasure mine which is near the Mckinney Rubicon OHV area. During a restoration monitoring survey at Cookhouse Meadow a goshawk was visually detected as it flew directly overhead. A crew member also visually detected a goshawk juvenile near the Grass Lake survey area while hiking to a wolverine survey camera station.

NDOW surveyed seven sites. There was one detection at the Memorial Point survey area. The Slaughterhouse North survey area was surveyed by NDOW using the dawn acoustic protocol. This site was completely encompassed by the Bliss Creek MP17b sample unit and was therefore also surveyed by LTBMU. There were no detections in Slaughterhouse North by NDOW.

1.2.4 RECOMENDATIONS FOR NORTHERN GOSHAWK SURVEYS

In order to avoid difficulties encountered in 2009, future monitoring plan efforts should be more closely supervised with finer attention to detail. Planning for this complex effort should take place farther in advance of the field season. Coordination with partner agencies should be emphasized and handled by a LTBMU Wildlife Biologist.

Expanding the coverage of project area broadcast surveys to include adjacent historic nesting areas if time and budget permits may increase detections, nesting status results, movement and home range data, and reproductive success information.

Resources and funding permitting, 2010 surveys should include those areas that had inconclusive survey data or were new territories in 2009. These should include Trout Creek, Ward Canyon, Tahoe City, High Meadows, Martis Peak, and Hellhole.

2.3 OSPREY

2.3.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

The LTBMU led collaborative surveys with TRPA to assess the spatial location and reproductive activity of osprey (*Pandion haliaetus*) nesting in the Lake Tahoe Basin in 2009. TRPA led osprey monitoring efforts prior to 2004 and provided records of osprey nesting activity collected from 1976-2003. In 2004, the USFS took the lead for the osprey surveys and data management in the Lake Tahoe Basin. Surveys were conducted for osprey and osprey nests within approximately 0.25 mile of the shorelines of Lake Tahoe, Fallen Leaf Lake, and Cascade Lake, and at the following sites located further inland: CAB01, CAB03, CRB01, CRB02, CRB03, MMP04, MMP09, SKH08, SKH11, DMP09, DMP10, GLB03, CVR03, CVR04, SCH08, SLT08, FLL02 and FLL18 (Appendix 3). California Department of Parks and Recreation conducted independent surveys in the near-shore areas of Bliss, Sugar Pine Point, Burton, and Emerald Bay State Parks between 21 April and 28 August 2009. Nevada Department of Wildlife (NDOW) monitored Marlette Lake, Tunnel Creek, Bonpland Creek, Slaughterhouse Canyon, and Memorial Point for osprey activity during the 2009 breeding season.

We followed the "TRPA Osprey Boat/Walk-In Protocol" and conducted surveys from May through September 2009. Surveyors visited all known osprey nest sites during the initial visiting period in May, excepting those designated "tree gone" with certainty during the 2008 field season. Once a month between June and September 2009, LTBMU biologists visited all historic sites for which the nest tree was confirmed to be still standing, with a minimum of 17 days between return visits. The Lake Tahoe shoreline was surveyed from aboard a TRPA boat at low speed (<8 mph) approximately 75 meters from shore on 19 May, 16 June, 21 July, 21 August, and 16 September 2009. The remaining sites were surveyed shortly before or after each boat survey by hiking to vantage points near and above (if possible) nest sites, but far enough away to avoid disturbing nesting activity. Surveyors spent several minutes per visit at each active nest site to assess nesting activity and conducted additional visits as necessary through 22 September 2009 to determine nest fate and reproductive success. However, we decided not to represent the number of juveniles fledged in the 2009 report because juveniles cannot be reliably aged once they have fledged. Nests were considered active if nesting activity was observed on any visit. Nests that had never been detected before were labeled with a 3-letter prefix to indicate relative location (per method developed by TRPA, see Appendix 4) and with a numerical suffix to indicate order of discovery for that area. For example, the third recorded nest in the Crystal Bay area, a new initiation this field season, was labeled CRB03.

Osprey on nest at Memorial Point. Photo courtesy of David Catalano, NDOW.

We collected digital photographs of new nests to facilitate nest tree identification as part of a photo-inventory project begun by TRPA in 2000. We also tried to photograph old nests not previously included in the inventory and those which had changed in character substantially (e.g. half of the nest tree had fallen) since the last photograph was taken.

2.3.2 SURVEY RESULTS

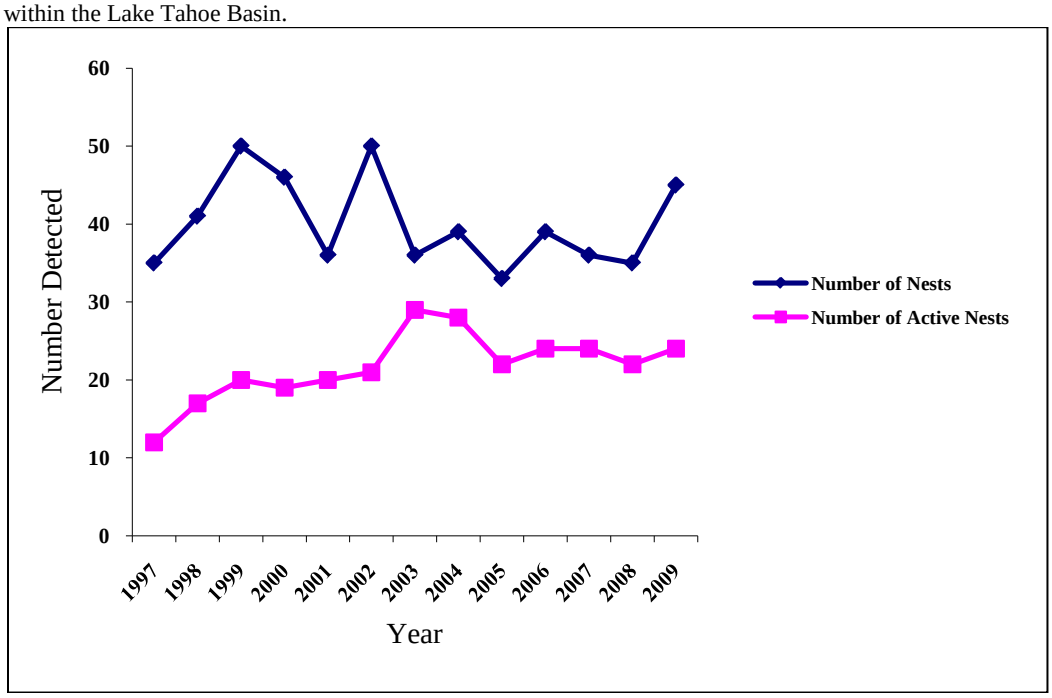
The LTBMU, NDOW, and CDPR surveyed 17,411 acres (7,046 hectares) of suitable osprey habitat and made initial visits to 77 historic nest sites. One nest tree confirmed to have broken at or near the base was assigned 'tree gone' status and not subsequently re-visited. Over the course of the 2009 field season, nine additional trees were observed to contain new osprey nests, to which visits continued for the remainder of the summer. NDOW observed osprey activity at Secret Harbor, Tunnel Creek, Bonpland Creek, Slaughterhouse Canyon, and Memorial Point throughout the 2009 season. It is now assumed, due to consistency in observing an osprey pair soaring over Marlette Lake, that there is likely a nest in neighboring Hobart Canyon, just outside the Tahoe Basin. In total, the LTBMU and its partners surveyed 85 nest sites and detected 45 intact nests, 24 (53%) of which were active (Table 5). However, there were nine nests that had activity early in the season but later were inactive (likely failed or no reproductive effort). All of these nests were still classified as active, to be consistent with analysis methods in previous years. In total, the LTBMU and its partners detected 45 osprey nests (up 47% from 35 in 2008), 24 of which were active nests (up 8% from 22 in 2008) (Figure 4).

Table 5. The total number of osprey nests and active nests detected by LTBMU and its partners, 1997-2009, within the Lake Tahoe Basin. The "Nest Active" classification refers to 2009 only.

Nest Site	Nest Present	Nest Active	Nest Site	Nest Present	Nest Active	Nest Site	Nest Present	Nest Active
CAB01	Y	Y	**FLL04**	Y	Y	**RUP20**	N	N
CSL04	N	N	**FLL06**	N	N	**RUP22**	N	N
CSL06	N	N	**FLL09+**	TG	N	**RUP23**	N	N
CSL07	Y	N	**FLL14**	Y	N	**RUP24**	N	N
CSL08	Y	N	**FLL15**	N	N	**RUP25**	N	N
CSL09*	Y	Y	**FLL16**	Y	N	**RUP26**	Y	N
CRB01	N	N	**FLL17**	Y	N	**RUP27**	Y	Y
CRB02	N	N	**FLL18***	Y	N	**RUP28***	Y	Y
CRB03*	Y	Y	**FLP01**	N	N	**SAH02**	Y	Y
CVR03+	Y	Y	**FLP02**	N	N	**SAH06**	N	N
DMP03	Y	Y	**GLB01**	N	N	**SAH07**	N	N
DMP09	N	N	**GLB02**	N	N	**SAH08***	Y	N
DMP10	Y	Y	**GLB03**	N	N	**SCH02**	Y	Y
EMB02+	Y	Y	**MEB01***	Y	N	**SCH06**	N	N
EMB05	Y	Y	**MMP04**	N	N	**SCH07**	N	N
EMB09	N	N	**MMP05**	Y	Y	**SKH03**	Y	N
EMB11	N	N	**MMP06**	Y	N	**SKH07**	N	N
EMB14	Y	Y	**MMP08**	Y	Y	**SKH10**	N	N
EMB 15	N	N	**RUP01+**	Y	Y	**SKH11**	N	N
EMB17	Y	N	**RUP03+**	Y	Y	**SLT02**	Y	N
EMB18	N	N	**RUP04**	Y	Y	**SLT03**	N	N
EMP19	N	N	**RUP07**	N	N	**SLT04**	N	N
EMB20	Y	Y	**RUP09**	Y	Y	**SLT05**	Y	N
EMB21	Y	N	**RUP11**	N	N	**SLT06**	Y	Y
EMB22+	Y	N	**RUP13**	N	N	**SLT07**	Y	N
EMB23* +	Y	Y	**RUP15**	Y	N	**SLT08***	Y	N
EMB24*	Y	N	**RUP16**	N	N	**SPP02**	Y	Y
Subtotal	**17**	**11**	**Subtotal**	**15**	**7**	**Subtotal**	**13**	**6**
						Grand Total	**45**	**24**

* Indicates new nest detected during 2009 surveys.
[+] Active in early season and later likely abandoned with failed reproductive effort.

Figure 4. The total number of osprey nests and active nests detected by LTBMU and its partners, 1997-2009, within the Lake Tahoe Basin.



Photographs were taken of new 2009 nests and old nests whose appearance had changed. Copies of the photos were filed in the osprey photo binder continuing the photo-inventory project initiated by TRPA. The Wildlife 2000 database and GIS shape files have been updated with the osprey data collected during the 2009 survey season.

2.3.3 DISCUSSION OF SURVEY RESULTS

The osprey survey effort, expanded in 2005 in comparison to 2004 due to increased staffing and additional survey efforts performed by CDPR, continued through 2009, however in 2009 CDPR surveys were conducted by volunteers. Surveys were well distributed throughout the osprey nesting season (May-September) and additional visits to active nests were completed as necessary to determine reproductive activity and success. The final round of surveys occurred during mid-September.

The osprey population in the Lake Tahoe Basin does not appear to have been affected by the 2007 Angora Fire, as most of the burned area occurred away from lake shoreline habitat. While additional runoff due to fire effects has been an issue over the past year, fish populations, the primary food source for osprey, appear to have been minimally impacted. Reproductive effort in 2009 was high in comparison to previous years, suggesting that osprey populations are stable.

2.3.4 RECOMENDATIONS FOR OSPREY SURVEYS

The collaborative efforts of the LTBMU, TRPA, NDOW, and CDPR have refined osprey surveys within the Lake Tahoe basin and initiated the development of a database that will further contribute to our understanding of status and change in the local osprey population. This database should continue to be maintained and shared with partner agencies. Five boat surveys were done in collaboration with TRPA starting in mid-May. Initial surveys in subsequent years should continue to be initiated in May, in order to best detect early nesting attempts. September surveys may also reveal late-season nest activity and indicate trees that individuals will return to early during the next breeding season and continue to build. If funding were available, October monitoring could provide information on migration chronology.

2.4 BALD EAGLE

2.4.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

The LTBMU hosted the 27th annual mid-winter bald eagle (*Haliaeetus leucocephalus*) count on January 9 and 16 of 2009 as part of an ongoing effort led by the UC Santa Cruz Predatory Bird Research Group (SCPBRG) to assess the status of bald eagle populations in California, and to contribute to the National Midwinter Bald Eagle Survey. The mid-winter count is an event in which participants, arrayed at suitable sites throughout the Lake Tahoe Basin, watch for bald eagles during a pre-established three-hour time period (Appendix 5). The additional survey on January 16 was an attempt to gauge the precision (i.e. statistical variation around the estimate) of the count and determine whether one annual count is sufficient to track population changes. Originally three surveys were planned however, due to inclement weather and a lack of volunteers, the third survey was cancelled. Participants were recruited by the LTBMU from local agencies and the community. Volunteers recorded the time, direction of flight, and age-class of all bald eagles detected. The data was reviewed to determine whether multiple observers may have recorded the same bald eagle (based on time and direction of flight) before a summary report was distributed to participants and the SCPBRG. Only the data from the first survey on January 9 was sent to SCPBRG.

Bald eagle. Photo courtesy of J. Knight, Shasta-Trinity NRA Bald Eagle Project.

The LTBMU also conducted limited bald eagle nest surveys in conjunction with the osprey nest survey program (Appendices 3 and 5). The only recently active bald eagle nest in the basin, at Emerald Point in Emerald Bay, was monitored for signs of presence or nesting activity five times between May and September 2009 from the TRPA boat during osprey nest surveys. CDPR surveyed the Emerald Point nest multiple times between March and July 2009. The latter surveys were conducted from above the nest on the Vikingsholm access road. We also surveyed suitable eagle habitat within approximately 0.25 mile of the shorelines of Lake Tahoe, Cascade Lake, and Fallen Leaf Lake, incidentally, as part of the osprey nest survey program.

2.4.2 SURVEY RESULTS

Thirty-six participants, stationed at 26 survey points around the Basin, observed 16 bald eagles (13 adults and 3 immatures) at 14 locations during the January 9, 2009 official mid-winter bald eagle count (Table 6). During the second visit on January 16, 27 participants surveyed the same 26 points and observed only 10 adult bald eagles (no immatures) at 8 sites, with the total count being 38% less than that of the first visit (Table 6).

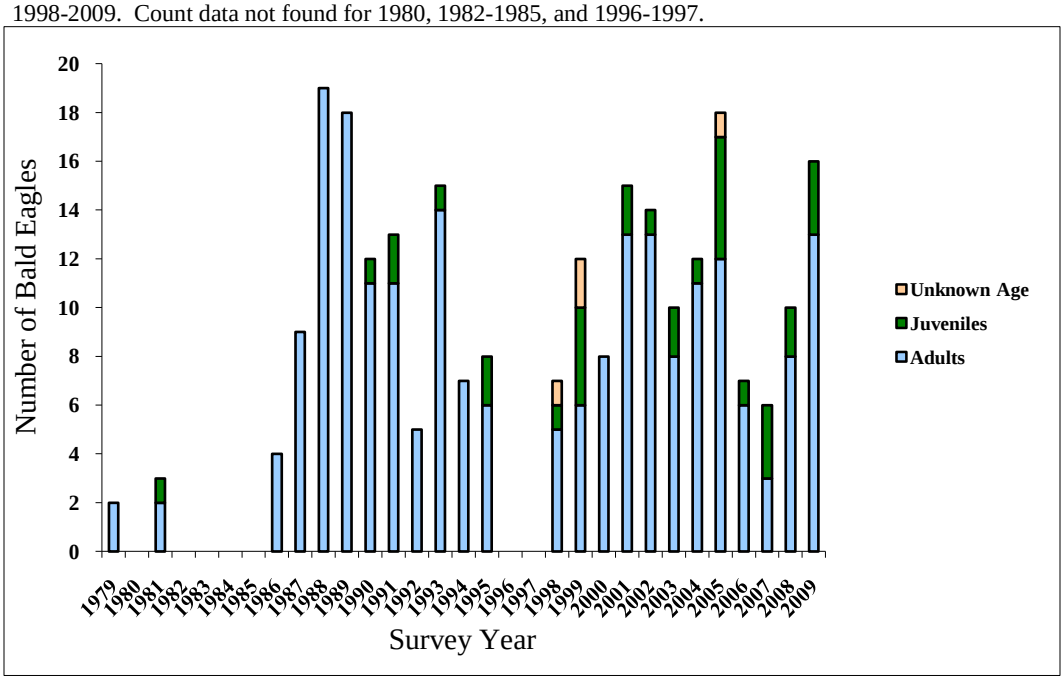
Table 6. Locations and age-classes of bald eagles detected during the mid-winter bald eagle counts conducted by the Lake Tahoe Basin Management Unit and its partners, January 9 and 16, 2009.

Survey Location	Bald Eagles Detected	
	January 9	January 16
Baldwin Beach	1 adult, 1 juvenile	None
Cave Rock	1 adult	1 adult
DL Bliss State Park	2 adults	None
Eagle Falls	None	2 adults
Eagle Point	1 adult, 1 juvenile	1 adult

Survey Location	Bald Eagles Detected	
	January 9	**January 16**
Glenbrook	None	1 adult
Kaspian Picnic Area	2 adults	None
Kings Beach	1 adult	None
Lake Forest	2 adults	2 adults
Meeks Bay	2 adults, 2 juveniles	None
Pope Marsh	1 adult	None
Regan Beach	None	1 adult
Sand Harbor	None	1 adult
Sugar Pine State Park	1 adult	2 adults
Timber Cove Pier	1 adult	None
Truckee Marsh	1 adult	None
Valhalla Pier	1 juvenile	None
Zephyr Cove	1 adult	None
TOTAL (minus redundant detections)	**16 (13 adults, 3 juveniles)**	**10 (10 adults, no juveniles)**

The number of bald eagles detected during the mid-winter count increased in 2009 (n= 16, up 45% from 11 in 2008) (Figure 5).

Figure 5. Bald eagles detected during mid-winter counts in Lake Tahoe Basin in 1979, 1981, 1986-95, and 1998-2009. Count data not found for 1980, 1982-1985, and 1996-1997.



The nest in Emerald Bay (BAEA01/EMB16) was the only active nest observed in the Lake Tahoe Basin in 2009 and it did not fledge any young. The number of active bald eagle nests detected (n=1) is consistent with that of 2008, however the juvenile survivorship is less than that recorded during the 1997-2008 period (Table 7).

Table 7. Number of bald eagle nests and fledged juveniles detected in Lake Tahoe Basin, 1997-2009.

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Active Nests	1	1	0	0	0	1	1	0	1	1	1	1	1
Juveniles Fledged	2	2	0	0	0	2	0	0	1	2	2	2	0

2.4.3 DISCUSSION OF SURVEY RESULTS

Though there was an increase in bald eagle abundance during the mid-winter surveys, no reproductive success was observed in 2009. The increase in mid-winter abundance may be explained by within-season variation in local population size relative to the survey date chosen. There were six fewer total bald eagles (no juveniles) counted just within one week (Table 6) with no obvious changes in weather pattern. The difference in individuals detected between the two surveys in 2009 suggests that once per year survey offers a limited precision in estimating population size.

2.4.4 RECOMENDATIONS FOR BALD EAGLE SURVEYS

Our continued participation in the mid-winter bald eagle count is important in assisting the UC Santa Cruz Predatory Bird Research Group in their long-term effort to assess population levels nationwide. This participation should continue in the future. Future efforts should also explore possibilities for a logistically achievable standardized winter population survey by conducting multiple bald-eagle counts within a single month of time in order to assess the statistical validity of the count.

With the leadership of CDPR, survey efforts verified the fate of the bald eagle nest at Emerald Point, showing a failed reproductive attempt. Continued collaboration with CDPR and NDOW is necessary to adequately assess bald eagle fecundity in the Lake Tahoe Basin.

2.5 GOLDEN EAGLE

2.5.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

Golden eagles (*Aquila chrysaetos*) were originally monitored by the Tahoe Regional Planning Agency (TRPA) as a Special Interest Species (SIS) for the Lake Tahoe Basin. Because of their SIS status, TRPA aims to maintain a minimum 0.25-mile 'disturbance zones' around population sites (a.k.a. 'threshold sites') for golden eagle. The locations of these sites are identified on TRPA adopted Special Interest Species map overlays (1987) and in the Environmental Impact Statement for the establishment of Environment Threshold Carrying Capacities, Tahoe Regional Planning Agency (TRPA, 1982). The intent of TRPA SIS threshold standards is to protect and enhance critical habitat that this species uses for significant periods of their life history and discourage harmful activities at current and future population sites. The SIS management goals for golden eagle have not been attained since their inception in 1982, in spite of available and relatively undisturbed nesting and roosting habitat.

Golden eagle in flight. Photo courtesy of Dave Herr.

2.5.2 SURVEY RESULTS

Golden eagles were detected in April-May 2009 at Angora Peak during the first two peregrine falcon surveys of the year (Appendix 6). This golden eagle territory continued to be monitored under the same protocol, survey time periods and vantage points as for peregrine falcon. A single adult golden eagle was first detected at Angora Peak in late April, where it was observed perching

high on a ledge and catching prey on a snow field nearby. During the second visit in mid-May, a single adult golden eagle was observed around sunrise flying overhead into a recessed ledge in the cliff, where it disappeared and remained for the duration of the survey. A nest was confirmed here, due to the fresh nesting material that could be seen jutting out from this location. However, no activity was witnessed in mid-July and we concluded that the nesting effort had failed. The historic golden eagle nest located on a bluff of Round Lake was unable to be monitored in 2009 by LTBMU. There was an additional incidental detection of two golden eagles flying overhead in the Eagle Lake area on May 16 but no follow-up surveys were done in the area.

2.5.3 DISCUSSION OF SURVEY RESULTS

The nest at Angora Peak was determined to have failed. However, there was never a pair detected. The designation of an active nest was based on seeing an individual perch on a ledge for an extended time that had an obvious nest with green branches. It's known that golden eagle pairs will build supernumerary nests and tend them throughout the breeding season, even if they have an active nest elsewhere. These supernumerary nests can be up to 4 miles from the active nest (McGahan, 1968). It's possible that this nest was such a nest.

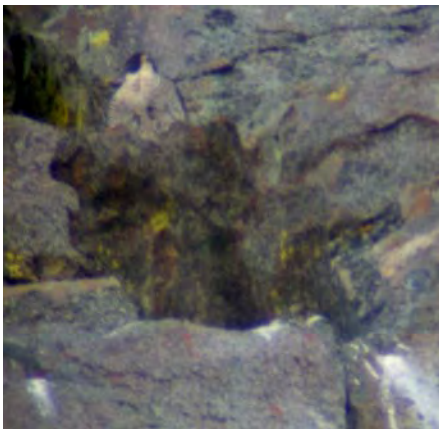
2.5.4 RECOMMENDATIONS FOR GOLDEN EAGLE SURVEYS

Recommendations for future surveys include the re-instigation of protocol surveys that were last conducted by LTBMU wildlife crews in 1999 and 2000. Known historic nesting sites in the basin (Angora Peak and Round Lake) as well as other potential sites should be surveyed, particularly in areas where incidental sightings have been made.

2.6 PEREGRINE FALCON

2.6.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

LTBMU biologists continued peregrine falcon surveys initiated in 2008. The Luther Rock, South Maggie's Peak and Angora Peak sites were surveyed in accordance with "Protocol for Observing Known and Potential Peregrine Falcon Eyries in the Pacific Northwest" (J. E. Pagel, USFS internal document). Each site was slated to be visited once a month from April through September, for a minimum of four consecutive hours per visit and a minimum of 14 days between surveys. If a site was visited twice with no detections, surveys as that site were suspended for the year. In the event that a nest was found, each survey only need be continued for the amount of time necessary to determine the current status of the nest. Observations were conducted by two biologists at a location suitable for observing the whole area for activity.



Adult peregrine falcon perched above nest at Luther Rock, 2009. Photo by LTBMU wildlife staff.

2.6.2 SURVEY RESULTS

Luther Rock (Appendix 7) was visited a total of four times during 2009, three of which were official four-hour surveys. The fourth non-protocol visit was made by two wildlife biologists to assess the proximity of the nest and falcon activity to rock climbing routes and determine whether any areas of the cliff needed to be closed to public access during the breeding season. Following no detections in the first two visits to Angora Peak and South Maggie's Peak (Appendix 7), surveys were discontinued per protocol. However, incidental golden eagle

detections were made at Angora Peak during the first two peregrine falcon visits. This golden eagle continued to be monitored for a third visit under the same protocol and same survey location as for the peregrine falcons (see section 1.5). Therefore, Angora Peak was surveyed for peregrine falcons three times in 2009.

Luther Rock was the only site determined to have an active peregrine territory in 2009. Two adults were very active during visits, frequently calling and making multiple food exchanges and prey deliveries. A nest was located and fledged two juveniles (confirmed in mid-June 2009). Additional incidental sightings of these juveniles were reported later in the summer by LTBMU biologists nearby at Cookhouse meadow – located 1.5 kilometers south of Luther Rock.

2.6.3 DISCUSSION OF RESULTS

Though peregrine falcons have been occasionally observed in the Lake Tahoe Basin during surveys and incidentally in previous years, a nest with productivity has not been confirmed since 1985. Because only one individual could be seen during the first visit to Luther Rock, biologists decided to hike ~250m further up the slope to get a better vantage point due to the difficulty of viewing the site with the spotting scope (original distance was ~500m down slope of the cliff), Much more falcon activity could be followed during the next three visits from the new location roughly 250m down slope of the cliff.

In 2008 and 2009, it was determined that a large hack box installed in 1985 by the Santa Cruz Predatory Bird Research Group atop the cliff was not in use. Three juvenile birds were released at the hack box in 1985 and successfully fledged later that breeding season (Drager et. al., 1985). The procedure was repeated in 1986 and 1987. It is not known if any breeding pairs used the structure in subsequent years as a nesting site.

2.6.4 RECOMMENDATIONS FOR PEREGRINE FALCON SURVEYS

As Luther Rock is a moderately popular rock climbing destination, it is recommended that an official closure to rock climbing be put in place where recreational activities would be likely to disrupt reproductive success at this nest site. The closure should remain in place between the months of March and August starting next breeding season in 2010 and continue indefinitely. Education signage and outreach efforts should be initiated in 2010 to provide interpretive information to rock climbing groups and individuals. South Maggie's Peak and Angora Peak are sites located far enough above popular hiking and sightseeing areas to sufficiently limit potential disturbance without need for an area closure. Survey efforts at sites could be expanded to check for nesting from the top of the cliff areas, but only if the vantage point was positioned far enough away (using a spotting scope) to avoid disturbing reproduction efforts. Additionally, areas in the Basin with tall cliffs and ledges that have not been historically surveyed for peregrine falcons should be scouted and potentially surveyed in future years.

2.7 WILLOW FLYCATCHER

2.7.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

The LTBMU conducted surveys for willow flycatcher (*Empidonax traillii*) in coordination with the Tahoe National Forest Willow Flycatcher Demography Study. All surveys followed the USFS, Region 5 protocol "A Willow Flycatcher Survey Protocol for California" (Bombay et al., 2003). The purpose of surveys was to assess presence or probable absence, reproductive activity, and nesting success of willow flycatcher. The LTBMU conducted surveys for willow flycatchers during the first (June 1–14) second (June 15-25) and third (June 26-July 15) survey periods. All sites were surveyed once during the (mandatory) second survey period. A minimum of 5 days elapsed between surveys of each site. Surveys began approximately 1 hour before sunrise and

ended at or by 10:00 a.m. Willow flycatcher songs were broadcast approximately every 50 meters within suitable habitat.

A total of seven sites were surveyed for this species in the Basin in 2009 (Appendix 8). The LTBMU surveyed Ward Creek and Washoe State Park and Hauge-Brueck Associates surveyed Incline Lake. The Tahoe National Forest Willow Flycatcher Demography Study was able to survey Tallac Creek, Taylor Creek and Uppermost Upper Truckee sites. Blackwood Canyon was not technically surveyed but a single male present there was monitored throughout the breeding season.

Willow flycatcher nestling banded in Blackwood Canyon, 2004. Photo courtesy of Willow Flycatcher Demography Crew, Tahoe NF (Theresa Pope).

Survey site selection was determined according to direction given in the Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement, Record of Decision (hereafter ROD; 2004) and project work in suitable habitat (Table 8). The ROD describes willow flycatcher 'emphasis habitat' as meadows larger than 15 acres with standing water on June 1 and a deciduous shrub component; 'emphasis meadows' are meadows of 15 acres or larger within 5 miles of a historically occupied site; and 'historically occupied sites' are those where this species is known to have occurred.

Table 8. Locations surveyed to assess presence or probable absence, reproductive activity, and nesting success of willow flycatcher by the Lake Tahoe Basin Management Unit and its partners within the Lake Tahoe Basin, 2008. Associated USFS projects listed may be under consideration, proposed, underway, or completed.

Survey Area	Type of Survey Area	Associated Project	Surveyor
Incline Lake	Newly Acquired FS land	Incline Lakes Management Plan	Hauge-Brueck Associates
Ward Creek	Emphasis Habitat	NEPA Resource Inventory	LTBMU
Washoe SP	Historically Occupied	NEPA Resource Inventory	
Blackwood Canyon	Historically Occupied	Demography Study	Tahoe National Forest Willow Flycatcher Demography Study
Taylor Creek	Historically Occupied	Demography Study	
Tallac Creek	Historically Occupied	Demography Study	
Uppermost Upper Truckee	Historically Occupied	Demography Study	

2.7.2 SURVEY RESULTS

The LTBMU and its partners surveyed an estimated 156 acres (63 hectares). The LTBMU surveyed 63 acres (25 hectares). The Tahoe National Forest Willow Flycatcher Demography Study surveyed 77 acres (31 hectares). Hauge Brueck Associates surveyed 17 acres (7 hectares). We calculated the area surveyed using 50 meter buffers around each survey point. Willow flycatchers were detected in Blackwood Canyon, Tallac Creek marsh, Taylor Creek, and at the Uppermost Upper Truckee sites (Table 9).

The LTBMU and Hauge-Brueck Associates completed surveys for willow flycatchers at three sites between June 9 and July 11, 2009. No individuals were detected at any of these sites; however an incidental detection of a single male was made by LTBMU in the South Lake Tahoe

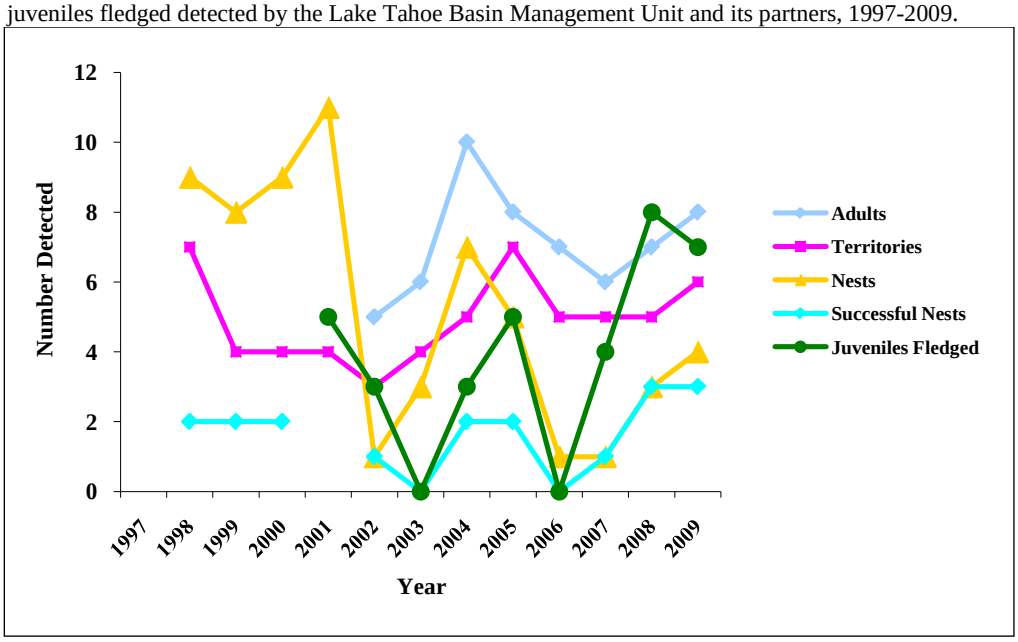
airport area of the Upper Truckee River on 8 August. This individual could have been just passing through, as it was seen at the tail end of the breeding season. The Tahoe National Forest Willow Flycatcher Demography Study surveyed and monitored Tallac and Taylor Creek and reported 4 nesting attempts, 3 of which were successful (7 total fledglings). Taylor Creek was one of the conspecific experiment sites in 2008 and had 2 successful nests and 5 fledglings in 2009 (where in years previous to 2008 there has been no known nesting activity).

Table 9. Summary of willow flycatcher detections, nests, and recruitment in areas surveyed by the Lake Tahoe Basin Management Unit and its partners, 2007.

Survey Area	Territories	Adults	Successful Nests	Failed Nests	Juveniles Fledged
Blackwood Canyon	1	1	-	-	-
Incline Lake	-	-	-	-	-
South Lake Tahoe Airport	1	1	-	-	-
Tallac Creek	1	2	1	-	2
Taylor Creek	2	3	2	1	5
Uppermost Upper Truckee	1	1	-	-	-
Ward Canyon	-	-	-	-	-
Washoe State Park	-	-	-	-	-
Totals	**6**	**8**	**3**	**1**	**7**

The number of willow flycatcher territories (n=6, up from 5 in 2008), adults (n=8, up from 7 in 2008), nests (n=4, up from 3 in 2008), successful nests (n=3, same as in 2008), and juveniles fledged (n=7, down from 8 in 2008) detected in 2009 are shown in comparison to those for the period 1997-2009 (Figure 6).

Figure 6. Number of willow flycatcher territories, adults, nests (including re-nests), successful nests, and juveniles fledged detected by the Lake Tahoe Basin Management Unit and its partners, 1997-2009.



2.7.3 DISCUSSION OF SURVEY RESULTS

In 2007, the LTBMU conducted a willow flycatcher habitat assessment at the Tallac marsh in order to provide information on the long-term trends of vegetation communities in that complex. Disturbance activities, such as overgrazing or trampling by animals and people, resulted in

vegetation changes to shallower, weakly rooted species. These species have a reduced ability to buffer the forces of moving water and keep the stream's hydrologic features in balance. Therefore, an evaluation of the vegetative composition can provide a valuable indication of the general health of a riparian area (successional status) as well as the current strength of the stream banks in buffering the forces of water (stream bank stability). A project was completed in 2009 to permanently close the Baldwin grazing allotment located within the Taylor-Tallac Marsh for in part to the protect the existing willow flycatcher habitat and other resources.

2.7.4 RECOMMENDATIONS FOR WILLOW FLYCATCHER SURVEYS

Continuation of WIFL monitoring for post-restoration activities and assistance with the Regional Demographic Study will aid in the determination of management recommendations for the species. Surveys should continue as outlined in the Sierra Nevada Forest Plan Amendment FEIS, ROD (USDA 2004).

Brown-headed cowbirds commonly parasitize broods of willow flycatchers and other songbirds. A brown-headed cowbird control program would improve passerine nesting success in the Basin. The Tahoe National Forest Willow Flycatcher Demography Study addles cowbird eggs that have been laid in willow flycatcher nests to prevent hatching, but addling does not solve the initial problem of cowbirds removing host eggs from nests. Control of brown-headed cowbird numbers would likely result in greater productivity and survivorship of willow flycatchers in the basin. The current survey protocol records presence of cowbirds and could be used to inform cowbird control measures.

2.8 SMALL MAMMALS

2.8.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

The wildlife crew conducted small mammal trapping at two sites near Fallen Leaf Lake (A06 and FL20) from 17 August to 27 August, 2009 (Appendix 9). Although located in the same general area, the surveys were continuations of two different monitoring programs. A06 was first surveyed in 2002 as part of the MSIM (Multi-Species Inventory and Monitoring) project, an ambitious program primarily designed to monitor the status and change of animal communities over time throughout the Sierra Nevada Mountain range. The MSIM small mammal data depicts this site before aspen stands were restored in 2004. Monitoring at FL20 is a continuation of the Aspen Community Restoration Project, intended to discover the response of small mammals to restoration efforts in aspen stands. Protocols for these trapping sites were similar except for the sequence and timing of trap visits, and composition of the bait. Both sites contained sizeable aspen stands although the majority of each site was dominated by conifers. Less common habitat types were grassy meadow, bare soil, and brushy areas of manzanita (*Arctostaphylos patula*) and mountain whitethorn (*Ceanothus cordulatus*).

Crew leader Sandee Harvill, processing a ground squirrel. Photo by LTBMU staff.

Each trap line radiated from a central location within an aspen stand. Six spokes spread out from this designated point at 60° from each other employing the same azimuths used in prior years. Extra-large Sherman live traps were placed every 15 meters along each transect line at the nearest appropriate location that ensured that the trap was sufficiently protected from the elements (e.g. sun). Traps were baited with rolled oats and peanut butter at FL20. Mealworms and birdseed containing sunflower seeds supplemented the mixture at A06. Site FL20 traps were checked three times daily (morning, mid-day, and dusk) starting mid-day on the first day and concluding on the fourth morning, resulting in a total of 9 visits. Site A06 traps were checked twice daily (in the morning and around dusk) for three consecutive days for a total of six visits.

All captured animals were identified to species and sexed and aged if possible. All rodents except vole and shrew species were tagged with numbered aluminum ear tags that allow for individual identification. Voles were marked by clipping a small amount of fur from the rump. Due to their sensitive nature, shrews were not handled and were released as soon as possible.

2.8.2 SURVEY RESULTS

A06

Deer mice were easily the most abundant species comprising 65% of all new captures at A06. Yellow-pine chipmunks were the second most common species captured (21% of all captures). Other species captured more than once at that site were Montane vole (*Microtus montanus*), Trowbridge's shrew (*Sorex trowbridgii*), California ground squirrel (*Spermophilus beecheyi*) and Long-eared chipmunk (*Tamais quadrimaculatus*) (Table 10).

Table 10. Number of individuals of small mammal species captured at the MSIM site at A06, Lake Tahoe Basin, California, in 2002, 2008, and 2009.

Common Name	Scientific Name	2002 (prior to treatment)	2008	2009
Montane vole	*Microtus montanus*	-	-	5
Short-tailed weasel	*Mustela ermine*	-	-	1
American Pika	*Ochotona princeps*	1	-	-
Deer mouse	*Peromyscus maniculatus*	82	1	96
Trowbridge's shrew	*Sorex trowbridgii*	-	-	2
Montane shrew	*Sorex monticolus*	-	1	-
Unidentified shrew	*Sorex spp.*	-	1	1
California Ground Squirrel	*Spermophilus beecheyi*	36	7	4
Golden-mantled ground squirrel	*Spermophilus lateralis*	-	1	-
Yellow-pine chipmunk	*Tamais amoenus*	35	-	31
Long-eared chipmunk	*Tamais quadrimaculatus*	-	-	7
Shadow chipmunk	*Tamais senex*	4	3	-
Lodgepole chipmunk	*Tamais speciosus*	58	13	-
Unidentified chipmunk	*Tamais spp.*	2	-	-
Douglas' Squirrel	*Tamiasciurus douglasii*	-	-	1
	Total captures	**218**	**27**	**148**
	Number of species	7	7	9

FL20

Deer mice were again the most abundant species at FL20 comprising 55% of all new captures. Long-eared chipmunks were the second most common species captured at FL20 (34% of all captures). Other species captured more than once at that site were Northern flying squirrel (*Glaucomys sabrinus*), Trowbridge's Shrew (*Tamais amoenus*), California ground squirrel and Yellow-pine chipmunk (*Tamais amoenus*) (Table 11).

Table 11. Detail of small mammal trapping array captures at the aspen restoration monitoring site at Fallen Leaf Lake (FL20), Lake Tahoe Basin, California, for years 2004, 2005, 2006, 2008 and 2009.

Common Name	Scientific Name	2004 (prior to treatment)	2005	2006	2008	2009
Northern flying squirrel[1]*	*Glaucomys sabrinus*	-	-	3	3	2
Montane vole	*Microtus montanus*	-	1	-	-	-
Long-tailed weasel	*Mustela frenata*	1	-	-	-	-
Deer mouse	*Peromyscus maniculatus*	60	5	14	2	105
Trowbridge's shrew[1]	*Sorex trowbridgii*	-	2	-	2	2
Unidentified shrew	*Sorex spp.*	-	-	-	-	1
California Ground Squirrel	*Spermophilus beecheyi*	6	7	5	5	2
Yellow-pine chipmunk*	*Tamais amoenus*	14	1	6	8	13
Long-eared chipmunk	*Tamais quadrimaculatus*	-	6	7	9	64
Shadow chipmunk	*Tamais senex*	87	19	16	4	-
Lodgepole chipmunk	*Tamais speciosus*	-	-	-	1	-
Unidentified chipmunk	*Tamais spp.*	-	-	-	-	1
	Total captures	**168**	**41**	**51**	**34**	**190**
	# of species	5	7	6	8	8

[1]Desired condition
*Potentially vulnerable mammal species associated with aspen

2.8.3 DISCUSSION OF SURVEY RESULTS

A06

Mammal trapping first occurred at A06 in 2002 as part of the MSIM project and has only occurred once since, in 2008. In both prior years, seven species of mammal were trapped; in 2009, nine species were caught at A06. There was also an increase in the abundance of mammals captured over 2008: 148 animals trapped in 2009 versus 27 in 2008.

Yellow-pine and Long-eared chipmunks were not found present in 2008 data while these were the only species of chipmunks noted in 2009. The variations in chipmunk species found present could be in part due to incorrect identification of several species: Lodgepole and Yellow-pine chipmunks tend to appear very similar as do Allen's and Long-eared chipmunks.

Small mammal populations can be influenced by environmental condition such as vegetation type, precipitation, and downed woody debris (USDA, 2001). Small mammals often show annual fluctuations that may be related to changes in temperature, food resources or other factors. The year 2009 had a mild winter and unusually high rainfall in the month of June that may have been a factor in the prodigious quantity of deer mice.

FL20

Studies have shown that aspen stands can support a greater diversity and abundance of mammals than surrounding conifer-predominated forest. (Salt 1957, Flack 1976, DeByle 1985). Aspen stands are declining in habitat quantity and quality largely due to encroachment by conifers, which is caused by natural drought, human-induced lowering of water tables, fire suppression, and recreation impacts (USDA, 2009). Encroachment of conifers in aspen stands has a deleterious effect on herbaceous cover, stand moisture, insect abundance, and small mammal species richness and abundance. Aspen stand restoration entails the removal of encroaching conifer species. Removal of conifers can help aspen stands persist and preserve the ecological function of the aspen stands (USDA, 2009). The goal of the small mammal trapping is to access the response of small mammals to the aspen restoration.

The aspen stands contained within the small mammal trap site FL20 were treated in 2004. Five to eight species of small mammals were captured during the field seasons between 2004 and 2008. In 2009, eight species were captured at FL20. Although species diversity in 2009 falls within the limits of prior years, the abundance of animals captured was considerably higher than in 2008 with 190 individual animals trapped at FLL20 in 2009 versus 41, 51, and 34 in 2005, 2006 and 2008, respectively. Eight different species were caught in 2009 versus 7, 6, and 8 in 2005, 2006 and 2008. In 2004, prior to treatment, the total number of animals captured was 168, however only 5 species were caught. This may indicate a desired trend toward increase species diversity at the site.

Shadow chipmunk (*Tamais senex*) captures have declined precipitously, numbering 87 in 2004 compared to zero caught in 2009; seeming to have been replaced by Long-eared chipmunks numbering zero in 2004 increasing to 64 in 2009. Since the two species are very similar in appearance there is a possibility that they have been mis-identified.

The aspen restoration project described several mammal species considered as indicators of healthy aspen stands (USDA, 2000) (Table 12). In 2009, capture of potentially vulnerable mammal species was restricted to two species. Two northern flying squirrels and 13 yellow-pine chipmunks were caught at FL20. It is an encouraging development that 2009 boasts the highest number of yellow-pine chipmunks captured since 2004.

Table 12. List of potentially vulnerable mammals associated with aspen stands (Manley et al. 2000).

Water shrew (*Sorex palustris*)
Vagrant shrew (*Sorex vagrans*)
Broad-footed mole (*Scapanus latimanus*)
Snowshoe hare (*Lepus americanus*)
Pika (*Ochontona princeps*)
Belding's ground squirrel (*Spermophilus beldingi*)
Douglas' squirrel (*Tamiasciurus douglasii*)
Northern flying squirrel (*Glaucomys sabrinus*)
Long-tailed vole (*Microtus longicaudus*)
Yellow-pine chipmunk (*Tamias amoenus*)
Western jumping mouse (*Zapus princeps*)
Western gray squirrel (*Sciurus griseus*)
Yellow-bellied marmot (*Marmota flaviventris*)
Muskrat (*Ondatra zibethicus*)
Mink (*Mustela vison*)
Badger (*Tasidea taxus*)
Wolverine (*Gulo gulo*)
American marten (*Martes americana*)
Sierra Nevada red fox (*Vulpes vulpes*)

2.8.4 RECOMMENDATIONS FOR SMALL MAMMAL SURVEYS

Reliable identification of chipmunk species by the mammal trapping crew needs to be incorporated into training in order to improve data quality. All available printed resources should be studied. Examination of study skins may be one way to familiarize researchers with the subtle differences between the species. Skins of local chipmunks are available for viewing at the University of Nevada at Reno and University of California at Davis.

May and June rainfall in 2009 was more than twice the normal precipitation for these months in the Lake Tahoe Basin, thus resulting in an eruption in small mammal reproduction. This may have caused a transitory trend in the population of some species of small mammals. Due to misleading tendencies caused by fluctuations in weather and other factors it is important to continue mammal surveys to reveal significant long-term developments. Documenting weather patterns should be incorporated into survey protocol and summaries.

2.9 BATS

2.9.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

Following detections of Townsend's Big-eared bat in 2007, the Forest Service initiated an assessment of mines for bat habitat suitability and conducted surveys in 2008. These surveys continued in 2009.

Three mine openings were found to be potential roosts and were surveyed in 2008 for presence of bats (Appendix 10). Tahoe Treasure/Noonchester I and II, as well as Mountain Top mine were monitored, starting at dusk, by two observers for two and a half hours using two dim red lights to aid in observation via night vision binoculars. These surveys detected bats only at Tahoe Treasure/Noonchester I. Later, biologists returned with a Pettersson bat detection device and Sonobat recording setup. During two visits, bat signature files were recorded at both Tahoe Treasure mine openings. The data analysis was imprecise due to recording distortions caused by cavern echo and the inexperience of personnel examining the data. California Bat (*Myotis californicus*), Western Long-eared Myotis (*Myotis evotis*), Little Brown Bat (*Myotis lucifugus*)

and Hoary Bat (*Lasiurus cinereus*) were species potentially recorded in 2008; however these were identified with a relatively low level of confidence. It was determined that monitoring of the mine sites should be continued in 2009 using electronic recording devices.

In 2009, surveys were conducted to determine bat species diversity at both Tahoe Treasure mine openings and at Mountain Top mines. Acoustic bat surveys used Pettersson ultrasonic detectors (model D240X) and small Sony voice-activated tape recorders to collect bat vocalizations to be assessed later for bat species composition. At each site, the recorders were placed at the mine opening and angled away from the cavern and rock walls to lessen distortion caused by echo. Recordings were made on three different nights separated by at least one week beginning in early July and ending in August.

A field crew member, Leslie Farnham assembles bat detection stations at Mountain Top mine, 2009. Photo by LTBMU wildlife staff.

A meeting was arranged between bat-analysis expert Mike Morrison, PhD (Professor and Caesar Kleberg Chair in Wildlife Ecology and Conservation Texas A&M University) and two LTBMU Wildlife Biologists to learn how to decipher the 2009 tapes using the Sonobat program. Sonobat translates tapes into interpretable sonograms (visual pictures of the frequency, time and amplitude components of a sound). It enhances harmonic elements of bat calls so they can be examined and compared to known species calls for identification. This is a skill that requires a lot of practice to be proficient. In order to identify bats to species with some level of confidence analysis was conducted independently by two separate biologists. Only those species that were identified by both biologists were included in the results. To further improve vigor of results, only those calls with 0.8 quality or higher were analyzed. Despite these precautions, data from 2009 should be considered as preliminary due to the inexperience of those conducting the analysis. Select recordings will be sent to biologists outside of the forest service in an attempt to verify species presence with greater confidence.

2.9.2 RESULTS OF SURVEYS

Due to difficulties with equipment operation and in acquiring additional parts, the LTBMU crew did not have two functioning bat detection systems until early July. This prevented bat surveys per desired protocol during the last week of June. Recordings of bat vocalizations were obtained at all sites (Table 13). The tapes will be analyzed to species during the winter of 2009-2010.

The Tahoe Treasure I mine opening recorded bats in the vicinity of the mine on all three sampling occasions. Due to seasonal water flow over the entrance of the Tahoe Treasure II mine opening surveys could not be conducted until the end of July. On July 28, detectors were put into place at Tahoe Treasure II. They recorded the sound of water flow as well as some bat calls which may have come from the mine itself or been bats from other roosts foraging for insects in the lush dampness at the mine opening.

Mountain Top Mine has two possible openings: one opening is on a diagonal adit into the mountain's side (Mountain Top Mine I) and the other is a vertical shaft (Mountain Top Mine II). Both are blocked with jumbled rock, although there are dark crevices that presumably go deep into the old mine. During the first visit to Mountain Top Mine in 2009 only one recorder was placed at the diagonal shaft. During subsequent visits recording devices were placed at both openings. Surprisingly, both openings at Mountain Top Mine yielded bat detections, although just the scant

chirps of one or two individuals. The resonant quality of the sounds leads one to believe that the bats calls are originating within the mines.

On July 30th, Gay Eitel (LTBMU interpretive services personnel) reported to wildlife staff that bats were roosting in the abandoned Newhall House at Skunk Harbor. This colony has been present in this house for at least one year (probably longer as evidenced by the large pile of guano on the floor). This colony was reported to LTBMU biologists by a member of the wildlife crew in 2008, but was mistakenly determined to be private property. This house, erected in 1923, is constructed of stone and heavy wooden beams and has been abandoned for decades. The solid wooden doors are locked, windows are protected with heavy wire mesh and many are covered over by wood shutters to prevent trespassers. This creates a dark shelter for roosting bats and could conceivably be attractive to Townsend's big-eared bats. A daytime inspection of the Newhall House revealed approximately 100 bats roosting at the apex of the main room of the house. All observations were done through the tight wire mesh of the windows so accurate description of the resident bats could not be made. Researchers did not enter the structure to avoid agitating the bats which may cause them to abandon this roost. On the evening of August 13, two bat detection units were placed uphill of the house adjacent to a chink in the door that was suspected to be the bat's access to the roost.

Detectors at the Newhall House were able to acquire over one hour of tape as the bats indeed left through the gap in the front door (as noted by visual observation). Two further daytime checks of the Newhall house on the 3rd and 22nd of September, revealed that far fewer bats were roosting in the house and that they had moved their daytime roost from the central main room to a smaller corner room. Presumably, these bats have migrated to warmer climates as freezing temperatures approach.

Table 13. Location, dates, and duration of bat sonogram recordings collected in 2009.

Location	Date	Time	Detection	Approximate number of minutes of tape
Tahoe Treasure I	7/07/2009	2015-0700	Yes	10 minutes
Tahoe Treasure I	7/28/2009	1945-0700	Yes	15 minutes
Tahoe Treasure II	7/28/2009	2000-0710	Yes	> 30 minutes, mostly sounds of water
Tahoe Treasure I	8/25/2009	1945-0630	Yes	12 minutes
Tahoe Treasure II	8/25/2009	1945-0630	Yes	7 minutes
Mountain Top Mine I	7/08/2009	2000-2400	Yes	< ½ minute
Mountain Top Mine I	7/27/2009	2000-2400	Yes	< ½ minute
Mountain Top Mine II	7/27/2009	2000-2400	Yes	< 1 minute
Mountain Top Mine I	8/26/2009	1945-2400	Yes	< 1 minute
Mountain Top Mine II	8/26/2009	1945-2400	Yes	< ½ minute
Newhall House (trail)	8/13/2009	2000-2400	Yes	> 50 minutes
Newhall House (road)	8/13/2009	2000-2400	Yes	19 minutes

Due to the subjective nature of bat call analysis and the level of expertise required to be certain of a species identification, these species need to be verified by an expert prior to any management actions.

Mountain Top mine had the least amount of triggered recording time. The recordings were also of low quality. Three species were preliminarily identified, Mexican free-tailed bat, hoary bat, and spotted bat, however only one recording that was identified as hoary bat was above the 0.8 quality standard needed

There were six species preliminarily identified at Newhall house: silver-haired bat, Mexican free-tailed bat, hoary bat, Yuma myotis, little brown bat, and possibly Townsend's big-eared bat. Call quality overall was better at Newhall house.

Tahoe Treasure I and II had identical species make-up. Species preliminarily identified were silver-haired bat, hoary bat and Mexican free-tailed bat, and Townsend's big-eared bat, with silver-haired bat being the most common.

2.9.3 DISCUSSION OF RESULTS

It is still unclear whether both Tahoe Treasure I and II mines are used as roosts. Tahoe Treasure I, although the shallower of the two is known to be a roost. The adit at Tahoe Treasure I is approximately 20 feet deep and dry. Although bats have been seen entering and exiting the Tahoe Treasure II mine entry in 2008, the presence of water and a brush constricted entry has made it difficult to situate detectors in such a way as to positively determine that bats recorded are using that adit. Tahoe Treasure II is suspected to be much deeper and is protected by a metal grate to prevent would-be spelunkers from accessing it.

When surveyors reached Mountain Top mine they discovered fresh bicycle tracks in the vicinity of the rocky mound that encompasses both mine entrances. People interested in the mines may have been drawn to examine the openings and old timbers at the mine openings despite some faded signs in the area discouraging approach to the two Mountain Top shafts. Although humans could not enter the mines they may be inclined to toss rocks or debris into the small openings which would disturb any roosting bats.

The Newhall House at Skunk harbor was found late in the summer season and recordings were only collected in mid-August. Visual inspections found a moderately large colony roosting in the main room of the house. Skunk Harbor is a popular beach area for boaters and for beach-goers willing to make the 1.5 mile hike to the beach. No doubt these visitors peer into the old structure through the metal grates over the windows and possibly disturb the roosting bat colony.

Although adequate recordings were collected at all sites, there were some problems with the Pettersson detector and Sony tape recorder set up. The tapes produced were not optimum for analysis because of a low level of background distortion on all tapes. The distortion prevents the taped recordings from being parsed into smaller segments for analysis and makes the digitized bat calls more difficult to categorize into species. Experts in the field attribute this to equipment malfunctions not normally found in this apparatus arrangement although they do not know why this anomaly occurred.

Additional results for 2009 bat detections can be found in Section 2.6 of this report (specifically for the restoration monitoring surveys).

2.9.4 RECOMMENDATIONS FOR BAT SURVEYS

Townsend's big-eared bat is a forest service sensitive species. If the presence of this species at the Newhall house and Tahoe Treasure mines can be verified, appropriate measures will need to be taken in order to protect this species at the project level. Signs should be installed at the Newhall house at Skunk Harbor to discourage the public from harassing roosting bats. Also the house may need repairs to windows or doors to prevent any chance of entry by tourists. An inspection should be scheduled in the fall or spring when bats are not present.

The planned destruction of the mine entrances at the Mountain Top mine should be prevented because of the detections made this year at both mine openings. Old and faded signs warning against approach to the site should be replaced. Installation of grates and additional warning signs at the two mine entrances could discourage harassment of roosting bats by hikers and bicyclists.

The fact that bats were discovered at two sites (Newhall House and Mountain Top mine) where bats were not previously recognized illustrates the importance of continuing to scrutinize all potential roosting sites, however unlikely. Such sites should be protected from disturbance or destruction until surveys protocols can be employed to determine the presence or absence of bats. Old and abandoned buildings standing on forest service property should be examined for bats during the peak roosting months. Wildlife personnel should inform other forest service field crews that may come across empty structures to check for signs of bats.

Protocol surveys should continue at the Tahoe Treasure mines and Newhall House in 2010. If resources are available, more frequent surveys should be implemented starting as soon as the sites are accessible after snow melt. In addition, the bat survey protocol should be modified to include 10-14 sample nights from May through August. This will ensure that all species present will be captured and will hopefully establish the approximate date of the bats arrival in the basin. If the new protocol can be implemented in 2010 and adequate data is collected, future surveys should be conducted every three to five years, in order to monitor the population and the long-term use of these structures. Due to the minimal numbers of bats detected, surveys at Mountain Top mine should be suspended in 2010; however, periodic surveys should be conducted on the same schedule as Tahoe Treasure mine and Newhall House.

Further research into the cause of the recording problems is necessary. If the current set-up is determined to be inadequate the purchase of other recording devices may be necessary in order to collect higher quality recordings in the future.

2.10 WOLVERINE

2.10.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

Wolverines (*Gulo gulo*) have been considered extirpated from the Sierra Nevada range since the 1930's until a single wolverine was caught on film in the Sagehen area north of the Basin in Tahoe NF in 2008. A hair sample was later collected from this individual, which identified it as a wolverine from the Rocky Mountains. It is unknown whether this animal traveled to the Sierras on foot or was somehow transported here.

Wolverine captured at a camera station on the Tahoe National Forest, CA.
Photo courtesy of Pacific Southwest Research Station, 2008.

On 9/13/ 2009 a reasonably credible source reported an incidental sighting of a wolverine close to the southern border of the Lake Tahoe basin, near Luther Pass (Appendix 11). Immediately following the incidental sighting, a joint effort was quickly launched between LTBMU and the Humboldt-Toiyabe National Forest in an attempt to capture a wolverine on film and to collect a hair sample. Eight monitoring sites were established in proximity to the incidental detection, in habitat that a wolverine might choose to travel through. Each site was equipped with a camera positioned to capture movement near or at bait attached to a nearby tree. Trail Scan model DC-1BU cameras from Leafriver Outdoor Products were attached to a tree 3-10 meters from the bait. The bait consisted of raw chicken enclosed in a chicken-wire mesh packet. This was attached to the tree 2-3 meters above the ground and a commercial trapping lure (GUSTO™, Minnesota Trapline Products, Pencock, MN) was dabbed on a sponge placed above the bait. Six hair snares were also placed under the bait to collect hair samples. As an additional distraction, for bears in particular, another mesh packet with chicken was hung by rope from a branch above the bait tree. Cameras were

adjusted so that there was a three minute interval between pictures to prevent using up batteries and to save image space on SD cards.

Eight camera stations were in operation for six weeks, initially visited twice per week for three weeks and then once per week for the remaining survey period. Camera station locations are shown in appendix 11. Bait, scent lures and camera batteries were replaced when necessary. Hair samples were taken and photos were downloaded for each visit. If there was bear activity at a given station for repetitive visits, that station could be moved after being in place for a 16-day latency period.

2.10.2 SURVEY RESULTS

There were no additional wolverine detections captured on camera following the initial incidental sighting in 2009. There was heavy bear activity at camera stations, and cameras had to be relocated in attempt to avoid further bear disturbance.

2.10.3 DISCUSSION OF SURVEY RESULTS

Immediately following the reported wolverine sighting, LTBMU biologists thoroughly searched the area for additional evidence (e.g. hair samples, tracks). Using baited camera stations in the Basin to document wolverine presence proved to be difficult in the fall, as bear activity is still high during that time of year. Many survey dates were not ideally represented via photographs, as bears frequently tore open camera housing units and ate the bait and scent lures. Tracks were frequently observed in snow later in the survey period but none were identified to be wolverine.

2.10.4 RECOMMENDATIONS FOR WOLVERINE SURVEYS

It is recommended that wolverine camera stations be installed immediately after an incidental sighting has been reported. Unfortunately, we were unable to set up camera stations until we were able to gather all the necessary equipment, eight days after the detection was reported. This greatly decreased the chance of re-sighting the individual, as wolverines are able to travel long distances in a short amount of time. More camera stations could be installed in the winter, an optimum time to document wolverines and other forest carnivores, when bear disturbance is less likely. Additionally, an in-depth set of criteria should be set in place to determine the credibility of the individual who reports an incidental wolverine sighting where photographic evidence is not available. Coordination with other Forest's in developing this protocol would be prudent as a single wolverine may trek though several Forests during reports of incidental sightings.

2.11 AMERICAN MARTEN

2.11.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

The American marten (*Martes americana*) is a USFS sensitive species and a Region 5 management indicator species used as an indicator of the health of old-growth forest habitat. Surveys have historically occurred sporadically in the Lake Tahoe Basin, primarily in the NW and SE portions of the lake. The Pacific Southwest Research Station of the Forest Service (PSW) has conducted broad carnivore surveys in the Sierra Nevada, during which many detections of American marten were reported. In addition, PSW is in the process of studying marten populations at ski resorts in the Lake Tahoe area. In 2009, there were no standardized surveys for American marten performed by the LTBMU.

2.11.2 SURVEY RESULTS

During a northern goshawk survey in Sugar Pine Point State Park (Appendix 12), there were three individual martens detected (one adult female and two juveniles) by LTBMU wildlife crews. The biologists observed two individuals frozen in place, with the mother alarmed and protective until the second juvenile emerged from an underground hole and ran off. It was later determined that this was the location of a maternal den, defined as a resting den for mothers with young following departure from the natal den (Slauson personal communication, 2009).

2.11.3 DISCUSSION OF SURVEY RESULTS

This is the first maternal den historically to be found in the basin. An extensive American marten monitoring effort is planned to occur in the summer of 2010, primarily utilizing track plates as part of the population monitoring survey effort. This effort is not likely to result in discovery of further den sites except by chance because it won't utilize any cameras.

2.11.4 RECOMMENDATIONS FOR AMERICAN MARTEN SURVEYS

The maternal den that was found in 2009 should be used as a reference location to detect these individuals again in 2010, ultimately leading to the location of the natal den for this territory. In addition, now that a den has been identified, sites with similar burrow structures could be monitored with remote cameras to determine if they could also be marten den sites.

American marten at a camera station. Photo courtesy of Pacific Southwest Research Station, 2005

3.0 RESTORATION MONITORING

2009 Restoration Monitoring Survey Summary

- **Meadow wetness:** 2 sites surveyed; Sunset Reach – dry by middle of June, Cookhouse Meadow – still wet at end of August.
- **Butterflies:** 2 sites surveyed; 45 species detected.
- **Herpetofauna:** 4 sites surveyed; 3 species detected.
- **Passerines: Point count:** 2 sites surveyed; 39 species detected.
- **Passerines: Nest monitoring:** 4 sites surveyed; 63 nests monitored; 37 successful nests.
- **Bats:** 2 sites surveyed; raw data given to Michael Morrison; no summary available at this time.
- **Small mammals:** 4 sites surveyed; 14 species detected; 316 captures.

In 2004 seven areas within the Lake Tahoe Basin were slated for restoration aimed at restoring ecosystem function (Cookhouse Meadow, High Meadow, Blackwood Creek, Upper Truckee River Sunset Reach, Meeks Creek Meadow, Taylor/Tallac Marsh, and Ward Creek). Monitoring wildlife species before and after restoration is critical for evaluating the success of restoration, resulting in invaluable information that will help guide future restoration projects (Borgmann 2004). For a full explanation of these restoration projects, associated monitoring, and management recommendations reference Borgmann and Morrison (2004, 2005, 2006, 2007, and 2008). Background information concerning this effort has been excerpted from those reports.

Development of restoration and associated management activities in the Lake Tahoe Basin are centered on achieving a desired ecological condition that approximates as closely as possible those existing prior to major impacts caused by 20th century humans. Common restoration techniques for these sites include the use of erosion control structures to prevent excessive sediment runoff and widening channels to disperse more water throughout adjacent meadow/riparian areas. Two of these restoration sites, Cookhouse Meadow and Sunset Reach (Appendix 13), were monitored for wildlife richness and abundance in an ongoing six-year baseline data collection protocol. The overall objective for wildlife at each restoration site, in addition to corresponding reference sites, was to collect three years of pre-restoration data and three years of post-restoration data using various survey protocols. Separate protocols were followed for songbirds, butterflies, herpetofauna, bats and small mammals and meadow wetness. Cookhouse Meadow and Sunset Reach, along with their associated control sites (Big Meadow and Trout Marsh, respectively), were the only meadow restoration sites that were monitored for wildlife in 2009 by LTBMU staff. The following table illustrates the protocols that were conducted at each site (Table 14).

Table 14. Restoration monitoring surveys conducted in 2009.

	Passerine Point Counts	Passerine Nest Monitoring	Butterflies	Small Mammals	Herpetofauna	Bats	Meadow Wetness
Cookhouse Meadow	X	X	X	X	X	X	X
Big Meadow (control)	X	X	X	X	X	X	
Sunset Reach		X		X	X		X
Trout Marsh (control)		X		X	X		

The Cookhouse Meadow project site is located within the Big Meadow Creek watershed in El Dorado County, California (Appendix 14). This site (6 ha) is immediately adjacent to Highway

89, five km south of the junctions of Highways 50 and 89 in Meyers, California. Prior to degradation from European settlement that began around the 1850s, it was formerly a moist-to-wet meadow. Cookhouse Meadow was previously surveyed for three seasons from 2004-2006, finishing just before natural geomorphic and hydrologic function in the meadow was restored in fall 2006. The site was monitored for an additional three years (2007-2009) following restoration for comparison purposes. Big Meadow (19 ha.) was chosen as a control site for Cookhouse Meadow and the same wildlife protocols were followed there during all six years (Appendix 15).

Sunset Reach encompasses approximately 3.7 km of the Upper Truckee River (Appendix 16), including about 150 ha of the stream and surrounding area. Roughly 22 hectares of this site was sampled during wildlife surveys. The Lake Tahoe Airport borders the marsh on the east while residential areas form the western boundary. Prior to incision of the stream, caused primarily by channelization, grazing, urban development, and the adjacent airport and golf course (ENTRIX 2004), the floodplain historically received more water, longer lasting vegetation and less conifer encroachment.

Sunset Reach (referred to as Upper Truckee Marsh in Borgmann et al. 2006, unpublished report) is slated for restoration in 2010, and three years of pre-restoration wildlife data (2006-2009) have been collected. Trout Marsh was chosen as a control site for Sunset Reach and the same protocols were followed there each year. This site is located on the south side of highway 50 along Trout Creek and approximately 5 hectares were sampled for wildlife surveying there (Appendix 17).

The overall goal at Cookhouse Meadow and Sunset Reach following restoration was to increase diversity and complexity of riparian and meadow communities and enhance wildlife species that rely on these communities. More specifically, the following objectives were established prior to restoration:

- Increase richness and abundance of butterflies and desired condition butterfly species.
- Increase richness and abundance of desired condition reptile and amphibian species.
- Increase richness and abundance of songbirds and desired condition songbird species.
- Maintain or increase productivity of focal songbird species. Expect nesting success to increase within meadows due to increased meadow wetness which will reduce the ability of mammalian predators to access nests.
- Increase species richness and relative frequency of use by desired condition bat species.
- Increase species richness and abundance of desired condition small mammal species.
- Decrease abundance of chipmunk species and increase abundance of voles, shrews, weasels and jumping mice within meadows as a result of increased meadow wetness.

3.1 MEADOW WETNESS

3.1.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

One of the purposes of the restorations at Cookhouse Meadow and Sunset Reach is to extend wetness throughout meadows and prolong the duration of wetness further into the summer. Objectives resulting from these restorations include the reestablishment of willow flycatcher populations, in addition to the increase of overall wildlife species richness and abundances.

Soil wetness was measured at set points every two weeks until either all locations proved dry, or until late August. Points were established every 10 meters along north-south transects, spaced 10 meters apart, covering the entire meadow area at Cookhouse Meadow and at sample meadow plots in Sunset Reach. Soil wetness was recorded as dry, saturated, or measured for depth if under standing water.

3.1.2 SURVEY RESULTS AND DISCUSSION

Sunset Reach was almost entirely dry when transects were established and the first round of data gathered in June 2009 (Table 15). Based on pre-restoration meadow wetness measurements at Sunset Reach, it is clear that this site needs restoration. Restoration efforts should help this site benefit greatly, bringing greater wildlife richness and abundances as more of the site retains water. Increasing wetness will enable a greater density of willow habitat to be established at both sites, increasing the likelihood of establishing willow flycatchers and increasing productivity and survivorship of desired condition species.

Table 15. Weekly overall meadow percent dryness at Sunset Reach, 2008-2009. N/A indicates that no survey was conducted

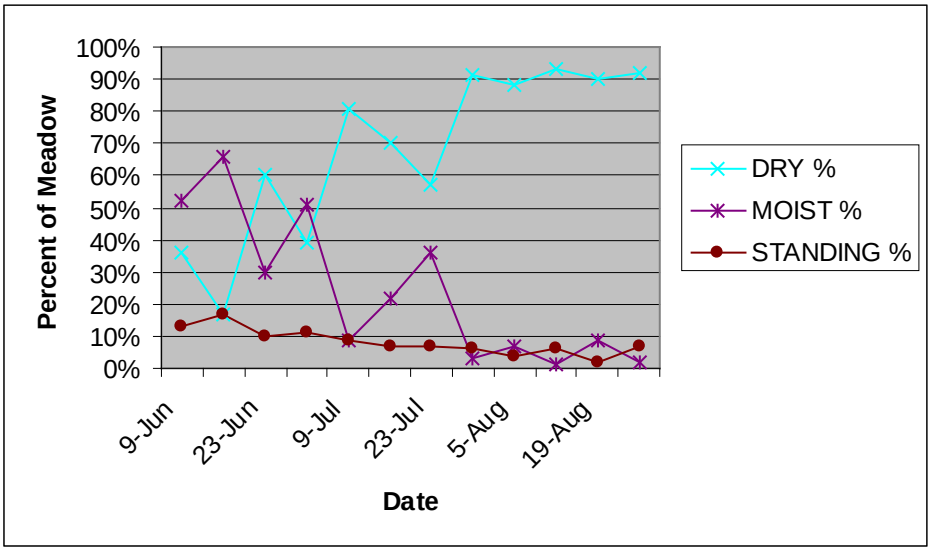
Week	Month	2008	2009
1	JUNE	100%	N/A
2	JUNE	100%	99%
3	JUNE	N/A	100%
4	JUNE	N/A	100%

Cookhouse Meadow exhibited a majority of points with either saturated soil or standing water in early June, which gradually became mostly dry by late July (Table 15). Cookhouse Meadow did stay wet longer into the field season in 2009 (Table 16, Figure 7), likely due to unseasonably high amounts of rainfall throughout most of June.

Table 16. Weekly overall meadow percent dryness at Cookhouse Meadow, 2007-2009. N/A indicates that no survey was conducted.

Week	Month	2007	2008	2009
4	MAY	4%	N/A	N/A
1	JUNE	3%	70%	36%
2	JUNE	38%	83%	17%
3	JUNE	32%	85%	60%
4	JUNE	82%	92%	39%
1	JULY	86%	91%	81%
2	JULY	90%	93%	70%
3	JULY	88%	95%	57%
4	JULY	N/A	96%	91%
5	JULY	N/A	95%	88%
1	AUG	N/A	97%	93%
2	AUG	N/A	N/A	90%
3	AUG	N/A	N/A	92%

Figure 7. Weekly percentages of moist ground, standing water and dryness at Cookhouse Meadow, 2009.



3.2 BUTTERFLIES

3.2.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

The main objective of the Cookhouse restoration project in regards to butterflies was to increase species richness and abundance, particularly for desired condition species. Surveys were conducted by thoroughly covering meadow plots in small teams and recording all butterflies utilizing or flying over the habitat. "Fringe" habitat was classified as being 25m from the meadow edge into forest/upland areas. The sections of fringe habitat that were shaded were not surveyed due to inactivity of butterflies. A corresponding vegetation class was assigned to each individual butterfly detection. Plant species that individuals were observed using as a nectar source were also recorded. Any individuals that could not be identified on the wing were captured by net and released if confirmed to species. Individuals unable to be identified in the field were collected and later assessed in the lab. Surveys lasted as long as necessary to cover each plot. Cookhouse Meadow and its control site (Big Meadow) were surveyed twice a month during June, July, and August in 2009. However, the number of visits varied (between four and six) from year to year during 2004-2008, depending on funding availability. Observers did not survey during inclement weather (e.g. precipitation or lack of sunlight due to heavy cloud cover).

Sylvan hairstreak nectaring on goldenrod spp. Photo courtesy of Dan Gaube.

We calculated species richness as the total number of species detected across all surveys for each year. To calculate abundance we averaged the total number of individuals detected for the year and divided by the number of visits. To compare between sites, we divided this result by the overall site area (ha) to determine abundance/hectare.

3.2.2 SURVEY RESULTS AND DISCUSSION

Compared to the previous five years, butterfly species richness and abundance at Cookhouse Meadow was the greatest in 2009 (Table 17). The average abundance during post-restoration (2007-2009) was 50% greater (46.38) than that of pre-restoration (2004-2006) (Table 17). Of the nine desired condition species detected at Cookhouse Meadow, seven species were more abundant during post restoration and the remaining two species were about equal to pre-restoration numbers (Table 18).

Table 17. Butterfly species richness/abundance at Cookhouse Meadow (CH) and Big Meadow (BM), 2004-2009.

Site	Year	# species	# desired condition species	Abundance/ visit	Restoration period	Abundance/ period
CH	2004	18	5	30.06	PRE	30.97
	2005	29	8	23.79		
	2006	32	7	39.08		
	2007	32	7	44.82	POST	46.38
	2008	26	6	44.17		
	2009	45	8	50.13		
BM	2004	24	7	17.18	PRE	22.98
	2005	41	8	21.85		
	2006	46	10	29.91		
	2007	40	8	69.86	POST	50.34
	2008	29	6	27.19		
	2009	41	9	53.96		

species = species richness for all species detected
Abundances/visit are shown per hectare to correct for size difference between sites

There were similar trends among species richness and abundance at the control site (Big Meadow) during the same time period, suggesting that butterflies in general are thriving in the region. Overall, the objective to increase species richness and abundance at Cookhouse Meadow has been met. However, the situation of certain individual butterfly species still being low in abundance should be addressed. The Sierra Nevada blue (*Agriades podarce*) is the only desired condition species at Cookhouse Meadow that was noticeably less abundant than at Big Meadow for all years (Table 19). This is likely due to a much greater presence of the shooting star (*Dodecatheon jeffreyi*), a wet habitat species that serves as the only host plant to the Sierra Nevada blue, at Big Meadow. Recommendations for Cookhouse meadow are outlined in the 2008 Meadow Restoration Project report, Appendix 1.4.

Table 18. Summary of desired condition butterfly species abundance at Cookhouse Meadow and Big Meadow, pre-restoration (2004-2006) vs. post-restoration (2007-2009).

	Cookhouse Meadow		Big Meadow	
Species	Pre-restoration	Post-restoration	Pre-restoration	Post-restoration
Northern Blue	0	0	0.02	0.01
Greenish Blue	4.01	7.16	3.93	10.83
Sierra Nevada Blue	0.12	0.18	0.71	0.91
Great Spangled Fritillary	0	0.04	0.01	0
Pacific Fritillary	0.05	0.03	0.08	0.09
Western tiger swallowtail	0.38	1.24	0.12	0.34
Purplish copper	0.01	0.01	0.01	0
Lilac-bordered copper	0.04	0.07	0.17	0.05
Satyr comma	0	0	0.01	0.08
Mourning cloak	0.41	0.59	0.06	0.05

	Cookhouse Meadow		Big Meadow	
Species	**Pre-restoration**	**Post-restoration**	**Pre-restoration**	**Post-restoration**
Lorquin's admiral	0.05	0.29	0.06	0.17
# Desired condition species	**8**	**9**	**11**	**9**

Values were calculated by averaging the number of individuals/visit for each year. These values were then divided by total site area (ha) to accurately compare abundances between sites. Values/ha were then averaged across pre-restoration years (2004-2006) and post-restoration years (2007-2009).

Table 19. Butterfly species list with abundances at Cookhouse Meadow (CH) and Big Meadow (BM), 2009.

Common Name	Scientific name	CH	#/visit	BM	#/visit
American lady	*Vanessa virginiensis*	X	0.03	X	0.02
Anise swallowtail	*Papilio zelicaon*	X	0.05	X	0.06
Boisduval's blue	*Icaricia icarioides*	X	0.08	X	0.36
Cabbage white	*Pieris rapae*	X	0.05	X	0.03
California tortoiseshell	*Nymphalis californica*	X	0.11	X	0.32
Checkered white	*Pontia protodice*	X	0.03		
Clodius Parnassian	*Parnassius clodius*	X	0.00	X	0.02
Common buckeye	*Junonia coenia*	X	0.03	X	0.05
Common checkered skipper	*Pyrgus communis*	X	7.85	X	0.36
Edith's copper	*Lycaena editha*	X	0.05		
Field crescent	*Phyciodes pratensis*	X	10.14	X	2.00
Great spangled fritillary*	*Speyeria cybele*	X	0.11		
Greenish blue*	*Plebejus saepiolus*	X	5.45	X	4.62
Hedgerow hairstreak	*Satyrium saepium*	X	0.03	X	0.01
Hoary comma	*Polygonia gracilis zephyrus*	X	0.05	X	0.03
Hoffmann's checkerspot	*Chlosyne hoffmanni*	X	0.03	X	0.04
Juba skipper	*Hesperia juba*	X	0.03	X	0.04
Lilac-bordered copper*	*Lycaena nivalis*	X	0.11	X	0.05
Lorquin's admiral*	*Limenitis lorquini*	X	0.22	X	0.17
Mariposa copper	*Lycaena mariposa*			X	0.01
Melissa blue	*Lycaeides melissa*			X	0.01
Milbert's tortoiseshell	*Nymphalis milberti*	X	0.03		
Mourning cloak*	*Nymphalis antiopa*	X	0.40	X	0.04
Northern blue*	*Lycaeides idas*			X	0.02
Northern checkerspot	*Chlosyne palla*	X	0.35	X	1.18
Northern cloudywing	*Thorybes pylades*	X	0.05	X	0.02
Orange sulphur	*Colias eurytheme*	X	1.02	X	1.10
Pacific fritillary*	*Boloria epithore*	X	0.05	X	0.01
Pale swallowtail	*Papilio eurymedon*	X	0.51	X	0.17
Pine white	*Neophasia menapia*	X	0.46	X	0.02
Plebejus spp	*Plebejus spp*	X	0.05	X	0.08
Red admiral	*Vanessa atalanta*			X	0.01
Satyr comma*	*Polygonia satyrus*			X	0.02
Sierra Nevada blue*	*Agriades podarce*	X	0.03	X	0.84

Common Name	Scientific name	CH	#/visit	BM	#/visit
Silvery blue	*Glaucopsyche lygdamus*	X	0.19	X	0.10
Sonoran skipper	*Polites sonora*	X	0.54	X	5.57
Spring azure	*Celastrina ladon*	X	0.05	X	0.10
Spring white	*Pontia sisymbrii*	X	0.03	X	0.08
Stella orangetip	*Anthocharis stella*	X	0.16	X	0.32
Sylvan hairstreak	*Satyrium sylvinus*	X	0.03		
Tailed copper	*Lycaena arota*	X	0.03	X	0.08
Two-tailed swallowtail	*Papilio multicaudata*	X	0.03		
Unknown crescent	*Phyciodes spp.*	X	9.60	X	2.76
Unknown dotted-blue	*Euphilotes spp*	X	0.16	X	0.17
Unknown fritillary	*Genus Speyeria*	X	9.68	X	32.14
West coast lady	*Vanessa annabella*	X	0.03		
Western pine elfin	*Callophrys eryphon*	X	0.03	X	0.04
Western tailed blue	*Everes amyntula*	X	0.05		
Western tiger swallowtail*	*Papilio rutulus*	X	1.40	X	0.43
Western white	*Pontia occidentalis*	X	0.03		
Woodland skipper	*Ochlodes sylvanoides*	X	0.03		
Total abundance/visit			**50.13**		**53.96**
Total # species		**45**		**41**	

*Desired condition species
Abundances/visit are shown per hectare to correct for size difference between sites.

3.3 HERPETOFAUNA

3.3.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

The objective for herpetofauna at Cookhouse Meadow and Sunset Reach was to increase richness and distribution of species following restoration. Reptile and amphibian surveys were completed twice during June of 2009 at Cookhouse Meadow, Big Meadow, Sunset Reach and Trout Marsh. Surveys were attempted during mid-day or afternoon hours with warm temperatures and sunlight. Encounter surveys entailed slowly walking zigzag patterns through meadow areas and along all standing and moving water, recording all visual detections.

Western fence lizard being identified during a herpetofauna survey at Cookhouse Meadow, 2009. Photo by LTBMU wildlife staff.

3.3.2 SURVEY RESULTS AND DISCUSSION

Cookhouse Meadow
In 2009, there were only two species detected at Cookhouse Meadow and three species at Big Meadow (Table 20). However, when combining data from all three post-restoration years, there were seven species at Cookhouse Meadow, compared to four species detected there during pre-restoration years. The first round of herpetofauna surveys in 2009 were conducted under less than ideal conditions, as the month of June was unseasonably cold and rainy. Weather may have

contributed to low species diversity in 2009. More herpetofauna species were incidentally detected (not represented in Table 20) at Cookhouse Meadow and Big Meadow later in the season when weather conditions were more conducive to reptile and amphibian activity. The higher overall species richness at Cookhouse Meadow following restoration suggests that the herpetofauna objective is proceeding in the right direction.

Table 20. Species list of reptile and amphibians detected at Cookhouse Meadow and Big Meadow, 2004-2009. No surveys were conducted at Big Meadow in 2007.

		Cookhouse Meadow						**Big Meadow**				
Common Name	**Scientific Name**	2004	2005	2006	2007	2008	2009	2004	2005	2006	2008	2009
Bullfrog	*Rana catesbeiana*											
Common garter snake	*Thamnophis sirtalis*					X		X	X		X	X
Long-toed salamander	*Ambystoma macrodactylum*					X						
N. alligator lizard	*E. coerulea*		X		X			X	X			
Pacific tree frog	*Hyla regilla*	X	X	X	X	X	X	X	X	X	X	X
Rubber Boa	*Charina bottae*											
S. alligator lizard	*Elgaria multicarinata*					X						
Unknown garter snake	*Thamnophis spp.*		X			X		X			X	
Unknown *Sceloporus*	*Sceloporus spp.*											
W. aquatic garter snake	*T. atratus*								X			
W. fence lizard	*Sceloporus occidentalis*											
W. terrestrial garter snake	*T. elegans*	X				X	X	X	X	X	X	X
W. toad	*Bufo boreas*								X		X	
Total # species/year		**2**	**3**	**1**	**2**	**6**	**2**	**5**	**6**	**2**	**5**	**3**
Total # species/period		**4**			**7**			**7**			**5**	

Sunset Reach

Three species were detected at Sunset Reach and none at Trout Marsh in 2009 (Table 21). Lower herpetofauna species richness in 2009 at both sites might have been due to the cold and rainy weather conditions during most of June, when surveys were conducted. Though Sunset Reach is still slated for restoration, three years of herpetofauna surveys yielded a combined total of six species, while the control site, Trout Marsh, only had a combined total of two species (Table 21). Increasing meadow wetness at Sunset Reach is expected to increase species richness there. One possible suggestion could be to change the control site and/or add another control site to Sunset Reach for post-restoration surveys, as the Trout Marsh site has a lot of disturbance and generally does not get very wet.

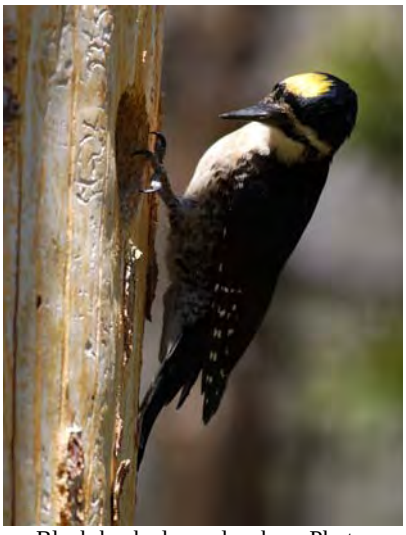
Table 21. Species list of reptile and amphibians detected at Sunset Reach and Trout Marsh, 2006-2009. No surveys were conducted in 2007.

		Sunset Reach			Trout Marsh		
Common Name	**Scientific Name**	2006	2008	2009	2006	2008	2009
Bullfrog	*Rana catesbeiana*						
Common garter snake	*Thamnophis sirtalis*	X	X	X			
Long-toed salamander	*Ambystoma macrodactylum*		X				
N. alligator lizard	*Elgaria coerulea*						
Pacific tree frog	*Hyla regilla*	X	X	X		X	
Rubber Boa	*Charina bottae*						
S. alligator lizard	*Elgaria multicarinata*	X					
Unknown garter snake	*Thamnophis spp.*	X					
Unknown *Sceloporus*	*Sceloporus spp.*						
W. aquatic garter snake	*Thamnophis atratus*						
W. fence lizard	*Sceloporus occidentalis*						
W. terrestrial garter snake	*Thamnophis elegans*		X	X		X	
W. toad	*Bufo boreas*						
Total # species/year		**4**	**4**	**3**	**0**	**2**	**0**
Total # species/period		**6**			**2**		

3.4 PASSERINES: POINT COUNTS

3.4.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

One objective of the Cookhouse restoration project for songbirds was to increase species richness and abundance, particularly for desired condition species. We established avian point-count stations at Cookhouse Meadow and Big Meadow, to assess bird species richness and abundance. We established point-count stations 200m apart, with the number of point-count stations at each site varying by the size of the meadow. Each site was surveyed three times separated by one week during June. Point counts began 15 minutes before sunrise and finished no later than four hours after sunrise. Observers recorded all birds seen or heard within 50 m, 50-100m and beyond 100m of the point-count station for 10 minutes at each point. However, only detections within the 50m radius were used for analysis. Observers also recorded Douglas squirrels (*Tamiasciurus douglasii*) during point counts. Observers did not conduct point counts during inclement weather (e.g. precipitation or wind >9 km/hr).



Black-backed woodpecker. Photo courtesy of Dan Gaube.

Species richness was calculated as the total number of species detected across all surveys for each year. Abundance was calculated as the average number of individuals detected within 50 m of point-count stations across the three surveys and then divided by the number of points sampled to correct for differences in the number of points surveyed at each site.

3.4.2 SURVEY RESULTS AND DISCUSSION

In 2009 songbird species richness at Cookhouse Meadow increased by 32% (n = 33) from that in 2008 (Table 22). When including detections beyond 50 meters, the number of species in 2008 was equal to that in 2009 (n = 37) (Table 22). Species richness at this site averaged across post-restoration years (2007-2009) was 11% greater (n = 31) than during the pre-restoration period (2004-2006) (Table 22). Of all six monitoring years at Cookhouse Meadow, the total number of individuals per point was the highest in 2009 (n =10.75) (Table 22).

Table 22. Summary of songbird species richness and overall abundance at Cookhouse Meadow (CH) and Big Meadow (BM), 2004-2009.

Site	Year	# Species < 50m	# Indivs/point < 50m	# Species > 50m
Big Meadow	2004	41	10.17	47
	2005	39	10.00	45
	2006	33	7.42	42
	2007	38	8.08	47
	2008	32	4.83	41
	2009	39	9.75	49
Cookhouse Meadow	2004	28	9.75	36
	2005	30	8.75	40
	2006	25	7.25	35
	2007	34	7.75	45
	2008	25	4.00	37
	2009	33	10.75	37

Following the restoration, Cookhouse Meadow species richness increased in 2007, decreased in 2008, and increased in 2009 (Table 22). Since Big Meadow shared the same trends in richness over this period, changes in species richness observed are likely not due to restoration. Species not previously observed at Cookhouse Meadow before restoration included yellow warbler (*Dendroica petechia*), spotted sandpiper (*Actitis macularia*), Swainson's thrush (*Catharus ustulatus*) (all desired condition species), and black-headed grosbeak (*Pheucticus melanocephalus*) (Table 23). Desired condition species detected in 2009 following restoration included yellow warbler, calliope hummingbird (*Stellula calliope*), red-breasted sapsucker (*Sphyrapicus ruber*) and Lincoln's sparrow (*Melospiza lincolnii*) (Table 23). After completing the required three years of post restoration monitoring, the species richness objective at Cookhouse Meadow is proceeding in the right direction.

Table 23. Songbird species list and abundance/point for all detections <50m at Cookhouse Meadow and Big Meadow, 2009.

	Cookhouse Meadow		Big Meadow	
Species	**Present?**	**Mean # indiv/point**	**Present?**	**Mean # indiv/point**
American robin	X	0.67	X	0.75
Brown-headed cowbird	X	0.08	X	0.28
Brewer's Blackbird			X	0.33
Brown creeper	X	0.13	X	0.19
Band-tailed pigeon		0.00	X	0.06
Cassin's finch	X	0.08	X	0.14
Calliope hummingbird*	X	0.17	X	0.08
Cassin's vireo	X	0.13	X	0.03
Chipping sparrow			X	0.03
Dark-eyed junco	X	1.00	X	0.53
Dusky flycatcher	X	0.92	X	1.17
Evening grosbeak	X	0.33	X	0.03
Fox sparrow	X	0.33	X	0.28
Golden-crowned kinglet	X	0.17	X	0.14
Hairy woodpecker	X	0.04	X	0.06
Hermit thrush	X	0.17	X	0.11
Lincoln's sparrow*	X	0.33	X	0.22
McGillivray's warbler	X	0.50	X	0.28
Mountain chickadee	X	0.83	X	0.81
Mountain Quail	X	0.08		
Nashville warbler	X	0.08	X	0.17
Orange-crowned warbler	X	0.04		
Olive-sided flycatcher			X	0.11
Pine grosbeak			X	0.17
Pine siskin	X	0.17	X	0.22
Pileated woodpecker	X	0.04		
Red-breasted nuthatch	X	0.25	X	0.03
Red-breasted sapsucker*	X	0.13	X	0.08
Ruby-crowned kinglet			X	0.06
Red-winged blackbird	X	0.33	X	0.28
Savannah sparrow			X	0.06
Song sparrow	X	0.83	X	0.36
Steller's jay	X	0.38	X	0.03
Warbling vireo	X	0.92	X	0.56
White-breasted nuthatch			X	0.11
White-crowned sparrow			X	0.14
Western tanager	X	0.08	X	0.25
Western wood-pewee	X	0.50	X	0.75
White-headed woodpecker			X	0.03
Wilson's warbler	X	0.25	X	0.19
Yellow-rumped warbler	X	0.75	X	0.61
Yellow warbler*	X	0.04	X	0.06
Total # Species	**32**		**39**	

*Desired condition species

3.5 PASSERINES: NEST SEARCHING

3.5.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

The main objective at restoration sites is to maintain or increase productivity of focal songbird species. Nesting success should increase within meadows due to increased meadow wetness which will reduce the ability of mammalian predators to access nests. At Cookhouse Meadow and Big Meadow, we searched for and monitored nests of six focal species: willow flycatcher (*Empidonax traillii*) dusky flycatcher (*Empidonax oberholseri*), warbling vireo (*Vireo gilvus*), yellow warbler (*Dendroica petechia*), McGillivray's warbler (*Oporornis tolmiei*), and Wilson's warbler (*Wilsonia pusilla*) to quantify productivity (i.e. reproductive success) and brown-headed cowbird (*Molothrus ater*) parasitism. At Sunset Reach and Trout Marsh, we chose the song sparrow (*Melospiza melodia*) as an additional seventh focal species to search for. This addition was made to get a larger sample size of nest attempts because song sparrows are very abundant at these sites (the yellow warbler is the only other original focal species that was abundant at Sunset Reach and Trout Marsh). We chose to monitor nests of these species because (1) their nests are low in height (nests typically <5 m tall), (2) they are a species of concern (e.g. willow flycatcher), or (3) they are associated with riparian vegetation. At each site, observers searched for nests within 200 m of the meadow/riparian area (the area surveyed pre- and post-restoration was similar). Nests were monitored every three to five days until nest outcome could be determined.

2.5.2 SURVEY RESULTS AND DISCUSSION

Nests were considered successful if at least one fledgling of the host species was observed. Failed nests were those at which the eggs or nestlings were destroyed or when parental activity ceased prior to the expected fledging date. The percentage of successful nests for each focal species was calculated out of the total number of nesting attempts that were beyond the egg-laying stage. The percentage of host nests parasitized by cowbirds was taken from the total number of nesting attempts. Warbling vireo nest parasitism is not represented because we were unable to check the contents of many nests from this species, which frequently built nests over 3m high.

Cookhouse/Big Meadow

Nest totals were combined into two time periods: pre-restoration (2004-2006) and post restoration (2007-2009) for each site. The following focal species at Cookhouse Meadow showed decreased nest success during the post-restoration period (compared to pre-restoration years): dusky flycatchers decreased 18% (58 attempts, 36% successful), McGillivray's warblers decreased 71% (7 attempts, 29% successful), warbling vireos decreased 11% (23 attempts, 57% successful), and Wilson's warblers decreased 5% (19 attempts, 37% successful) (Table 24). This trend of decreased nest success during post-restoration years also occurred at Big Meadow for dusky flycatchers, warbling vireos and Wilson's warblers. McGillivray's warblers did show higher nest success at Big Meadow during 2007-2009, though the sample size for this species was low at both sites for all years.

McGillivray's warbler nestlings at Big Meadow. Photo by LTBMU wildlife staff.

During 2009 alone at Cookhouse Meadow, dusky flycatchers were 35% successful (17 attempts), McGillivray's warblers were 25% successful (4 attempts), warbling vireos were 58% successful (12 attempts), and Wilson's warblers were 75% successful (4 attempts) (Table 25). We detected yellow warblers (a desired condition species) for the first time following restoration at Cookhouse

in 2007. Although two individuals attempted to breed at Cookhouse Meadow in 2007, neither nesting attempt was successful. In 2008, we detected one male yellow warbler; however, the male disappeared in late June and no females or nests were located. In 2009, three males and one female were detected but they all had relocated from Cookhouse Meadow by mid June, without any nest attempts. Yellow warblers have been present at Big Meadow over the years. The only nest found there was in 2009 (fledged four juveniles, not parasitized). Willow flycatchers were never detected at either Cookhouse or Big Meadow for all six years of monitoring.

Table 24. Summary of songbird focal species nest success and cowbird parasitism at Cookhouse Meadow (CH) and Big Meadow (BM), pre-restoration (2004-2006) vs. post-restoration (2007-2009).

Species	Period	Site	# nest attempts	% successful	Tot. # Successful nests (minus unk.)	% parasitized
Dusky Flycatcher	PRE	BM	24	54%	17	0%
		CH	49	55%	49	6%
	POST	BM	31	32%	30	3%
		CH	58	36%	53	11%
McGillivray's Warbler	PRE	BM	6	50%	6	33%
		CH	1	100%	1	0%
	POST	BM	8	100%	8	38%
		CH	7	29%	7	43%
Warbling Vireo	PRE	BM	14	64%	N/A	N/A
		CH	25	68%	N/A	N/A
	POST	BM	29	62%	N/A	N/A
		CH	23	57%	N/A	N/A
Wilson's Warbler	PRE	BM	17	71%	17	0%
		CH	24	42%	24	29%
	POST	BM	20	60%	20	35%
		CH	19	37%	19	84%

nest attempts = Total number of nests built that made it to the laying stage.
Tot. # Nests = Total number of nests that made it to the laying stage and were low enough to check contents.
Warbling vireo parasitism is not represented because of too many nests that were too high to check contents.

Brown-headed cowbird nest parasitism at Cookhouse Meadow increased for the following species during the post-restoration period: dusky flycatchers increased 5% (11% parasitized, of 53 nests), McGillivray's warblers increased 43% (43% parasitized, of 7 nests), and Wilson's warblers increased 55% (84%, of 19 nests) (Table 25). This trend of increased parasitism also occurred for these species at Big Meadow. Warbling Vireo nest parasitism rates are not displayed because most of the nests from this species were too high to check contents.

Table 25. Summary of songbird focal species nest success and cowbird parasitism at Cookhouse Meadow (CH) and Big Meadow (BM), 2009.

Species	Site	# nest attempts	% successful	Tot. # successful nests (minus unk.)	% parasitized
Dusky Flycatcher	BM	10	20%	9	0%
	CH	17	35%	13	8%
McGillivray's Warbler	BM	2	100%	2	50%
	CH	4	25%	4	25%
Warbling Vireo	BM	9	44%	N/A	N/A
	CH	12	58%	N/A	N/A
Wilson's Warbler	BM	4	100%	4	0%
	CH	4	75%	4	75%
Yellow Warbler	BM	1	100%	1	0%
	CH	0	N/A	N/A	N/A

nest attempts = Total number of nests built that made it to the laying stage.
Tot. # Nests = Total number of nests that made it to the laying stage and were low enough to check contents.
Warbling vireo parasitism is not represented because of too many nests that were too high to check contents.

Low levels of nesting success such as those observed at Cookhouse Meadow and Big Meadow are a cause of concern and effort should be directed at finding ways to improve nesting success. Nest failure was primarily caused by predation, but many nest failures were also attributed to brown-headed cowbird parasitism.

The arrival of yellow warblers at Cookhouse during post-restoration years suggests that conditions are approaching niche component requirements, but that some features may still be missing. Yellow warblers decreased in abundance in other riparian systems when willow volume fell below 5000 m^3/ha (Sanders and Edge 1998). Another study found that yellow warbler selected territories with an average of 428 willows/ha (Knopf and Sedgwick 1992). Currently at Cookhouse Meadow there are approximately 32 willows per hectare, therefore it is recommend that willow density increase to approximately 428 willows/ha. This could also attract the willow flycatcher, another desired condition focal species that nests in wet dense willow habitats. Reasons why parasitism increased at Cookhouse and Big Meadow post-restoration in unknown but high levels of parasitism may be a cause of concern.

Sunset Reach/Trout Marsh

Song sparrows, warbling vireos and yellow warblers all had low nest success at Sunset Reach and Trout Marsh in 2008 and 2009 (Table 26). The remaining focal species are not represented due to very low abundances at these sites. At Sunset Reach in 2009, song sparrow nest success decreased 33% (2 attempts, 0% successful) and yellow warbler nest success decreased 8% (4 attempts, 25% successful) (Table 26). Trout Marsh showed higher nest success in 2008 than both years at Sunset Reach but only 45% were successful (11 attempts) (Table 26). The search effort at Trout Marsh for song sparrow nests was poor, resulting in no nests that made it to the egg stage. Yellow warbler nest success was lower at Trout Marsh than at Sunset Reach for both years. There were two warbling vireo nesting attempts in 2009 at Sunset Reach (both failed), and no nests made it to the egg stage there in 2008 or in 2008-2009 at Trout Marsh.

All song sparrow nests at Sunset Reach were parasitized in 2008 (of 4 attempts) and 2009 (2 attempts) (Table 26). Yellow warbler parasitism did decrease 75% in 2009 at Sunset Reach (25% parasitism, of 4 attempts), from 100% in 2008 (3 attempts) (Table 26). However, at Trout Marsh parasitism increased 55% in 2009 (80% parasitism, of 5 attempts) (Table 26).

Table 26. Summary of songbird focal species nest success and cowbird parasitism at Sunset Reach (SR) and Trout Marsh (TT) in 2008 vs. 2009.

Species	Year	Site	# nest attempts	% Successful	Tot. # nests (minus unk.)	% parasitized
Song Sparrow	2008	TT	11	45%	11	18%
		SR	6	33%	4	100%
	2009	TT	0	N/A	0	N/A
		SR	2	0%	2	100%
Yellow Warbler	2008	TT	4	0%	4	25%
		SR	3	33%	3	100%
	2009	TT	5	20%	5	80%
		SR	4	25%	4	25%
Warbling Vireo	2008	TT	0	N/A	N/A	N/A
		SR	0	N/A	N/A	N/A
	2009	TT	0	N/A	N/A	N/A
		SR	2	0%	N/A	N/A

nest attempts = Total number of nests built that made it to the laying stage.
Tot. # Nests = Total number of nests that made it to the laying stage and were low enough to check contents.
Warbling vireo parasitism is not represented because of too many nests that were too high to check contents.

Low levels of nesting success at Sunset Reach and Trout Marsh is a cause of concern and, though Sunset Reach is slated for restoration, additional efforts should be directed at finding ways to improve nesting success along the Upper Truckee River in general. Nest failures were caused by predation and brown-headed cowbird parasitism. Observers noticed, at both sites, that whenever a focal species was attempting to build or maintain a nest, multiple cowbirds and Stellar's jays were present close by, likely keying into that host bird's territory. The high abundance of cowbirds and predators is a likely reason for such low abundances of all focal species at these sites.

3.6 BATS

3.6.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

Bat detection devices have been employed at Cookhouse Meadow since 2004 to determine richness and relative frequency of bat species prior to and after the meadow was restored in the fall of 2006. Big Meadow has been monitored as well, as a control site. Surveys hope to discover an increase in species richness and frequency, particularly by desired condition bat species. In 2007, a Townsend's big-eared bat was recorded at Cookhouse Meadow. These bats are considered a sensitive species by the US Forest Service due to sharp population declines attributed to destruction of roost habitat

Townsend's big-eared bat (*Corynorhinus townsendii*). Photo courtesy of Kent Woodruff, Okanogan National Forest, Washington.

and to human disturbance. No roosts are known on the LTBMU and the nearest known roosts are located over 50 miles from the basin in the Sierra Nevada foothills (Pierson and Rainey 1998).

In 2009 two bat detection devices were placed at Cookhouse and Big Meadows at three separate intervals from 13 July to 29 August. Each station was comprised of a Pettersson ultrasonic detector and a tape player mounted on a post or tripod. Stations were placed in habitat transition zones or near likely movement corridors between willows or trees and adjacent to the meadow. Bat vocalizations were recorded at six different locations at each site over the study protocol period. The tapes were started at dusk and collected the next day. Tapes were sent to Michael Morrison for download and analysis. Please refer to section 2.9 for project inventory bat survey information.

3.6.2 RESULTS OF SURVEYS AND DISCUSSION

Due to difficulties with equipment operation and a delay in acquiring additional components, two functioning bat detection systems were not available in June; consequently recordings scheduled for the end of June were collected in early July. Also the tapes produced by the Pettersson detector and Sony tape recorder were not optimum for analysis because of a low level of background distortion. Despite these problems, adequate recordings of bat vocalizations were obtained at each session except Site 4 at Cookhouse Meadow (Table 27). The tapes will be analyzed to species by Michael Morrison during the winter of 2009-2010.

Table 27. Dates and UTM locations (NAD 83 Z10) of bat ultrasonic detectors placed at Cookhouse Meadow and Big Meadow in 2009.

Site	Station	Date	Visit	Zone	Easting	Northing
Cookhouse Meadow	S1	07/12/2009	1	10	759881	4297694
Cookhouse Meadow	S2	07/13/2009	1	10	759798	4297763
Cookhouse Meadow	S3	07/22/2009	2	10	759859	4297921
Cookhouse Meadow	S4	07/22/2009	2	10	760054	4297874
Cookhouse Meadow	S5	08/28/2009	3	10	760012	4297995
Cookhouse Meadow	S6	08/28/2009	3	10	759779	4297943
Big Meadow	S1	07/14/2009	1	10	761019	4296403
Big Meadow	S2	07/15/2009	1	10	760523	4296820
Big Meadow	S3	07/23/2009	2	10	760711	4296384
Big Meadow	S4	07/23/2009	2	10	760472	4296140
Big Meadow	S5	08/29/2009	3	10	760380	4296574
Big Meadow	S6	08/29/2009	3	10	760410	4296442

Bat recordings in 2009 continue six years of study begun in 2004. The relative frequency of desired bat species declined over the first five years of the survey, possibly due to low rainfall during the years of 2007 and 2008. Collection of bat data can be used to evaluate the success of meadow restoration projects planned throughout the Basin in future years.

3.7 SMALL MAMMALS

3.7.1 BACKGROUND, PROTOCOL, AND SURVEY METHODS

Meadow restoration projects provided an opportunity for biologists to study changes within meadow communities. One indicator of a successful restoration is the increase of desired small mammals.

Cookhouse Meadow has long been used as a grazing site for livestock and, when highway culverts were installed, the level of the already damaged creek was further reduced. This altered the historic seasonal flooding that preserved the wet meadow habitat. In the fall of 2006 the meadow streambed was altered and made to replicate a natural meandering watercourse. Small mammals have been trapped at Cookhouse Meadow and at Big Meadow (control site) yearly since 2004 to assess changes in the ecosystem.

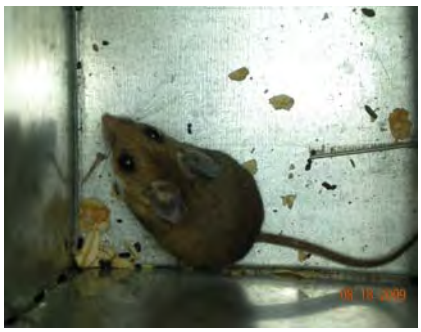
At Sunset Reach surveys are being conducted prior to a restoration project intended to raise the river channel to improve connectivity to the floodplain and improve sediment trapping. At both Sunset Reach and Trout Marsh (control site) small mammal trapping studies have occurred in 2006 and 2008.

In 2009, small mammal trapping was conducted at Cookhouse Meadow, Big Meadow, Sunset Reach, and Trout Marsh between 20 July and 13 August. Large Sherman traps were placed along established arrays and extra-large Sherman traps were added at every other trap location. Sixty-four traps were placed at Cookhouse Meadow, 82 traps at Big Meadow, 38 at Trout Marsh, and 45 at Sunset Reach. Traps were baited with peanut butter and oatmeal. They were checked twice each day, in the morning and at dusk for a total of six times. Small mammals were identified to species and ear tagged or marked. Sex and age were determined when possible. Mammals found to be recaptures of individuals marked in 2009 were not included in capture data.

3.7.2 SURVEY RESULTS AND DISCUSSION

Cookhouse

One hundred and twenty-eight individual mammals of eleven species were captured at Cookhouse (56) and Big Meadow (72). Deer mice, (*Peromyscus maniculatus*) were the most commonly trapped species at both sites (36 at Cookhouse and 34 at Big Meadow). At Cookhouse Meadow the second most common species captured (10) was the Lodgepole chipmunk, (*Tamias speciosus)* while at Big Meadow yellow-pine chipmunks, *(Tamias amoenus)* were the second most common capture (26). We captured one mammal species representative of desired conditions. These were two Western jumping mice, *Zapus princeps* trapped at Cookhouse Meadow (Table 28).



Deer mouse (*Peromyscus maniculatus*) in Sherman trap. Photo by LTBMU wildlife staff.

Sunset Reach

One hundred and eighty-eight individual mammals of eight species were caught during trapping at Sunset Reach (77) and at Trout Marsh (111). Again, deer mice were the most frequently captured mammal at both sites (41 at Sunset Reach and 59 at Trout Marsh). At Sunset Reach the second most common species captured (29) were yellow-pine chipmunks, *(Tamias amoenus)*. At Trout Meadow, montane voles, *(Microtus montanus)* were the second most common capture (32), followed by yellow-pine chipmunks (19). We captured one mammal species representative of desired conditions; one vagrant shrew, (*Sorex vagrans*) was captured at each site (See Table 28).

Table 28. Number of unique individual small mammals (i.e. minimum alive) trapped at Sunset Reach, Trout Marsh (control site), Cookhouse Meadow, and Big Meadow (control site) during the summer of 2009. An asterisk indicates a desired condition species.

Common Name	Scientific Name	Cookhouse Meadow	Big Meadow	Sunset Reach	Trout Marsh
Montane vole	*Microtus montanus*	3	8	2	32
Unknown vole	*Microtus spp.*	-	1	1	-
Short-tailed weasel	*Mustela erminea*	-	1	1	-
Unknown weasel	*Mustela spp.*	-	-	1	-
Deer mouse	*Peromyscus maniculatus*	36	34	41	59
Vagrant shrew*	*Sorex vagrans*	-	-	1	1
California ground squirrel	*Spermophilus beecheyi*	1	-	-	-
Golden-mantled ground squirrel	*Spermophilus lateralis*	-	2	-	-
Yellow-pine chipmunk	*Tamias amoenus*	1	26	29	19
Shadow chipmunk	*Tamias senex*	1	-	-	-
Lodgepole chipmunk	*Tamias speciosus*	10	-	-	-
Long-eared chipmunk	*Tamias Quadrimaculatus*	2	-	-	-
Unknown chipmunk	*Tamias spp.*	-	-	1	-
Western Jumping Mouse*	*Zapus princeps*	2	-	-	-
Total captures		**56**	**72**	**77**	**111**
Number of species		**8**	**6**	**8**	**4**

At all sites numbers of deer mice captured increased dramatically compared to any previous year of this study. May and June 2009 were unusually wet months in the Basin which could have caused the increase in some species, however it is hard to say whether these variations are caused by weather changes or other factors in the environment. Species diversity (number of different species captured) in 2009 was within fluctuations in species diversity of past years at all sites.

4.0 ACKNOWLEDGEMENTS

Wildlife biologists and biological science technicians from the USFS, TRPA, NDOW, EDAW, Hauge Brueck Associates, and Insignia Environmental, resource ecologists from California Department of Parks and Recreation, and volunteers conducted the wildlife surveys described in this report. For their assistance in conducting the surveys, we thank: Garth Alling, D.J. Allison, Abbie Alterman, Kathi Borgmann, Cate Brown, David Catalano, Kevin Duggan, Holly Eddinger, Maureen Easton, Rena Escobedo, Leslie Farnham, Lisa Fields, Sue Fox, Dan Gaube, Brian Harasha, Sandra Harvill, Molly Hurt, Ryan Kalinowski, Kevin Kilpatrick (and the Insignia Environmental crew), Stan Kot, Ashli Lewis, Victor Lyon, Mike Morrison, Hannah Pruett, Michelle Rambo, Cecilia Reed, Michael Robison, Raul Sanchez, Debra Scolnick, Ellen Sherrill, Blake Taylor, Desirae Weyland, Lisa Vormwald (and the TNF WIFL crew), Shay Zanetti, and all of our volunteers who helped.

5.0 REFERENCES

Bombay, et.al. 2003. A Willow Flycatcher Survey Protocol for California.

Borgmann, K.L. and M.L. Morrison. 2004. Wildlife Inventory and Monitoring in the Lake Tahoe Basin, California: Pre-Restoration.

Borgmann, K.L. and M.L. Morrison. 2005. Wildlife Inventory and Monitoring in the Lake Tahoe Basin, California: Pre-Restoration.

Borgmann, K.L., Groce, J. and M.L. Morrison. 2006. Restoration and Wildlife Inventory and Monitoring at Cookhouse Meadow, High Meadow, Tallac Marsh, Taylor Marsh, and Upper Truckee Marsh and Inventory and Monitoring at Control Sites: Big Meadow, Fountain Place, Grass Lake, Truckee Marsh, and Truckee-Trout Marsh in the Lake Tahoe Basin, California.

Borgmann, K.L., J. Groce, and M.L. Morrison. 2007. Wildlife Inventory and Monitoring in the Lake Tahoe Basin, California.

Borgmann, K. L. and Morrison, M.L. 2008. Wildlife Inventory and Monitoring in the Lake Tahoe Basin, California.

DeByle, N. V. and R.P Winkours, editors. 1985. Aspen: ecology and management in the western United States. United States Forest Service GTR-RM-119:135-152.

Drager, T. and Linthicum, J. 1985. Peregrine Falcon Nest Management, Hack Site, and Cross-Fostering Efforts. Santa Cruz Predatory Bird Research Group. University of California, Santa Cruz.

ENTRIX. 2004. Final draft existing conditions report for the Sunset Stables Restoration and Resource Management Plan Project. Sacramento, California.

Flack, J. A. D. 1976. Bird populations of aspen forest in western North America. Ornithological Monographs 19:1–97.

Knopf, F. L., and J. A. Sedgwick. 1992. An experimental study of nest-site selection by yellow warblers. Condor 94:734-742.

McGahan, J. 1968. Ecology of the golden eagle. The Auk, 85: 1-12.

Pagel, J.E. Protocol for Observing Known Peregrine Falcon Eyries in the Pacific Northwest. USFS Internal Document.

Pierson, E.D. and W.E. Rainey. 1998. Distribution, status, and management of Townsend's big-eared bat (*Corynorhinus townsendii*) in California. Wildlife Management Division Bird and Mammal Conservation Program Final Report for Contract No. FG7129. California Dept. Fish and Game. 34 pp.

Salt, G. W. 1957. Analysis of avifaunas in the Teton Mountains and Jackson Hole, Wyoming. Condor. 82:373–393.

Slauson, K. 2009. Personal communication.

Slauson, K and W. Zielinski. In Development. Northern Goshawk Population Monitoring Plan.

Slauson, K and W. Zielinski, In Development. Bald Eagle Population Monitoring Plan.

Tahoe Regional Planning Agency. 1982. Tahoe Regional Planning Agency's Goals and Policies.

Tahoe Regional Planning Agency. 2000. Tahoe Regional Planning Agency Osprey Survey Protocol.

USDA Forest Service. 1993. Protocol for Surveying for Spotted Owl in Proposed Management Activity Areas and Habitat Conservation Areas.

USDA Forest Service, 2000. Pages 403-598 *in* Lake Tahoe watershed assessment: Volume 1. Pacific Southwest Research Station, General Technical Report PSW-GTR-175, Berkeley, California.

USDA Forest Service. 2001. Riparian biological diversity in the Lake Tahoe Basin Report, USDA Forest Service, Pacific Southwest Research Station, Berkeley, California.

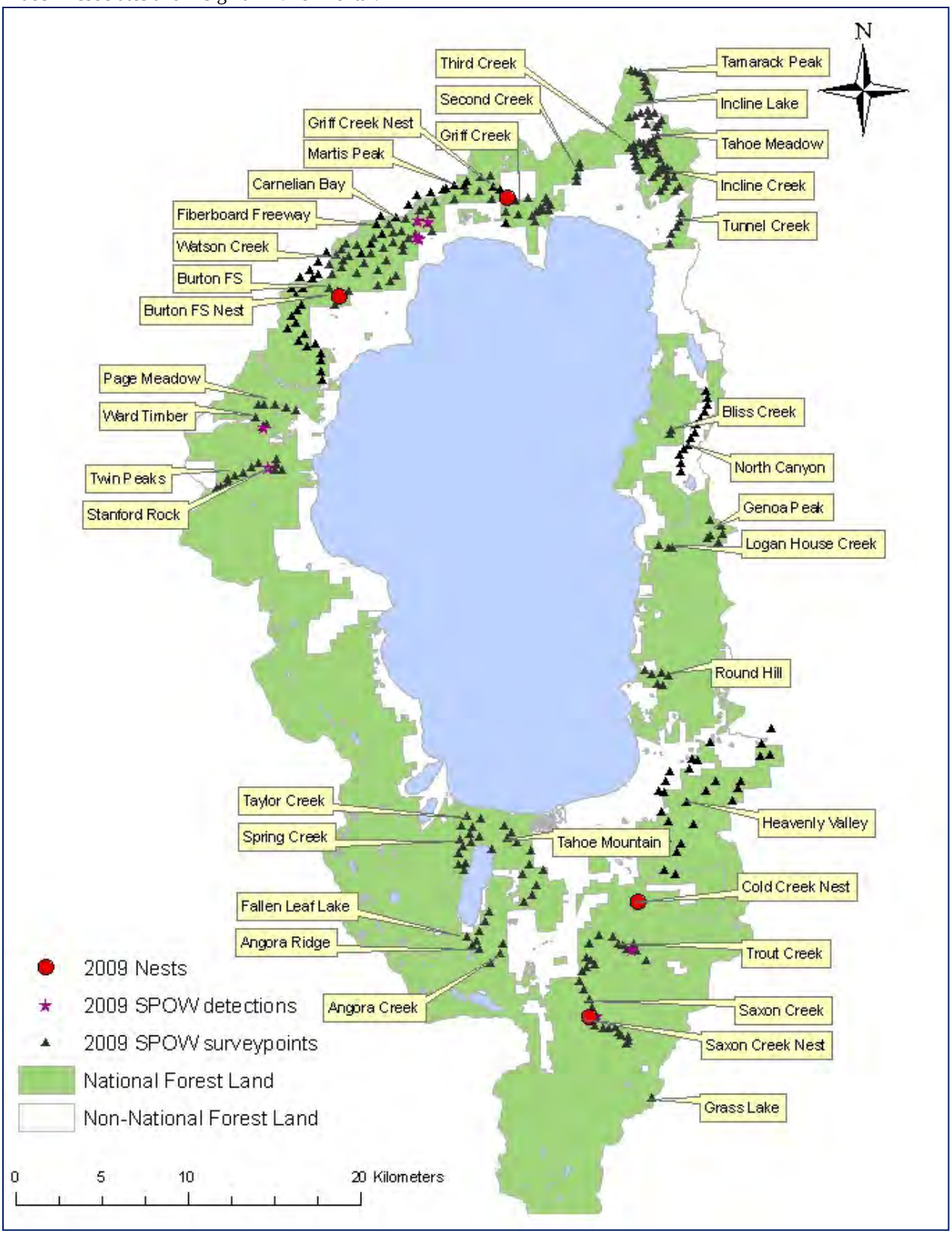
USDA Forest Service, 2004. Sierra Nevada Forest Plan Amendment, Final Environmental Impact Statement, Record of Decision. U.S. Forest Service, Pacific Southwest Region.

USDA Forest Service, 2006. Northern goshawk inventory and monitoring technical guide. Gen. Tech. Rep. WO-71.

USDA Forest Service. 2007a. Record of Decision, Sierra Nevada Forests Management Indicator Species Amendment. U.S. Forest Service, Pacific Southwest Region.

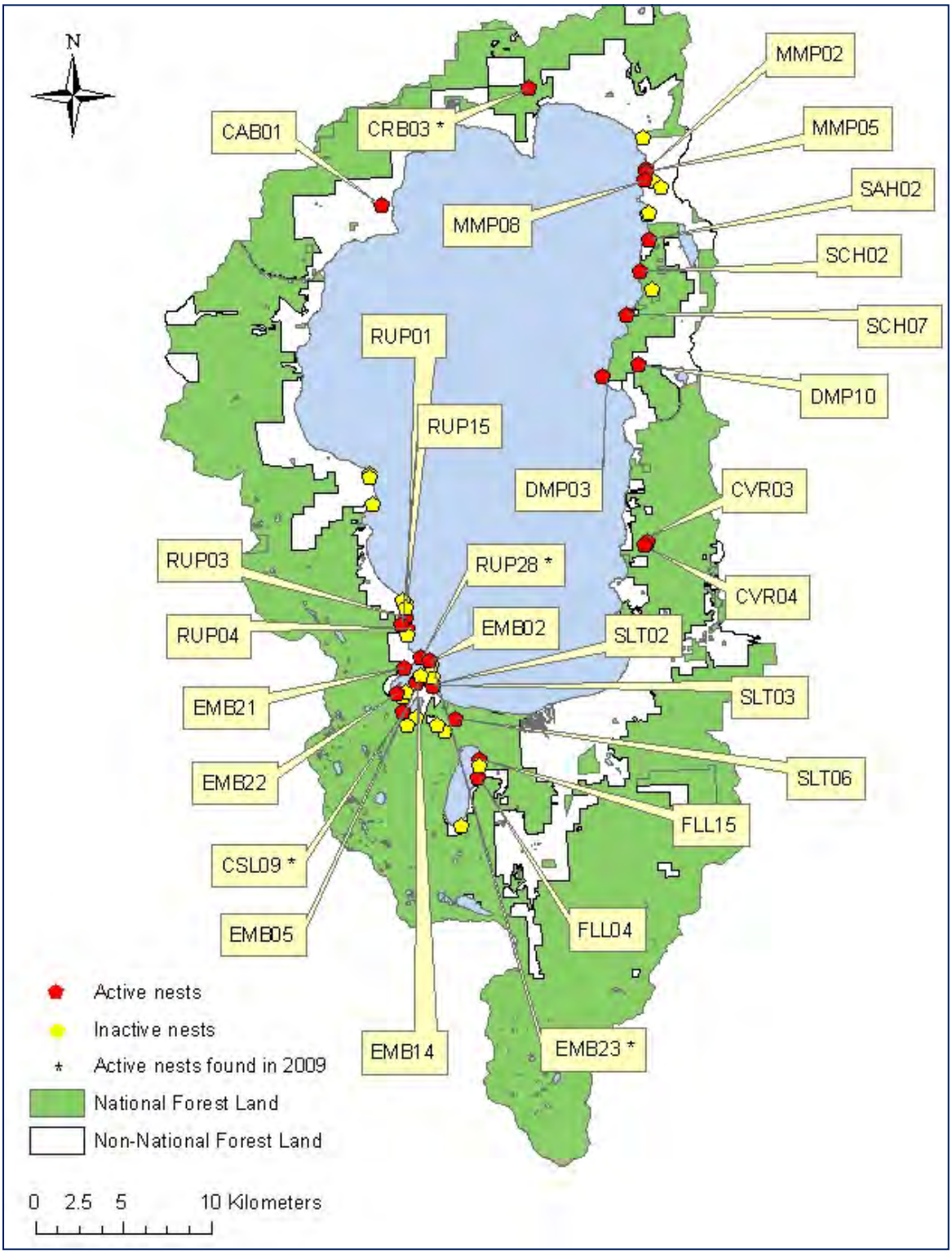
USDA Forest Service, 2009. Aspen Community Restoration Project Decision Memo.

Appendix 1. Locations of California spotted owl survey call stations and nest stand habitat surveys within the Lake Tahoe Basin, 2009. Surveys conducted by Lake Tahoe Basin Management Unit, Nevada Division of Wildlife, Hauge Brueck Associates and Insignia Environmental.

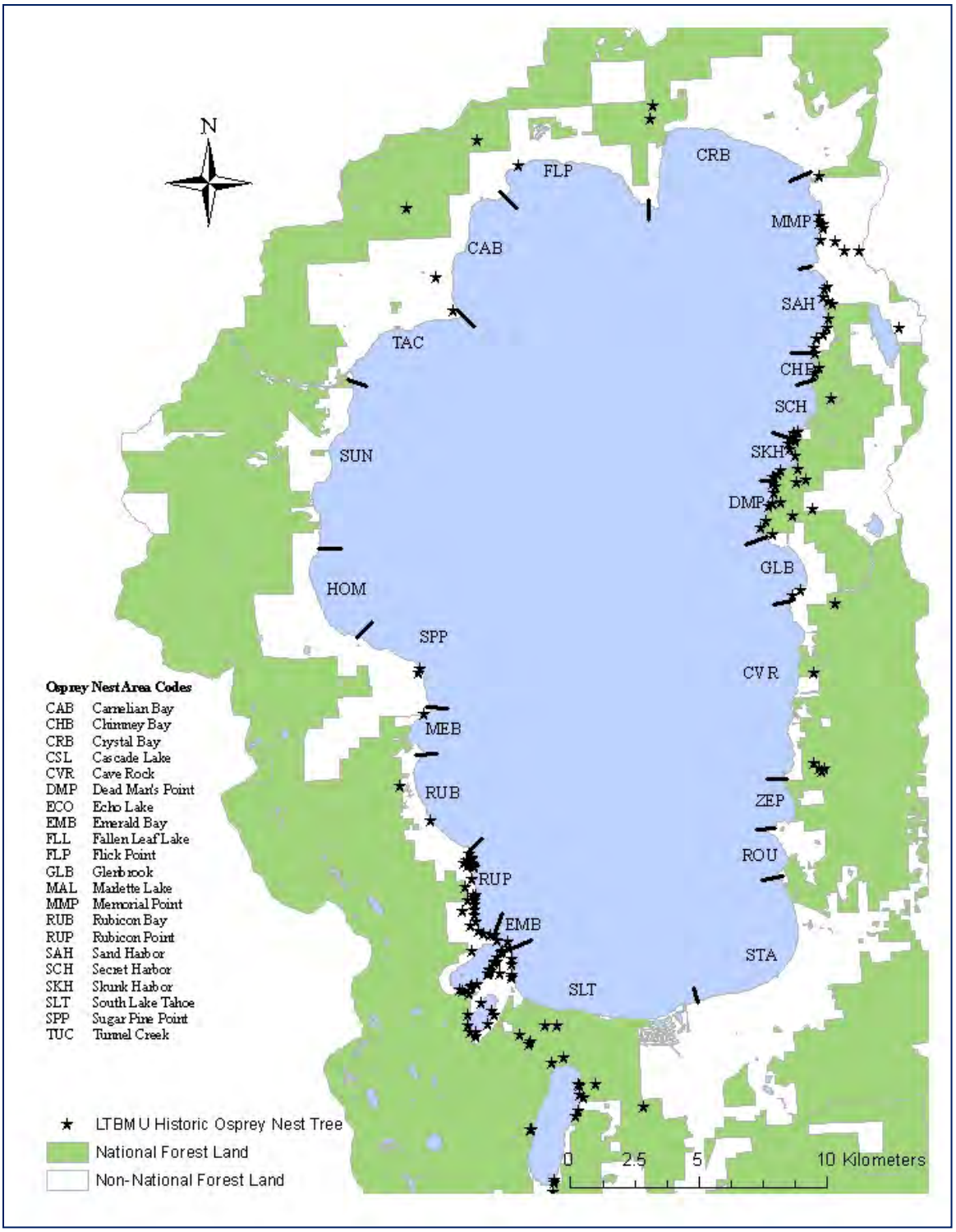


Appendix 2. Locations of northern goshawk survey polygons within the Lake Tahoe Basin, 2009. Surveys conducted by Lake Tahoe management Unit, Nevada Department of Wildlife, Hauge Brueck Associates and Insignia Environmental.

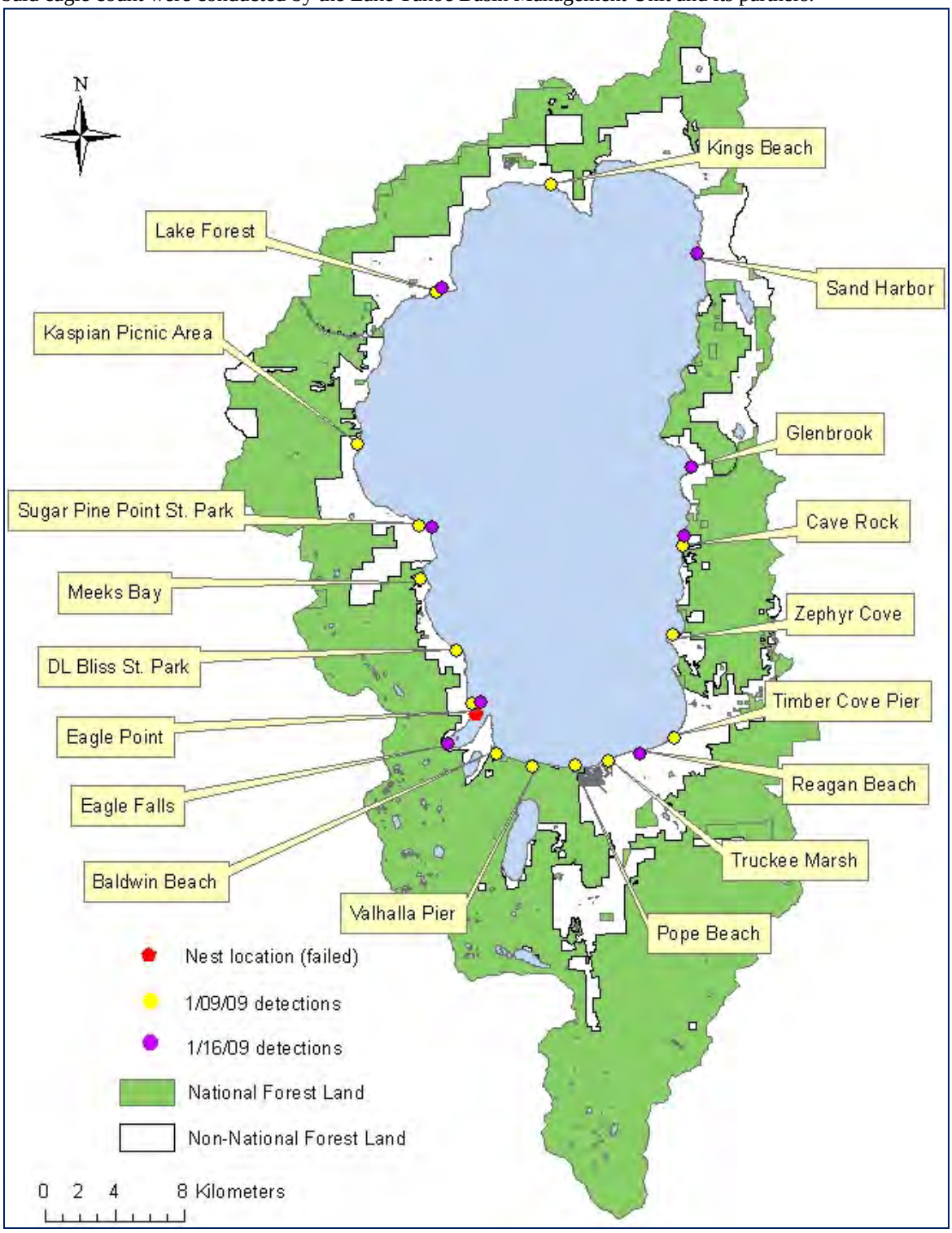
Appendix 3. Locations of all Osprey nests, active and inactive, surveyed by LTBMU and its partners in 2009.



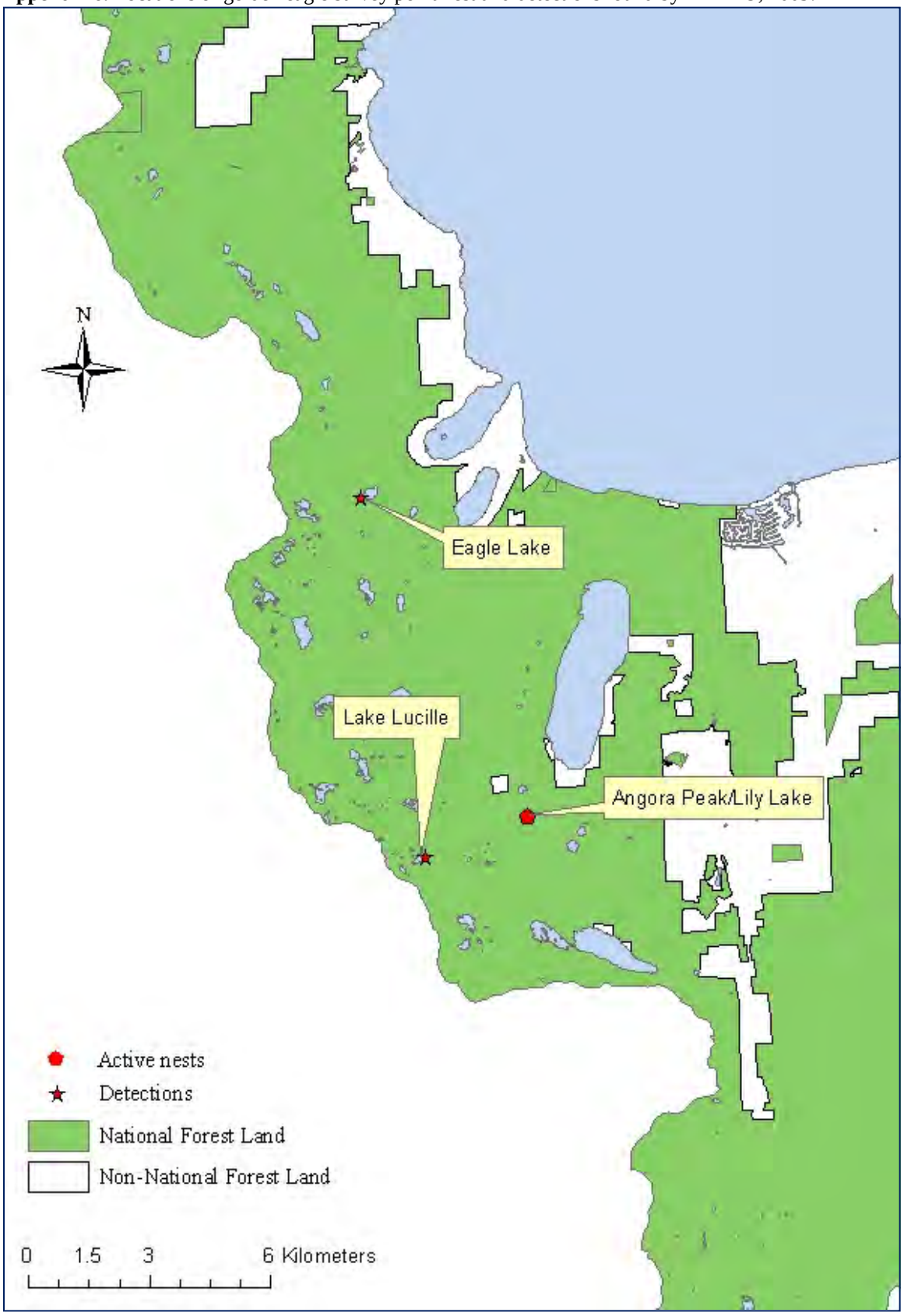
Appendix 4. Area surveyed by LTBMU, TRPA, Nevada Department of Wildlife, and California Department of Parks and Recreation to assess the spatial location and reproductive activity of osprey in the Lake Tahoe Basin, 2009.



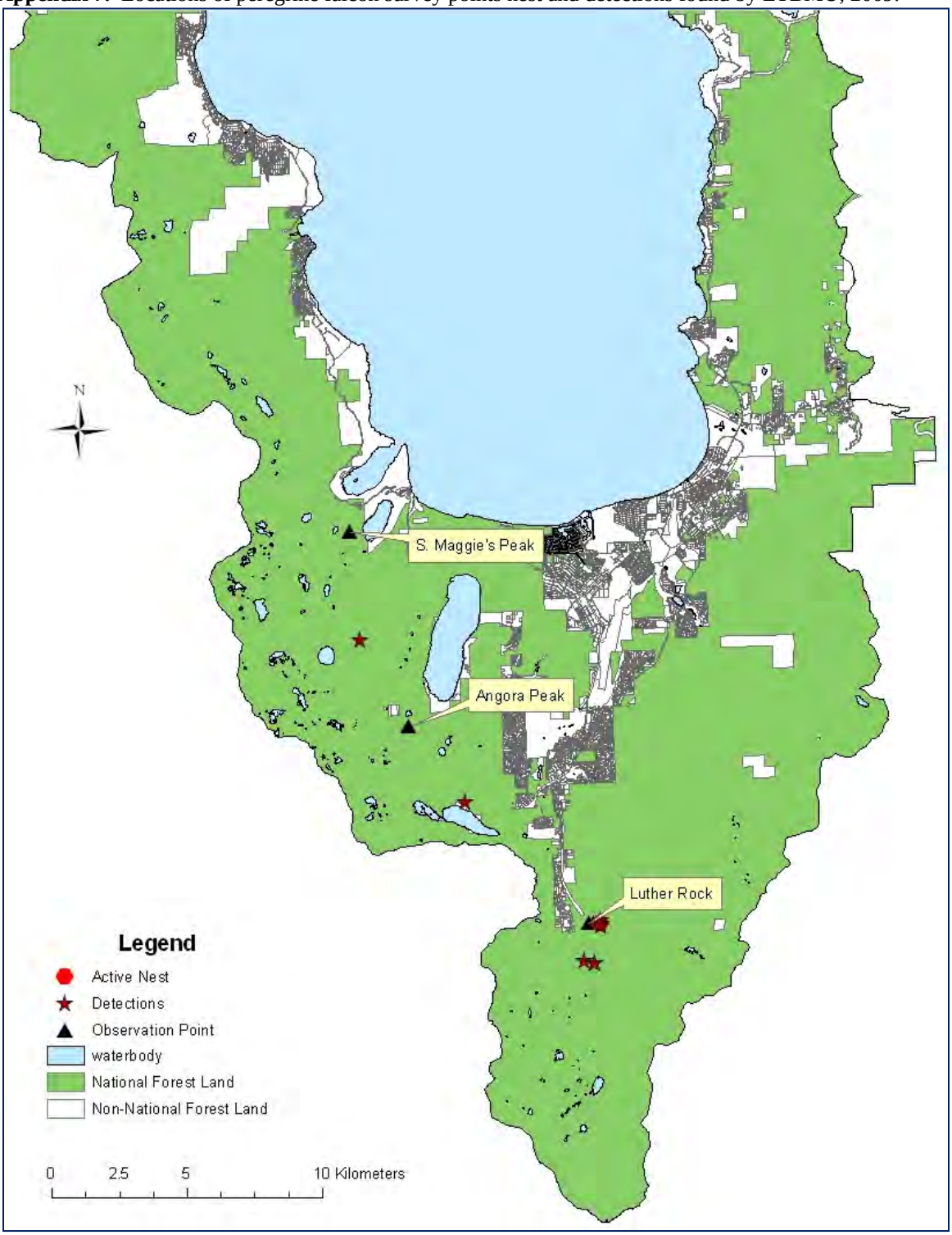
Appendix 5. Location of bald eagle nest, mid-winter bald eagle count observation points and locations of bald eagles detected during the mid-winter count, 2009. Surveys for bald eagle nests and the mid-winter bald eagle count were conducted by the Lake Tahoe Basin Management Unit and its partners.



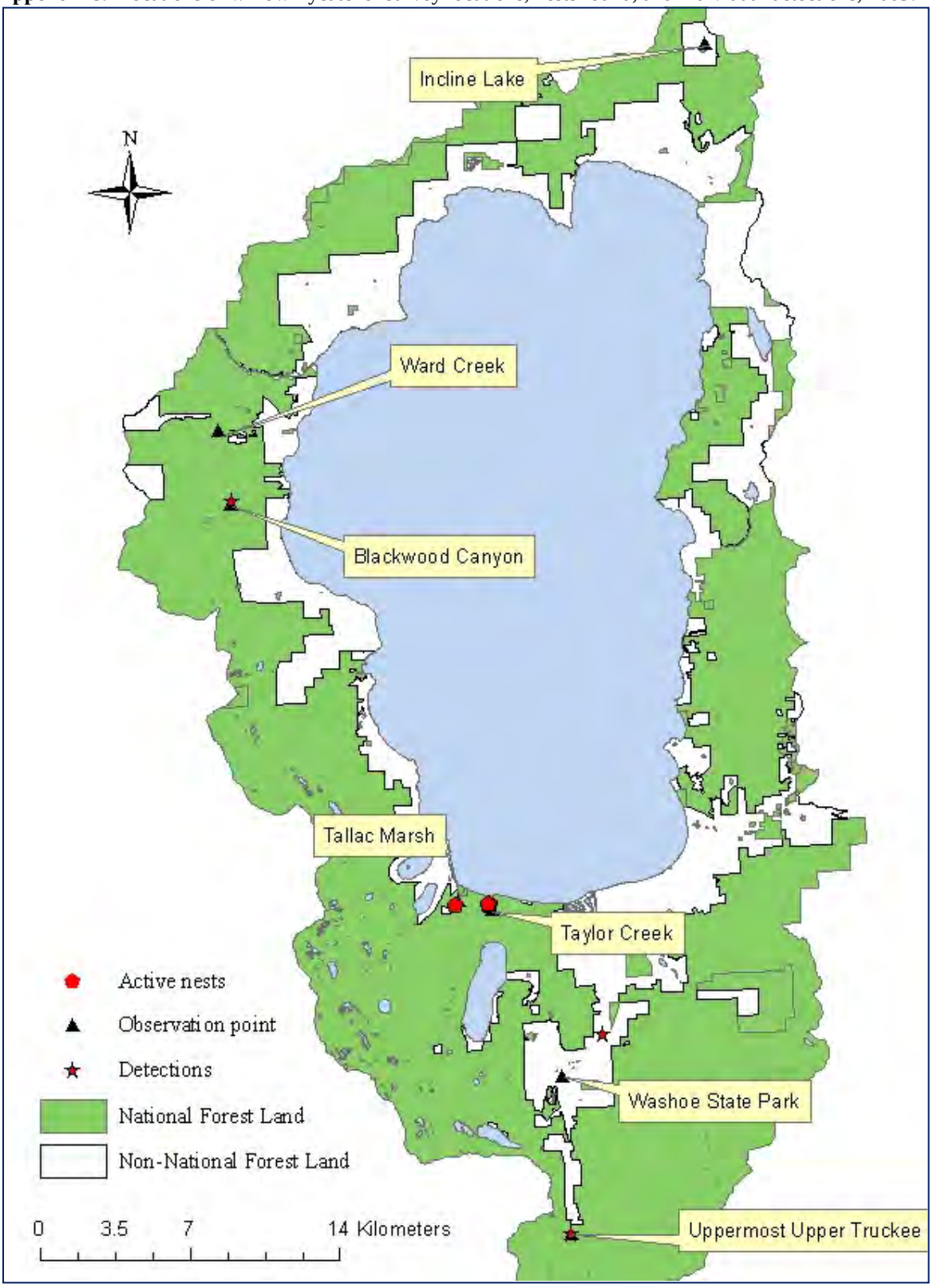
Appendix 6. Locations of golden eagle survey point nest and detections found by LTBMU, 2009.



Appendix 7. Locations of peregrine falcon survey points nest and detections found by LTBMU, 2009.

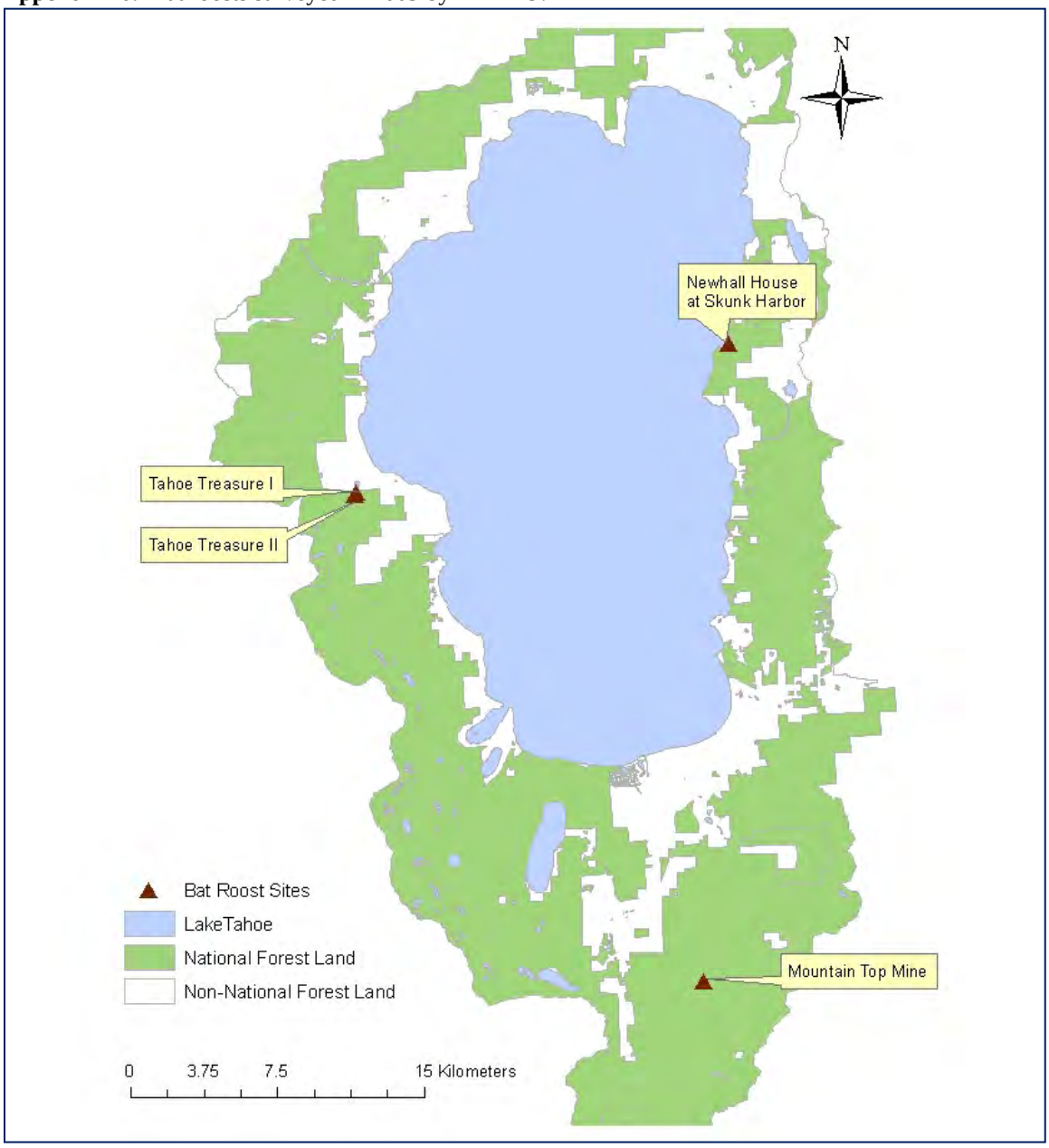


Appendix 8. Locations of willow flycatcher survey locations, nests found, and individual detections, 2009.

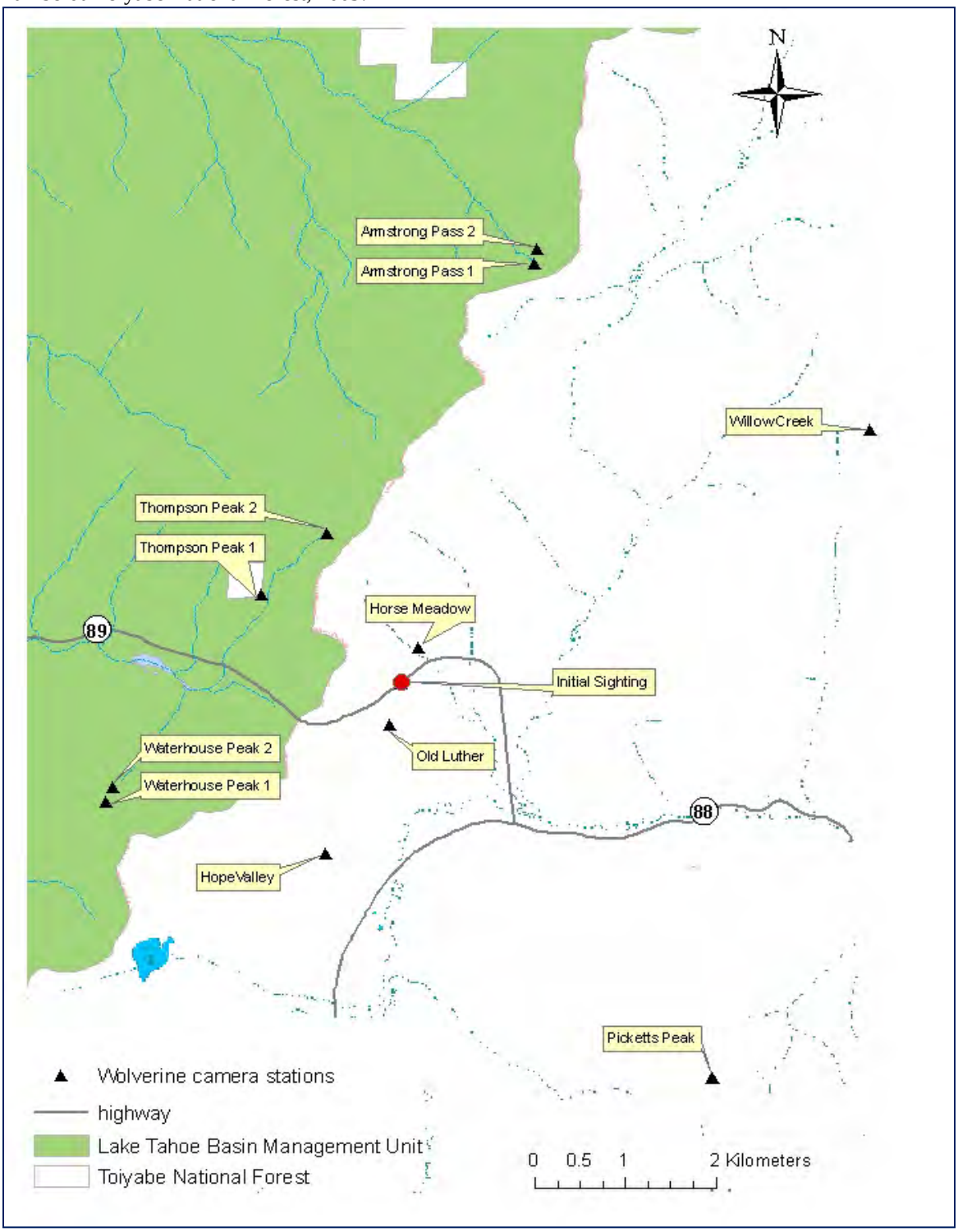


Appendix 9. Locations of 2009 Aspen Community Restoration Project small mammal trapping sites.

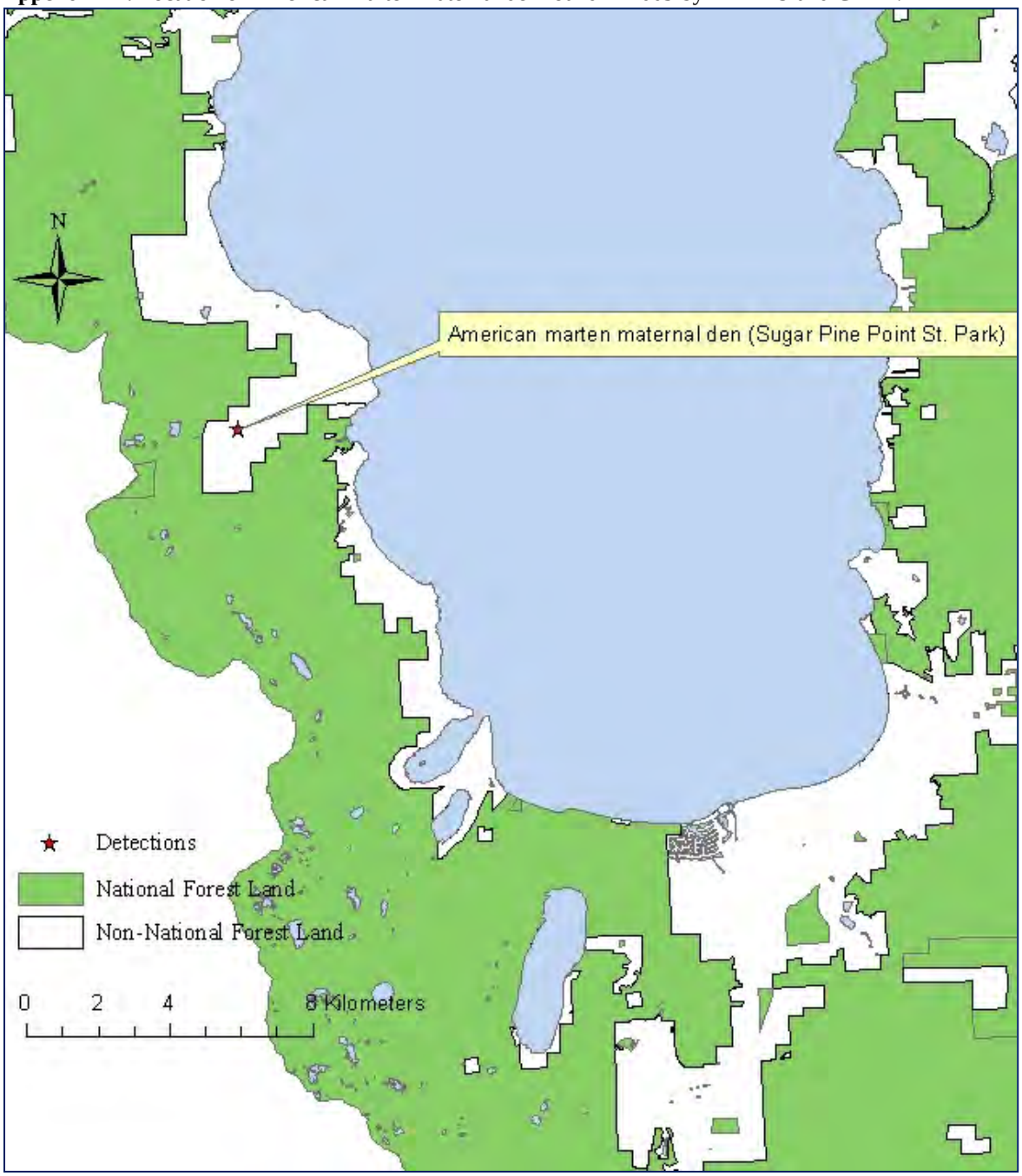
Appendix 10. Bat roosts surveyed in 2009 by LTBMU.



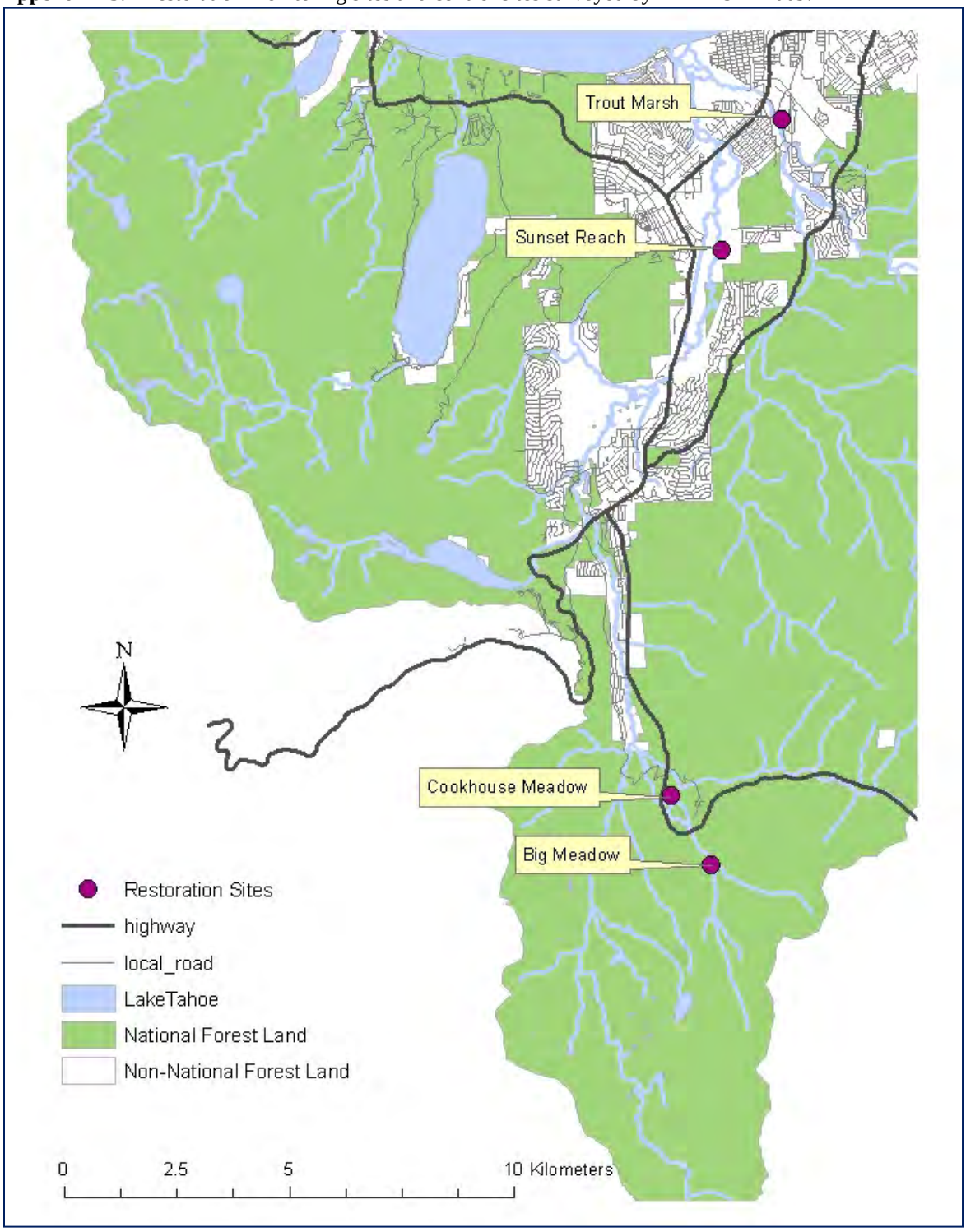
Appendix 11. Locations of initial sighting and wolverine camera station sites installed by LTBMU and Humboldt-Toiyabe National Forest, 2009.



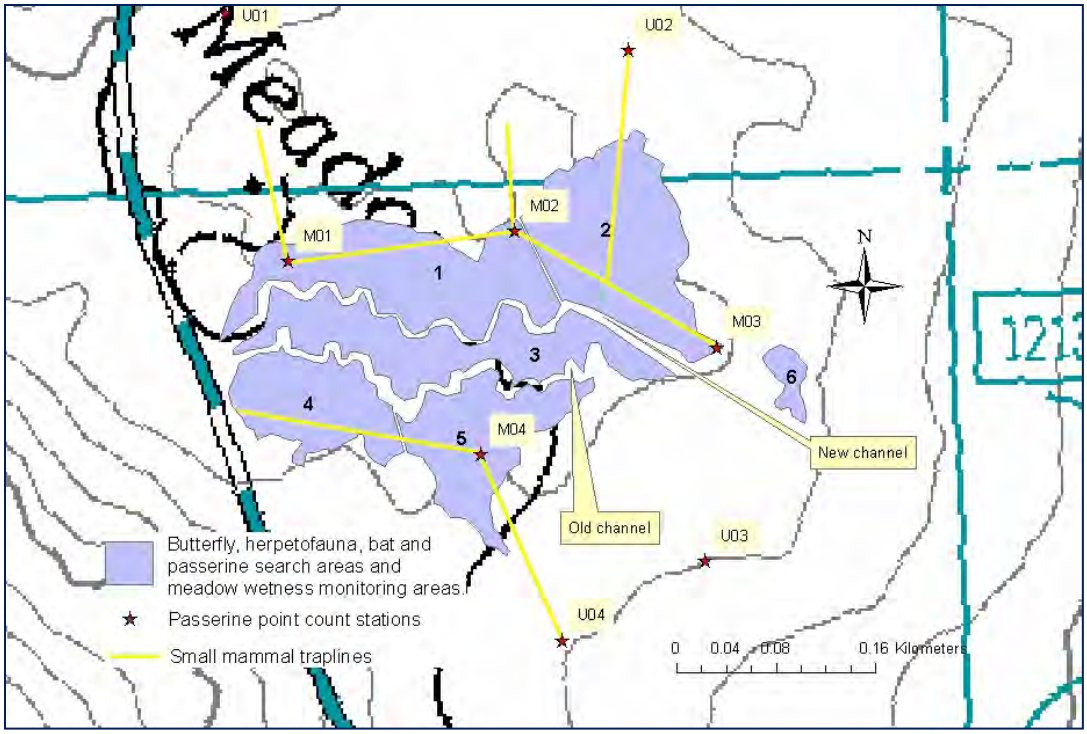
Appendix 12. Location of American marten maternal den found in 2009 by LTBMU and CDPR.



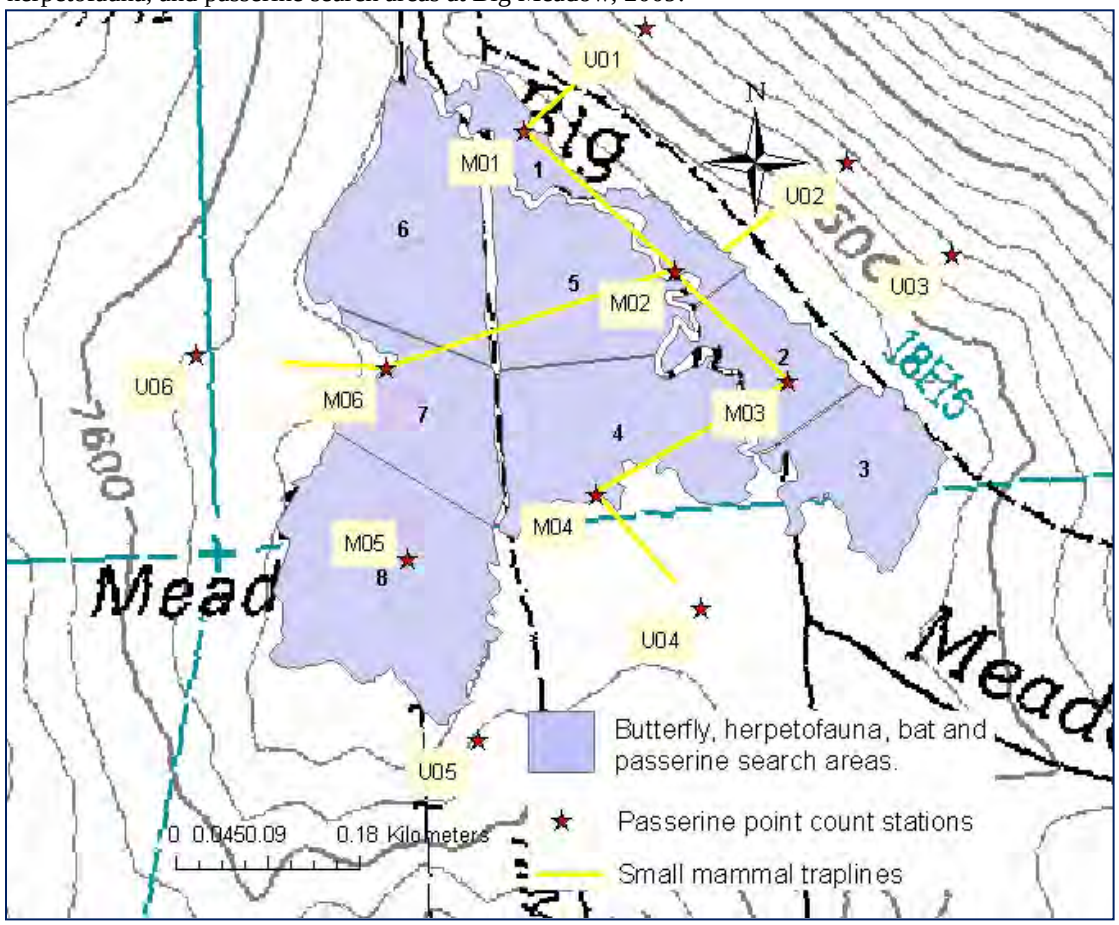
Appendix 13. Restoration monitoring sites and control sites surveyed by LTBMU in 2009.



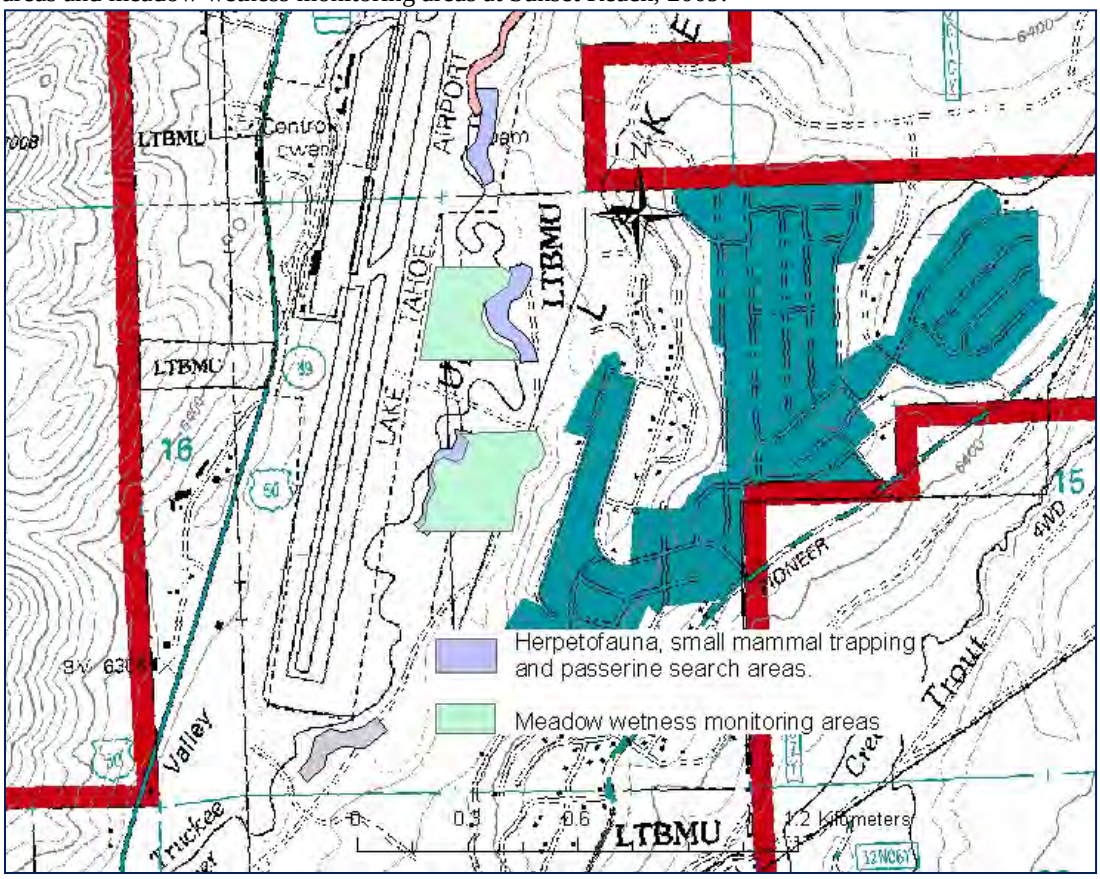
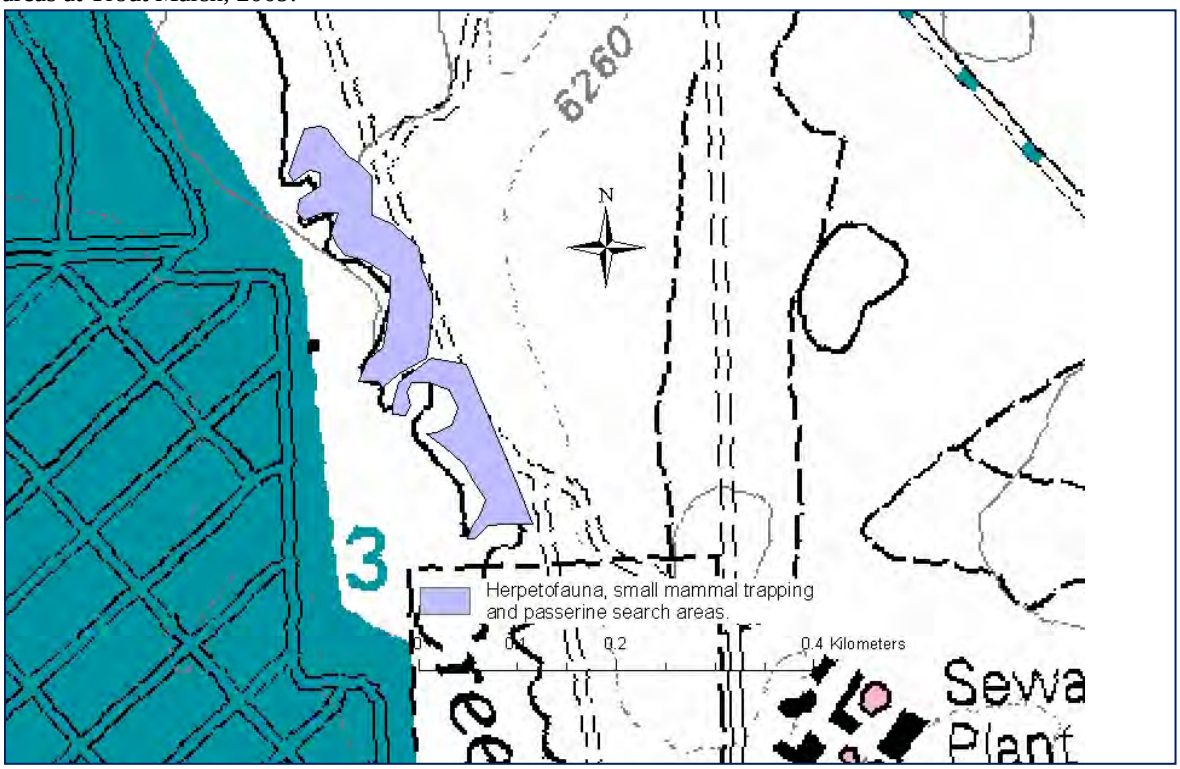
Appendix 14. Locations of avian point count stations, small mammal trap lines, butterfly, herpetofauna, and passerine search areas and meadow wetness monitoring areas at Cookhouse Meadow, 2009.


U01
U02
M01
M02
M03
M04
U03
U04
1
2
3
4
5
6
N
New channel
Old channel
Butterfly, herpetofauna, bat and passerine search areas and meadow wetness monitoring areas
Passerine point count stations
Small mammal traplines
0 0.04 0.08 0.16 Kilometers

Appendix 15. Locations of avian point count stations, small mammal trap lines, butterfly, herpetofauna, and passerine search areas at Big Meadow, 2009.



Appendix 16. Locations of small mammal trapping areas, herpetofauna search areas, passerine search areas and meadow wetness monitoring areas at Sunset Reach, 2009.



Appendix 17. Locations of small mammal trapping areas, herpetofauna search areas and passerine search areas at Trout Marsh, 2009.