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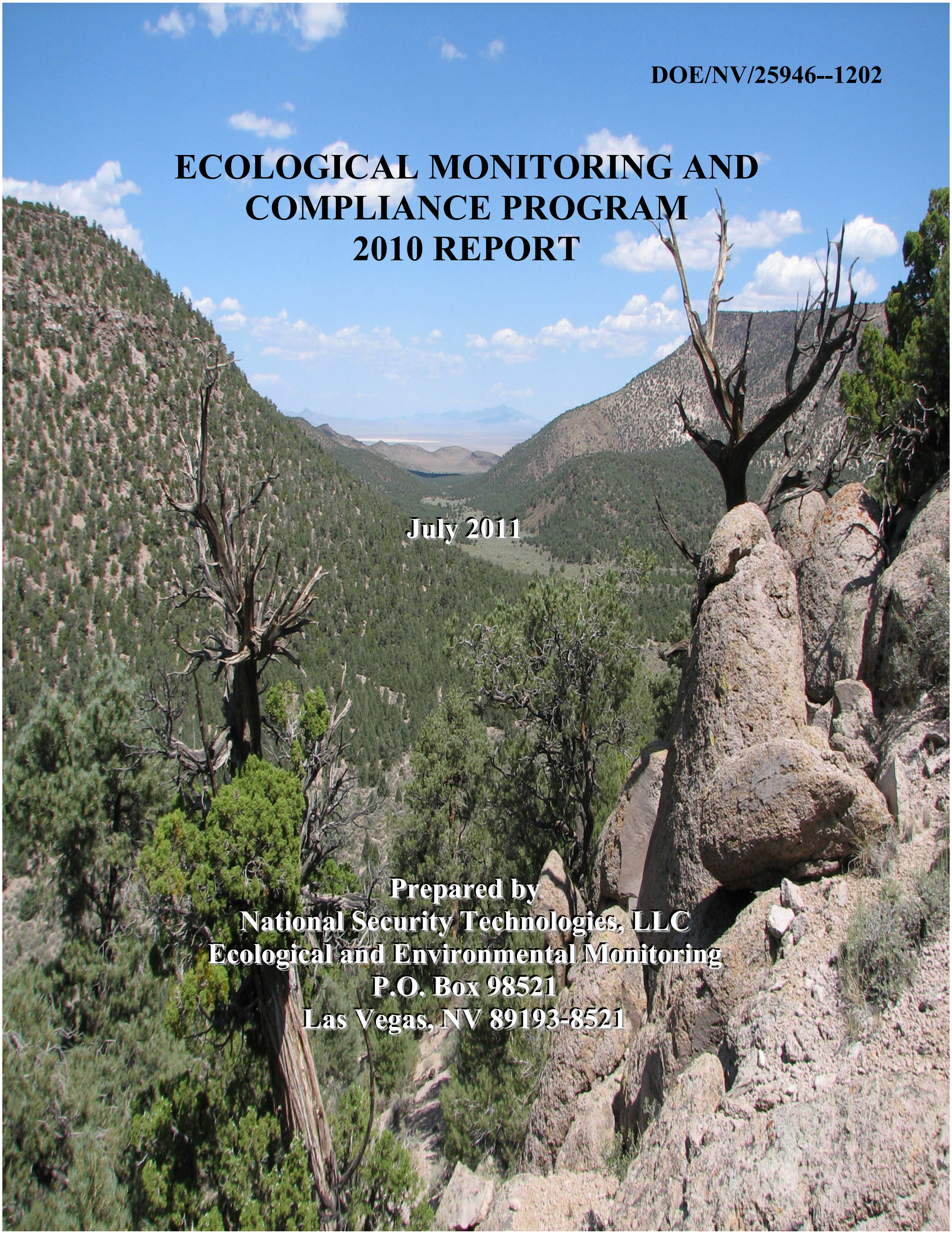
ECOLOGICAL MONITORING AND COMPLIANCE PROGRAM 2010 REPORT



July 2011

Prepared by
National Security Technologies, LLC
Ecological and Environmental Monitoring
P.O. Box 98521
Las Vegas, NV 89193-8521

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Front Cover Picture: Kawich Canyon, looking north, near the northernmost boundary of the Nevada National Security Site (photo by D. B. Hall, August 25, 2009)

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ECOLOGICAL MONITORING AND COMPLIANCE PROGRAM 2010 REPORT

Dennis J. Hansen, David C. Anderson, Derek B. Hall,
Paul D. Greger, and W. Kent Ostler

Prepared by
National Security Technologies, LLC
Ecological and Environmental Monitoring
P.O. Box 98521
Las Vegas, NV 89193-8521

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P.O. Box 98518
Las Vegas, NV 89193-8518

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EXECUTIVE SUMMARY

The Ecological Monitoring and Compliance (EMAC) Program, funded through the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office (NNSA/NSO), monitors the ecosystem of the Nevada National Security Site (NNSS) and ensures compliance with laws and regulations pertaining to NNSS biota. This report summarizes the program's activities conducted by National Security Technologies, LLC (NSTec), during calendar year 2010. Program activities included (a) biological surveys at proposed construction sites, (b) desert tortoise compliance, (c) ecosystem monitoring, (d) sensitive plant species monitoring, (e) sensitive and protected/regulated animal monitoring, (f) habitat restoration monitoring, and (g) monitoring of the Nonproliferation Test and Evaluation Complex (NPTEC). During 2010, all applicable laws, regulations, and permit requirements were met, enabling EMAC to achieve its intended goals and objectives.

Sensitive and protected/regulated species of the NNSS include 42 plants, 1 mollusk, 2 reptiles, 238 birds, and 27 mammals. These species are protected, regulated, or considered sensitive according to state or federal regulations and natural resource agencies and organizations. The threatened desert tortoise (*Gopherus agassizii*) is the only species on the NNSS protected under the *Endangered Species Act*. Biological surveys for the presence of sensitive and protected/regulated species and important biological resources on which they depend were conducted for 30 projects. A total of 608.00 hectares (ha) (1,502.40 acres [ac]) was surveyed for these projects. Sensitive and protected/regulated species and important biological resources found during these surveys included 1 desert tortoise, 12 desert tortoise burrows, 19 kit fox (*Vulpes velox macrotis*) burrows, 3 predator burrows, 2 burrowing owl (*Athene cunicularia*) burrows, 1 common raven (*Corvus corax*) nest with 2 chicks, a bat roost, mature Joshua trees (*Yucca brevifolia*), and cacti. NSTec provided to project managers a written summary report of all survey findings and mitigation recommendations, where applicable. All flagged desert tortoise burrows were avoided during project activities.

Of the 30 projects on the NNSS, 20 occurred within the range of the threatened desert tortoise. NNSA/NSO must comply with the terms and conditions of the Biological Opinion rendered by the U.S. Fish and Wildlife Service (FWS) when conducting work in desert tortoise habitat. One desert tortoise was found in a project area and it was moved off the project area. No desert tortoises were accidentally injured, killed, or captured during project activities. Two desert tortoises were killed by vehicles along Jackass Flats Road in Area 22. Thirteen desert tortoises were removed from roads by NNSS personnel to avoid injury or death. In 2010, approximately 1.81 ha (4.46 ac) of desert tortoise habitat were disturbed. One project paid mitigation fees of $3, 374.64 for areas that were disturbed in 2010.

Since 1978, there has been an average of 11.5 wildland fires per year on the NNSS. The mean area burned per fire is 81.2 ha (200.6 ac). Historically most wildland fires are caused by lightning and do not occur randomly across the NNSS, but occur more often in particular vegetation types that have sufficient fuels (woody and fine-textured) that are conducive to ignition and spread of wildland fires. There were three wildland fires during 2010. One fire, near the U1a Complex in Area 1, was caused by a common raven landing on a power pole. Two other fires were caused by ordnance and were associated with training exercises. No fires were caused by lightning in 2010. Total area burned was less than 0.5 ha (1.0 ac). Wildland fire fuel hazards were evaluated and categorized as fine fuels, woody fuels, and combined fuels.

One sensitive plant previously reported to occur on the NNSS was removed from the list of sensitive plant species. Based on field surveys it was determined that *Phacelia parishii* (Parish phacelia) does not occur on the NNSS. Previously reported locations of this species on the NNSS have been determined to be *P. filiae* (Clarke phacelia). Field surveys in 2010 focused on the distribution of *P. filiae* as well as *Cymopteris ripleyi* var. *saniculoides* (Sanicle biscuitroot) in Scarp Canyon, *Galium hilendiae* ssp.

kingstonense (Kingston Mountains bedstraw) in the Tongue Wash area, and *Astragalus oophorus* var. *clokeyanus* (Clokey eggvetch) in the Cat Canyon area.

Two populations of *P. filiae* were located in Rock Valley and the northern slopes of Red Mountain. Several hundred individuals were found at both locations. Additional populations of *C. ripleyi* var. *saniculoides* were found in the Scarp Canyon area and around Camera Butte. A population of *A. oophorus* var. *clokeyanus* was surveyed in the Cat Canyon area where several hundred individual plants were found. A survey in the Tongue Wash area for *G. hilendiae* spp. *kingstonense* resulted in the identification of a single population of less than 50 individuals. Long-term monitoring plots were established for eight sensitive plant species this year. The density of the sensitive plant species at each monitoring plot was determined.

Surveys of sensitive and protected/regulated animals during 2010 focused on (1) western red-tailed skinks (*Eumeces gilberti rubricaudatus*), (2) bats, (3) wild horses (*Equus caballus*), (4) mule deer (*Odocoileus hemionus*), and (5) mountain lions (*Puma concolor*). Ten skinks were captured at eight new locations. These new locations filled in several distribution gaps both spatially and habitat-wise. Internal and external bat monitoring at U12u Tunnel and Test Cell C was conducted to minimize any threats to roosting bats in these facilities before activity resumed or demolition began. The wild horse population appears to be stable at about 35 horses, with very few foals surviving through the year. Mule deer abundance as measured from the nightly deer count increased by about 50% from 2009. A total of 22 mountain lion photographs/video clips were taken during 138,099 camera hours across all sites. This equates to about 0.2 mountain lion photo/video clips per 1,000 camera hours. Mountain lions were detected at 8 of the 23 sites. A mountain lion telemetry study was initiated in 2010 with the capture of two female mountain lions in December. GPS satellite transmitters were attached to each lion to record six locations per day for a year. Locations will be field checked and analyzed to determine food habits, home range, and habitat use during 2011. West Nile virus surveillance continued in 2010 with no mosquitoes testing positive for the virus. Hantavirus sampling detected 4 of 471 (0.8%) animals carrying the virus. All four animals were deer mice (*Peromyscus maniculatus*). Information about other noteworthy wildlife observations, bird mortalities, and a summary of nuisance animals and their control on the NNSS are also presented.

Two previously revegetated sites on the NNSS and two on the Tonopah Test Range (TTR) were monitored in 2010. The two previously revegetated areas on the NNSS include the closure cover on the U-3ax/bl disposal unit, which was revegetated in 1998, and the Control Point (CP) waterline that was revegetated in 2009. Total plant cover on the U-3ax/bl closure cover was 20 percent in 2010. *Atriplex confertifolia* (shadscale) made up 74 percent of the total cover; *Ephedra nevadensis* (Nevada jointfir) and annual species made up the rest of the plant cover. Plant density in 2010 was 1.3 perennial plants/square meter (m^2) (1.0 plants/square yard [yd^2]), which is about double the plant density of perennial plant species on the reference area. Perennial plant density has declined from 4.7 plants/m^2 (3.9/yd^2) in 2005 to just 1.3 plants/m^2 (1.0/yd^2) in 2010.

Plant cover on the CP waterline was not measured this year, but plant density was 71 plants/m^2, which included 32 shrubs/m^2 (27/yd^2), 16 perennial grasses/m^2 (14/yd^2), and 23 annual forbs/m^2 (19/yd^2). The most common shrub was *Coleogyne ramosissima* (blackbrush) followed by *E. nevadensis* and *Krascheninnikovia lanata* (winterfat). The most common grass was *Achnatherum hymenoides* (Indian ricegrass).

The two sites monitored on the TTR included Corrective Action Unit (CAU) 400, Five Points Landfill, which was revegetated in 1997, and CAU 407, Rollercoaster RADSAFE, which was revegetated in 2004. Plant cover on the Five Points Landfill was 8%, which was about 80% of the reclamation success standard for the Five Points Landfill site. Forb cover was 15.6%, which was almost double the standard of

8.7%. Perennial plant density at Five Points Landfill was 0.9 plants/m^2, which is almost 80% of the revegetation success standards for plant density at the Five Points Landfill site.

Shrub cover on the Rollercoaster RADSAFE site is the highest it has ever been—about three times the revegetation success standard. Shrub cover was about 16% the first year after revegetation occurred, dropped to 8% in 2008, and increased to 21% this year, which is probably the result of increased growth of the plants that have established on the site.

No chemical spill test plans were reviewed in 2010, and no baseline monitoring was conducted at NPTEC.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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ACRONYMS AND ABBREVIATIONS

ac	acre
BECAMP	Basic Environmental and Compliance Monitoring Program
CAU	Corrective Action Unit
CI	Confidence Interval
cm	centimeter
CP	Control Point
DOE/NV	U.S. Department of Energy, Nevada Operations Office
EEM	Ecological and Environmental Monitoring
EGIS	Ecological Geographic Information System
ELU	Ecological Landform Unit
EM	Environmental Monitor
EMAC	Ecological Monitoring and Compliance
EMAD	Engine Maintenance, Assembly, and Disassembly
ENSO	El Niño Southern Oscillation
ESA	Endangered Species Act
ft	feet
ft^2	square feet
FWS	U.S. Fish and Wildlife Service
FY	fiscal year
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare
in.	inch
INL	Idaho National Laboratory
km	kilometer
km^2	square kilometer
m	meter
m^2	square meter
mi	mile
mi^2	square mile
mm	millimeter

ACRONYMS AND ABBREVIATIONS (continued)

N	sample size
NAC	Nevada Administrative Code
NNHP	Nevada Natural Heritage Program
NNPS	Nevada Native Plant Society
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NNSS	Nevada National Security Site
NOAA	National Oceanic and Atmospheric Administration
NOAA/ARL/SORD	National Oceanic and Atmospheric Administration/Air Resources Laboratory/ Special Operations and Research Division
NPTEC	Nonproliferation Test and Evaluation Complex
NSTec	National Security Technologies, LLC
RWMC	Radioactive Waste Management Complex
SOC	Special Operations Center
ssp.	subspecies
spp.	Species
TBD	To be determined
TTR	Tonopah Test Range
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
var.	variety
WNV	West Nile virus
yd^2	square yard

1.0 INTRODUCTION

In accordance with U.S. Department of Energy Order DOE O 450.1A, "Environmental Protection Program," the Office of the Assistant Manager for Environmental Management of the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) requires ecological monitoring and biological compliance support for activities and programs conducted at the Nevada National Security Site (NNSS) formerly called the Nevada Test Site. National Security Technologies, LLC (NSTec), Ecological and Environmental Monitoring (EEM) has implemented the Ecological Monitoring and Compliance (EMAC) Program to provide this support. EMAC is designed to ensure compliance with applicable laws and regulations, delineate and define NNSS ecosystems, and provide ecological information that can be used to predict and evaluate the potential impacts of proposed projects and programs on those ecosystems. During 2010, all applicable laws, regulations, and permit requirements were met, enabling EMAC to achieve its intended goals and objectives.

This report summarizes the EMAC activities conducted by NSTec during calendar year 2010. Monitoring tasks during 2010 included seven program areas: (a) biological surveys, (b) desert tortoise compliance, (c) ecosystem monitoring, (d) sensitive plant monitoring, (e) sensitive and protected/regulated animal monitoring, (f) habitat restoration monitoring, and (g) biological monitoring at the Nonproliferation Test and Evaluation Complex (NPTEC). The following sections of this report describe work performed under these seven areas.

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2.0 BIOLOGICAL SURVEYS

Biological surveys are performed at project sites where land-disturbing activities are proposed. The goal is to minimize adverse effects of land disturbance on sensitive and protected/regulated plant and animal species (Table 2-1), their associated habitat, and other important biological resources. Sensitive species are defined as those at risk of extinction or serious decline or whose long-term viability has been identified as a concern. They include species on the Nevada Natural Heritage Program (NNHP) Animal and Plant At-Risk Tracking List and bat species ranked as moderate or high in the Nevada Bat Conservation Plan Bat Species Risk Assessment. Protected/regulated species are those that are protected or regulated by federal or state law. Many species are both sensitive and protected/regulated (Table 2-1). Important biological resources include cover sites, nest or burrow sites, roost sites, or water sources important to sensitive species. Survey reports document species and resources found and provide mitigation recommendations.

2.1 Sites Surveyed and Sensitive and Protected/Regulated Species Observed

During 2010, biological surveys for 30 projects were conducted on the NNSS (Figure 2-1 and Table 2-2). For some of the projects, multiple sites were surveyed (Figure 2-1). Scientists surveyed a total of 608.00 hectares (ha) (1,502.40 acres [ac]) for the projects (Table 2-2). A total of 20 projects was within the range of the threatened desert tortoise (*Gopherus agassizii*). Sensitive and protected/regulated species and important biological resources found included 1 desert tortoise, 12 desert tortoise burrows, 3 predator burrows, 19 kit fox (*Vulpes velox macrotis*) burrows, 1 burrowing owl (*Athene cunicularia*) burrow, 1 common raven (*Corvus corax*) nest with 2 chicks, a bat roost, Joshua trees (*Yucca brevifolia*), and cacti (Table 2-2). NSTec provided written summary reports to project managers of all survey findings and mitigation recommendations, where applicable (Table 2-2). The desert tortoise burrows were flagged and avoided during project activities.

2.2 Potential Habitat Disturbance

Surveys are conducted at old industrial or nuclear weapons testing sites whenever vegetation has recolonized the sites and sensitive or protected/regulated species known to occur in the area may be found. For example, desert tortoises may move through revegetated earthen sumps and may be concealed under vegetation during activities where heavy equipment is used. Preactivity surveys are conducted to ensure that desert tortoises are not in harm’s way. Burrowing owls frequently inhabit burrows and culverts at disturbed sites, so preactivity surveys are conducted to ensure that adults, eggs, and nestlings are not harmed.

Of the 30 projects for which surveys were conducted, 27 were within sites previously disturbed (e.g., road shoulders, old building sites, industrial waste sites, or existing well pads) (Table 2-2). Three projects were located in areas that had not been previously disturbed. These projects could potentially disturb 147.64 ha (364.83 ac) of land that were previously considered undisturbed. Two projects occurred in areas designated as important habitats (Table 2-3 and Figure 2-2). During vegetation mapping of the NNSS (Ostler, et al., 2000), Ecological Landform Units (ELUs) were evaluated for importance. Some ELUs were identified as *Pristine Habitat* (having few man-made disturbances), *Unique Habitat* (containing uncommon biological resources such as a natural wetland), *Sensitive Habitat* (containing vegetation associations that recover very slowly from direct disturbance or are susceptible to erosion), and *Diverse Habitat* (having high plant species diversity) (U.S. Department of Energy, Nevada Operations Office [DOE/NV], 1998). A single ELU could be classified as more than one type of these four types of important habitats.

Table 2-1. List of sensitive and protected/regulated species known to occur on or adjacent to the NNSS

Plant Species	Common Names	Status[a]
Moss Species		
Entosthodon planoconvexus	Planoconvex cordmoss	S, T
Flowering Plant Species		
Arctomecon merriamii	White bearpoppy	S, W
Astragalus beatleyae	Beatley milkvetch	S, W
Astragalus funereus	Black woollypod	S, W
Astragalus oophorus var. *clokeyanus*	Clokey eggvetch	S, W
Camissonia megalantha	Cane Spring suncup	S, W
Cymopterus ripleyi var. *saniculoides*	Sanicle biscuitroot	S, W
Eriogonum concinnum	Darin buckwheat	S, W
Eriogonum heermannii var. *clokeyi*	Clokey buckwheat	S, W
Frasera pahutensis	Pahute green gentian	S, W
Galium hilendiae ssp. *kingstonense*	Kingston Mountains bedstraw	S, T
Hulsea vestita ssp. *inyoensis*	Inyo Hulsea	S, W
Ivesia arizonica var. *saxosa*	Rock purpusia	S, W
Penstemon fruticiformis ssp. *amargosae*	Death Valley beardtongue	S, T
Penstemon pahutensis	Pahute Mesa beardtongue	S, W
Phacelia beatleyae	Beatley Scorpionflower	S, W
Phacelia filiae	Clarke Phacelia	S, W
Phacelia mustelina	Weasel Phacelia	S, W
Agavaceae	Yucca (3 species), Agave (1 species)	CY
Cactaceae	Cacti (18 species)	CY
Juniperus osteosperma	Juniper	CY
Pinus monophylla	Pinyon	CY

Table 2-1. List of sensitive and protected/regulated species known to occur on or adjacent to the NNSS (continued)

Animal Species	Common Name	Status[a]
Mollusk Species		
Pyrgulopsis turbatrix	Southeast Nevada pyrg	S, A
Reptile Species		
Eumeces gilberti rubricaudatus	Western red-tailed skink	S, E
Gopherus agassizii	Desert tortoise	LT, S, NPT, IA
Bird Species[b]		
Accipiter gentilis	Northern goshawk	S, NPS, IA
Alectoris chukar	Chukar	G, IA
Aquila chrysaetos	Golden eagle	EA, NP, IA
Buteo regalis	Ferruginous hawk	S, NP, IA
Callipepla gambelii	Gambel's quail	G, IA
Coccyzus americanus	Western yellow-billed cuckoo	C, S, NPS, IA
Falco peregrinus	Peregrine falcon	S, NPE, IA
Haliaeetus leucocephalus	Bald eagle	EA, S, NPE, IA
Ixobrychus exillis hesperis	Western least bittern	S, NP, IA
Lanius ludovicianus	Loggerhead shrike	NPS, IA
Oreoscoptes montanus	Sage thrasher	NPS, IA
Phainopepla nitens	Phainopepla	S, NP, IA
Spizella breweri	Brewer's sparrow	NPS
Toxostuma bendirei	Bendire's thrasher	S,NP, IA
Toxostoma lecontei	LeConte's thrasher	S, NP, IA
Mammal Species		
Antilocapra americana	Pronghorn antelope	G, IA
Antrozous pallidus	Pallid bat	M, NP, A
Cervus elaphus	Rocky Mountain elk	G, IA
Corynorhinus townsendii	Townsend's big-eared bat	S, H, NPS, A
Equus asinus	Burro	H&B, IA
Equus caballus	Horse	H&B, A
Euderma maculatum	Spotted bat	S, M, NPT, A
Lasionycteris noctivagans	Silver-haired bat	M, A

Table 2-1. List of sensitive and protected/regulated species known to occur on or adjacent to the NNSS (continued)

Animal Species	Common Name	Status[a]
Lasiurus blossevillii	Western red bat	S, H, NPS, A
Lasiurus cinereus	Hoary bat	M, A
Lynx rufus	Bobcat	F, IA
Microdipodops megacephalus	Dark kangaroo mouse	NP, A
Microdipodops pallidus	Pale kangaroo mouse	S, NP, A
Myotis californicus	California myotis	M, A
Myotis ciliolabrum	Small-footed myotis	M, A
Myotis evotis	Long-eared myotis	M, A
Myotis thysanodes	Fringed myotis	S, H, NP, A
Myotis yumanensis	Yuma myotis	M, A
Ovis canadensis nelsoni	Desert bighorn sheep	G, IA
Odocoileus hemionus	Mule deer	G, A
Pipistrellus hesperus	Western pipistrelle	M, A
Puma concolor	Mountain lion	G, A
Sylvilagus audubonii	Audubon's cottontail	G, IA
Sylvilagus nuttallii	Nuttall's cottontail	G, IA
Tadarida brasiliensis	Brazilian free-tailed bat	NP, A
Urocyon cinereoargenteus	Gray fox	F, IA
Vulpes velox macrotis	Kit fox	F, IA

[a]Status Codes:

Endangered Species Act, U.S. Fish and Wildlife Service
- LT - Listed Threatened
- C - Candidate for listing

U.S. Department of Interior
- H&B - Protected under *Wild Free Roaming Horses and Burros Act*
- EA - Protected under *Bald and Golden Eagle Act*

State of Nevada – Animals
- S - Nevada Natural Heritage Program – Animal and Plant At Risk Tracking List
- NPE - Nevada Protected-Endangered, species protected under Nevada Administrative Code (NAC) 503
- NPT - Nevada Protected-Threatened, species protected under NAC 503
- NPS - Nevada Protected-Sensitive, species protected under NAC 503
- NP - Nevada Protected, species protected under NAC 503
- G - Regulated as game species
- F - Regulated as fur-bearer species

Table 2-1. List of sensitive and protected/regulated species known to occur on or adjacent to the NNSS (continued)

State of Nevada – Plants
- S - Nevada Natural Heritage Program – Animal and Plant At Risk Tracking List
- CY - Protected as a cactus, yucca, or Christmas tree

Nevada Native Plant Society (NNPS)
- T - Threatened Species
- W - Watch Species

Long-term Animal Monitoring Status for the NNSS
- A - Active
- IA - Inactive
- E - Evaluate

Nevada Bat Conservation Plan – Bat Species Risk Assessment
- H - High
- M - Moderate

[b] All bird species on the NNSS are protected by the *Migratory Bird Treaty Act* except for chukar, Gambel's quail, English house sparrow, Rock dove, and European starling.

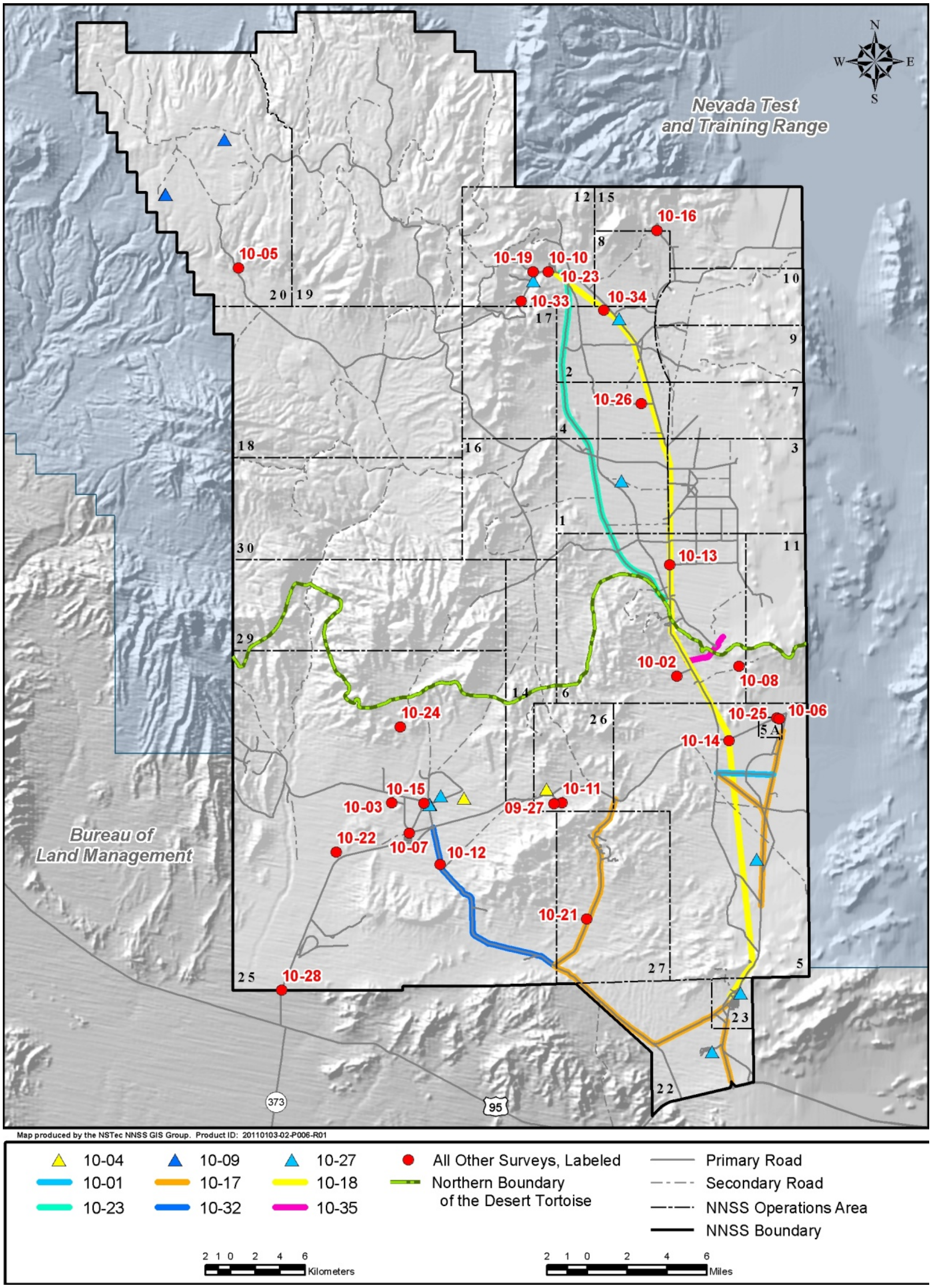

Figure 2-1. Biological surveys conducted on the NNSS during 2010

Table 2-2. Summary of biological surveys conducted on the NNSS during 2010

Project No.	Project	Important Species/Resources Found	Area Surveyed in ha (ac)	Proposed Project Area in Undisturbed Habitat in ha (ac)	Mitigation Recommendations
10-01	5-07 Road mowing	None	9.18 (22.68)	0	Environmental monitor (EM) needed
10-02	Device Assembly Facility Security Trailer	None	0.83 (2.05)	0	EM needed
10-03	Engine Maintenance, Assembly, and Disassembly (EMAD) Demolition	None	0.001 (0.002)	0	None
10-04	Reactor Maintenance, Assembly, and Disassembly/Pluto Demolitions	Joshua trees	0.65 (1.61)	0	Avoid Joshua trees if possible
10-05	Underground Test Area ER-20-4	None	1.33 (3.29)	0	None
10-06	Radioactive Waste Management Complex Disposal Pit	Joshua trees	8.96 (22.14)	0	Salvage Joshua trees if possible
10-07	Area 25 Waterline break	None	1.44 (3.56)	0	EM needed
10-08	Explosive Ordnance Disposal Unit	None	1.32 (3.26)	0	EM needed
10-09	Borehole plugging	None	0.45 (1.11)	0	None
10-10	Area 12 road mowing	None	0.025 (0.06)	0	None
10-11	Port Gaston Pad Extension	None	0.54 (1.33)	0.24 (0.59)	Mitigation required; EM needed
10-12	Area 25 Cable Splice	None	0.025 (0.06)	0	EM needed
10-13	Tweezer Road mowing	None	4.40 (10.87)	0	None
10-14	Frenchman Flat Substation mowing	None	1.86 (4.60)	0	EM needed
10-15	J-14 Water Well	None	1.07 (2.64)	0	EM needed
10-16	Source Physics Experiments	None	27.00 (66.72)	26.0 (64.25)	None
10-17	Jackass Flats Road mowing	Tortoise, kit fox burrow, tortoise burrow, predator burrow	126.34 (312.19)	0	EM needed; tortoise moved out of project area; avoid burrows if possible

Table 2-2. Summary of biological surveys conducted on the NNSS during 2010 (continued)

Project Number	Project	Important Species/Resources Found	Area Surveyed in ha (ac)	Proposed Project Area in Undisturbed Habitat in ha (ac)	Mitigation Recommendations
10-18	Fiber Optic Cable (Mercury – Area 12)	1 tortoise burrow, 2 kit fox burrows, 2 predator burrows, cacti/yuccas	118.94 (293.91)	0	EM needed for southern part; avoid burrows if possible
10-19	U12u	Raven nest w/2 chicks, bat roost	0.24 (0.59)	0	Avoid nest until chicks fledge
10-21	Area 27 Landing zone	None	1.00 (2.47)	0	EM needed
10-22	Area 25 Waterline break	None	0.08 (0.20)	0	EM needed
10-23	Tippipah Highway roadside grading	None	71.17 (175.86)	0	None
10-24	Calico Hills road grading	None	1.00 (2.47)	0	None
10-25	Power Pole installation at Radioactive Waste Management Complex (RWMC)	None	0.03 (0.07)	0	None
10-27	Corrective Action Unit 561	None	5.47 (13.52)	0	EM needed on some sites
10-28	Solar Demonstration Project	9 tortoise burrows, 16 kit fox/predator burrows, cacti	121.40 (300.00)	121.40 (300.00)	EM needed; mitigation required; avoid burrows
10-32	Various Roadside mowing	None	79.73 (197.02)	0	EM needed on one site
10-33	Area 12 Fiber Optic line	None	4.18 (10.33)	0	None
10-34	Valley Substation	None	0.08 (0.20)	0	None
10-35	Area 6 Fiber Optic Line	1 tortoise burrow, 2 owl burrows	19.26 (47.59)	0	EM needed; avoid burrows
		Totals in ha (ac)	**608.001 (1502.403)**	**147.64 (364.83)**	

Table 2-3. Total area in hectares (acres in parentheses) disturbed within important habitats in 2010 and over the past 12 years

Project No.	Project Name		Pristine Habitat	Unique Habitat	Sensitive Habitat	Diverse Habitat
10-16	Source Physics Experiments		0	0	26.0 (64.25)*	0
10-28	Solar Demonstration Project		0	0	121.40 (300.00)*	0
	2010 Total:	**147.40**	**0**	**0**	**147.40**	**0**
		(364.24)	**(0)**	**(0)**	**(364.24)**	**(0)**
	1999–2010 Grand Total:	**441.73**	**9.46**	**11.85**	**334.59**	**85.83**
		(1,091.54)	**(23.37)**	**(29.28)**	**(826.79)**	**(212.11)**

* This is the total projected area to be disturbed; actual area disturbed may be much less. This will be updated in 2011.

Figure 2-2 shows the distribution of these important habitats, ranked so that pristine habitat overlays unique habitat, which then overlays sensitive habitat, which then overlays diverse habitat. The expected area disturbed in important habitats due to 2010 projects is 147.40 ha (364.24 ac) (Table 2-3). Since 1999, the total area of important habitat disturbed by NNSA/NSO activities is 441.73 ha (1,091.54 ac). This tally may be used to document the loss of important habitat.

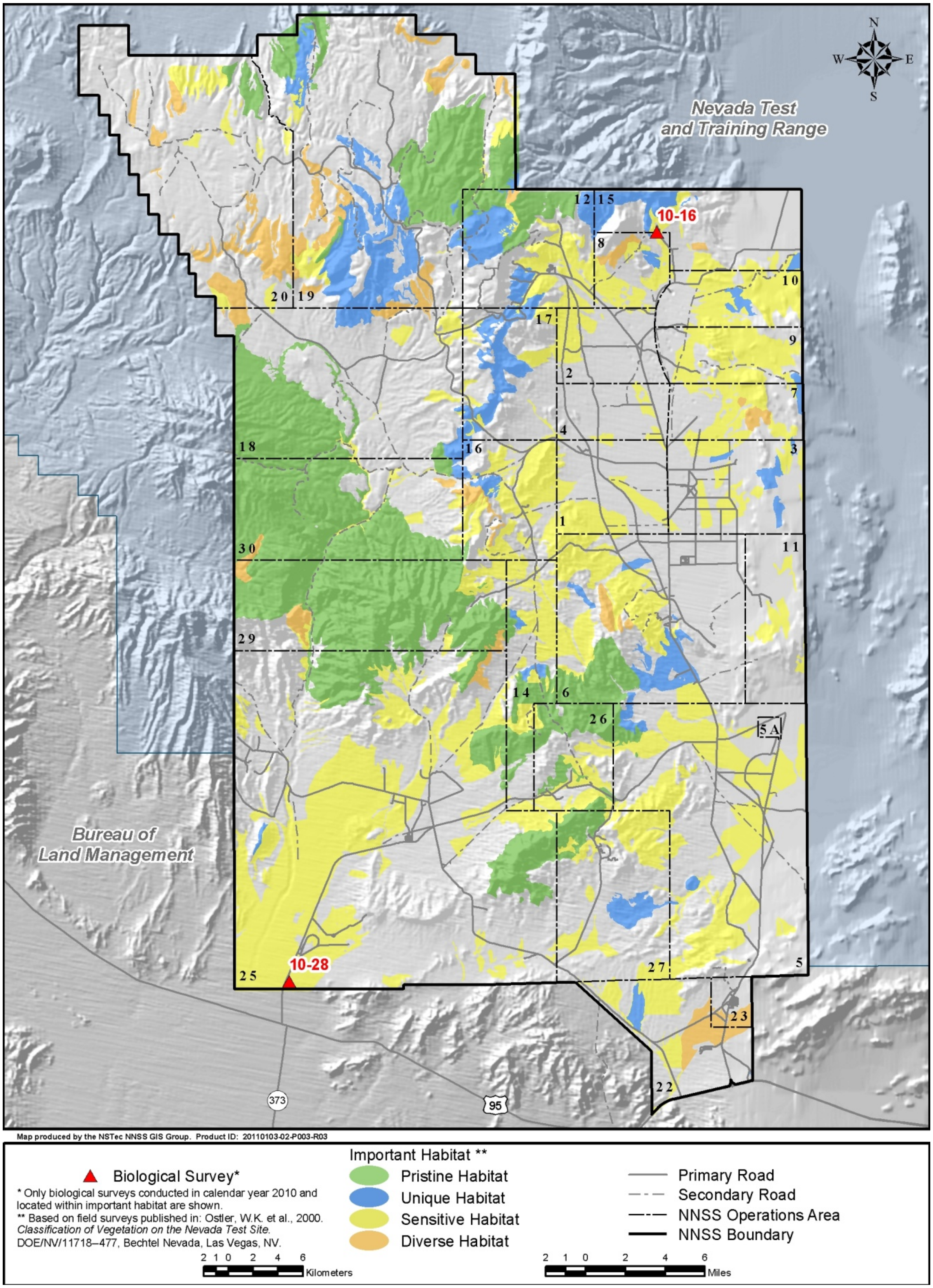

Figure 2-2. Biological surveys conducted in important habitats of the NNSS during 2010

3.0 DESERT TORTOISE COMPLIANCE

Desert tortoises occur within the southern one-third of the NNSS. This species is listed as threatened under the *Endangered Species Act*. In December 1995, NNSA/NSO completed consultation with the U.S. Fish and Wildlife Service (FWS) concerning the effects of NNSA/NSO activities, as described in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996), on the desert tortoise. NNSA/NSO received a final Biological Opinion (Opinion) from the FWS in August 1996 (FWS, 1996). On July 2, 2008, NNSA/NSO provided the FWS with a Biological Assessment of anticipated activities on the NNSS for the next 10 years and entered into formal consultation with FWS to obtain a new Opinion for the NNSS. NNSA/NSO received the final Opinion on February 12, 2009. This Opinion covers the anticipated activities at the NNSS until 2019.

The Desert Tortoise Compliance task of EMAC implements the terms and conditions of the Opinion, documents compliance actions taken by NNSA/NSO, and assists NNSA/NSO in FWS consultations. The terms and conditions that were implemented by NSTec staff biologists in 2010 include (a) conducting clearance surveys at project sites within one day from the start of project construction, (b) ensuring that environmental monitors are on site during site clearing and during heavy equipment operation, (c) developing effects analysis for proposed disturbances to append to the Opinion, and (d) preparing an annual compliance report for NNSA/NSO submittal to the FWS.

3.1 Project Surveys and Compliance Documentation

During 2010, biologists conducted biological and desert tortoise clearance surveys prior to ground-disturbing activities for 20 proposed projects within the range of the desert tortoise on the NNSS (Table 3-1 and Figure 3-1). Most of these projects were in, or immediately adjacent to, roads, existing facilities, or other disturbances. One desert tortoise was moved from a project area, and 12 tortoise burrows were found during tortoise clearance surveys (Table 2-2). These tortoise burrows (Projects 10-17, 10-18, 10-28, and 10-35) were flagged and avoided or will be avoided during project activities.

Two projects were initiated that disturbed previously undisturbed desert tortoise habitat. Project 09-27 and 10-11 disturbed 1.81 ha (4.46 ac) of desert tortoise habitat (Table 3-1). These projects are located south of Port Gaston in Area 26. Project 10-28 is anticipated to disturb as much as 121.4 ha (300.00 ac) of undisturbed habitat near the southern border of the NNSS east of Lathrop Wells gate in Area 25. This project has not yet started disturbing ground, so the final total area disturbed cannot be calculated, but will be included in the 2011 report. NSTec Ecological Services ensured that onsite construction monitoring was conducted by a designated environmental monitor at all sites where desert tortoise clearance surveys were performed.

Post-activity surveys to quantify the acreage of tortoise habitat actually disturbed were conducted for one project during this reporting period (Table 3-1). Post-activity surveys were not conducted if the projects were located within previously disturbed areas or if the environmental monitor documented that the project stayed within its proposed boundaries. In 2010, a total of 1.81 ha (4.46 ac) of tortoise habitat was disturbed (Table 3-1).

Table 3-1. Summary of tortoise compliance activities conducted by NSTec biologists during 2010

Project Number	Project	Compliance Activities 100% Coverage Clearance Survey	Tortoise Habitat Disturbed in ha (ac)
09-27	Port Gaston	Yes, post-activity survey completed	1.57 (3.87)
10-01	5-07 Roadside mowing	Yes*	0 (0)
10-02	Device Assembly Facility Security Trailers	Yes*	0 (0)
10-04	Reactor Maintenance, Assembly, and Disassembly/Pluto Demolitions	Yes*	0 (0)
10-06	Radioactive Waste Management Complex (RWMC) Disposal pit	Yes*	0 (0)
10-07	Area 25 Waterline break	Yes*	0 (0)
10-08	Explosive Ordnance Disposal Unit	Yes*	0 (0)
10-11	Port Gaston Pad Extension	Yes*	0.24 (0.59)
10-12	Area 25 Cable Splice	Yes*	0 (0)
10-14	Frenchman Flat Substation mowing	Yes*	0 (0)
10-15	J-14 Water Well	Yes*	0 (0)
10-17	Roadside mowing	Yes*	0 (0)
10-18	Fiber Optic Line Mercury – Control Point	Yes*	0 (0)
10-21	Area 27 Landing Zone	Yes*	0 (0)
10-22	Area 25 Waterline break	Yes*	0 (0)
10-24	Calico Hills Road grading	Yes*	0 (0)
10-25	Power Poles to RWMC	Yes*	0 (0)
10-27	Corrective Action Unit 561	Yes*	0 (0)
10-28	Solar Demonstration Project	Yes, post-activity survey not completed yet; project is on-going	TBD
10-32	Roadside mowing	Yes*	0 (0)
10-35	Area 6 Fiber Optic Line	Yes*	0 (0)
		Total	**1.81 (4.46)**

*Post-activity survey was unnecessary because project was located within previously disturbed tortoise habitat.

TBD = To be determined

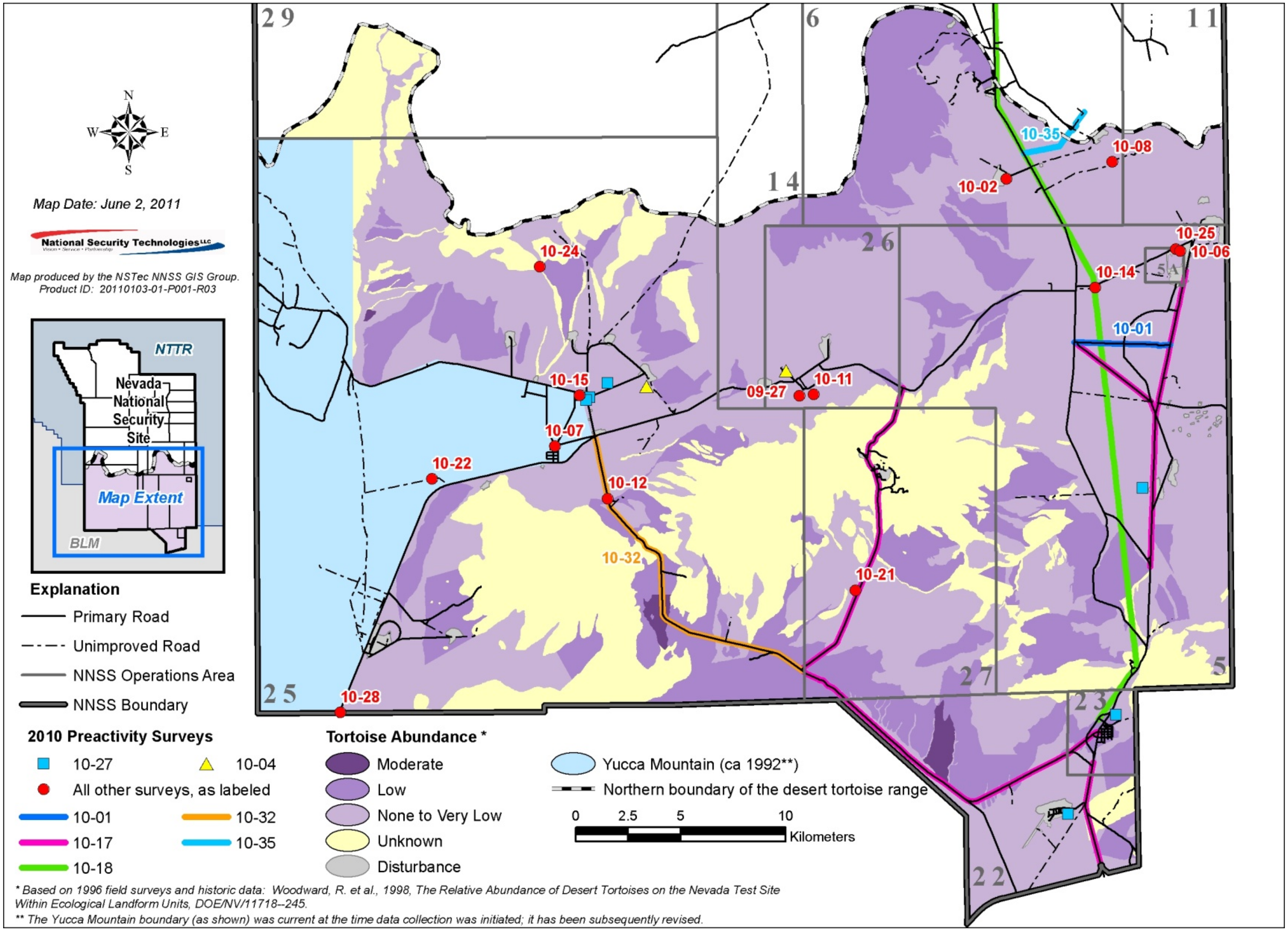

Figure 3-1. Biological surveys conducted in desert tortoise habitat on the NNSS during 2010

In January 2010, NSTec submitted to NNSA/NSO the annual Opinion report that summarized tortoise compliance activities conducted on the NNSS from January 1 through December 31, 2009. This report, required under the Opinion, contains (a) the location and size of land disturbances that occurred within the range of the desert tortoise during the reporting period; (b) the number of desert tortoises injured, killed, or removed from project sites; (c) a map showing the location of all tortoises sighted on or near roads on the NNSS; and (d) a summary of construction mitigation and monitoring efforts.

Compliance with the Opinion ensures that the desert tortoise is protected on the NNSS and that the cumulative impacts on this species are minimized (DOE/NV, 1998). In the Opinion, the FWS determined that the "incidental take" of tortoises on the NNSS and the cumulative acreage of tortoise habitat disturbed on the NNSS are parameters to be measured and monitored annually. During 2010, the threshold levels established by the FWS for these parameters were not exceeded (Table 3-2). No desert tortoises were accidentally injured or killed by project activities. One desert tortoise was picked up and removed from a project site. This "take" is listed in the other column for Infrastructure Development. Two desert tortoises were killed by vehicles both along Jackass Flats Road in Area 22 in 2010. This brings the cumulative number of tortoises killed under this Opinion to three (Table 3-2). In 2010, 13 tortoises were removed from roads to avoid being killed or injured. This brings the total number of tortoises moved during the first 2 years of the Opinion to 18 as reported in the "Other" column of Table 3-2.

Table 3-2. Parameters, cumulative values, and thresholds for desert tortoise monitoring on the NNSS as set forth in the Opinion

Program	Number of Acres Impacted (maximum allowed)	Number of Tortoises Anticipated to be Incidentally Taken (maximum allowed)	
		Killed/Injured	Other
Defense	5.61* (500)	0 (1)	0 (10)
Waste Management	0 (100)	0 (1)	0 (2)
Environmental Restoration	0 (10)	0 (1)	0 (2)
Nondefense Research and Development	0 (1,500)	0 (2)	0 (35)
Work for Others	6.93 (500)	0 (1)	0 (10)
Infrastructure Development	0 (100)	0 (1)	1 (10)
Roads	0 (0)	3 (15)	18 (125)
Totals	**12.54 (2,710)**	**3 (22)**	**19 (194)**

*Estimated area, project is not yet completed.

3.2 Mitigation for Loss of Tortoise Habitat

Mitigation for the loss of tortoise habitat is required under the terms and conditions of the Opinion. The Opinion requires NNSA/NSO to perform either of two mitigation options: (a) pre-pay funds into the Desert Tortoise Mitigation Funds administered by Clark County (current 2010 rate is $1,912.55 per each ha [$774 for each ac] of habitat disturbed), or (b) prepay mitigation funds at the current rate, then revegetate disturbed habitat following specified criteria;

once the revegetation is successful, the money paid for mitigation will be refunded. Two projects, 09-27 and 10-11, disturbed land in 2010. Project 09-27 paid $2,917.98 for 1.566 ha (3.87 acres) at the 2009 mitigation rate of $1,863.13/ha ($754/acre). Project 10-11 paid $456.66 for disturbing 0.2387 ha (0.59 acres) at the 2010 rate of $774/acre. A total of $3,374.64 was paid into the Desert Tortoise Mitigation Fund to mitigate the 1.81 ha (4.46 ac) of land disturbed in 2010.

3.3 Coordination with Other Biologists and Wildlife Agencies

The 8.5 ha (21 ac) circular enclosures in Rock Valley were visited in 2010 with Phil Medica, a biologist with the U.S. Geological Survey (USGS) Western Ecological Research Center in Las Vegas, Nevada, to observe desert tortoises in the fenced plots. Two tortoises are still not accounted for in the enclosures. No marked desert tortoises were found above ground, but two young unmarked tortoises were found within the enclosures. An old tortoise burrow, where an unaccounted for tortoise was last seen within an enclosure, was excavated to determine if it had died in the burrow. Nothing was found in the burrow. Prior to 2010, evidence, in the form of tortoise shells with bite marks matching the width of a mountain lion's teeth, suggested that several desert tortoises had been killed, eaten, or removed from the enclosures by predators.

During February 26–28, 2010, an NSTec biologist attended the Desert Tortoise Council's 35th Annual Meeting and Symposium. This meeting was held in Ontario, California, and included numerous presentations on desert tortoise biology, ecology, and recovery efforts.

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4.0 ECOSYSTEM MONITORING

Ecological Services began comprehensive mapping of plant communities and wildlife habitat on the NNSS in fiscal year (FY) 1996. Data were collected describing selected biotic and abiotic habitat features within field mapping units called ELUs. ELUs are landforms (Peterson, 1981) with similar vegetation, soil, slope, and hydrology. Boundaries of the ELUs were defined using aerial photographs, satellite imagery, and field confirmation. ELUs are considered by NSTec biologists to be the most feasible mapping unit by which sensitive plant and animal habitats can be described. In 2000 and 2001, topical reports describing the classification of vegetation types on the NNSS were published and distributed (Ostler et al., 2000; Wills and Ostler, 2001). Ten vegetation alliances and 20 associations were reported to occur on the NNSS.

Efforts are made to update and collect new habitat data when possible. Efforts generally focus on the following tasks in support of ecosystem monitoring:

- **ELU sampling and photography –** No ecosystem mapping, sampling, or photography of ELUs was conducted in 2010.
- **Wildland fire fuels surveys –** A vegetation survey was conducted in the spring to determine wildland fire hazards due to accumulation of woody and fine fuels.
- **Evaluation of woody plant plots –** 22 pinyon/juniper woody plant plots were sampled in 2010 to document species presence and relative abundance.
- **West Nile virus (WNV) surveillance –** Seven mosquitoes from a total of 12 sites on the NNSS were surveyed and analyzed for WNV.
- **Hantavirus sampling –** 401 small mammal samples were collected and analyzed for hantavirus.
- **Natural wetlands monitoring** – Eight natural wetlands were monitored in 2010.
- **Constructed water source monitoring** – 20 sites containing constructed water sources were monitored in 2010.
- **Offsite Coordination –** Coordination was made with ecosystem management agencies and scientists.

4.1 Vegetation Survey for Determining Wildland Fire Hazards

Wildland fires on the NNSS require considerable financial resources for fire suppression and mitigation. For example, costs for fire suppression on or near the NNSS can cost as much as $198 per ha ($80 per ac) (Hansen and Ostler, 2004). Additional costs are also incurred for replacement of burned structures. For example, the Egg Point Fire in August 2002 (121 ha [300 ac]) cost well over $1 million to replace burned power poles, while reclamation of the site cost more than $200,000 to stabilize and revegetate.

There has been an average of 11.5 wildland fires per year on the NNSS since 1978 with an average of about 81.2 ha (200.6 ac) burned per fire (Table 4-1). Historically most wildland fires are caused by lightning and do not occur randomly across the NNSS, but occur more often in particular vegetation types that have sufficient fuels (woody and fine-textured fuels) that are conducive to ignition and spread of wildland fires. Once a site burns, it is much more likely to burn again because of the invasive annual plants that quickly colonize these areas (Brooks and Lusk, 2008).

Table 4-1. Number and acreage of wildland fires on the NNSS

Year	Fires	Hectares	Acres
1978	10	3,197	7,901
1979	6	1	2
1980	26	5,465	13,504
1981	13	3	7
1982	6	1	2
1983	16	7,402	18,291
1984	17	458	1,132
1985	11	651	1,609
1986	12	96	236
1987	14	86	213
1988	23	332	821
1989	15	131	323
1990	7	3	7
1991	4	2	4
1992	12	97	239
1993	7	3	7
1994	8	6	15
1995	8	1,864	4,605
1996	2	688	1,700
1997	6	6	15
1998	9	1,044	2,580
1999	7	20	50
2000	11	61	151
2001	8	198	490
2002	7	146	360
2003	4	2	4
2004	8	3	8
2005	31	5,261	13,000
2006	16	3,486	8,615
2007	15	6	15
2008	20	1	2
2009	17	95	235
2010	3	<0.5	<1.0
33-Year Total	**379.0**	**30,814.1**	**76,144.0**
Average Per Year	**11.5**	**933.8**	**2,307.4**
Average Per Fire		**81.2**	**200.6**

Source: Hansen, 2010

There were three wildland fires during 2010. One fire, near the U1a Complex in Area 1, was caused by a common raven landing on a power pole. Two other fires were caused by ordnance and were associated with training exercises. No fires were caused by lightning in 2010. Total area burned was less than 0.5 ha (1.0 ac) (Hansen, 2010).

Beginning in 2004, and in response to DOE O 450.1A, surveys were initiated on the NNSS to identify wildland fire hazards. Vegetation surveys were conducted in April and May 2010 at sites located along and adjacent to major NNSS corridors to estimate the abundance of fuels produced by native and invasive plants. Information about climate and wildland fire-related information reported by other government agencies was also identified and summarized as part of the wildland fire hazards assessment.

4.1.1 Survey Methods

The abundance of fine-textured (grasses and herbs) and coarse-textured (woody) fuels were visually estimated on numerical scales using an 11-point potential scale: 0 to 5 (in 0.5 increments, where 0.0 is barren and 5.0 is near maximum biomass encountered on the NNSS). Details of the methodology used to conduct the spring survey for assessing wildland fire hazards on the NNSS are described in a report by Hansen and Ostler (2004).

Photographs of sites typifying these different scale values are found in Appendix A of the *Ecological Monitoring and Compliance Program Calendar Year 2005 Report* (Bechtel Nevada, 2006). Additionally, the numerical abundance rating for fine fuels at a site was added to the numerical abundance rating of woody fuels to derive a combined fuels rating for each site that ranged from 0 to 10 in one-half integer increments. The index ratings for fuels at these survey sites were then plotted on a Geographic Information System (GIS) map and color-coded for abundance to indicate the wildland fire fuel hazards at various locations across the NNSS.

4.1.2 Survey Results

Climate – There are 17 rain gauges on the NNSS (Hansen and Ostler, 2004) that are used to measure precipitation. Precipitation during the months of January, February, March, and April is most correlated with production of vegetation that produces fine fuels and contributes to woody fuels. The total accumulated precipitation during this period was observed to be correlated with fine fuels biomass production during this winter/spring period as reported by Hansen and Ostler (2004). During 2010 the average precipitation of all 17 rain gauge stations on the NNSS during January–April was 13.16 centimeters (cm) (5.18 inches [in.]), or about 156% of the normal amount (i.e., the average precipitation for the last 30 years) (Table 4-1). Temperatures were also cooler than normal.

At the beginning of the national fire season, the National Wildfire Significant Fire Potential Outlook (National Interagency Fire Center, 2010) for the summer of 2010 (June, July, and August) predicted abnormally warmer average temperatures and about normal precipitation through the fire season summer months, with significant fire potential expected to be below normal.

Precipitation as measured by rain gauge stations on the NNSS is correlated with the El Niño Southern Oscillation (ENSO) patterns in the Pacific Ocean. These patterns can be useful in predicting wildland fire fuels. By historical standards, to be classified as a full-fledged El Niño or La Niña episode, Equatorial Pacific water temperatures must exceed threshold levels of +0.5°C (El Niño) or −0.5°C (La Niña) from the neutral (i.e., normal or mean) temperature. These thresholds (± 0.5°C) must be exceeded for a period of at least five consecutive overlapping 3-month seasons and also be forecasted to persist for 3 consecutive months (National Oceanic and Atmospheric Administration [NOAA], 2010). The ENSO patterns for the period of 1950–2010 (NOAA, 2010) are shown in Figure 4-1.

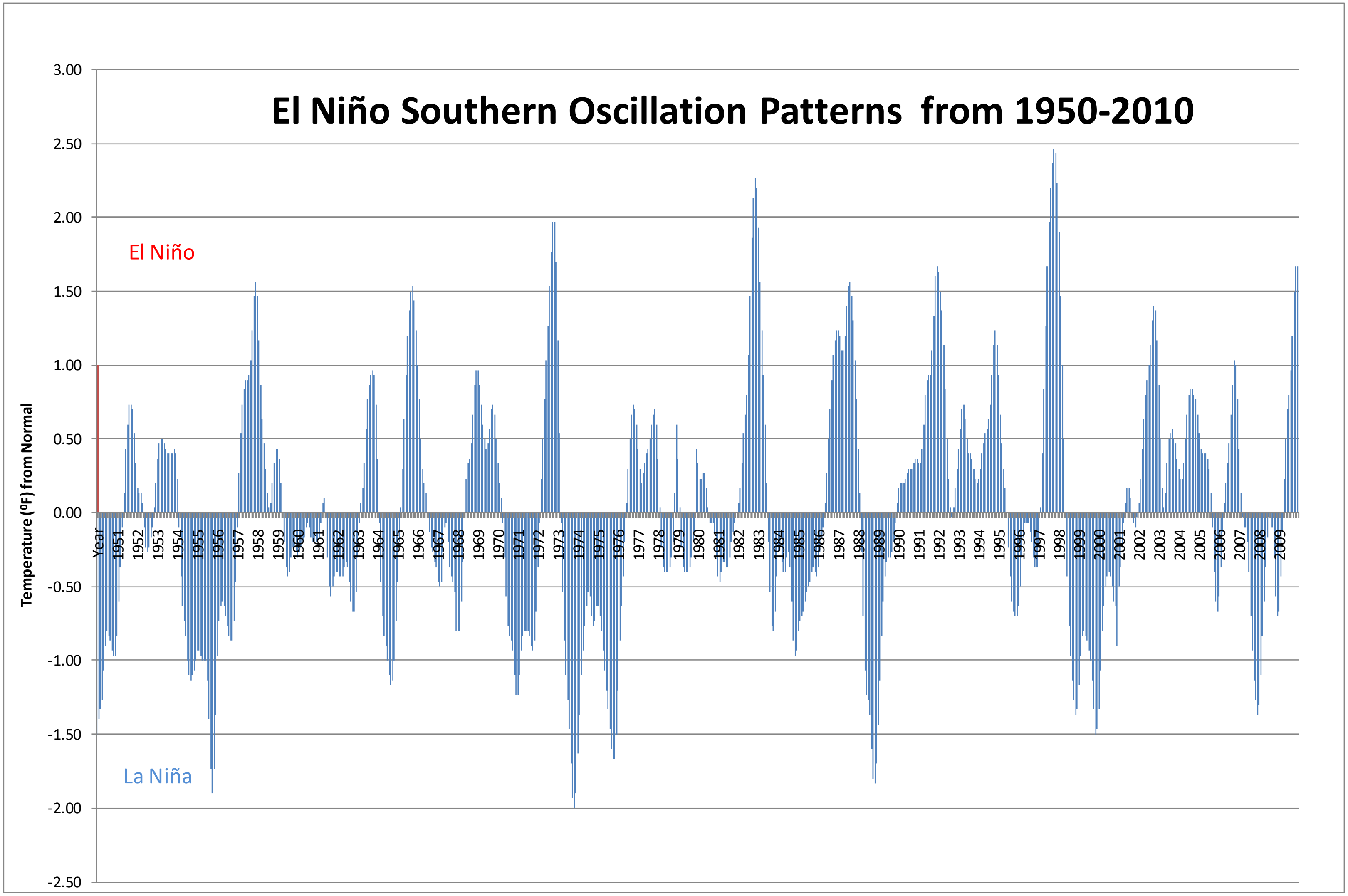


Figure 4-1. El Niño Southern Oscillation Patterns from 1950 to 2010 (NOAA, 2010)

Precipitation recorded at 11 representative rain gauge stations on the NNSS is shown in Table 4-2. These stations represent the major geographic areas of the NNSS (National Oceanic and Atmospheric Administration/Air Resources Laboratory/Special Operations and Research Division [NOAA/ARL/SORD], 2010). Precipitation from the other six rain gauge stations had fewer years of record or were located near areas with more complete records; these six sites are not included in Table 4-2. During periods of El Niño, precipitation at the 11 NNSS stations averaged approximately 139% of normal precipitation (i.e., precipitation during the ENSO neutral periods of time). During periods of La Niña, precipitation at the 11 NNSS stations averaged 88% of normal precipitation. Once an El Niño was reported, it continued from 7 to 21 months. The unusually long period of persistence of El Niño conditions provides a good indication that precipitation during the next 6 months may be above average and may therefore increase production of wildland fuels.

Fuels –Because of the increased precipitation in January, February, March, and April of 2010, there were higher amounts of new fine fuels than during 2007, 2008, or 2009 at most of the 106 sampling sites. Fine fuels observed in 2010 represent little or no residual fine fuels persisting from previous years. There was a slight increase in woody fuels, as foliage on branches of shrubs and trees grew and increased foliar canopy cover in response to the increased precipitation that occurred during the winter and spring months. The average combined index values (fine fuels plus woody fuels) for 2010 corresponds to the potential for fuels on the NNSS to support wildland fires once fuels are ignited. The higher the index, the greater the potential for wildland fires to spread. The NNSS average combined index value for fine fuels and woody fuels for 2010 was 4.89 compared to 4.52 in 2009, 4.81 in 2008, 4.77 in 2007, 5.26 in 2006, 5.64 in 2005 (a wet year), and 4.88 in 2004 (an average or normal precipitation year) (Hansen et al., 2008).

Figure 4-2 shows a comparison in trends of mean precipitation and mean combined fuel index values. The continuing drought (2007–2009) significantly reduced fine fuels and to a lesser extent woody fuels, and contributed to low moisture content in the fuels.

The location of the 106 survey stations on the NNSS inspected during 2010 are shown in Figures 4-3, 4-4, and 4-5, respectively.

The figures show average fine fuels, woody fuels, and combined fuels index values by NNSS operational area. Highest index values occurred in Fortymile Canyon, Pahute Mesa, and at moderate elevations and slopes around Yucca Flat.

Photographs were taken for all 106 sites during the past 6 years and can be compared for visual changes in site conditions. For example, Figure 4-6 shows photographs of Site 99 in Yucca Flat for the last 4 years. As in past years, sites with blackbrush and annual grasses appeared to respond to higher precipitation, resulting in increases in fine fuels and increases in woody fuels more than sites in the Mojave Desert (southern one-third of the NNSS) and the Great Basin Desert (northern one-third of the NNSS).

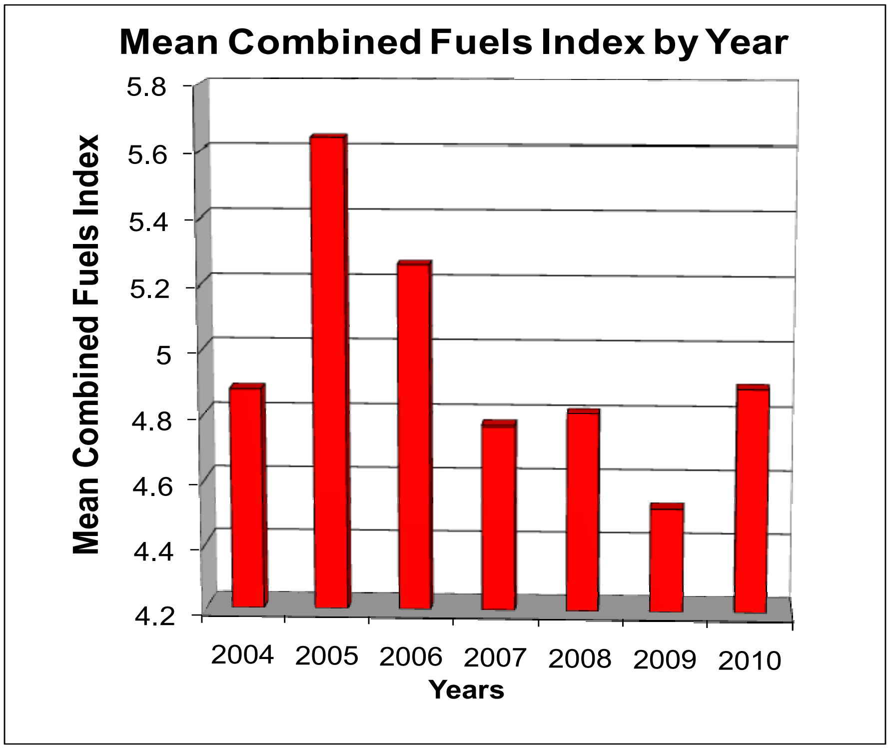
Fine fuels in 2010 were about 2 to 3 weeks delayed in maturing in most areas of the NNSS, perhaps due to the lower ambient temperatures. Based on the evidence of healthy green color and appearance of new plant growth, even in late May when vegetation usually begins to dry from the higher temperatures on the NNSS, it appeared that shrubs and trees were relatively moist compared to plant growth of shrubs and trees in 2007, 2008, and 2009. The hazards of fuels contributing to wildland fires were lower than average and were dependent on incidence of lightning, high winds, and ordnance training-related activities. The rapid response by NNSS Fire and Rescue after fires were ignited was a key factor in minimizing wildland fire spread and severity in 2010.

Table 4-2. Correlations of the El Niño Southern Oscillation Patterns and precipitation at selected NNSS weather stations (NOAA/ARL/SORD, 2010)

Correlations Between El Niño, La Niña, El Niño Southern Oscillation Neutral Periods, and Precipitation on the Nevada National Security Site

	El Niño			ENSO Neutral			La Niña		
Station (Span of Years)	Number Months	Ave. Precip./Month*	Percent of Neutral	Number Months	Ave. Precip./Month*	Percent of Neutral	Number Months	Ave. Precip./Month*	Percent of Neutral
Jackass Flats (1957-2010)	200	0.63 ± 0.13 inches	154%	279	0.41 ± 0.08 inches	100%	153	0.39 ± 0.11 inches	95%
Rainier Mesa (1959-2010)	180	1.30 ± 0.23 inches	148%	240	0.88 ± 0.14 inches	100%	152	0.89 ± 0.17 inches	101%
Rock Valley (1963-2010)	185	0.68 ± 0.14inches	148%	232	0.46 ± 0.09 inches	100%	143	0.39 ± 0.11 inches	85%
Mid Valley (1964-2010)	185	0.99 ± 0.20 inches	146%	214	0.68 ± 0.13 inches	100%	122	0.54 ± 0.15 inches	79%
Buster Jangle (1960-2010)	192	0.67 ± 0.12 inches	143%	259	0.47 ± 0.08 inches	100%	152	0.45 ± 0.10 inches	96%
PHS Farm (1964-2010)	185	0.77 ± 0.14 inches	138%	222	0.56 ± 0.10 inches	100%	133	0.50 ± 0.12 inches	89%
Paiute Mesa (1964-2010)	185	0.77 ± 0.11 inches	133%	230	0.58 ± 0.10 inches	100%	144	0.56 ± 0.73 inches	97%
Well 5B (1963-2010)	185	0.50 ± 0.09 inches	132%	229	0.38 ± 0.07 inches	100%	150	0.32 ± 0.08 inches	84%
Cane Springs (1964-2010)	185	0.81 ± 0.16 inches	133%	225	0.61 ± 0.13 inches	100%	143	0.46 ± 0.12 inches	75%
Mercury (1962-2010)	163	0.59 ± 0.11 inches	131%	194	0.45 ± 0.10 inches	100%	132	0.34 ± 0.09 inches	76%
Little Feller (1976-2010)	140	0.77 ± 0.15 inches	128%	189	0.60 ± 0.11 inches	100%	78	0.53 ± 0.16 inches	88%
		Mean/Station	**139%**					**Mean/Station**	**88%**

* Confidence interval at the α=0.05 level



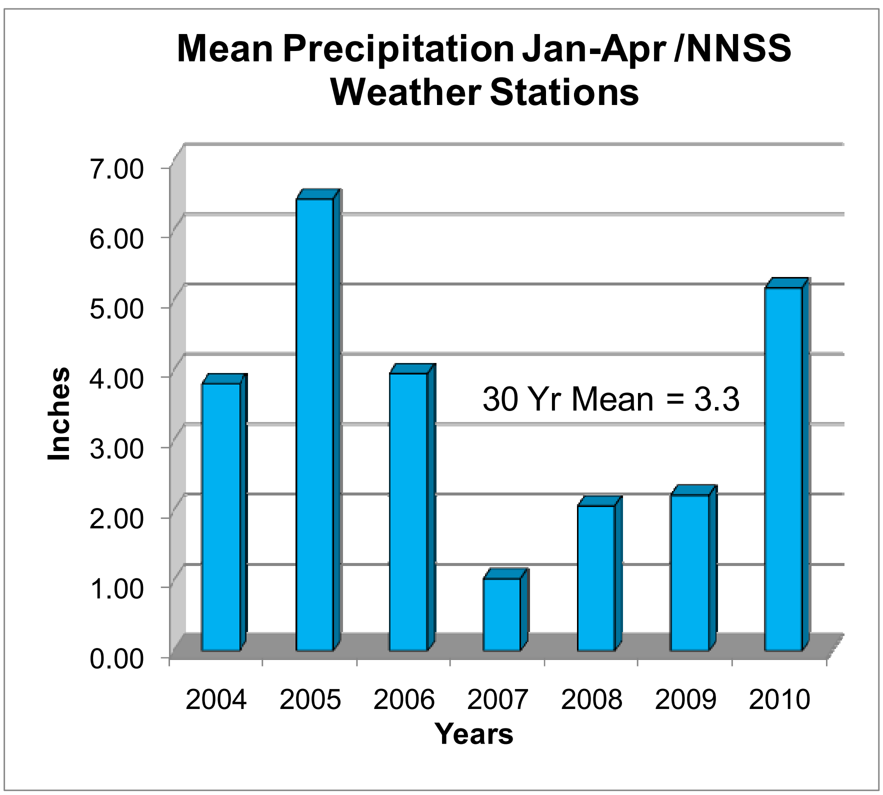


Figure 4-2. Mean combined fuels index (top) and percent of average precipitation for January through April (bottom) for the years 2004 to 2010

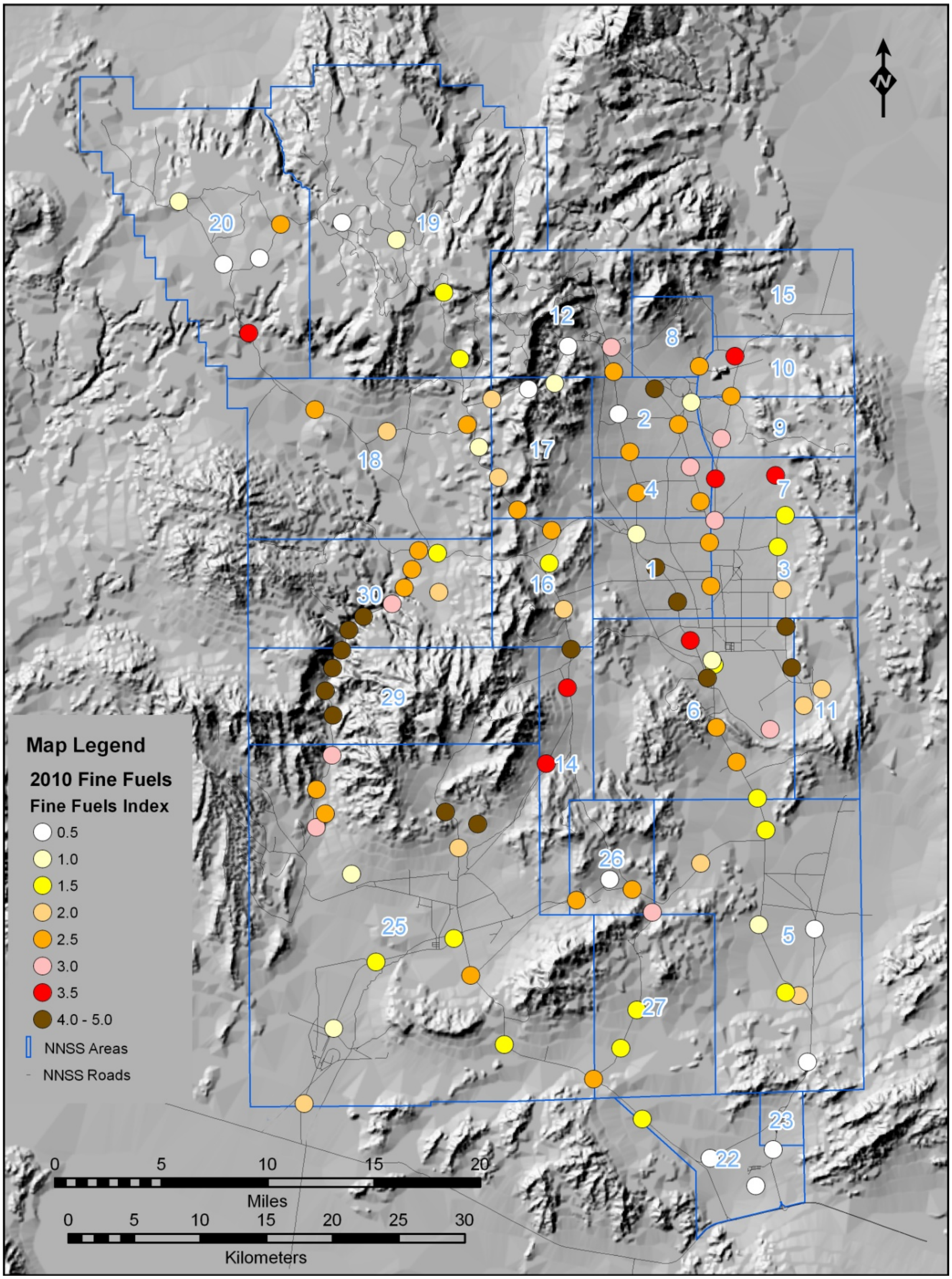


Figure 4-3. Index of fine fuels for 106 survey stations on the NNSS during 2010

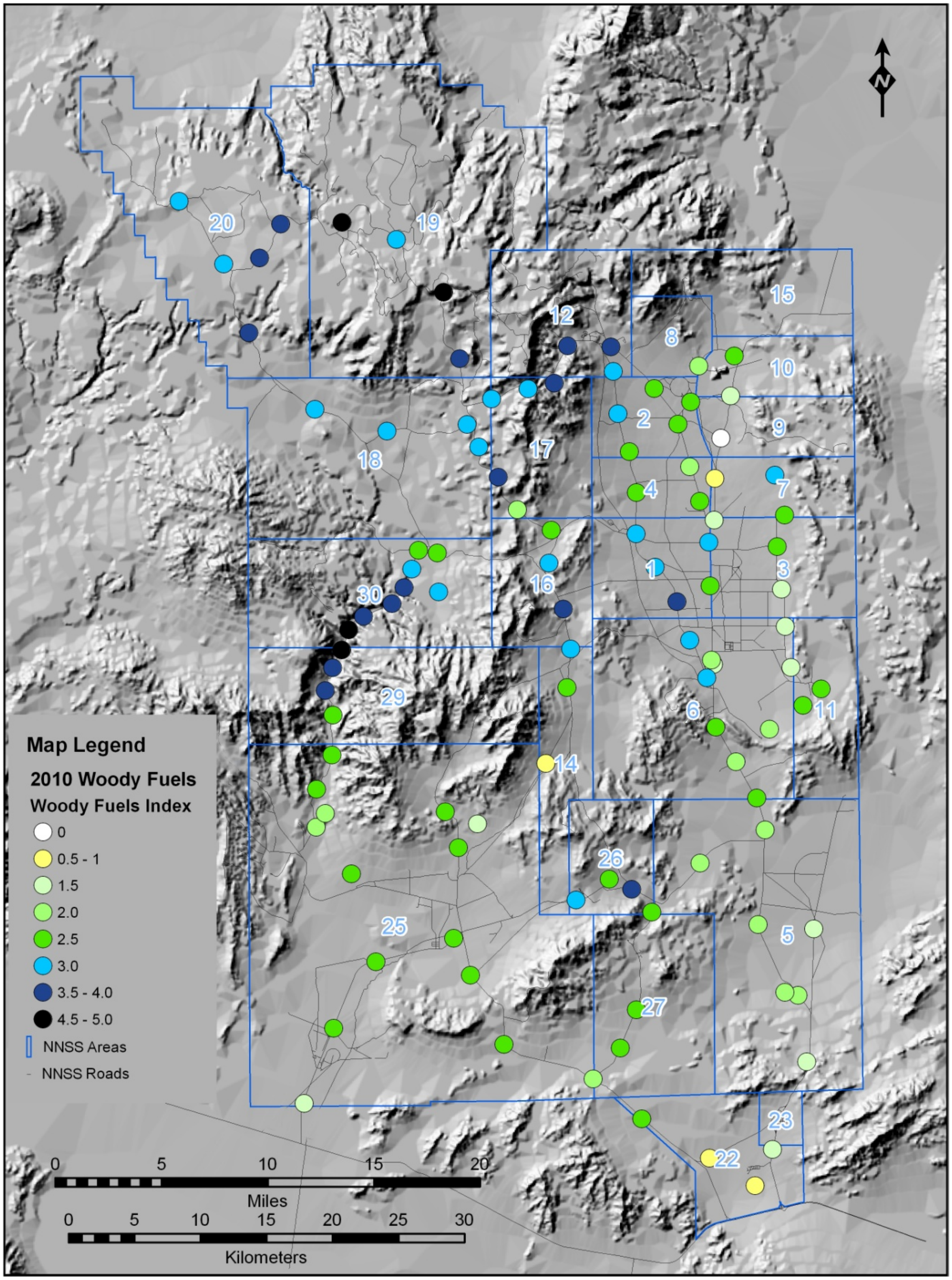


Figure 4-4. Index of woody fuels for 106 survey stations on the NNSS during 2010

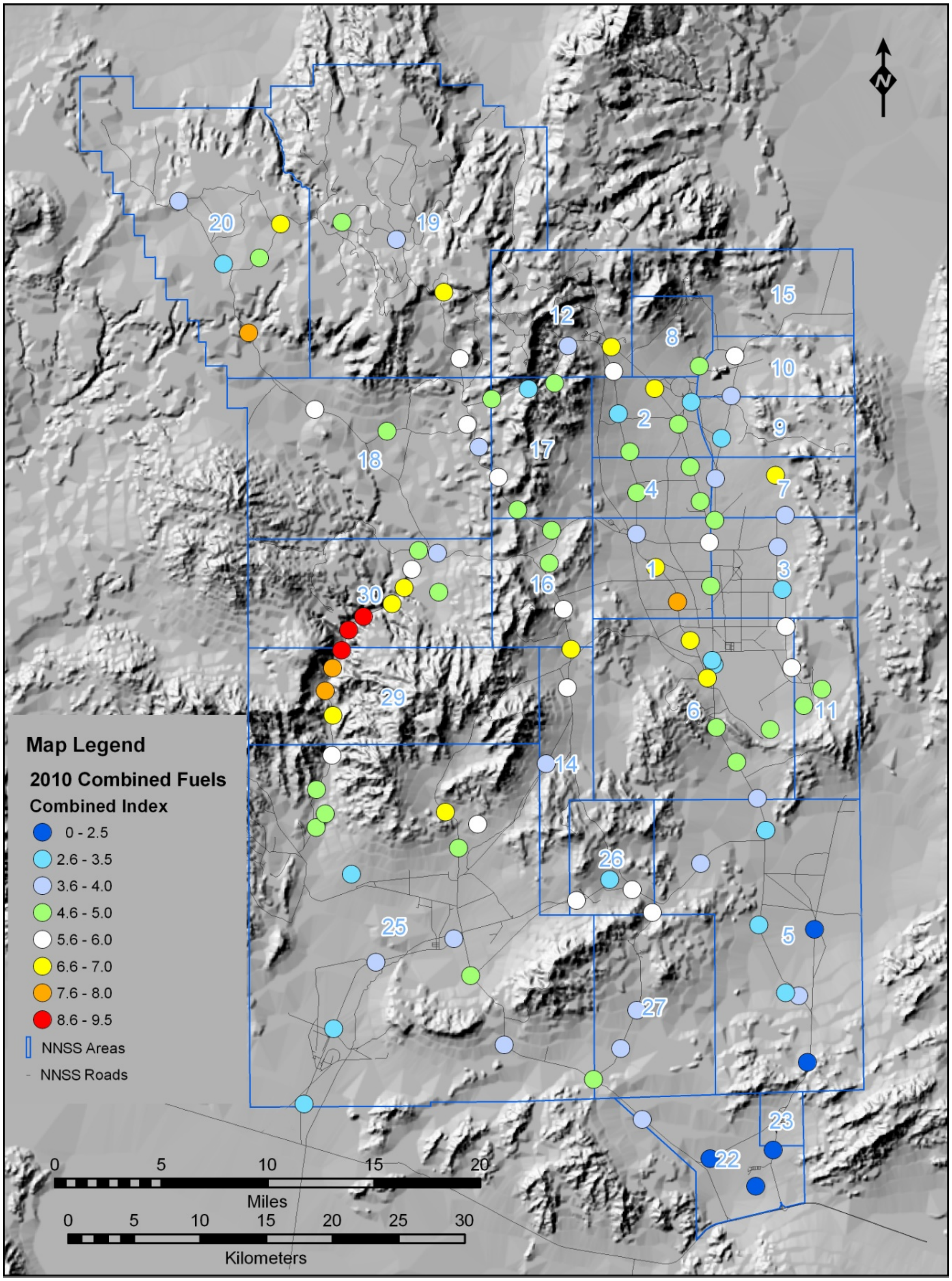


Figure 4-5. Index of combined fine fuels and woody fuels for 106 survey stations on the NNSS during 2010

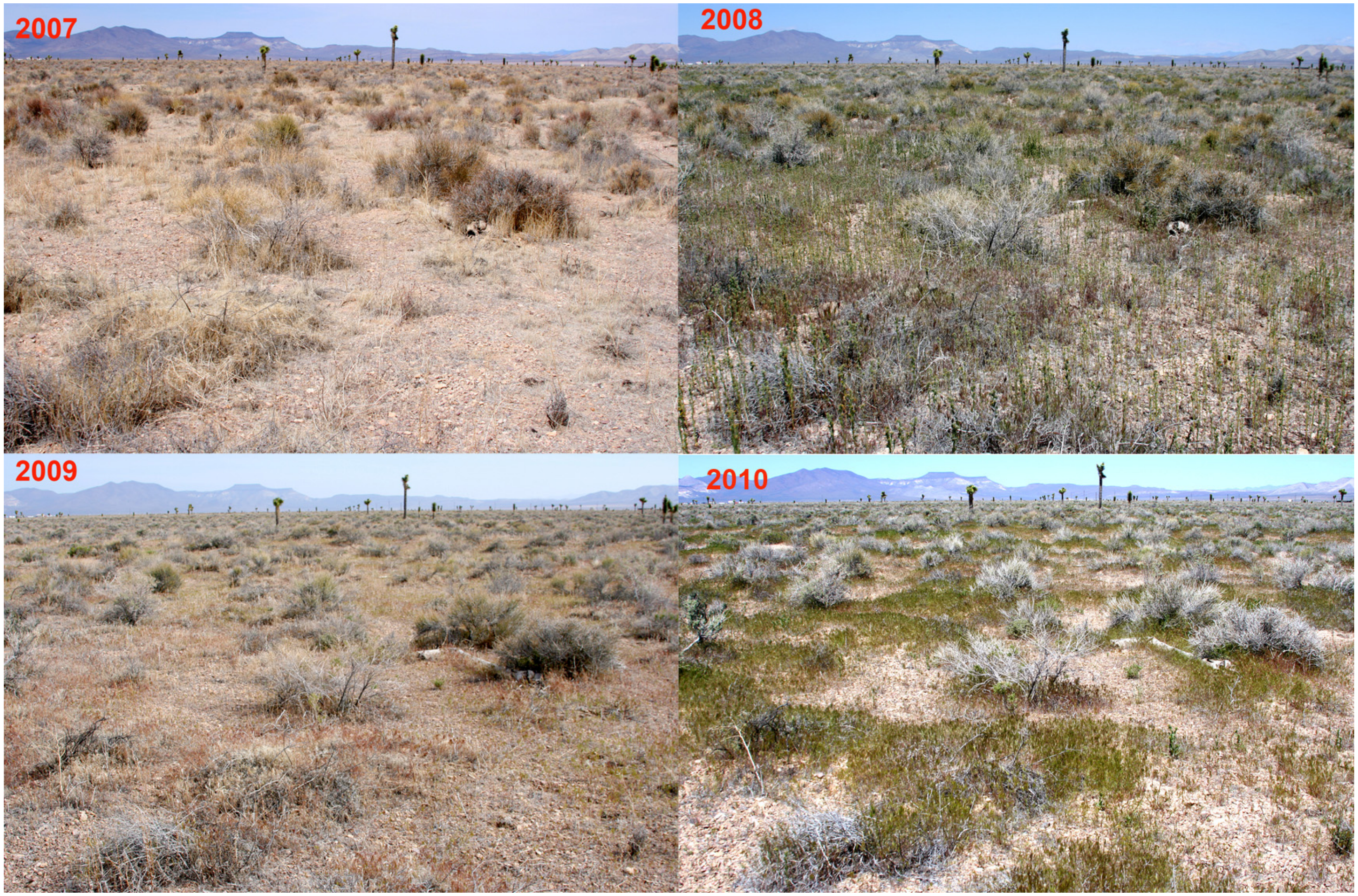


Figure 4-6. Site 99 on the West Side of Yucca Flat in 2007–2010
(Photos by W. K. Ostler, April 19, 2007 [top left]; April 10, 2008 [top right]; April 30, 2009 [bottom left]; and May 3, 2010 [bottom right]

Invasives – The three most commonly observed invasive annual plants to colonize burned areas on the NNSS are *Schismus arabicus* (Arabian schismus), found at low elevations; *Bromus rubens* (red brome), found at lower to moderate elevations; and *Bromus tectorum* (cheatgrass), found at middle to high elevations (Table 4-3). Colonization by invasive species increases the likelihood of future wildland fires because they provide abundant fine fuels that are more closely spaced than native vegetation. *Coleogyne ramosissima* (blackbrush) vegetation types appear to be the most vulnerable plant communities to fire, followed by pinyon-juniper/sagebrush vegetation types. Wildland fires are costly to control and to mitigate once they occur. Revegetation of severely burned areas can be very slow without reseeding or transplanting with native species and other rehabilitation efforts. Untreated areas become much more vulnerable to future fires once invasive species, rather than native species, colonize a burned area. Because of the higher amount of precipitation during January through April of 2010, fine fuels produced by invasive, introduced annual species and native species were higher than 2009.

Table 4-3. Precipitation history and percent presence of key plant species contributing to fine fuels at 106 surveyed sites

Precipitation History	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
	cm (in.)						
Precipitation* (January–April)	9.70 (3.82)	16.36 (6.44)	10.06 (3.96)	2.62 (1.03)	5.26 (2.07)	5.64 (2.22)	13.16 (5.18)
Invasive Introduced Species	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
	percent presence						
Bromus rubens (red brome)	51.7	64.4	67.8	0	63.0	63.2	58.5
Bromus tectorum (cheatgrass)	40.3	54.0	60.7	0	59.2	66.0	67.0
Erodium cicutarium (redstem stork's bill)	5.2	6.2	24.6	0	21.3	27.4	33.0
Schismus arabicus (Arabian schismus)	4.7	2.8	5.2	0	11.4	9.4	3.8
Native Species	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
	percent presence						
Amsinckia tessellata (bristly fiddleneck)	34.0	62.0	16.1	0	63.0	48.1	67.9
Mentzelia albicaulis (whitestem blazingstar)	49.8	8.1	0	0	2.4	18.9	51.9
Chaenactis fremontii (pincushion flower)	27.0	8.0	0	0	1.4	11.3	13.2

*30-year mean precipitation for the 17 rain gauges on the NNSS for the period of January–April is 8.46 cm (3.33 in.).

4.2 Woody Plant Plots

In 1963, Janice Beatley established 68 long-term ecological monitoring plots on the NNSS. These plots were located throughout much of the southern and eastern portions of the NNSS and represented the vegetation alliances in those areas. However, very few plots were established in the northwestern portions of the NNSS. Beatley originally classified the northwestern portions of the NNSS as mountains in her vegetation map of the NNSS that was included in her report on vascular plant distribution (Beatley, 1976). The major vegetation associations in this area include *Artemisia nova* (black sagebrush), *Artemisia tridentata* (big sagebrush), *Pinus monophylla/Artemisia nova* (pinyon/black sagebrush), and *Pinus monophylla/Artemisia tridentata* (pinyon/big sagebrush) (Ostler et al., 2000). These vegetation associations collectively make up 27.5% of the total area of the NNSS although they are nearly excluded in sites selected by Beatley for long-term monitoring. Beatley had one only plot in each of the four vegetation types.

In 2008, supplemental plots were established in the four vegetation associations listed above to better characterize the vegetation that occurs in the northern portion of the NNSS. These plots were selected randomly from ELUs that were located in major geographic and orographic areas of the NNSS that make up these four vegetation associations (Ostler et al., 2000). Eight plots were selected in black sagebrush. Ten plots were selected in both big sagebrush and pinyon/black sagebrush, and 12 plots in pinyon/big sagebrush. The number of plots per vegetation type varied slightly depending on the total acreage of these types on the NNSS. Results of the initial survey are described in Hansen et al. (2009).

In 2009, the black sagebrush and big sagebrush vegetation sites were sampled for cover and density . Because of restrictions in labor and the emergence of other priorities (e.g., the wildland fire fuels survey), only the pinyon/black sagebrush and pinyon/big sagebrush vegetation sites were sampled in 2010 for species presence and relative abundance. Data from the surveys were entered into EMAC's PLANTS database, a Microsoft Access® relational database for documenting vegetation parameters on the NNSS. Results of the surveys in 2009 and 2010 will be presented in a future EMAC report when data from all vegetation types have been collected during at least one favorable plant-growth year.

4.3 West Nile Virus Surveillance

WNV is a potentially serious illness that is spread to humans and other animals through mosquito bites. It was first discovered in Uganda in 1937 and was not detected in North America until 1999. In southern Nevada, it was not detected until the spring of 2004. WNV surveillance continued in 2010 for the seventh consecutive year. WNV surveillance entails setting mosquito traps baited with dry ice overnight at sites where standing water provides a potential breeding site for mosquitoes (Figure 4-7). As the dry ice sublimates, it produces carbon dioxide, which attracts mosquitoes. Nine sites were sampled during 12 surveys (Table 4-4). Mosquitoes collected during the surveys were taken to the Southern Nevada Health District for species identification and WNV testing. Seven individuals representing three species were captured and analyzed in 2010 (Table 4-4). All specimens were negative for WNV. Mosquito species identified were entered into the Ecological Geographic Information System (EGIS) faunal database to define mosquito distribution on the NNSS. In 2010, no new species were detected.

Figure 4-7. Mosquito trap set at Well 3 Pond, Area 6 in Yucca Flat
(Photo by D. B. Hall, August 27, 2008)

Table 4-4. Results of West Nile virus surveillance on the NNSS in 2010

Location	Date	Number Captured	Species	WNV
Camp 17 Pond, Area 18	6/8/10	3	*Culex tarsalis*	Negative
LANL Pond, Area 6	6/8/10	0	NA	NA
Yucca Playa Pond, Area 6	6/8/10	1	*Culex tarsalis*	Negative
Mercury SOC Park, Area 23	7/20/10	0	NA	NA
LANL Pond, Area 6	7/20/10	1	*Culex tarsalis*	Negative
Camp 17 Pond, Area 18	7/20/10	1	*Anopheles franciscanus*	Negative
Well C1 Pond, Area 6	8/3/10	0	NA	NA
Well 5B Pond, Area 5	8/3/10	0	NA	NA
Mercury Sewage Lagoons, Area 23	8/3/10	0	NA	NA
Whiterock Spring, Area 12	9/21/10	1	*Culiseta incidens*	Negative
J11 Pond, Area 25	9/21/10	0	NA	NA
Mercury SOC Park, Area 23	9/21/10	0	NA	NA

SOC: Special Operations Center
WNV: West Nile virus

4.4 Hantavirus Sampling

Hantavirus is a potentially harmful virus associated with infected rodents or their saliva, urine, and droppings (i.e., excreta). The biggest risk to humans is when excreta from an infected animal is deposited in or around structures where people might be working; the waste dries, is resuspended in the air through various means (e.g., sweeping, walking through), and then breathed in by the worker. Although other rodent species may carry the hantavirus, deer mice (*Peromyscus maniculatus*) are the primary carriers on the NNSS. They are most abundant at the middle to higher elevations but may occur throughout the NNSS. They often are associated with human structures and are known to nest in buildings.

Hantavirus was first detected in the southwestern United States in the spring of 1993, when several people in the Four Corners region died from respiratory problems. In July 1993, the first case of hantavirus infection in humans was confirmed in Nevada about 150 miles north of NNSS. This led to investigations by biologists with the Yucca Mountain Project and the Basic Environmental and Compliance Monitoring Program (BECAMP) to determine the presence and distribution of hantavirus on the NNSS. In 1993, 497 animals from nine rodent species, including some deer mice but mostly heteromyids, at Yucca Mountain were tested for the presence of hantavirus antibodies in their blood. All samples tested negative (EG&G/EM, 1994). Sampling by BECAMP in 1993, resulted in 14 of 60 rodents (23.3%), all deer mice, testing positive for hantavirus (Saethre, 1994). Sampling continued in 1994, at four areas with high human population (Mercury, Area 6 Control Point, Area 12, and a fenced compound in Area 27) and six areas away from most worker activity. Of 63 selected animals tested (deer mice had highest priority for analysis), four (6.3%) were seropositive for the presence of hantavirus. Three of these were from Dead Horse Flat (Area 19) and one was from around Sedan crater (Area 1). Combined results from both years showed that a total of 14.6% (18 of 123) of the animals tested were carriers of the hantavirus, all of which were deer mice (Saethre, 1995).

During 2010, NSTec biologists coordinated with the Industrial Hygiene and Solid Waste groups to conduct hantavirus sampling on the NNSS. The objective was to assess the risk of NNSS workers being exposed to hantavirus during rodent excreta cleanup operations. Sampling entailed using Sherman live traps to capture rodent species at or around five active facilities (Table 4-5; Figure 4-8). All rodents captured, regardless of species, were tested. Animals were euthanized and frozen until they were shipped out because the method for hantavirus testing entailed using brain tissue as opposed to blood. These 401 samples were combined with 107 other samples that had been previously collected opportunistically from glue traps or accidental deaths during other small mammal trapping efforts. A total of 508 rodents were sent to the Museum of Southwestern Biology at the University of New Mexico for hantavirus testing. Of these, 37 were not salvageable for various reasons. Results showed that only four of the 471 samples tested (0.8%) were positive for hantavirus. All four were deer mice with two (both adult, scrotal males) from Area 12 Camp, one (adult, scrotal male) from Gold Meadows (Area 12), and one (juvenile, female) from the Area 6 LANL Pond (near the Wet and Wild Complex).

Combined results from all hantavirus sampling on the NNSS, including Yucca Mountain data, show that only 2% (22 of 1,091) of rodents tested for hantavirus were positive for the virus, all of which were deer mice. These results suggest that hantavirus is not very prevalent on the NNSS but still does occur, primarily in deer mice. A study by Cao et al. (2011) revealed that increased risk of hantavirus can be predicted by measuring plant production. During years with above-normal precipitation, plant production increases substantially. The increased plant production allows for increased reproduction in deer mice, which results in a population explosion and a peak in numbers of deer mice 1–1.5 years later. The proportion of animals with hantavirus does not necessarily increase, but the absolute numbers of infected mice increases along with total mice numbers. Results from Cao et al. (2011) may help explain why percentages of infected mice were higher in 1993 and 1994 than in 2010. Precipitation during 1992 and 1993 was above-normal, whereas precipitation during 2009 was below normal. The risk of an NNSS worker being exposed to hantavirus appears to be low, especially during most years with average or below-average precipitation the year prior and at lower elevations such as Mercury. However, this risk increases 1–1.5 years after years with above-normal precipitation and at the middle to higher elevations such as Yucca Flat and Rainier Mesa.

Table 4-5. Results of 2010 small mammal trapping for hantavirus detection including sampling areas, dates, and number of animals tested by species

			Species										
Sampling Area	Sampling Dates	Number of Samples	*Ammospermophilus leucurus*	*Chaetodipus formosus*	*Dipodomys merriami*	*Dipodomys microps*	*Dipodomys ordii*	*Neotoma lepida*	*Onychomys torridus*	*Peromyscus eremicus*	*Peromyscus maniculatus*	*Perognathus parvus*	*Reithrodontomys megalotis*
Mercury (Area 23)	9/9 to 10/6	100	13	51	19	0	0	3	0	12	0	0	2
CP (Area 6)	9/22 to 10/7	76	8	22	39	1	0	0	1	5	0	0	0
Wet & Wild (Area 6)	10/12 to 11/9	75	7	0	24	0	0	5	2	7	28[a]	0	2
U1A (Area 1)	10/12 to 11/9	75	8	1	58	2	0	0	6	0	0	0	0
12 Camp (Area 12)	9/22 to 10/7	75	3	14	20	6	1	5	2	0	17[a]	2	5
	Totals	**401**	**39**	**88**	**160**	**9**	**1**	**13**	**11**	**24**	**45**	**2**	**9**

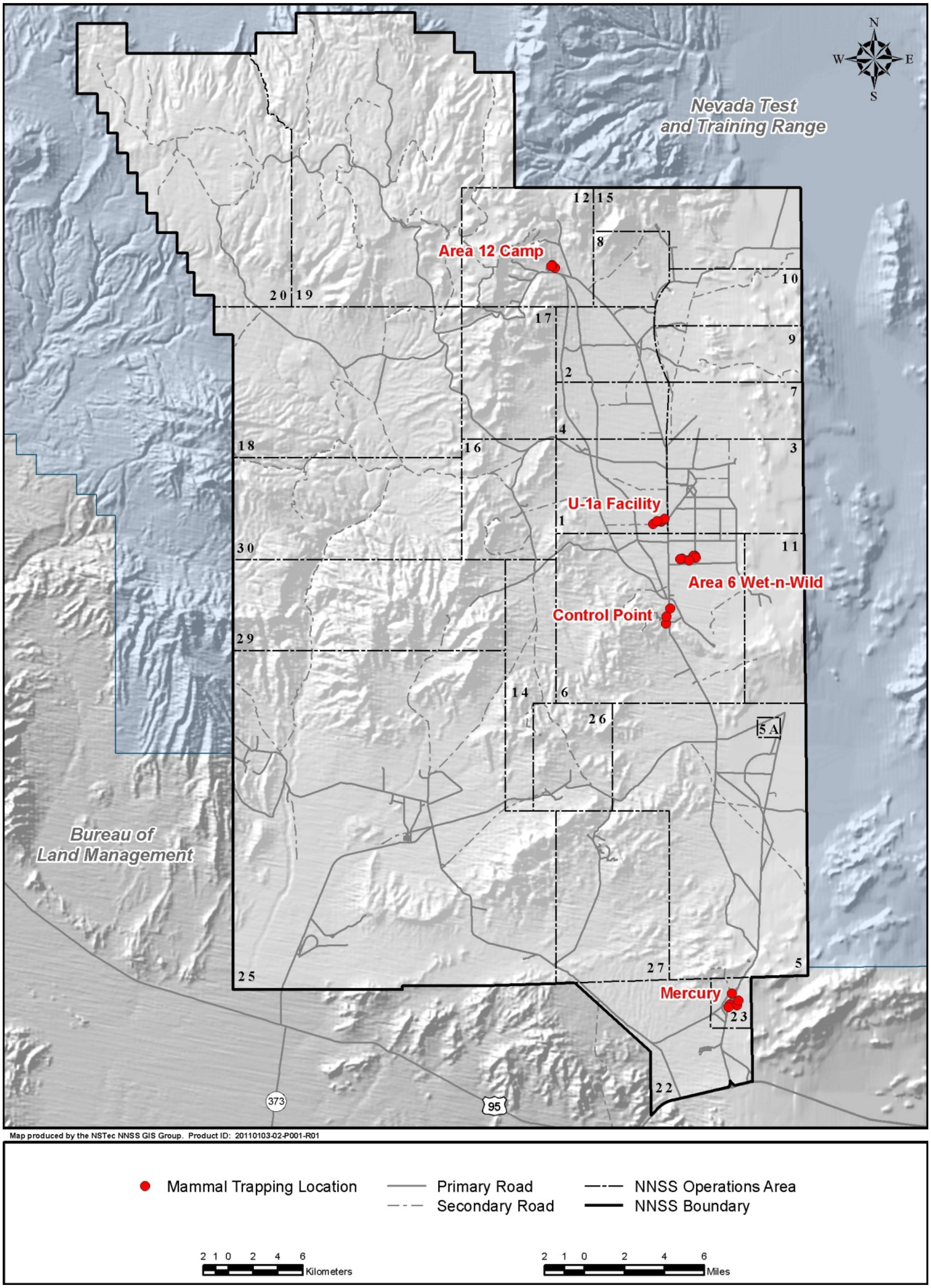


Figure 4-8. Small mammal trapping locations during 2010 for hantavirus sampling

4.5 Natural Wetlands Monitoring

Monitoring of numerous wetlands continued this year to characterize seasonal baselines and trends in physical and biological parameters. Eight wetlands (Figure 4-9) were visited at least once during 2010 to record wildlife use, the presence/absence of land disturbance, water flow rates when applicable, and surface area of standing water (Table 4-6).

Flow was generally estimated by collecting a known volume of water from permanently installed pipe(s) over a known time period. Sometimes a pipe was temporarily installed to accomplish this (i.e., Captain Jack Spring). Flow or discharge measured this way is an approximate measurement and is generally an underestimate of true flow. At some sites, water collects, but there is no way to estimate flow, which was the situation at Gold Meadows and Pahute Mesa Pond. Flow occurs as seepage through the local sediments into the pond collection area. Because monitoring of wetlands is qualitative, the objectives are to potentially identify large or obvious changes over time; smaller, subtle changes are not readily detectable from these methods.

Sizes of wetlands monitored varied greatly from very small areas (<1 square meter [m^2] [<10.8 square feet [ft^2]]) to moderately sized springs (180–600 m^2 [1,938–6,458 ft^2]) to large temporary playa pools (28,000 m^2). Surface flow rates were typically low (<5 liters per minute [1.3 gallons per minute]) at most wetlands where flow was measurable (Table 4-6). We noted disturbance from horses at one site and some form of natural change (sedimentation and dense spread of wetlands plants) at two other sites. Small wetlands and the wildlife associated can sometimes be impacted more by these factors than are larger wetlands. For example, at Cane Spring the heavy growth of cattails at the spring source pool could negatively impact the habitats of invertebrates if flow and spatial habitat is reduced significantly.

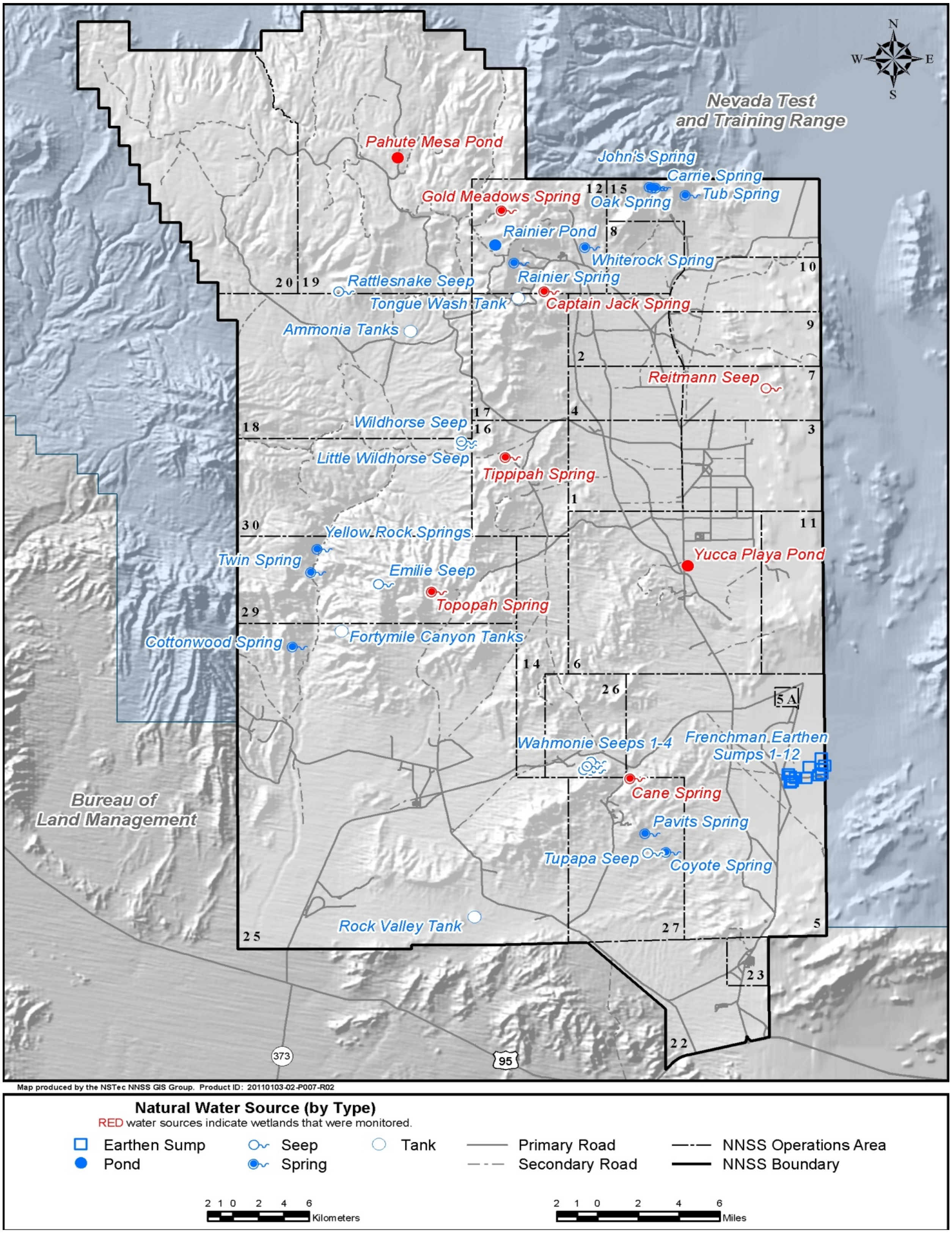


Figure 4-9. Natural water sources on the NNSS, including those monitored in 2010

Table 4-6. Hydrology and disturbance data recorded at natural water sources on the NNSS during 2010

Spring	Date	Surface Area of Water (m^2)	Flow Rate (L/min)	Disturbance at Spring
Cane Spring	5/30/2010	15	NM	Heavy growth of cattails
Captain Jack Spring	9/8/2010	30	NM	None
Captain Jack Spring	10/4/2010	30	1	None
Gold Meadows Spring	9/7/2010	50	NA	Horse grazing and trampling
Gold Meadows Spring	11/2/2010	1	NA	Horse grazing and trampling
Pahute Mesa Pond	9/30/2010	0	NA	None
Reitmann Seep	9/1/2010	0.25	NA	Natural sedimentation
Tippipah Spring	7/21/2010	210	NA	None
Topopah Spring	4/7/2010	7	NM	None
Topopah Spring	8/13/2010	3	NM	None
Yucca Playa Pond	6/8/2010	28,000	NA	None

NM = flow present but not measured

NA= not applicable due to diffuse flow

Wildlife use data recorded at natural water sources during daytime sampling are summarized in Table 4-7. Deer, antelope, and horses benefit significantly from the usage of the water sources. The evidence typically comes primarily from animal sign observed. The use of motion-activated cameras generally provides much more detailed information than sign alone (see Section 6.5.1 Motion-Activated Cameras). Typically, small birds benefit greatly from small water sources in the desert. At the NNSS few birds were observed from site visits at springs in 2010.

Table 4-7. Number of wildlife species observed or inferred at NNSS natural water sources in 2010

Wildlife Species Observed at NNSS Natural Water Sources	Cane Spring	Captain Jack Spring	Captain Jack Spring	Gold Meadows Spring	Gold Meadows Spring	Pahute Pond	Reitmann Seep	Tippipah Spring	Topopah Spring	Yucca Playa pond
Date Observed (month/day) of 2010:	**5/28**	**9/7**	**10/4**	**9/7**	**11/2**	**9/29**	**9/1**	**7/21**	**4/7**	**6/8**
Mammals										
Antelope *(Antilocapra americana)*				P	15					
Coyote (*Canus latrans*)	P	P	P	P	P	P		P	P	P
Feral horse (*Equus caballus*)				P	5					
Mule deer (*Odocoileus hemionus*)	P	P	P	P	P	P	P	P	P	P
Birds										
Black-throated sparrow (*Amphispiza bilineata*)	P								P	
Chukar (*Alectoris chukar*)	P	>10								
Great-Tailed Grackle (*Quiscalus mexicanus*)										>8
House Finch (*Carpodacus mexicana*)				>5						
Mourning dove *(Zenaida macroura)*		>4						>30		>3
Numbers of bird species detected:	**2**	**2**	**0**	**1**	**0**	**0**	**0**	**1**	**1**	**2**
P= Species presence inferred from sign										

4.6 Constructed Water Source Monitoring

NSTec biologists conducted quarterly monitoring of constructed water sources. These sources, located throughout the NNSS (Figure 4-10), include plastic-lined sumps at about 20 sites. Several ponds or sumps are located next to each other at the same project site. Many animals rely on these human-made structures as sources of water. However, wildlife and migratory birds may drown in steep-sided or plastic-lined sumps as a result of entrapment, or ingest contaminants in sumps with drilling fluids or evaporative ponds. Ponds are monitored to assess their use by wildlife and to develop and implement mitigation measures to prevent them from causing significant harm to wildlife.

During March, October, and December 2010, 29 constructed water sources (Figure 4-10) were visited at 20 sites. At each site, the presence or absence of standing water and the presence of animals or their sign around the water source were recorded. Sediment ramps or plastic ladders, which allow animals to escape if they fall in, have been installed at many plastic-lined sumps, and the presence, absence, and condition of these structures were noted. All dead animals in or adjacent to a human-made water source were recorded (Table 4-8). Monitoring frequency was decreased in 2010 for many sumps in areas like Yucca Flat where older sumps no longer pose high risk of entrapping animals. Older liners become less slippery over time from weathering, allowing animals to escape. During 2010, no dead animals were detected in sumps on the NNSS.

Typical water availability is in spring and fall–winter. Most sumps were dry until late October when rains occurred. Most sumps will fill with some water from the first snows in mid–late December. Use is limited to common species of passerine birds, ducks, and shorebirds.

Table 4-8. Results of monitoring plastic-lined sumps for wildlife mortality at the NNSS for 2010

Quarter	Number of ponds monitored	Number of ponds with water	Surface area (m^2)	Number of sediment ramps	Number of dead animals detected
January–March	8	7	1,350	7	None
April–June	2	2	400	1	None
July–September	0	0	0	0	None
October–December	19	11	4,100	9	None

Sediment ramps that are used by wildlife (typically coyotes and deer) have fresh tracks on the ramps. It is strongly recommended that sediment ramps be emplaced in new sumps when they are constructed especially if water is pumped and is deep. Sediment ramps are still missing in many sumps on NNSS, but where installed they have been very effective in allowing animals to exit sumps with deep water.

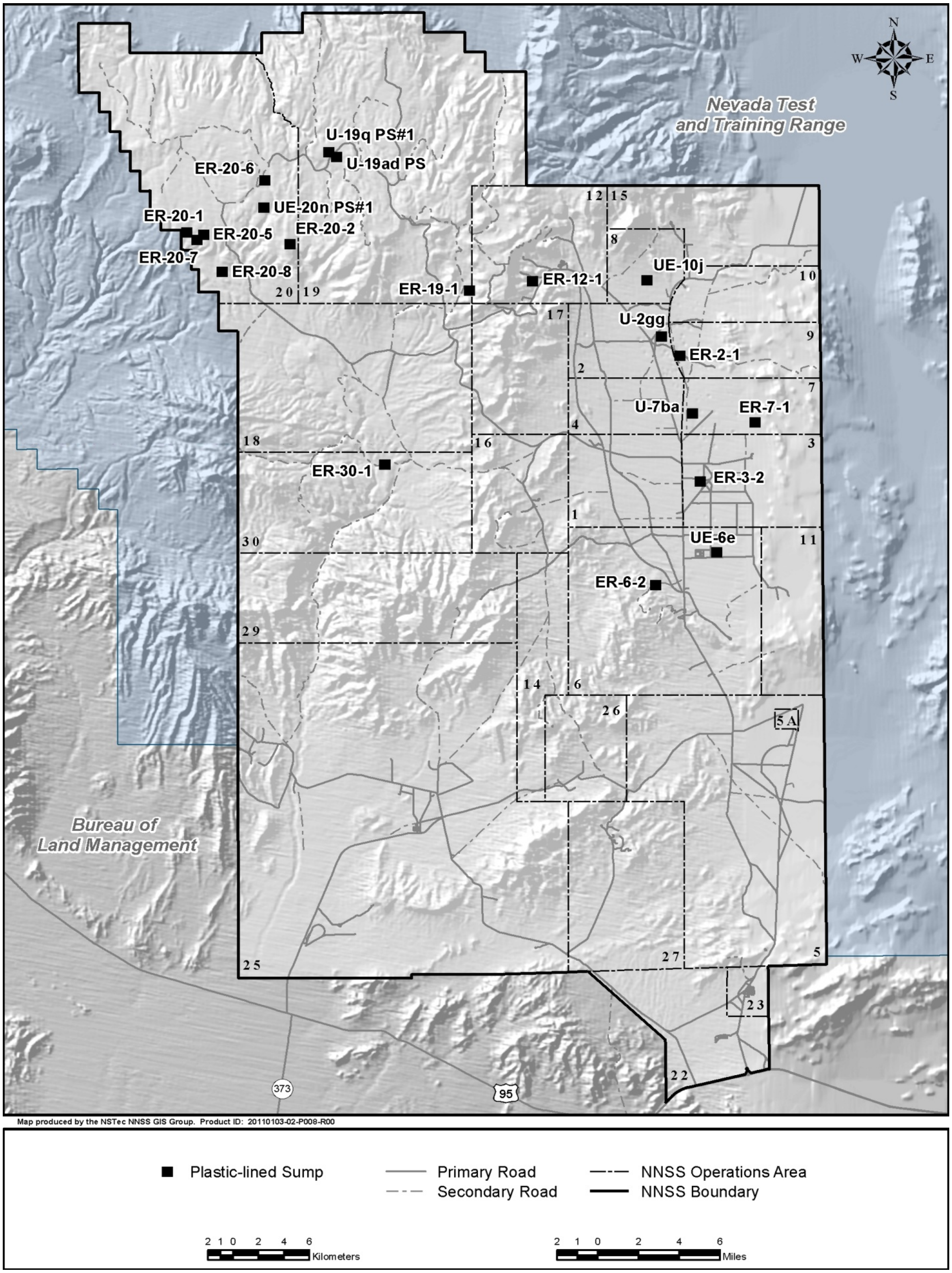


Figure 4-10. Constructed water sources monitored for wildlife use and mortality on the NNSS during 2010

4.7 Coordination with Scientists and Ecosystem Management Agencies

NSTec biologists interfaced with other scientists and ecosystem management agencies in 2010 for the following activities:

- Attended the Ash Meadows National Wildlife Refuge Symposium in Pahrump, Nevada.
- Attended the 16th Wildland Shrub Symposium (Threats to Shrubland Ecosystem Integrity) in Logan, Utah.
- Participated in several meetings of the Mojave Desert Initiative designed to address research needs in the areas of wildfires and reclamation of Mojave Desert lands.

5.0 SENSITIVE PLANT MONITORING

Under the NNSS sensitive plant monitoring program, the status or ranking of sensitive plants known to occur on the NNSS is evaluated annually to ensure such plants are afforded the appropriate protection under federal and state law (Table 2-1). This evaluation includes input from regional botanists as well as information obtained during sensitive plant monitoring activities on the NNSS.

5.1 List of Sensitive Plant Species for the NNSS

5.1.1 Phacelia parishii, *Parish phacelia*

In 2002 a new species, *Phacelia filiae*, was described and named (Atwood et al., 2002). This new species is known to occur on the NNSS based on the location of specimens collected from the NNSS and deposited in the Mercury herbarium. Dr. Atwood, who described this species, examined the herbarium specimens labeled *P. parishii* and found them to be *P. filiae*. The EEM GIS database has other locations of *P. parishii* that were not collected for the Mercury herbarium. Field surveys have been conducted periodically since 2002 to determine if these other locations of *P. parishii* were indeed *P. parishii* or the newly named species, *P. filiae*, but it was not until the 2010 field season that growing conditions were favorable for *Phacelias* that a meaningful field investigation could be conducted.

Historically *P. parishii* was known to occur at numerous locations on the NNSS, ranging from Frenchman Flat on the north to Little Skull Mountain to the south. The first indication that the species of *Phacelia* found on the NNSS and reported as *P. parishii* was actually a different species was after field surveys on Nellis Air Force lands in the spring of 1995 identified a new species of *Phacelia*, not fitting the description of *P. parishii* nor *P. beatleyae*, a closely related species (Atwood et al., 2002). Surveys that same year on the NNSS identified the location of plants that fit the description of the new species.

All historic locations of *P. parishii* on the NNSS were surveyed in 2010 as well as a known location of *P. parishii* off the NNSS. The offsite survey was conducted to become familiar with the morphological differences between the two species. All plants encountered on the NNSS this year, which were previously identified as *P. parishii,* were morphologically different than the individuals of *P. parishii* observed off site and, in fact, better fit the description of the new species, *P. filiae*. Results of field surveys this spring and summer revealed that all previously reported occurrences of *P. parishii* were actually the new species, *P. filiae* (Atwood et al., 2002).

Based on these results it has been determined that *P. parishii* does not occur on the NNSS and therefore has been removed from the list of sensitive plants. *P. filiae* has been permanently added to the list. It was tentatively included on the list after it was described in 2002, but its presence on the NNSS has not been verified until this year.

5.1.2 Penstemon albomarginatus, *White Margin Beardtongue*

Surveys for *Penstemon albomarginatus* on the NNSS have been conducted periodically throughout the last several decades with the last surveys being conducted in 1992–1994 (Blomquist et al., 1995). *P. albomarginatus* is known to occur less than 1 kilometer (km) (0.6 mile [mi]) south of the southern boundary of the NNSS on the south-facing slopes of the Striped Hills. This location represents the northern-most location for this species, which is also known from areas south of Las Vegas and into California and Arizona. A preliminary survey was conducted this year at the Striped Hills location to determine if it was present this year. Over 1,500 plants in full flower were found in the two populations surveyed just south of the NNSS boundary in the Striped Hills area (Figure 5-1).

Figure 5-1. *Penstemon albomarginatus* growing in sandy soils and in full flower at a population located south of the NNSS boundary
(Photo by D. C. Anderson, April 19, 2010)

Knowing that 2010 had good growing conditions for *P. albomarginatus,* a survey was conducted in late April on the NNSS along the south slopes of a range of hills extending to the northeast of the Striped Hills (Figure 5-2). No plants of *P. albomarginatus* were found. The soils found in the region of the NNSS are not the typical sandy soils that this species prefers. Surveys for this species in the future may focus on the south-facing slopes of Little Skull Mountain. Other than this location, it is unlikely to be found anywhere else on the NNSS.

5.1.3 Program Awareness

The annual Rare Plant Workshop, sponsored by NNHP and the Nevada Native Plant Society (NNPS), was held this year in Las Vegas, Nevada. NSTec scientists attended the 2-day meeting. There were no actions or recommendations from the participants of the workshop that affected the sensitive plants that are listed for the NNSS (NNPS, 2010).

A poster was prepared this year showing the sensitive plants known to occur on the NNSS (Anderson, 2010). The poster will be a tool for creating an awareness of sensitive plants on the NNSS among the scientific community and the NNSS workforce.

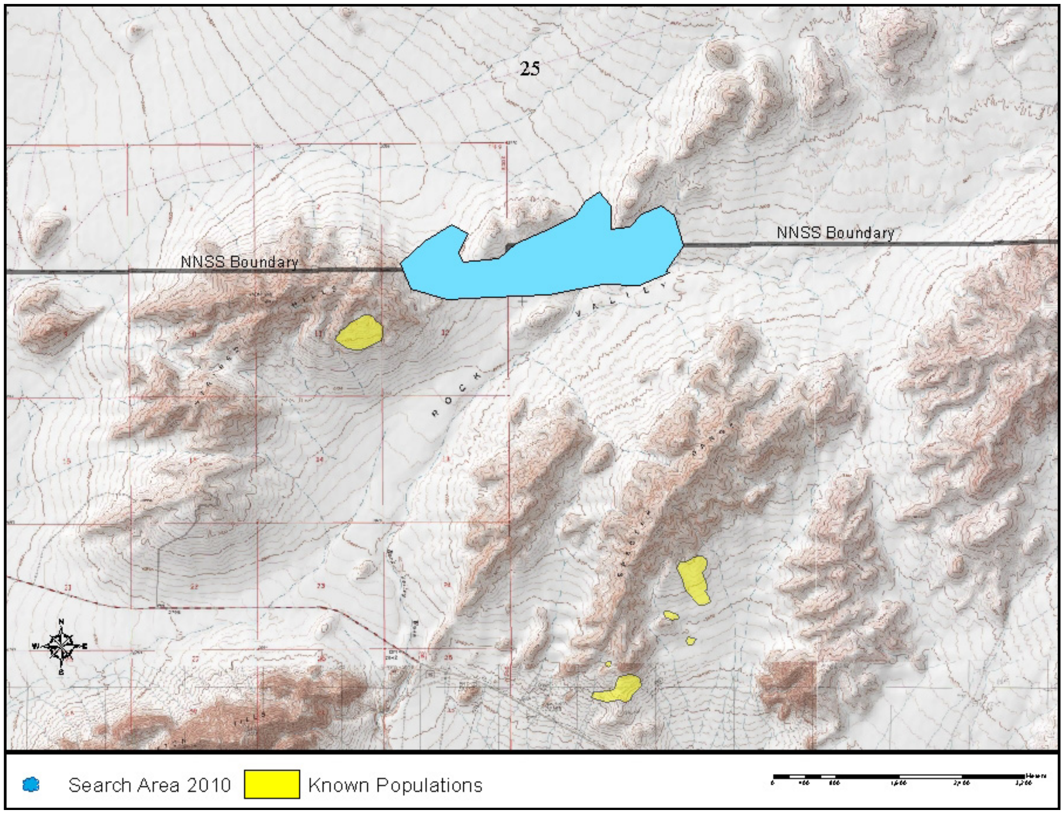


Figure 5-2. Known populations and areas searched for *Penstemon albomarginatus* in the Striped Hills area along the southern boundary of the NNSS

5.2 Long-term Monitoring

Since *P. filiae* was named as a new species in 2002, one of the objectives of the sensitive plant monitoring program has been to define its distribution on the NNSS. Field surveys in previous years were unable to locate any plants of this species because of non-optimum growing conditions. Growing conditions were good in 2010 and *Phacelias* were abundant. Monitoring efforts focused on verifying the presence of *P. filiae* at previously reported sites on the NNSS and surveying additional areas where it might possibly occur.

In addition to the surveys for *Phacelia*, several follow-up surveys were conducted this year. During plant monitoring efforts in recent years, potential locations for several sensitive species were identified but not surveyed. In 2009, a population of *Astragalus oophorus* var. *clokeyi* was found in Cat Canyon on Timber Mountain where it had not been previously reported. The optimum time of the year for conducting a field survey passed, so the area was not surveyed in 2009, but the survey was conducted in 2010. This was also the situation for *Cymopterus ripleyi* var. *saniculoides* and *Galium hilendiae* ssp. *kingstonense*.

In addition to the planned surveys in 2010, there were occasional opportunistic sightings of sensitive plant species on the NNSS. These sightings occurred during scheduled field surveys for other species or during the performance of other field tasks.

5.2.1 Field Surveys and Opportunistic Sightings

***Astragalus oophorus* var. *clokeyanus*, Clokey eggvetch**

In 2009, two previously unreported locations of *A. oophorus* var. *clokeyanus* were identified (Hansen et al., 2010). One location was found in the Tongue Wash area while conducting a survey for *G. hilendiae* var. *kingstonense* and the other was in a drainage flowing into Cat Canyon. These two areas were marked in 2009 as future sites to be surveyed. This year the Cat Canyon site was surveyed. Three days of surveys were conducted in the region, and over 750 individual plants were encountered, extending the distribution of the species over several small canyons in the area (Figure 5-3).

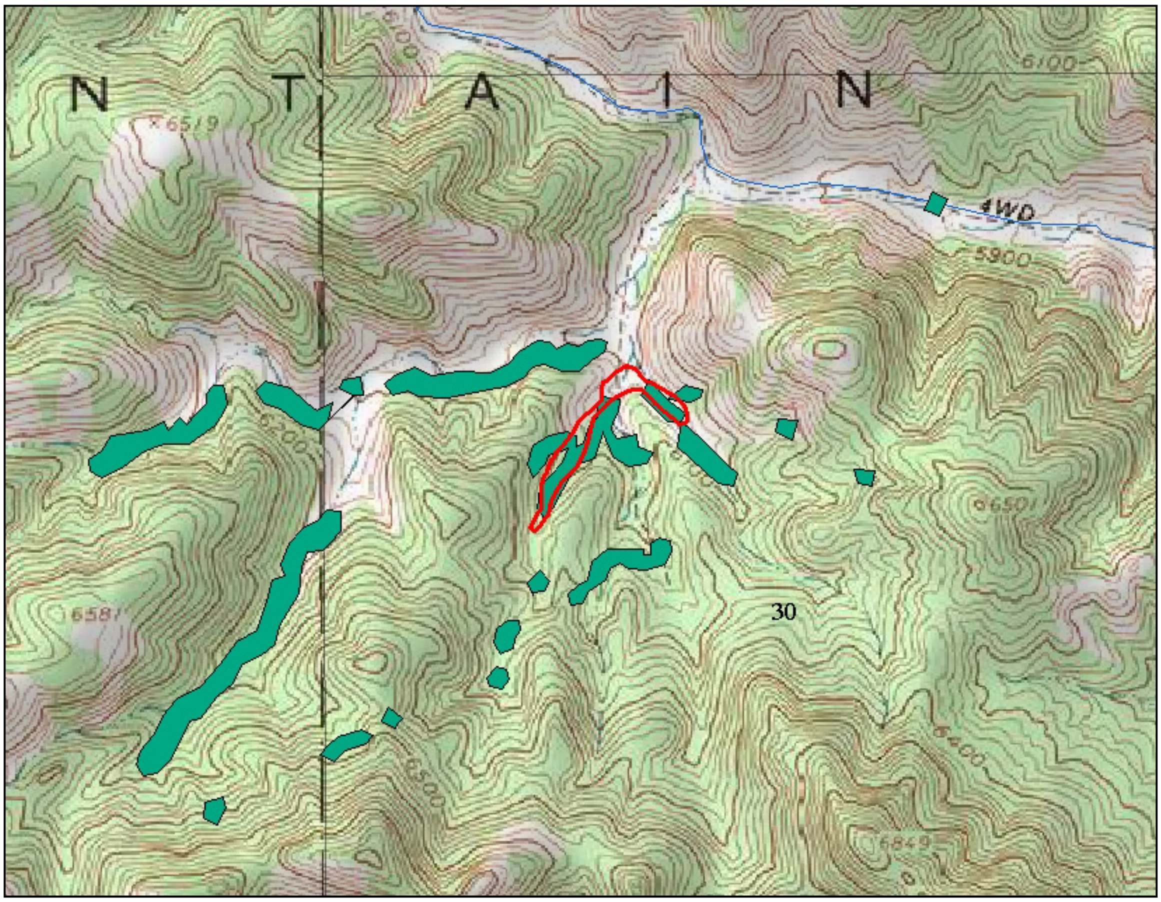


Figure 5-3. Distribution of *A. oophorus* var. *clokeyanus* in the Cat Canyon/Timber Mountain area
(The area circled in red was known distribution of this species prior to 2010)

***Cymopteris ripleyi var. saniculoides*, Sanicle biscuitroot**

The last couple years there has been an abundance of *C. ripleyi* var. *saniculoides* encountered throughout its range on the NNSS. In 2009 over 200 individuals were found north of Camera Butte on the eastern slope of Paiute Ridge, and hundreds of plants were found in several major drainages throughout Yucca Flat (Hansen et al., 2010). There was insufficient time last year to survey reported locations in the Scarp Canyon area, but this was the first area surveyed in 2010. During a single field survey-day, over 350 individuals were encountered along several small drainages in Scarp Canyon.

Later in the season during surveys for *P. filiae* in the Pink holes area, another 250 individuals were encountered. One small population of about 35 plants was found along Orange Blossom Road, and a few isolated individuals were opportunistically found along drainages northwest of Camera Butte. A thorough survey of those drainages in 2010 located nearly 150 plants.

Galium hilendiae ssp. *kingstonense*, Kingston Mountain bedstraw

G. hilendiae ssp. *kingstonense* is known from the Oak Spring Butte area on the NNSS. A reported location of this species around the Tongue Wash area on the eastern slope of Rainier Mesa was surveyed in 2009, but no plants were found. This same area was surveyed in 2010 where a single population of a little more than 40 individuals was found.

In an effort to verify that the subspecies of *G. hilendiae* on the NNSS is ssp. *kingstonense*, a survey was conducted in the type locality for this species, which is in the Kingston Mountains, south of Pahrump, Nevada, in San Bernardino County, California. An investigatory survey was conducted in late spring in an area where this species had previously been located (Blomquist et al., 1995), but no individuals were found. Surveys and work with this species in future years will focus on verifying that the sub-species of *G. hilendiae* found in the Oak Spring Butte area and near Tongue Wash are the same species found at the type locality for *G. hilendiae* ssp. *kingstonense* in the Kingston Mountains.

Phacelia filiae, Clark phacelia

The major emphasis this year was to locate and verify that populations reported as *P. parishii* were the newly described species, *P. filiae* (Atwood et al., 2002). *P. parishii* was first documented on the NNSS in 1977, but any listing as threatened or endangered was not supported because its presence depended on being “at the right place, at the right time” (Beatley, 1977). It was first proposed as an endangered species by Rhoades and Williams (1977), but it was later determined to be more widely distributed than it appeared and was not considered as threatened or endangered. Results of surveys for this species in the early 1990s suggested that the species was widespread across Nevada and was in no apparent danger (Blomquist et al., 1995). Since that time, it has been on the Watch List maintained by the NNPS (2010).

Preliminary surveys in the spring of 2010 indicated an abundance of spring annuals, including several *Phacelia*s and specifically *P. filiae*. Along with many other annual plant species, *P. filiae* has been absent from the annual spring flora on the NNSS for the last several years. A population of *P. filiae* along Burma Road was surveyed in April of 2010, and several hundred individuals were found. A known population of *P. parishii* in the Pahrump area was surveyed also a few days later to determine the morphological differences between the species. Flowers for *P. parishii* were found to be smaller than those of *P. filiae*, and the growth habitat was more erect, as opposed to the decumbent stems of *P. filiae* (Figure 5-4). Field surveys for *P. filiae* continued through the spring and focused on previously reported locations of *P. filiae* or *P. parishii* in the Pink Holes and Rock Valley regions of the NNSS. The Pink Holes region is located along the northern slopes of Red Mountain, specifically along Burma Road extending west to near the Pink Holes (Figure 5-5). The Rock Valley region extends from the low hills in the northeastern section of Rock Valley to the southeast slopes of Little Skull Mountain in the northwestern section of Rock Valley (Figure 5-6). In both of these areas, there were reported locations of both species of *Phacelia*.

Figure 5-4. Morphological differences between *P. parishii* (left) and *P. filiae* (right) include larger flowers and more decumbent stems of *P. filiae.*
(Photos by D. C. Anderson, April 19, 2010)

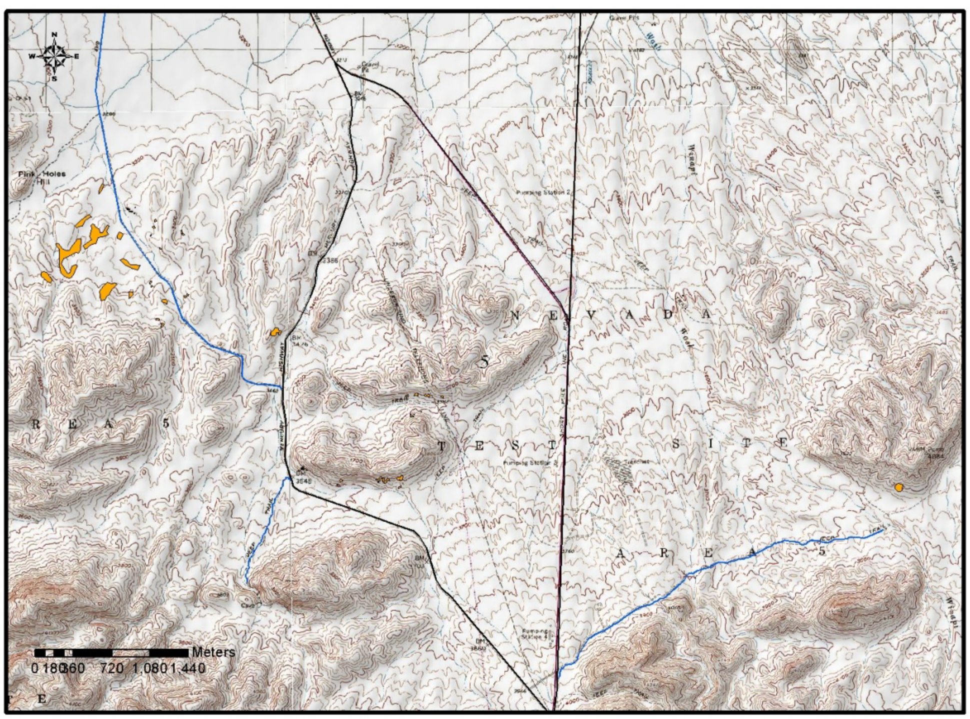


Figure 5-5. Known distribution of *P. filiae* in the Pink Holes region of the NNSS

Approximately 1,700 individuals of *P. filiae* were located in the Pink Holes area along with another 500 plants further east along Burma Road. In Rock Valley, around 300 plants were found on the southeastern slopes of Little Skull Mountain, and another 400 plants in the eastern regions of Rock Valley. All previously reported locations of *P. parishii* on the NNSS were confirmed to be the newly named species *P. filiae*. As previously stated, it appears that *P. parishii* does not occur on the NNSS.

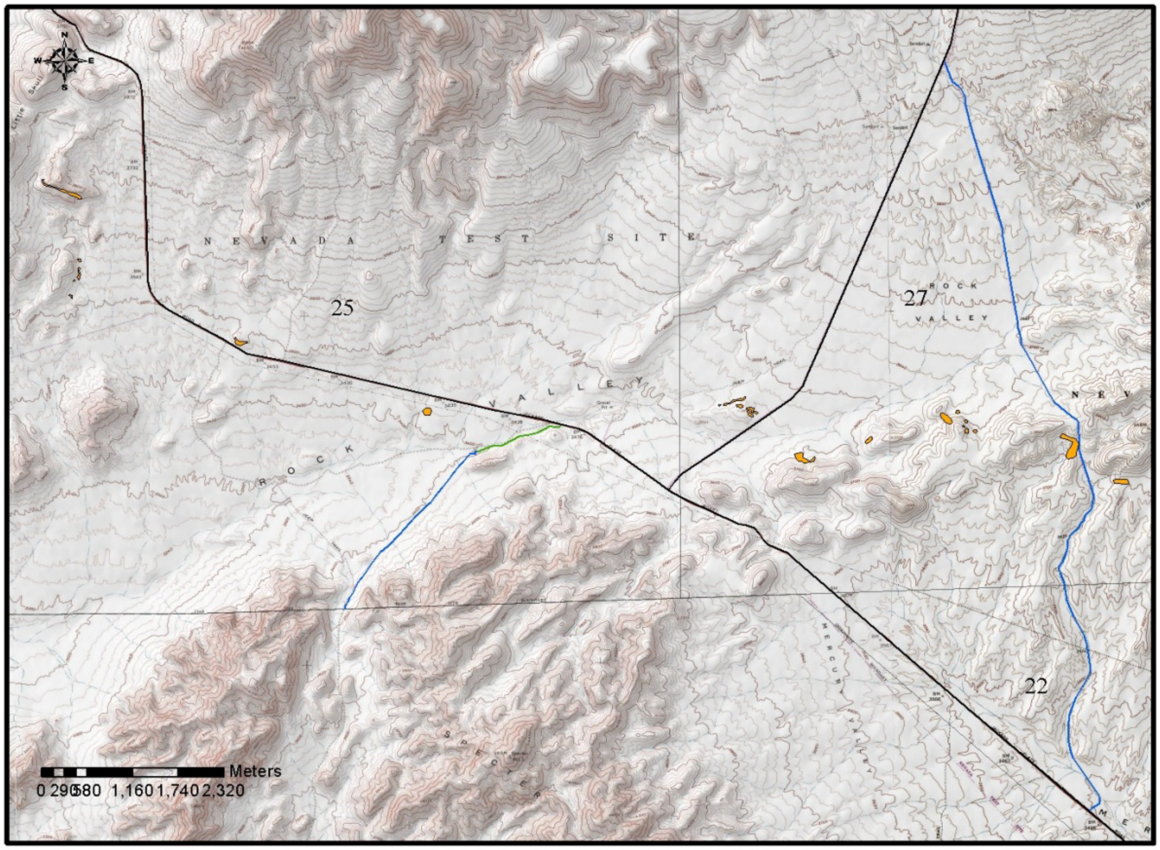


Figure 5-6. Known distribution of *P. filiae* in the Rock Valley region of the NNSS

***Phacelia mustelina,* Weasel phacelia**

No formal surveys were conducted in 2010 for *P. mustelina*; however, several opportunistic sightings were reported. Individuals were reported from the western edge of Jackass Flats, from Castle Point on Yucca Mountain, two locations in Red Rock Valley, scattered occurrences in Tongue Wash, and a location on Pahute Mesa east of Pahute Mesa Road between the 19-03 Road and Dead Horse Flats Road.

5.2.2 Monitoring

Monitoring sensitive plants is often difficult because of the ephemeral nature of many of the sensitive plant species on the NNSS. Many are annual plants and respond to timely increases in precipitation. Some plant species may only be monitored one year out of ten due to unfavorable plant growing conditions. Monitoring typically includes the establishment of permanently marked linear transects. Experience has shown that with time, transect markers are lost and the replicability of density estimates is compromised. In recent years, monitoring sensitive plant species on the NNSS has used advances in Global Positioning System (GPS) technology, which allows recording the location of individual plants over a large geographic area with minimal effort. These data are easily transferred to mapping programs, such as

ESRI's ArcMap™. This approach allows estimates from a larger area than would be covered with linear transects, and in less time. This method should potentially provide a more accurate estimate of plant densities over time.

Sensitive plant monitoring was conducted for eight species in 2010: six populations of *Astragalus beatleyae*, one population of *A. oophorus* var. *clokeyi*, three populations of *C. ripleyi* var. *saniculoides*, one of *Eriogonum heermannii* var. *clokeyanus*, two of *Frasera pahutensis*, one of *G. hilendiae* spp. *kingstonense,* one of *Penstemon fruticiformis* ssp. *amargosae* and four populations of *Phacelia filiae.* At each monitoring site, the number of individual plants within the sample plot was recorded and plant density estimated (Table 5-1).

***Astragalus beatleyae*, Beatley milkvetch**

Six populations of *A. beatleyae* were monitored in 2010. At each population, the location of each individual plant of *A. beatleyae* was recorded on a hand-held GPS unit. The location data were downloaded and imported into ArcMap™ (see Figure 5-7 as an example of the resulting map), and the density of individuals within the sample plot was calculated.

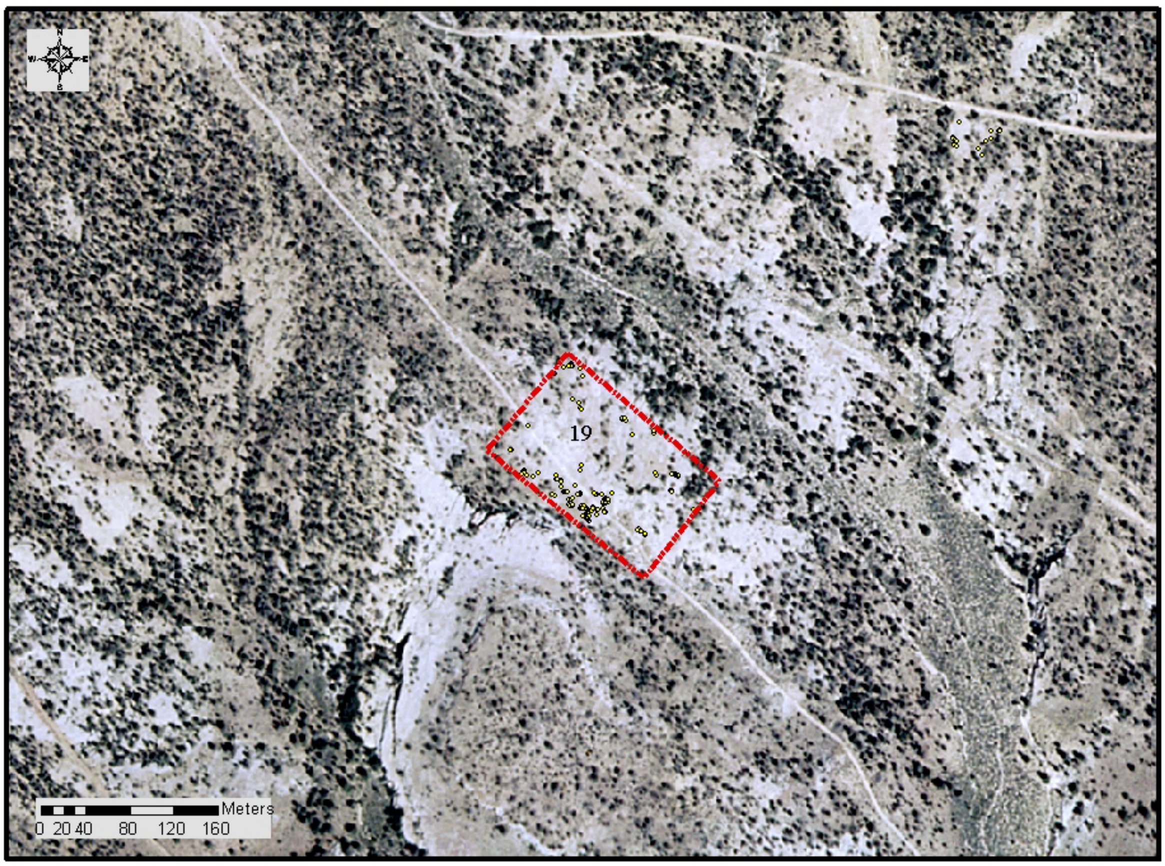


Figure 5-7. Long-term monitoring plot for *A. beatleyae* located in the Big Burn Valley

Density values ranged from a low of 0.8 plant/100 m^2 (1.0 plant/100 square yards [yd^2]) at a population in the southern end of Big Burn Valley to a high of 7.2 plants/100 m^2 (8.6 plants/100 yd^2) along the 19-02 Road. The population of *A. beatleyae* along the 19-02 Road in Area 19 is divided by a power line road. On one side of the road, the density of *A. beatleyae* was estimated to be 7.2 plants/100 m^2 (8.6 plants/100 yd^2). Across the road to the north in an area of similar size, plant density was

1.7 plants/100 m^2 (2.0 plants/100 yd^2). The density at the type locality in Area 20 and at a site east of Dead Horse Flat Road were both 1.6 plants/100 m^2 (1.9 plants/100 yd^2) (Table 5-1).

Table 5-1. Density estimates for plants monitored on the NNSS in 2010

Species	Population	Area Surveyed m^2 (yd^2)	Plants/ 100 m^2 (yd^2)
A. beatleyae	Area 19, 19-02 Rd North	6,173 (7,383)	1.7 (2.0)
A. beatleyae	Area 19, 19-02 Rd South	7,714 (9,226)	7.2 (8.6)
A. beatleyae	Area 19, Big Burn Valley	20,386 (24,381)	0.8 (1.0)
A. beatleyae	Area 19, Dead Horse Flat	1,670 (1,997)	1.6 (1.9)
A. beatleyae	Area 19, Pahute Mesa Rd	965 (1,154)	0.9 (1.1)
A. beatleyae	Area 19, Plateau Rd	8,896 (10,640)	5.1 (6.1)
A. beatleyae	Area 20, Type Locality	4,551 (5,443)	1.6 (1.9)
A. oophorus var. *clokeyanus*	Area 30, Timber Mountain	5,932 (7,095)	2.5 (3.0)
C. ripleyi var. *saniculoides*	Area 3, Scarp Canyon	5,233 (6,259)	1.7 (2.0))
C. ripleyi var. *saniculoides*	Area 3, Camera Butte	3,411 (4,080)	3.4 (4.1)
C. ripleyi var. *saniculoides*	Area 10, Yucca Flat	2,707 (3,238)	1.7 (2.0)
E. heermannii var. *clokeyi*	Area 5 & 23, Mercury Ridge	5,815 (6,955)	2.7 (3.2)
F. pahutensis	Area 19, 19-01 Road	16,588 (19,839)	1.1 (1.3)
F. pahutensis	Area 19, Gold Meadows	4,227 (5,055)	2.9 (3.5)
G. hilendiae spp. *kingstonense*	Area 15, Oak Springs Butte	6,025 (7,206)	2.3 (2.8)
P. fruticiformis var. *amargosae*	Area 25, Striped Hills	480 (574)	9.4 (11.2)
P. filiae	Area 27, Rock Valley	6,648 (7,951)	0.5 (0.6)
P. filiae	Area 25, Little Skull Mountain	3,500 (4,186)	1.4 (1.7)
P. filiae	Area 5, Pink Holes	25,625 (30,647)	1.3 (1.6)
P. filiae	Area 5, Burma Road	648 (775)	4.6 (5.5)

More than 1,400 individuals of *A. beatleyae* were located during monitoring efforts in 2010. Close to 500 plants were found along Plateau Road and almost 600 along the 19-02 Road (on both sides of the road). Only 75 plants were found at the Type Locality in Area 20, and only 9 plants were found at the population along Pahute Mesa Road.

***Astragalus oophorus* var. *clokeyanus*, Clokey eggvetch**

One permanent monitoring plot was established this year for *A. oophorus* var. *clokeyanus*. The plot is located in a small canyon that branches off from Cat Canyon to the south. This area represents one of the more dense populations of *A. oophorus* var. *clokeyanus* encountered so far on the NNSS. Several hundred individuals were found along the lower slopes and canyon bottoms. At other locations of *A. oophorus* var. *clokeyanus* on the NNSS, there are rarely more than 50 plants, which are widely scattered over a relatively small area.

The population of *A. oophorus* var. *clokeyanus* in the Timber Mountain region south of Cat Canyon is estimated to encompass about 202 ha (500 ac). During the 2 days of field surveys, over 750 individuals of *A. oophorus* var. *clokeyanus* were located. About 150 individuals of *A. oophorus* var. *clokeyanus* were located within the monitoring plot, which represents a density of 2.5 plants/100 m^2 (3.0 plants/100 yd^2) (Table 5-1). Permanent plots will be established at other sites in future years.

***Cymopteris ripleyi var. saniculoides*, Sanicle biscuitroot**

C. ripleyi var. *saniculoides* has been found at several locations on the NNSS. Field surveys prior to 2009 were unproductive because of poor growing conditions. Several days of field surveys were conducted in 2009 and again in 2010. Emphasis in 2010 was to survey reported locations of the species in the Scarp Canyon area and drainages around Camera Butte. The total number of individual plants located this year approached 900. There were over 350 individuals found in the Scarp Canyon area and about 250 individuals around Camera Butte and in the Pink Holes region. The Pink Holes population is not monitored and was actually opportunistically encountered during surveys for *P. filiae* this year in the rolling hills east of the Pink Holes. Over the last 2 years, approximately 450 individuals have been located along numerous drainages in the northern regions of Yucca Flat. One of those drainages located in Area 10 was monitored in 2010.

The density of *C. ripleyi* var. *saniculoides* has never been abundant. Plants are generally widely scattered along small drainages. Three plots were selected for monitoring in 2010. The estimated density in this area was 3.4 plants/100 m^2 (4.1 plants/100 yd^2), which is twice the density in Scarp Canyon and Yucca Flat (Table 5-1). One of the more dense populations of this species was found in the Camera Butte area along several drainages.

***Eriogonum heermannii* var. *clokeyi,* Clokey eggvetch**

E. heermannii var. *clokeyi* is only known to occur on the NNSS along the northern slopes of Mercury Ridge and Red Mountain. Field surveys for this species were completed in 2008 and 2009. Over the 2 years that surveys were conducted for this species, close to 4,500 individuals have been located along the north-facing slopes of Red Mountain and Mercury Ridge. A permanent monitoring plot was established in 2010 at a site along the northern slopes of Mercury Ridge. The density of *E. heermannii* var. *clokeyi* at this site was 2.7 plants/100 m^2 (3.2 plants/100 yd^2) (Table 5-1).

***Frasera pahutensis,* Pahute Green Gentian**

Field surveys for *F. pahutensis* were conducted in 2006 and 2008, and locations were plotted. There are two known populations of *F. pahutensis* on the NNSS. One is along the 19-01 Road on Pahute Mesa and the other is located in the Gold Meadows area on Rainier Mesa (Hansen et al., 2009). There were over 200 individuals of *F. pahutensis* located along the 19-01 Road in the open sagebrush shrubland and another 80 plus individuals north of the 19-01 Road in the wooded area. At Gold Meadows over 200 individuals were located during a 1-day survey. Monitoring plots were selected within each of the populations in 2010. The population along the 19-01 Road is composed of two different areas. One borders the 19-01 Road in an open sagebrush shrubland, while the other is in a wooded area further east along the 19-01 Road. The monitoring plot was established in the area in the open sagebrush shrubland. The density at this site was 1.1 plants/100 m^2 (1.3 plants/100 yd^2), which is less than half the density of 2.9 plants/100 m^2 (3.5 plants/100 yd^2) encountered at Gold Meadows (Table 5-1).

Galium hilendiae **spp.** ***kingstonense,*** **Kingston Mountain bedstraw**

Three populations of this species have been found on the NNSS. The largest population of *G. hilendiae* spp. *kingstonense* on the NNSS is located in the Oak Butte area. This area is characterized by sandy soils and plants typically found in the understory of pinyon/juniper or at the base of rocks. Over 200 individual plants were encountered at the Oak Spring Butte site. This compares to just 15 plants east of Oak Butte in the Tub Spring area and less than 40 individuals in the Tongue Wash area.

A single monitoring plot was established at the Oak Spring Butte site. The monitoring plot covered 6,025 m^2, which included most of the population located west of Oak Spring Butte. Density of *G. hilendiae* spp. *kingstonense* at this site was 2.3 plants/100 m^2 (2.8 plants/100 yd^2) (Table 5-1).

Penstemon fruticiformis **var.** ***amargosae,*** **Amargosa Valley beardtongue**

P. fruticiformis var. *amargosae* was only known from populations in the Specter Range south of the NNSS southern boundary until surveys were conducted for this species in the Striped Hills area in the spring of 2007, when about 70 plants were found. During those field surveys *P. fruticiformis* var. *amargosae* was found within the boundary of the NNSS. A monitoring plot was established in this area during 2010.

The monitoring plot was relatively small compared to the size of monitoring plots for other species. The density of *P. fruticiformis* var. *amargosae* was estimated to be 9.4 plants/100 m^2 (11.2 plants/100 yd^2) (Table 5-1). It is found primarily on rocky slopes with a few plants scattered in the bottom areas.

Phacelia filiae, **Clark phacelia**

P. filiae was the major focus of field surveys in 2010. As a result of those surveys, three populations of the species were identified on the NNSS. Two are located in the Rock Valley area: one around the southeastern slopes of Little Skull Mountain and one in the lowlands of the eastern edges of Rock Valley. The other population covers the northern slopes of Red Mountain in Area 5 of the NNSS. Four monitoring plots were established this year: one at each of the sites in Rock Valley and two along the lower slopes of Red Mountain. Plots ranged in size from 648 m^2 at a population along Burma Road to over 25,000 m^2 at the plot a mile or so west near the Pink Holes area (Table 5-1). Individual plant density was highest at the smallest plot along Burma Road. The plot with the lowest density was located in the eastern part of Rock Valley in Area 27. The density estimates at the other two sites, one in Rock Valley and the other near the Pink Holes, were about the same.

The largest number of individuals of *P. filiae* was in the Pink Holes area, where more than 1,600 plants were encountered. There were about 500 plants located along Burma Road east of the Pink Holes area.

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6.0 SENSITIVE AND PROTECTED/REGULATED ANIMAL MONITORING

The NNHP Animal and Plant At-Risk Tracking List; Nevada Administrative Code (NAC) 503, "Hunting, Fishing and Trapping; Miscellaneous Protective Measures"; and other sources were reviewed to determine if any changes had been made to the status of animal species known to occur on the NNSS. The mountain plover (*Charadrius montanus*), a rare migrant on the NNSS, was proposed to be listed as Threatened under the *Endangered Species Act*, but a final decision will not be announced until May 2011. Therefore, it was not added to our sensitive species list. No other changes to the status of any NNSS species were noted. The complete list with current designations is found in the Sensitive and Protected/Regulated Animal Species List (Table 2-1, shown previously).

Surveys of sensitive and protected/regulated animals during 2010 focused on (1) western red-tailed skinks (*Eumeces gilberti rubricaudatus*), (2) bats, (3) wild horses (*Equus caballus*), (4) mule deer (*Odocoileus hemionus*), and (5) mountain lions (*Puma concolor*). Information about other noteworthy wildlife observations, bird mortalities, and a summary of nuisance animals and their control on the NNSS are also presented.

6.1 Western Red-Tailed Skink Surveys

The western red-tailed skink (Figure 6-1) is considered a sensitive species by the NNHP and has an "Evaluate" status for monitoring on the NNSS. This means that there is insufficient information on its distribution and abundance to determine if it is threatened and, therefore, whether it warrants protection and monitoring or not. Surveys to determine the distribution and abundance of the western red-tailed skink on the NNSS began in 2006 and continued in 2010.

Figure 6-1. Western red-tailed skink (*Eumeces gilberti rubricaudatus*)
(Photo by D. B. Hall, June 8, 2010)

While the main focus of these surveys is to determine distribution and abundance of western red-tailed skinks, secondary objectives during 2010 included evaluating trap type for capture success, documenting captures of other species including the Great Basin skink (*Eumeces skiltonianus utahensis*), and genetic testing of western red-tailed and Great Basin skinks.

6.1.1 Western Red-Tailed Skink Distribution and Abundance

Western red-tailed skinks were sampled systematically using a 5 × 5 km (3.1 × 3.1 mi) grid overlay on the NNSS. The beginning point was approximately 8 km (5 mi) northwest of the northwest corner of the NNSS to ensure that the grid encompassed the entire NNSS (Figure 6-2). Each grid cell was assigned an alphanumeric label (A1 to M17). Cells to be sampled were selected based on data gaps and logistics such as travel time and access. Several sites from previous years were sampled again this year. Within each grid cell, one or two sampling sites were selected based on habitat features (e.g., rocky areas, mesic areas) known to be associated with western red-tailed skinks (Morrison and Hall, 1999; Stebbins, 2003; NSTec, 2007; Hansen et al., 2008; 2009; 2010). At each site, 30 funnel traps measuring 61.0 cm long × 21.0 cm wide × 21.0 cm tall (24.0 × 8.3 × 8.3 in.) were set near rocks and vegetation and positioned to direct animals into the traps.

Thirteen captures of 10 western red-tailed skinks were documented over 5,416 trap days (0.2% or 1 skink/417 trap days) at 8 of 29 sites (Table 6-1; Figure 6-2). At Sites #132 and #140, two skinks were captured. At Sites #132, #137, and #140 skinks were recaptured within 2 to 20 meters (m) (7 to 66 feet [ft]) of their original trapping location. Four of the eight sites where skinks were captured this year had been trapped in previous years with no skink captures, indicating that negative results in a given year do not necessarily mean skinks are not present. It is unlikely that skinks immigrated into these areas since the time they were last trapped. Rather, skinks were most likely there, and for whatever reason, they were not captured. Captures this year filled in several distribution gaps both spatially and habitat-wise including north-central Pahute Mesa, Timber Mountain, south slope of Rainier Mesa, north of Horse Wash (Site #70), and the top of Yucca Mountain (Figure 6-2). This year skinks were captured at the northernmost edge of the NNSS (Site #63) and at the highest elevation, 2,095 m (6,873 ft) above sea level, documented so far on the NNSS (Site #145).

The historic location (Site #1002) on the edge of Yucca Mountain is somewhat of an anomaly because it is in creosotebush habitat with no large rocks or outcrops. The site is situated on an outwash plain coming out of Pagany Wash at an elevation of 1,130 m (3,707 ft). An adult male was captured there on May 24, 1995, during 6,336 trap-days of pitfall and funnel trapping and about 1,000 person-days of noosing conducted from 1991 to 1995 (Boone and Sowell, 1999). Precipitation during winter 1994–1995 was near record levels for this region. It is believed that the capture site is not core skink habitat but that the skink moved down the slope from its core habitat in the rocky ledges of Yucca Mountain during this wet time period. Three skink captures at Sites #132 and #137 in the rocky ledges of Yucca Mountain support this belief.

6.1.2 Comparative Trap Design Study

At 16 sites (Table 6-1) two types of traps were used to determine if trap design affected trap success. Both were rectangular traps. One was a rectangular box-like funnel trap with metal frame (Figure 6-3, right side), and one was made from wire-mesh with no supporting frame (Figure 6-3, left side). Fifteen traps of each type were set for the same number of trap days in order to establish a comparative study. Percent trap success (number of reptiles captured/number of trap days × 100) was calculated and analyzed using a paired t-test to see which trap type was more effective.

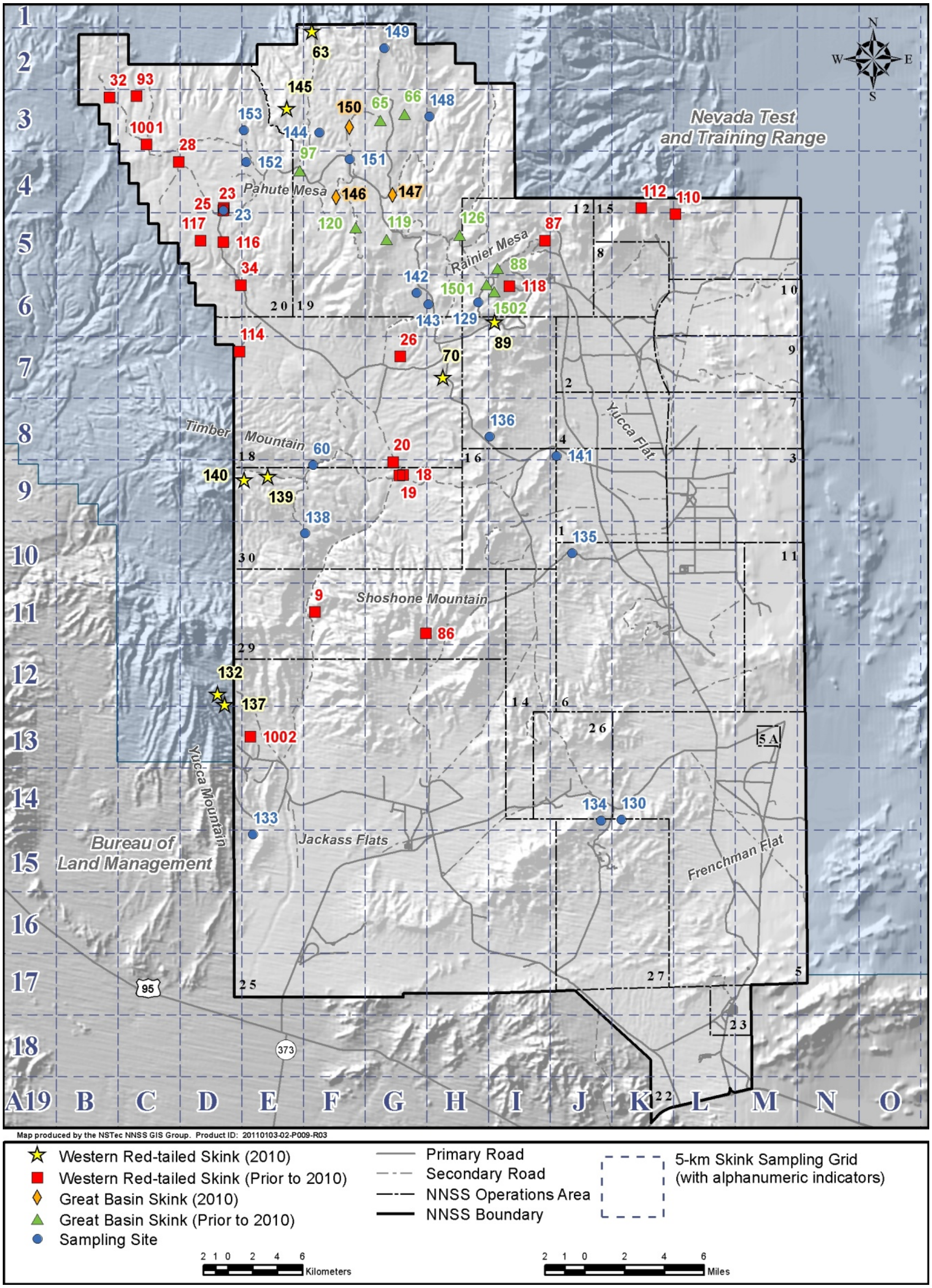

Figure 6-2. Western red-tailed and Great Basin skink capture sites on the NNSS showing all known locations of skinks, a 5 km sample grid, and sites sampled in 2010

Table 6-1. Number of skink and other reptile captures by NNSS area, site, and survey period

(P = species observed but not captured; [a] = Site where trap types were compared)

				Lizards										Snakes						
Site Number	NTS Area	Dates in 2010	Trap Days	*Cnemidophorus tigris*	*Coleonyx variegatus*	*Crotaphytus bicinctores*	*Eumeces gilberti*	*Eumeces skiltonianus*	*Gambelia wislizenii*	*Sceloporus graciosus*	*Sceloporus magister*	*Sceloporus occidentalis*	*Uta stansburiana*	*Crotalus mitchellii*	*Masticophis flagellum*	*Masticophis taeniatus*	*Pituophis catenifer*	*Salvadora hexalepis*	Total	Percent Trap Success
130[a]	27	5/3-5/6; 5/10-5/13	180	5							7		2		4		1		**19**	**10.6**
132	Off NNSS	5/3-5/6; 5-10-5/13; 5/17-5/20; 5/24-5/27	360	4		1	3				10	3	16				P	1	**38**	**10.6**
133	25	5/3-5/6; 5/10-5/13	180	2							21		13						**36**	**20.0**
134[a]	27	5/3-5/6; 5/10-5/13	188	2		1					8		18						**29**	**15.4**
135[a]	6	5/17-5/20; 5/24-5/27	188	6	1						11		4				1		**23**	**12.2**
136[a]	17	5/17-5/20; 5/24-5/27	180								6		3		2		1		**12**	**6.7**
137	Off NNSS	5/17-5/20; 5/24-5/27	180	1			2				5		12						**20**	**11.1**
138[a]	30	6/1-6/4; 6/7-6/10	180								1	7	1				4		**13**	**7.2**
139	30	6/1-6/4; 6/7-6/10	180				1					7	1						**9**	**5.0**
140[a]	30	6/1-6/4; 6/7-6/10	180				3					12							**15**	**8.3**
60	30	6/1-6/4; 6/7-6/10	180	1	1						3	1	1	1			4		**12**	**6.7**
89[a]	17	6/14-6/17; 6/21-6/24	180	1			1					6	1						**9**	**5**
141[a]	1	6/14-6/17; 6/21-6/24	180	3	1	P					2				1				**7**	**3.9**
142	19	6/14-6/17; 6/21-6/24	180									8							**8**	**4.4**
143	19	6/14-6/17; 6/21-6/24	180	1								10	1	1			1		**14**	**7.8**
70[a]	18	6/28-7/1; 7/6-7/9	180	P			1				3	8	1						**13**	**7.2**
129[a]	12	6/28-7/1; 7/6-7/9	180									5	1			1			**7**	**3.9**
144[a]	19	7/12-7/15; 7/19-7/22	180									3				P			**3**	**1.7**
145[a]	19	7/12-7/15; 7/19-7/22	180	1			1					5	1						**8**	**4.4**
146	19	7/12-7/15; 7/19-7/22	180					2				8							**10**	**5.6**
63	19	7/12-7/15; 7/19-7/22	180	1			1					5	3						**10**	**5.6**
147[a]	19	8/23-8/26; 8/30-9/2	180					1		1		7	3						**12**	**6.7**
148	19	8/23-8/26; 8/30-9/2	180	1								2	1						**4**	**2.2**
149	19	8/23-8/26; 8/30-9/2	180	1								2	3			1	1		**8**	**4.4**
150[a]	19	8/23-8/26; 8/30-9/2	180					1				7				1			**9**	**5.0**
151[a]	19	9/7-9/10; 9/13-9/16	180									1							**1**	**0.6**
152[a]	20	9/7-9/10; 9/13-9/16	180	1								5	P						**6**	**3.3**
153	20	9/7-9/10; 9/13-9/16	180	3					P			4	4			1			**12**	**6.7**
23	20	9/7-9/10; 9/13-9/16	180	1								1	5						**7**	**3.9**
		Total:	**5416**	**35**	**3**	**2**	**13**	**4**	**0**	**1**	**77**	**117**	**95**	**2**	**7**	**4**	**13**	**1**	**374**	**7.3**
Number of sites species was found:				**18**	**3**	**3**	**8**	**3**	**1**	**1**	**11**	**22**	**22**	**2**	**3**	**5**	**8**	**1**		

Figure 6-3. Rectangular mesh funnel trap (left) and rectangular box-like funnel trap (right) (Photo by D. B. Hall, June 4, 2010)

Trap success was significantly higher ($t=3.5$, $p=0.003$) in the box-like funnel traps with metal frame (8.0%, 115 captures/1,440 trap days) than in the wire-mesh traps (4.7%, 67 captures/1,440 trap days). The advantages of the wire-mesh traps are that they are cheaper to make and lighter than the box-like traps, so fewer trips are required to set them at sites long distances from roads. The disadvantage is that they are less effective than the box-like traps at capturing reptiles.

6.1.3 Other Species

A total of 10 of the 16 known lizards and 5 of the 17 known snake species on the NNSS were captured or observed, including 347 captures of lizards and 27 captures of snakes (Table 6-1). Western fence lizards (*Sceloporus occidentalis*), side-blotched lizards (*Uta stansburiana*), and desert spiny lizards (*Sceloporus magister*) were the most abundant species captured, with side-blotched and western fence lizards being the most ubiquitous. Four Great Basin skinks (Figure 6-4) were captured at three locations (Figure 6-2; Sites #146, #147, and #150). Other noteworthy reptile observations included a sagebrush lizard (*Sceloporus graciosus*) at Site #147, 13 captures of gopher snakes (*Pituophis catenifer*) at eight sites, and a western patch-nosed snake (*Salvadora hexalepis*) at Site #132 (Table 6-1 and Figure 6-2).

Figure 6-4. Great Basin skink (*Eumeces skiltonianus utahensis*) captured at Site #146
(Photo by D. B. Hall, July 15, 2010)

Overall trap success for reptiles was 7.3% (374 captures/5,416 trap days) in 2010 compared to 8.8% (538 captures/6,092 trap days) in 2006, 3.6% (162 captures/4,517 trap days) in 2007, 4.3% in 2008 (264 captures/6,099 trap days), and 7.8% in 2009 (451 captures/5,746 trap days). Trapping results indicate that percent trap success was highest during the first part of the trapping season (mean = 10.3 captures/trap day) versus the latter part of the year (mean = 4.1 captures/trap day) (Table 6-1). Possible reasons for this include reptiles are more active aboveground during this time, or mortality is high and there are fewer reptiles to capture later in the season. Additionally, three to four sites were trapped during the same time period, and trap success was high at some sites and low at other sites (Table 6-1), suggesting that some sites have better habitat for reptiles than other sites. General observations suggest that rock cracks may be the most important habitat feature necessary to support high reptile numbers and diversity.

Other species such as mammals and birds were also documented. A total of 85 captures or observations of 15 mammal species or their sign (e.g., tracks, scat) were recorded. In addition, 12 species of birds were detected audibly or by sight, including four captures of rock wrens (*Salpinctes obsoletus*). These data expand the knowledge of the distribution of wildlife across the NNSS, especially in areas not previously sampled.

6.1.4 Skink Genetics

Tissue samples of all captured western red-tailed and Great Basin skinks were collected and sent to Dr. Jonathan Richmond (USGS, Western Ecological Research Center) for genetic testing. Results were consistent with previous years' results (Hansen et al., 2009; 2010) and showed that western red-tailed skinks from the NNSS are part of the Inyo Clade and are most closely related to skinks located further northwest in Esmeralda County, Nevada, and west into the Panamint and Inyo/White Mountains in California. This is interesting because other western red-tailed skink samples collected by Dr. Richmond in 2008 in the Spring Mountains (Willow Creek area, about 30 km [19 mi] southeast of Mercury) belong to the Southwest Clade, which is a different evolutionary lineage than the Inyo Clade. Great Basin skinks from the NNSS are part of the Great Basin Clade, and their closest relatives are from eastern Nevada and central/southern Utah.

6.2 Bat Surveys

In 2010, bat monitoring focused on (a) conducting internal and external surveys at two sites to determine potential impacts to bats, (b) passive acoustic monitoring of bat activity at Camp 17 Pond, and (c) removing bats from buildings and documenting bat roosts.

6.2.1 Internal and External Surveys at U12u Tunnel and Test Cell C

Due to anticipated resumed activity inside U12u Tunnel in Area 12, an internal survey was conducted to determine if bats would be impacted. An external survey conducted in July 2003, indicated a few bats were using this tunnel as a night roost/foraging site. During the internal survey on June 16, 2010, guano was found in two places near the back of the tunnel. Based on this sign, an external survey was conducted on the same day for nearly 2.5 hours after sunset to determine species and relative abundance. Observations using a pair of night-vision goggles at the west portal revealed no bats entering or exiting the opening. However, acoustic monitoring at the east portal resulted in 19 files containing calls of long-legged myotis (*Myotis volans*) and 10 files containing calls of small-footed myotis (*Myotis ciliolabrum*). Video monitoring with a thermal-imaging camera at the east portal revealed four occurrences of bats entering, exiting, or flying around the opening, indicating the tunnel was being used by a few bats as a night roost/foraging site, similar to what was documented in 2003. Based on the low use, it was determined that resumed activity inside the tunnel would not significantly impact bat populations in the area.

Building 3210 within the Test Cell C Complex in Area 25 was scheduled to be demolished in late 2010. An internal survey conducted on October 14 resulted in four bats (*Myotis* species) and numerous guano piles being detected. Based on the presence of bats and abundant guano piles, an exit survey was conducted on October 25 for about 2 hours after sunset to determine species and relative abundance. Results from acoustic monitoring documented 11 files. Of these, four contained calls of fringed myotis (*Myotis thysanodes*), four contained calls of Yuma myotis (*Myotis yumanensis*), and three contained calls of silver-haired bats (*Lasionycteris noctivagans*). Results from video monitoring using a thermal-imaging camera documented nine occurrences of bats entering, exiting, or flying around the building. A final internal survey was conducted on December 15, the day demolition began, to help ensure bats were not present.

6.2.2 Passive Acoustic Monitoring System at Camp 17 Pond

To learn more about long-term bat activity through different seasons and years, a passive acoustic monitoring system (Anabat II) was installed at Camp 17 Pond on September 22, 2003. Hundreds of thousands of electronic files containing bat calls have been recorded and are in the process of being analyzed by O'Farrell Biological Consulting. Bat vocalizations and climatic data (e.g., temperature, humidity, wind, barometric pressure) were recorded again in 2010. Progress was made to summarize and format climatic data so it can be correlated directly with bat vocalization data. This will help elucidate patterns of bat activity in relation to weather conditions. NSTec personnel are collaborating with Dr. Mike O'Farrell (O'Farrell Biological Consulting) and Jason Williams (Nevada Department of Wildlife) to analyze these data.

6.2.3 Bats at Buildings

During 2010, four bats were documented at the EMAD building in Area 25, one bat at Building 23-752 in Mercury, one bat in the high bay at Radiological/Nuclear Countermeasures Test and Evaluation Complex in Area 6, and one dead bat in the Device Assembly Facility in Area 6. The dead bat was an unidentified *Myotis* species, and the others were not identified. Roost site locations were entered in the EGIS faunal database.

6.3 Wild Horse Surveys

Horse monitoring provides information on the abundance, recruitment (i.e., survival of horses to reproductive age), and distribution of the horse population on the NNSS. Monitoring of individual horses at the NNSS began in 1989. In 2010, NSTec biologists determined horse abundance and recorded horse sign (e.g., droppings and hoof prints) along roads. Some of the natural and human-made water sources were visited in the summer of 2010 to assess their influence on horse distribution and movements and document the impact horses are having on NNSS wetlands and water sources. Important information on horse abundance and recruitment from 1990 to 1998 is given in Greger and Romney (1999).

6.3.1 Abundance

In 2010, a count of horses was made during 17 non-consecutive days between May and November. A standard road course was driven to locate and identify horses. Motion/heat activated cameras at Camp 17 Pond, Gold Meadows Spring, and Captain Jack Spring were also used to photograph horses. Individuals were identified by their unique physical markings (facial blazes) and classified as foal, yearling, or older when possible. About eight horse bands were detected, which were composed of stallions, subordinate males, females, and their offspring. There were 35 adult horses counted in 2010. This is a close approximation to the actual number of horses that are present. Only eight foals were observed this year, but it is not known exactly how many foals were produced in 2010.

The NNSS horse population in 2010 is stable at about 35 individuals (Figure 6-5). Survival of yearlings and foals was low in 2010 as in previous years (Figure 6-5). Observations and photos taken indicate numerous foals were born in 2010 as in other years, but most disappeared over a few weeks. Greger and Romney (1999) found that over 60 healthy foals were lost over a 5-year period at the NNSS. Mountain lion predation is the most likely cause. Foal losses are a significant factor in controlling the size of the herd of horses on NNSS. The horse population has declined in size by about 40% since 1990 when horse population monitoring began on the NNSS. Historically, it is been very difficult to find horse kills by mountain lions on the NNSS. However, a new telemetry study of mountain lions initiated in winter 2010 will likely provide some information on the predation effects on horses by the end of 2011.

6.3.2 Annual Range Survey

During 2010, selected roads were driven within and along the range boundaries of horses, and all band sightings and fresh sign (estimated to be <1 year old) encountered were recorded and plotted using GIS.

Horse sign data collected during the road and walking surveys indicate that the horse range on the NNSS included Gold Meadows, the Eleana (mountain) Range, southwest foothills of the Eleana (mountain) Range, the Echo Peak region of Pahute Mesa, and Wildhorse Seep in Area 30

(Figure 6-6). The horse range boundary line was based on field observations of horse sign data and hand fitted by eye to make an approximation of the horse range boundaries on the GIS Map.

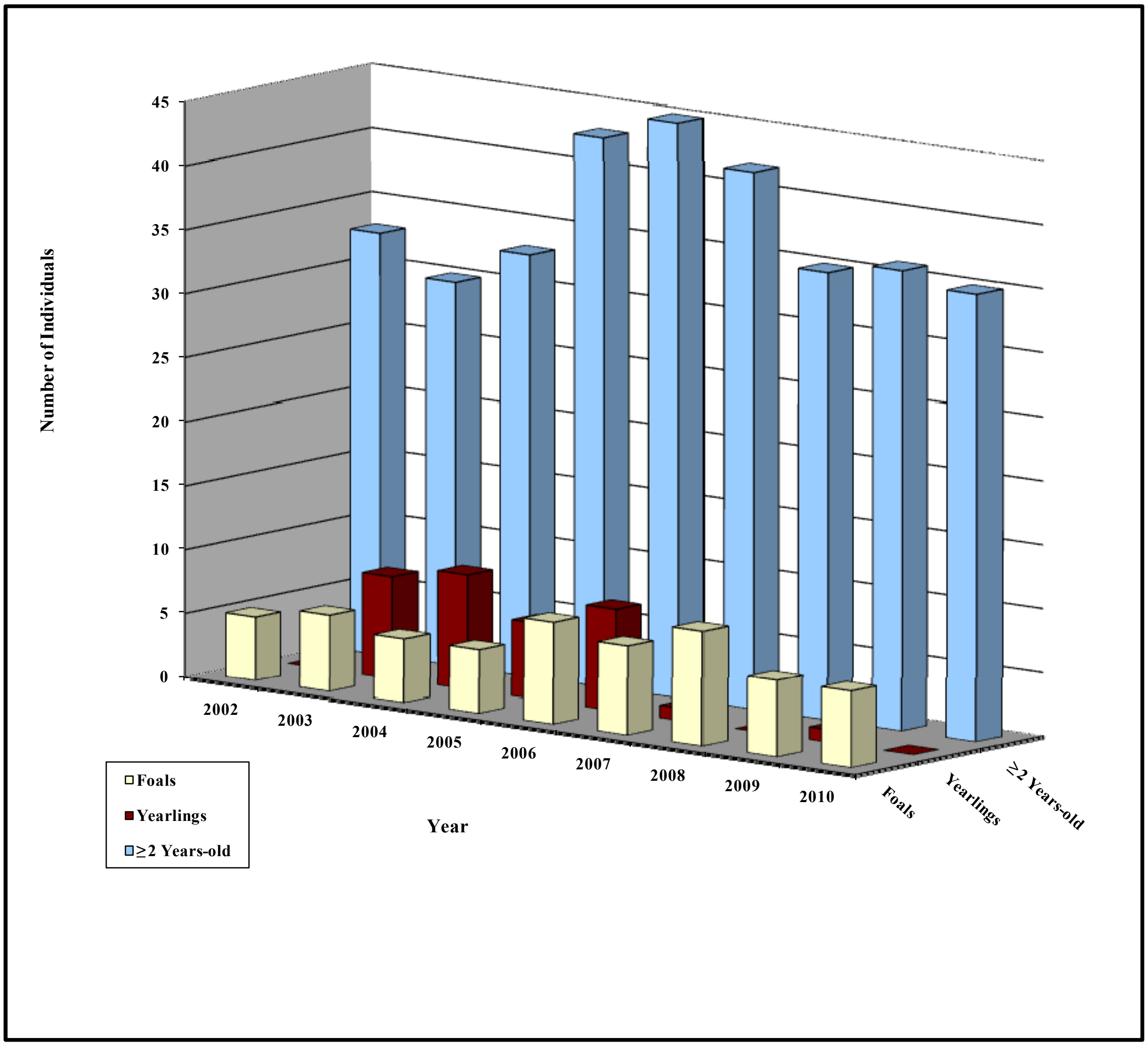

Figure 6-5. Trends in the age structure of the NNSS horse population from 2002 to 2010

Overall, the estimated annual horse range area in 2010 (271 square kilometers [km^2], 104 square miles [mi^2]) is similar to, but somewhat smaller than, the range area in 2009. The horse range on the NNSS is characterized by rather rugged topography, rolling hills with pinion-juniper, and sagebrush and was limited to a radius of approximately 8–11 km (5–7 mi) from any permanent water source. The preferred horse forage range appears to be above 1,524 m (5,000 ft) elevation, especially during the summer months. Horse activity was most heavy along roads from Camp 17 Pond in all directions shown by the concentrations of points (Figure 6-6).

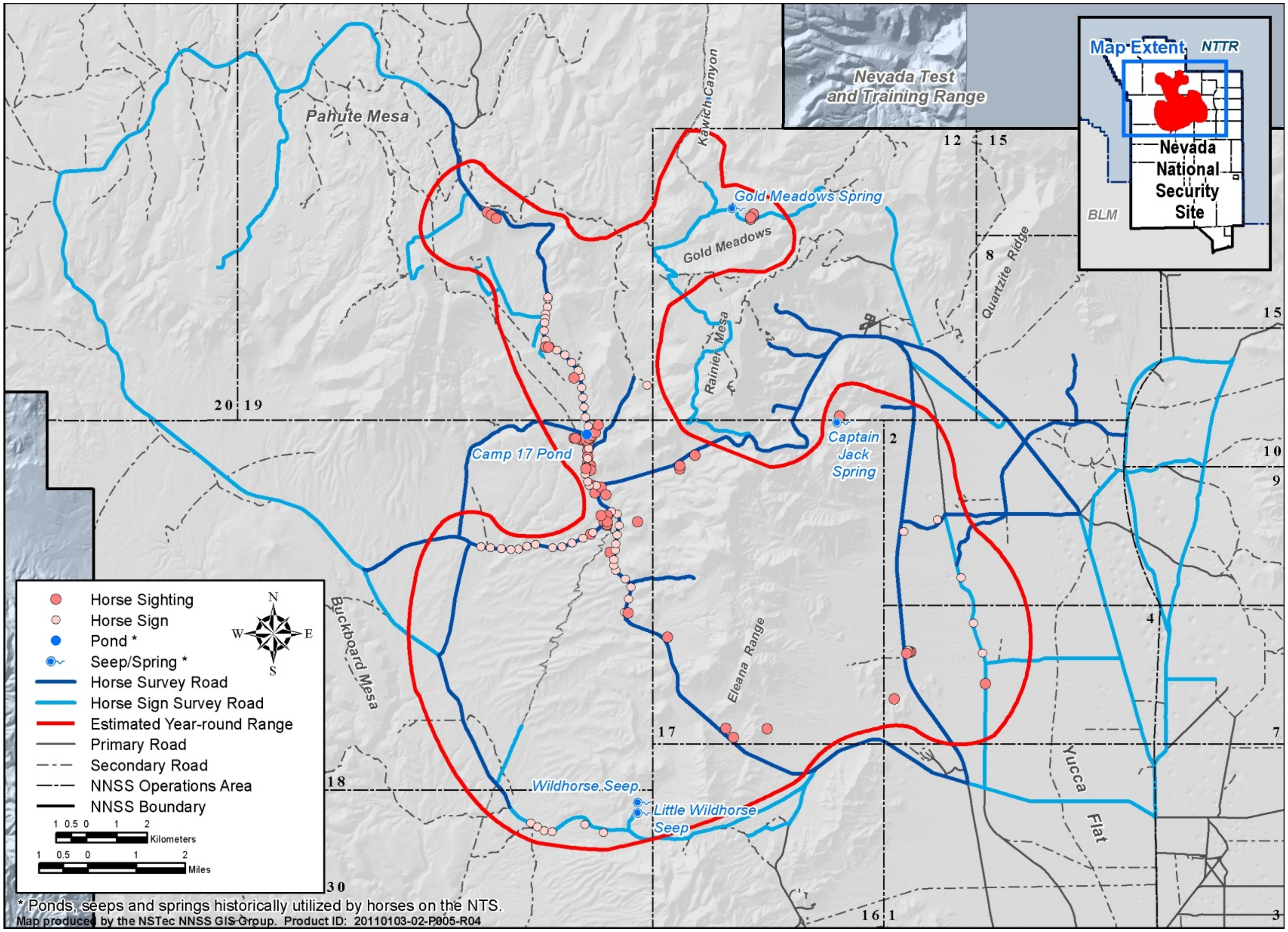

Figure 6-6. Feral horse sightings and horse sign observed on the NNSS during 2010

6.3.3 Horse Use of Water Sources

Some NNSS springs used by horses are ephemeral in nature such as the Wildhorse Seep, Little Wildhorse Seep, and Gold Meadows Spring. The Gold Meadows Spring was used intermittently by horses until it dried up in August 2010 (Figure 6-7), but was reused by horses late in the year after fall rains replenished the spring. In addition, one human-made pond (Camp 17 Pond in Area 18) was used heavily as in past years. Horses rarely used Captain Jack Spring during 2010. Seasonal horse use at Camp 17 Pond generally begins in March and extends through November. As in past years, horses did not use any of the plastic-lined sumps within or near the horse range in 2010.

Figure 6-7. Typical band of horses (stallion at left) at Gold Meadows Spring in August 2010 as the spring dries
(Photo by D. B. Hall, August 15, 2010)

Motion-activated cameras allow measurement of animal use and help identify horses from unique markings. During 2010 many photographs taken at water sources were analyzed to describe the diel (24 hour) use of the springs by horses and other wildlife. Total numbers of photos were tallied by species and summed by hourly periods for a month or longer. Motion-activated cameras were used at several locations to describe diel use of the water sources.

At Camp 17 Pond, diel horse use from May to August 2010 was primarily during the daytime hours, with an overall increase in use around 7:00–11:00 a.m. (Figure 6-8). Few horses appear to drink at night at Camp 17 Pond. The data suggest that the optimal viewing times for horses at

Camp 17 Pond would be in the early morning hours (6:00–9:00 a.m.). Similar results for horse use were recorded with a camera at Gold Meadows Spring in 2010 (see Figure 6-16).

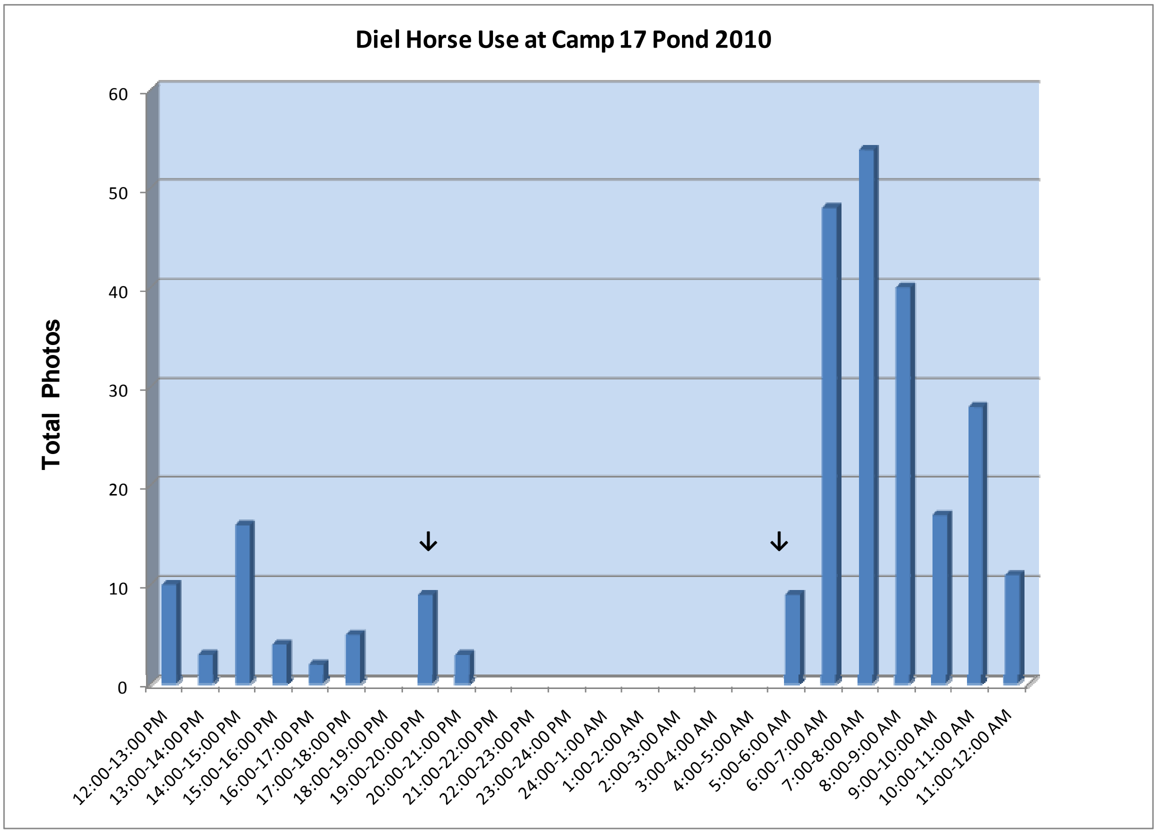

Figure 6-8. Diel Horse Use at Camp 17 Pond May 2–August 31, 2010, on the NNSS (N = 249)
Arrows bracket the approximate dark period.

6.4 Mule Deer Surveys

6.4.1 Mule Deer Abundance

Mule deer abundance on the NNSS was measured by driving two standardized road courses (74 km [44 mi] total length) (Figure 6-9) to count and identify mule deer. Previous studies of mule deer on the NNSS were conducted by Giles and Cooper (1985). Following advice that there were two main deer herd components in these regions of the NNSS, one route was centered around Rainier Mesa and the second route was centered around Pahute Mesa. Locations of all wildlife were recorded with a GPS from the road centerline. Perpendicular distance from the road to each deer group was measured with a laser range finder. For mapping deer groups, corrections were made to GPS locations taken from the road with the range finder distances. Locations of deer groups were displayed using GIS methodology (see Hansen et al., 2009).

During 2010, total observations were made of 376 mule deer, 7 gray foxes (*Urocyon cinereoargenteus*), 3 coyotes (*Canus latrans*), 3 bobcats (*Lynx rufus*), and numerous poor-wills (*Phalaenoptilus nuttallii*) during the nine surveys. The deer count with a mean of 41 deer per night, increased in 2010 compared to 2009; however, there appears to be no distinctive trend in deer numbers on the NNSS over time since 2006 (Figure 6-10). Rather, numbers have fluctuated (alternating regularly up and down) over the last 5 years of surveys. Standard deviation in the deer data have varied moderately over this period (Figure 6-10). There were significant differences over the last 5 years in total deer counts (Anova, square roots of counts, F = 9.69, 4, 40 d. f., P <0.0001) with 2006 having the highest mean, and being significantly greater than 2007, 2009, and 2010.

Overall, in recent years, deer numbers detected per distance are higher on the Rainier Mesa Route than on the Pahute Mesa Route (Figure 6-11). There was a significant difference in sighting rates of deer between transects from 2006 to 2010 (Anova, F=10.3, 1, 88 d. f., P=0.0018). Convincingly, more deer are being sighted on the Rainier Mesa transect in recent years. It is not clear why this is apparent. Conversely, deer sightings on the Pahute Mesa transect of the deer route appear to be moderately consistent across most years (Figure 6-11), excluding the obvious low counts of 1999–2000.

6.4.2 Mule Deer Density

Densities of deer were calculated using the software program DISTANCE (Thomas et al., 2006) on two transects and several sub-transects (Figure 6-9). Stratification of the data was based mostly on differences in topography and elevation. The model was run with a half cosine function with no adjustments, and density was calculated on mean group size. More details of the DISTANCE methodology are described in Hansen et al., 2009. Following the recommendations by Buckland et al., 2001, the furthest 10% of deer location data in 2010 were excluded from the data set prior to performing density calculations with distance models.

A total of 188 observations (deer groups) were detected during nine survey dates in September and October 2010. Overall, group size varied from 1 to 8 animals, and average group size was 2.3 and 1.8 deer, respectively, for Rainier Mesa and Pahute Mesa transects. Total number of deer spotted by region in 2010 varied from 163 on Rainier Mesa to 213 on Pahute Mesa. Deer density estimates after 9 days of sampling were 2.44/km^2 for Rainier Mesa and 1.91/km^2 for Pahute Mesa transect (Table 6-2). There were no statistically significant differences in deer density between transects, based on highly overlapping confidence intervals (CIs).

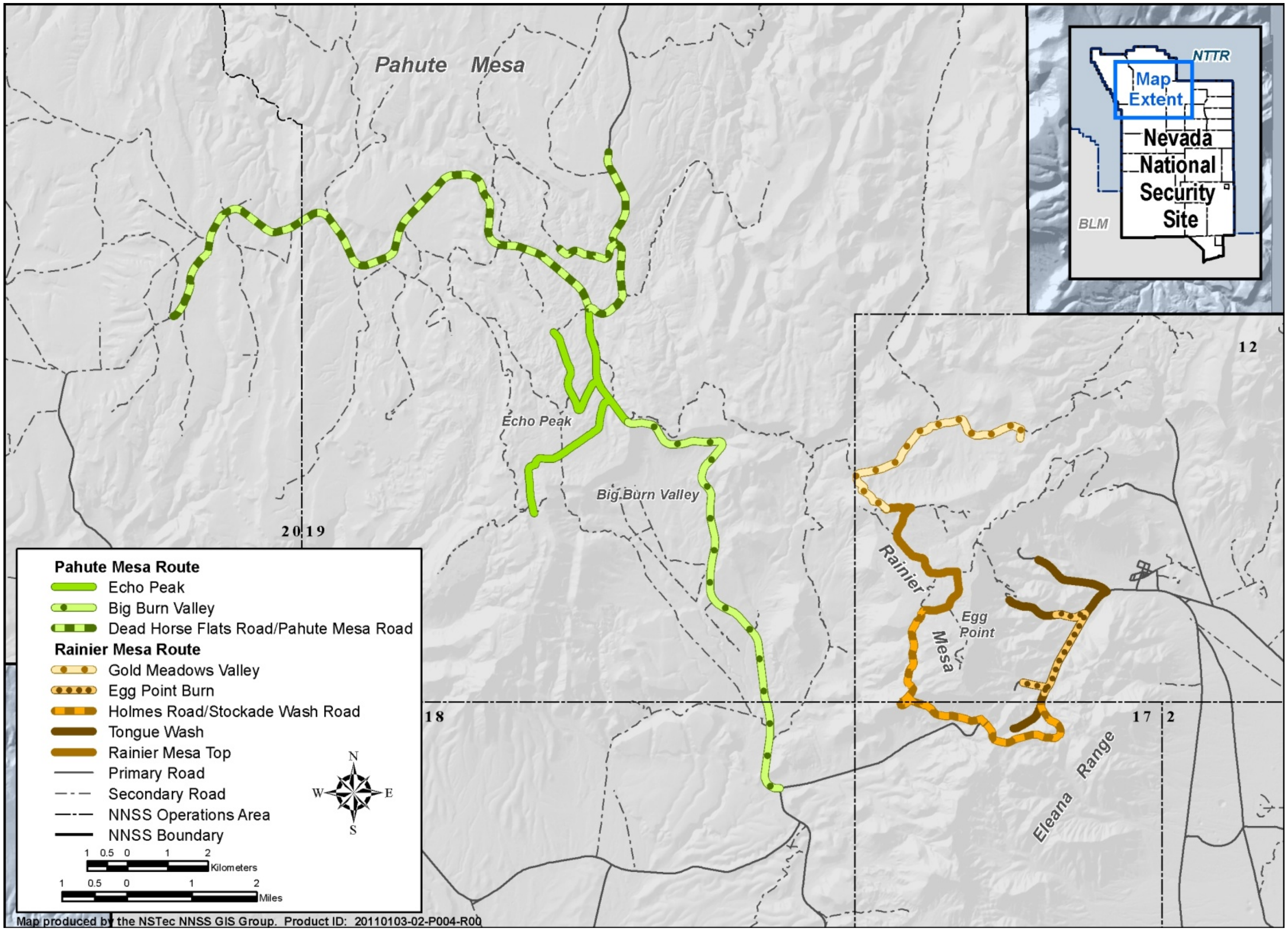

Figure 6-9. Road routes and sub-routes of areas driven to count deer on the NNSS in 2010

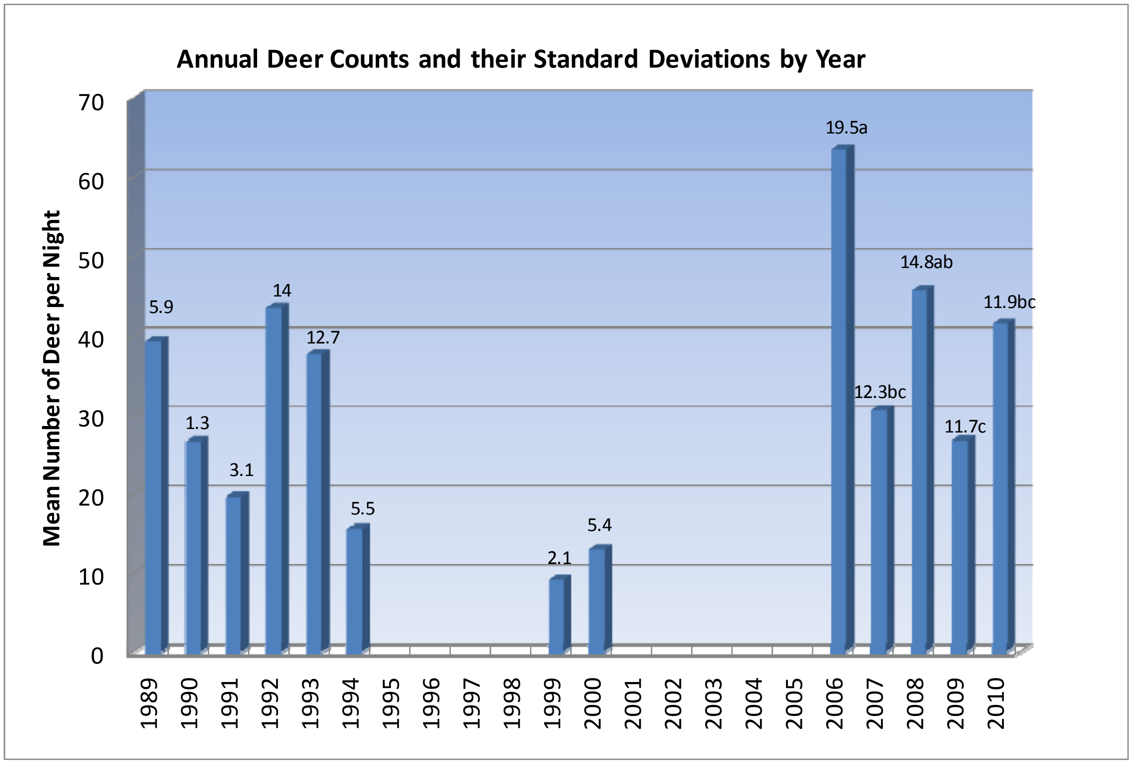

Figure 6-10. Trends in total deer counts per night on the NNSS from 1989 to 2010

Values above bars indicate standard deviation; values sharing similar letters are not significantly different at α = 0.05 level.

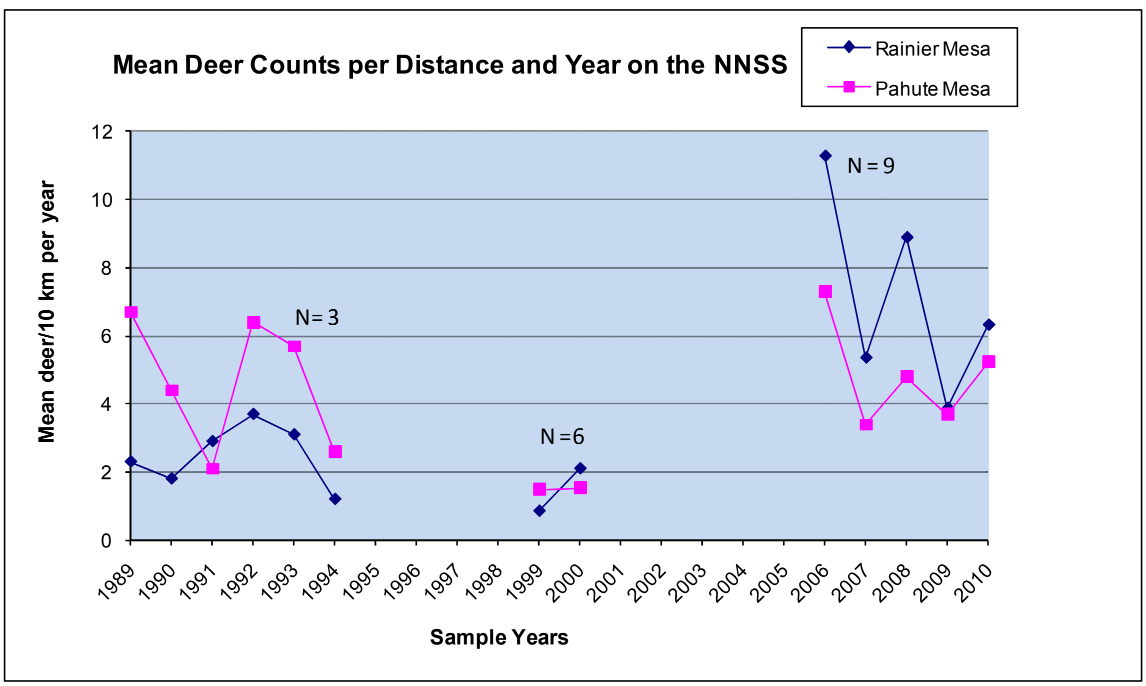

Figure 6-11. Mean deer counts per 10 km per year for the Rainier and Pahute Mesa routes on the NNSS (N = the number of survey nights per year)

Table 6-2. Deer density estimates, confidence intervals, and other parameters for two transects and sub-transects of the NNSS in 2010

Survey Transects	Transect Length (Km)	Total Observations	Deer Density D^b, n/Km^2	95% Lower Confidence Interval of D	95% Upper Confidence Interval of D	Coefficent of Variation of D
Pahute Mesa Total	**46.5**	**105**	1.91	1.32	2.75	0.176
Big Burn Valley	13.0	31	1.89	1.05	3.45	0.293
Echo Peak	10.1	55	3.93	2.30	6.70	0.258
Dead Horse Flat Road/Pahute Mesa Road	23.4	19	0.66	0.33	1.33	0.351
Rainier Mesa Total	**27.4**	**70**	2.44	1.79	3.31	0.154
Tongue Wash Area	5.5	13	2.21	1.06	4.60	0.31
Eggpoint Burn	3.6	16	3.89	1.84	8.23	0.38
Holmes Road/Stockade Wash Road	6.6	9	1.45	0.59	3.55	0.23
Rainier Mesa Top	5.1	10	2.71	1.07	6.86	0.472
Gold Meadows	6.6	22	4.42	2.11	9.27	0.374

[a]Model used is Conventional Distance Sampling, Half Normal Cosine Model, with 1 observer, and 1 parameter, Right truncation 10%

[b]Number of transects is 9 for all estimates

Overall deer density increased in 2010 over 2009 at the NNSS in both regions. However, density was significantly higher only for the Rainier Mesa transect in 2010 over 2009 (2.44 compared to 1.19 deer/km^2) with 95% CIs that did not overlap (Hansen et al., 2009). The deer density in 2010 for both transects combined averaged 2.2 deer/km^2. Assuming that about 252 km^2 of good deer habitat occur on the NNSS during summer–fall range (Giles and Cooper, 1985), the extrapolated deer population could be a minimum of 550 deer in 2010. This does not include areas to the south near Shoshone Mountain. An additional 50 deer could possibly live in the Shoshone Mountain region, which has enough summer water to support deer throughout the summer. The density analysis suggests that the deer habitat on the NNSS can be ranked from best to worst by survey sub-transect (Table 6-2). For example, on Rainier Mesa transect: Gold Meadows habitat > Egg Point Burn > Rainier Mesa Top > Tongue Wash > Holmes Road/Stockade Wash. Similarly on the Pahute Mesa transect: Echo Peak > Big Burn Valley > Dead Horse Flat/Pahute Mesa Road.

6.4.3 Sex/Fawn/Doe Ratios

The sex of deer can often be determined by observing the presence of antlers on the animal. During the fall deer surveys, male deer usually have antlers and females do not. However, the sex of some deer could not be determined during deer surveys due to the size of the antlers, the viewing angle, the amount of time the animal is in sight, or the distance to the animal. The percentage of deer whose sex could not be determined ranged from 15% in 2009 and 2010 to 21% in 2007; therefore, calculated sex ratios are not completely accurate. The possibility of improving accuracy will be investigated in future surveys by using spotting scopes with greater magnification and illumination than the binoculars that have previously been used. Sex ratios (number of males/female) have fluctuated from 0.89 in 2010 to 2.18 in 2007. It is interesting to note that M/F sex ratios were lowest in 2010 (Table 6-3). Even then, a M/F sex ratio of 1:1 is considered quite high for mule deer in the West (Giles and Cooper, 1985). Generally, deer populations in hunted areas in the West have much lower M/F ratios than measured on the NNSS. Giles and Cooper (1985) attributed the higher number of males to a lack of hunting on the NNSS.

The number of fawns detected also varied from 2006 to 2010, ranging from 0 in 2007 to 47 in 2008. The low count of fawns on the NNSS probably was related to the time of year that the surveys were conducted. Fawn surveys may be more effective if done earlier in the year (June–August) instead of September–October. Early season surveys would help determine early season fawn losses. Giles and Cooper (1985) conducted fawn/doe surveys from July to October (1977–1981) and determined fawn/doe ratios ranged from 0.34 to 0.73. These values are much higher than ratios from 2006 to 2010 (September–October) on the NNSS. Evidence continues to suggest that fawn surveys should be conducted earlier in the year.

Table 6-3. Mule deer sex ratios, fawns, and fawn to doe ratios across years on the NNSS

Year	M	F	Unclassified Sex	M/F Ratio	Fawns	Fawns/Doe
2006	224	222	96	1.01	31	0.14
2007	148	68	59	2.18	0	0
2008	164	147	50	1.12	47	0.32
2009	98	102	35	0.96	7	0.07
2010	133	150	50	0.89	32	0.21

6.4.4 Mule Deer Use of Habitat Types

Mule deer observation data were stratified in 2010 by shrublands and woodlands using the vegetation associations and alliances described by Ostler et al. (2000) to better determine deer habitat use. Deer observation transects (Hansen et al., 2009) were superimposed on areas created by polygons delineating natural vegetation (as well as recovering vegetation in the area burned by the Egg Point Fire in 2002) using GIS software (ArcGIS®). The lengths of deer transects in each habitat type were measured by route intersection analysis. Percentages of available habitat were calculated (Table 6-4). The locations of all deer groups detected were superimposed on the vegetation map (Figure 6-12) and summed, and percentage use by deer in each habitat was calculated (Table 6-4). Deer habitat selection indices (Table 6-4) were calculated by the quotient of percentage of deer habitat use and the percentage of available vegetative habitat (Stapp and Guttilla, 2002). Confidence intervals of selection coefficients, $\mathbf{w_i}$, were calculated after Krebs (1999) to examine statistical differences.

Two woodland associations, *Pinus monophylla*/*Artemisia tridentata* Woodland (PIMO/ARTR) and *Pinus monophylla*/*Artemisia nova* Woodland (PIMO/ARNO), comprise about 42% of the habitat where deer observations were made (Table 6-4). The *Artemisia* spp. Shrubland Alliance (*Artemisia* spp.) (29%) and the Miscellaneous-Disturbed habitats (20%) were also substantial components of the habitat. *Coleogyne ramosissima–Ephedra nevadensis* Shrubland (CORA-EPNE; 4.6%) and the Egg Point Burn (5%), comprised minor components of the habitats on the deer transects. The miscellaneous/disturbed category is composed of several elements, both minor vegetation types and land previously disturbed by NNSA/NSO activities. Minor vegetation types included *Cercocarpus* spp. and the *Chrysothamnus-Ericameria* Shrubland Alliance.

Table 6-4. Habitat Use Index W_i from Spotlighted Mule Deer on the NNSS during 2010

Habitat	Km's of Deer Transect in Habitat type	Percent of Available Habitat (A)	Observed Number Deer Groups	Percent Deer Use by Habitat (B)	Habitat Use Index w_i = B/A	95 % CI of w_i
PIMO/ARTR Woodland	18.1	24.5	33	17.5	0.7	0.5 , 0.9*
PIMO/ARNO Woodland	12.6	17.0	20	10.6	0.6	0.4 , 0.9*
Artemisia spp. Alliance[1]	21.4	29.0	77	41.0	1.4	1.2 , 1.6*
Miscellaneous-Disturbed	14.8	20.0	44	23.4	1.2	0.9 , 1.5
CORA-EPNE Shrubland	3.4	4.6	2	1.1	0.2	-0.1 , 0.6*
Eggpoint Burn, 2002	3.6	4.9	12	6.4	1.3	0.5 , 2.1
Total	73.9	100	188	100		

[1]Artemisia spp. Alliance = ARNO-ARTR, ARNO-CHVI and ARTR-CHVI Shrubland Associations

* An asterisk notes where selection is significantly different from 1.0 (i.e., confidence intervals [CI] did not include 1.0).

The most heavily selected habitat for deer was the *Artemisia* spp. Shrubland Alliance followed by the Egg Point Burn and then the Miscellaneous-Disturbed habitat (Table 6-4). Habitat selection coefficients calculated suggest that selection (>1.0) or avoidance (<1.0) by deer may have occurred in three habitat categories (Table 6-4). *Artemisia* spp. was heavily selected for use over all other habitats with selection values that were significantly different from random ($\mathbf{w_i}$ =1.0), with 95% confidence intervals that did not overlap 1.0 (Table 6-4). CORA-EPNE Shrubland, PIMO/ARTR, and PIMO/ARNO Woodland habitats were all avoided relative to availability. Overall, selection results for 2010 were different than those in 2009. This is mainly due to a much larger number of deer detections in the *Artemisia* spp. shrubland (77 versus 47) between years and less observations in the PIMO/ARTR Woodland habitat in 2010 compared to 2009 (33 versus 47) (Table 6-4). *Artemisia* spp. Shrubland and *PIMO/ARTR* Woodland habitats are closely juxtaposed in particular at Echo Peak (Figure 6-12) and therefore small deer movements across these habitat ecotones are highly probable and can change selectivity estimates greatly from time to time. Increased visibility of deer in open sagebrush could also bias the selectivity estimate in favor of that habitat over nearby woodland habitats where decreased visibility of deer may occur.

6.4.5 Wildlife Use of Water Sources

Camp 17 Pond

Motion-activated cameras are an effective way to measure relative animal use at water sources. Wildlife use at Camp 17 Pond was quantified using images with date and time recorded from a motion-activated camera, which could record a maximum of about 60 photos/hour. For the typical summer period, heavy deer use was concentrated during nighttime hours (Figure 6-13). Peaks in use occurred after sunset about 8:00–9:00 p.m. and near midnight, followed by a general decline in use throughout the early morning hours. Assuming diel (i.e., 24 hour) period of 9 hours dark/15 hour light during summer at Camp 17 Pond, 83% of photos (206) occurred during nighttime hours, and only 17% of photos (41) were during the daylight hours over a 1-month period (Figure 6-13 and 6-14).

During fall (September–November) of 2010 at Camp 17 Pond, deer use was of less magnitude but more dispersed over the 24-hour period (Figure 6-15) than during summer (Figure 6-13). Cooler temperatures in the fall may allow deer to spread the use out during the day with some moderate use occurring in the morning and afternoon. This pattern of dispersed deer use in fall at Camp 17 Pond was also found to be common in other prior years.

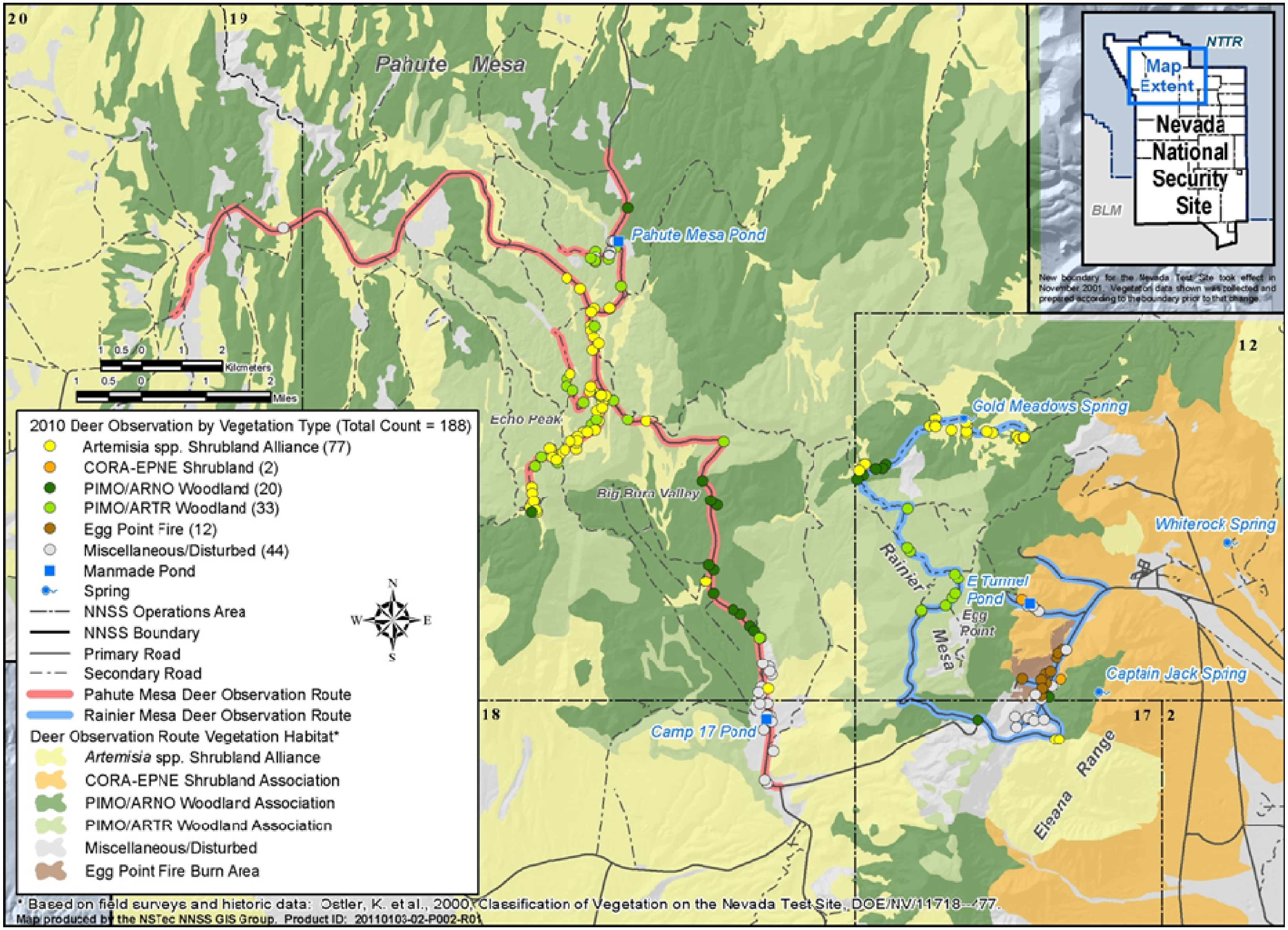

Figure 6-12. Mule deer observations by vegetation type on the NNSS

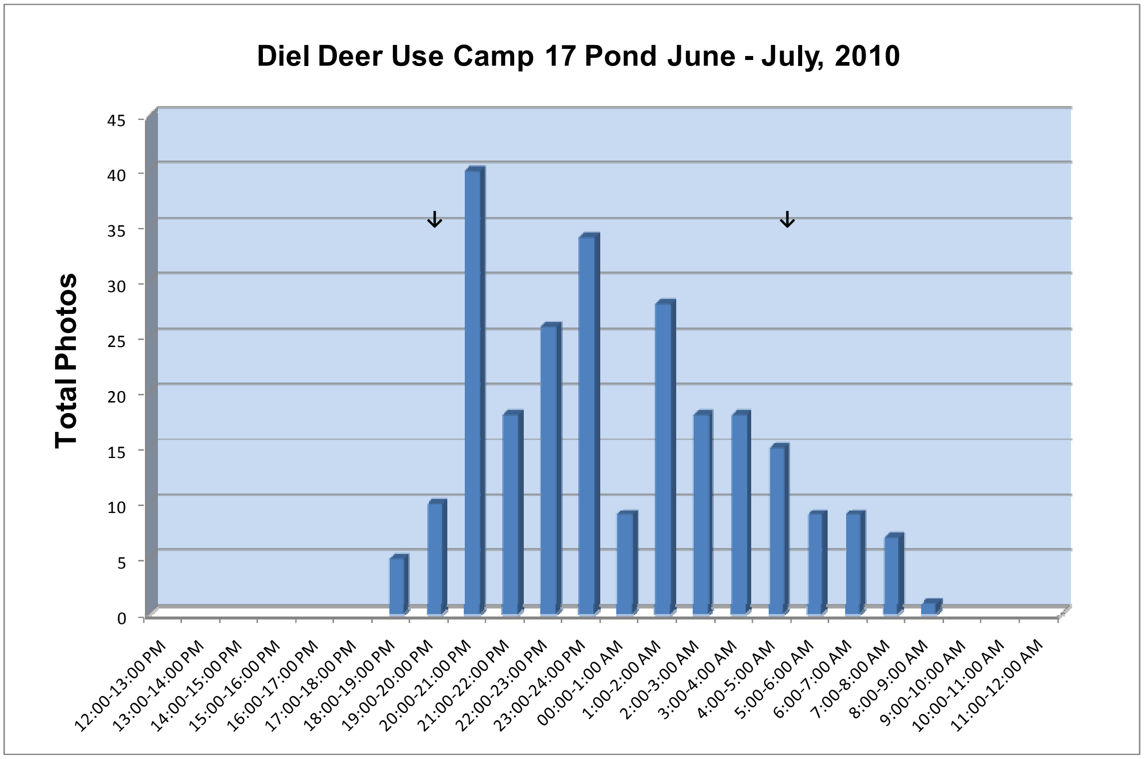

Figure 6-13. Diel Deer Use at Camp 17 Pond during June 24–July 23, 2010 (N = 247)
Arrows bracket the approximate dark period.

Figure 6-14. Large buck watering at Camp 17 Pond
(Photo by motion-activated camera, August 23, 2010, at 4:05 a.m.)

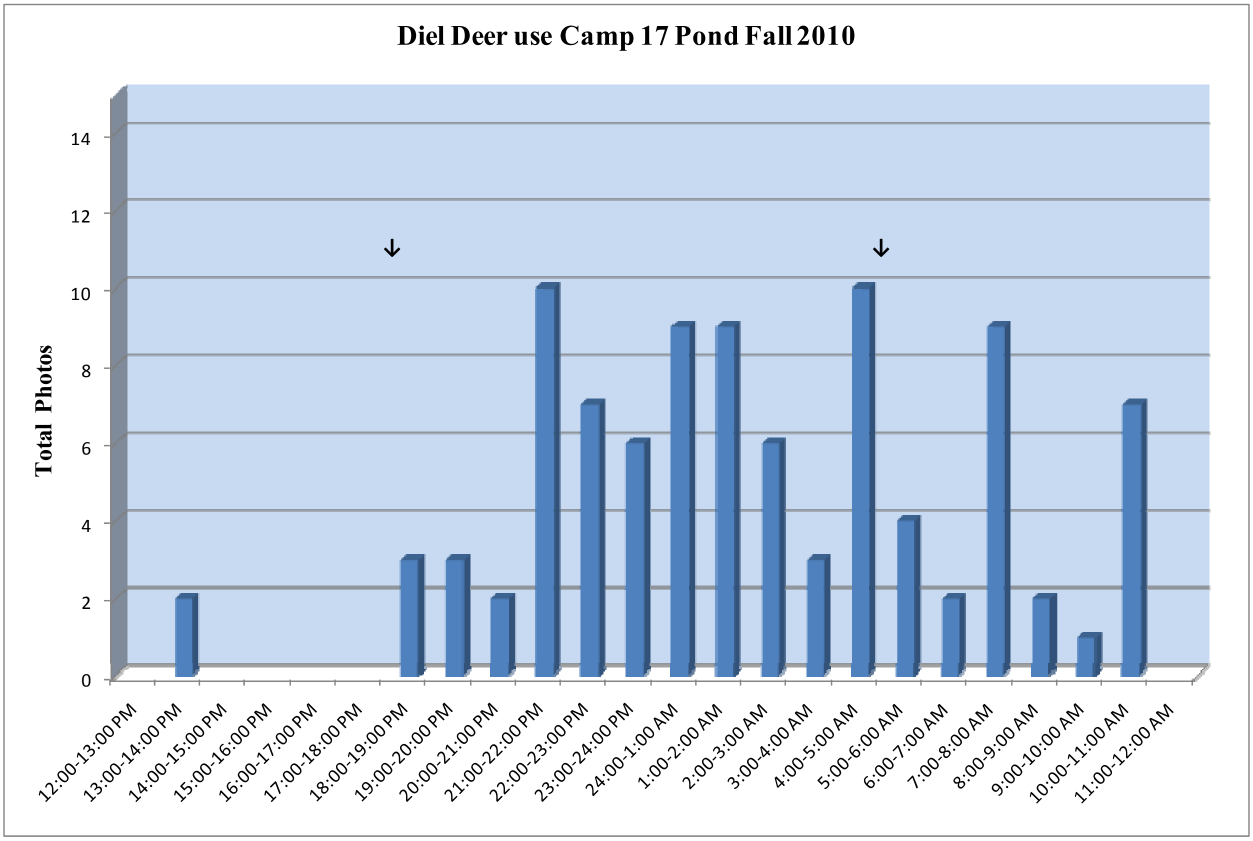

Figure 6-15. Diel deer use at Camp 17 Pond during September 1–November 26, 2010 (N = 95)
Arrows bracket the approximate dark period.

Gold Meadows Spring

Wildlife use at Gold Meadows Spring was also recorded by a motion-activated camera during the fall (September 1–November 26, 2010). Antelope, horses, and deer partitioned time spent during the 24-hour period during summer–fall with minimal overlap towards morning hours at Gold Meadow Spring in 2010 (Figure 6-16). Antelope and horses used the spring most heavily during the day, while mule deer used the spring at night (nearly identical to use at Camp 17 Pond). Overall, there were only a few records of antelope or horses using the spring during the nighttime period. Deer use patterns that were primarily restricted to night matched the patterns that deer showed at other water sources.

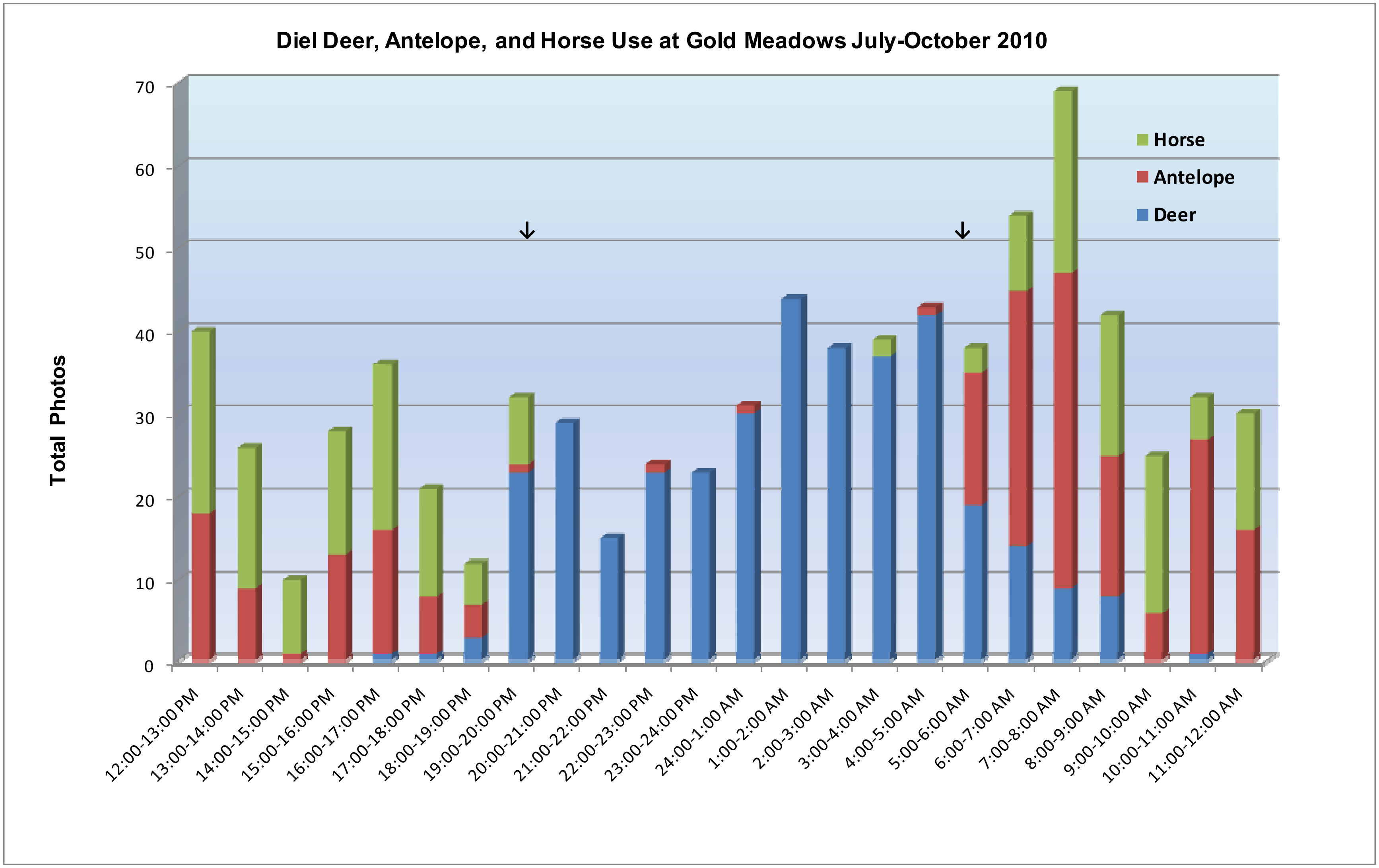

Figure 6-16. Diel wildlife and horse use at Gold Meadows Spring during July 2–October 28, 2010 (N = 546)
Arrows bracket the approximate dark period.

6.5 Mountain Lion Monitoring

Mountain lion monitoring during 2010 focused on (a) using motion-activated cameras to investigate distribution and abundance, and (b) capturing, radio collaring, tracking the movements, and investigating food habits of collared lions.

6.5.1 Motion-Activated Cameras

Little data exist for mountain lion numbers and distribution in southern Nevada, including the NNSS. Since 2006, NSTec biologists have collaborated with Dr. Erin Boydston, a research scientist with USGS, to use remote, motion-activated cameras to determine the distribution and abundance of mountain lions on the NNSS. Also opportunistic sightings of mountain lions or their sign on the NNSS have been recorded for the past 15 years to provide some location data.

In 2010, six locations of opportunistic sightings of mountain lions or their sign were recorded (Figure 6-17). Also during 2010, remote, motion-activated cameras were set up at 23 sites (4 new sites, 19 sites from 2009) (Figure 6-17 and Table 6-5). Sites were selected at previous mountain lion sightings, on infrequently traveled dirt roads, or areas known to be frequented by mule deer (e.g., deer trails, water sources), a primary prey species of the mountain lion.

A total of 22 mountain lion photographs/video clips were taken during 138,099 camera hours across all sites. This equates to about 0.2 mountain lion photo/video clips per 1,000 camera hours (Table 6-5). Mountain lions were detected at 8 of the 23 sites. Six of the eight sites were on roads (five dirt roads and one paved road) with little to no vehicle traffic. The other two sites were Topopah Spring and Gold Meadows Spring (Figure 6-17). In sharp contrast to last year (104 photographs/video clips of mountain lions), only one photograph of a mountain lion was taken at Topopah Spring during 2010 (Table 6-5). There was also a sharp decrease (70 in 2010 versus nearly 700 in 2009) in the number of deer photos taken at Topopah Spring during October and November. This decrease was most likely due to precipitation received during the fall of 2010, which created ephemeral water sources that the deer could drink from away from the spring. Drier conditions existed during the fall of 2009, which would have drawn deer as well as mountain lions in to the spring.

In order to investigate temporal activity of mountain lions, camera detection data from all 5 years (2006–2010) were combined. Mountain lions were detected in every month except April with peak occurrences in November (61 detections). The next most common months of occurrence were September (36 detections), August (33 detections) and July (22 detections). During most other months, there were fewer than 12 detections (Figure 6-18). This pattern may partially be explained by the availability of water or the presence or absence of mule deer and, to a lesser extent, other prey due to seasonal migration. Mountain lions were detected regularly between late afternoon and early morning with a peak between 8:00 and 9:00 p.m. (Figure 6-19). Only a few detections were documented during midmorning through early afternoon (Figure 6-19).

A secondary objective of the camera surveys is to detect other species using these areas to better define species distributions on the NNSS. Over 4,800 photographs/videos of at least 32 species other than mountain lions were taken during 138,099 camera hours across all sites (Table 6-5). This is about 35 photos/videos per 1,000 camera hours. The most prevalent species photographed was mule deer (1,899 photos/videos at 19 of 23 sites) (Table 6-5). Some of the rarer, more elusive species documented during camera surveys were Rocky Mountain elk (*Cervus elaphus*), desert bighorn sheep (*Ovis canadensis nelsoni*), bobcat, gray fox, badger (*Taxidea taxus*), kit fox (*Vulpes macrotis*), Costa's hummingbird (*Calypte costae*), and Lazuli bunting (*Passerina amoena*) (Table 6-5). Over 75% of the photos/videos were taken at four sites: Topopah Spring, Gold Meadows Spring, Camp 17 Pond, and Captain Jack Spring.

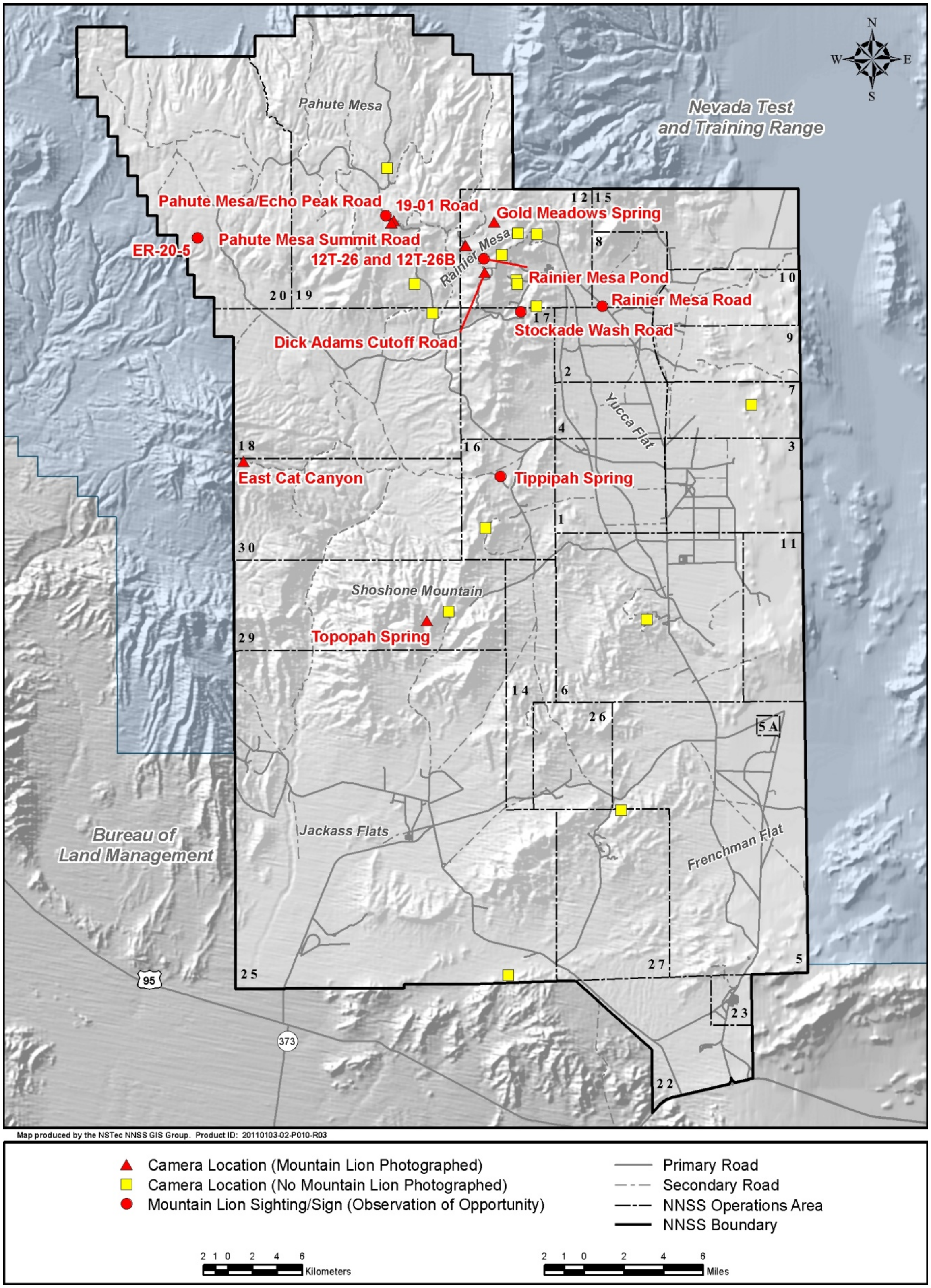

Figure 6-17. Locations of opportunistic mountain lion sightings, mountain lion photographic detections, and motion-activated cameras on the NNSS during 2010

Table 6-5. Results of mountain lion camera surveys during 2010

Location	Dates Sampled	Camera Hours	Mountain Lion photos/video clips (Number of photos/video clips per 1,000 camera hours)	Other Animals (Number of photos/video clips)
Gold Meadows Spring	6/29/10–12/14/10	4,034	8 (2.0)	Coyote (23), Rocky Mountain elk (11), pronghorn antelope (244), mule deer (388), horse (222), black-tailed jackrabbit (2), golden eagle (5), common raven (20)
East Cat Canyon	6/8/10–1/4/11	5,038	4 (0.8)	Coyote (6), mule deer (10), black-tailed jackrabbit (1), white-tailed antelope ground squirrel (1)
Pahute Mesa Summit, Road	1/5/10–12/14/10[b]	7,532	3 (0.4)	Bobcat (1), gray fox (11), coyote (4), Rocky Mountain elk (5), mule deer (75), horse (4), cliff chipmunk (1), common raven (1)
19-01 Road, Pahute Mesa	1/5/10–12/14/10[b]	4,914	2 (0.4)	Bobcat (3), gray fox (5), coyote (1), mule deer (14)
12T-26B, Rainier Mesa	1/6/10–12/14/10[b]	7,153	2 (0.3)	Bobcat (2), gray fox (12), coyote (4), Rocky Mountain elk (1), mule deer (28), black-tailed jackrabbit (6), rabbit (1)
Dick Adams Cutoff Road, Rainier Mesa[a]	1/6/10–12/14/10[b]	7,751	1 (0.1)	Gray fox (1), coyote (2), Rocky Mountain elk (3), mule deer (6), black-tailed jackrabbit (29), cottontail rabbit (1), rock squirrel (1), cliff chipmunk (4)
12T-26, Rainier Mesa	1/6/10–12/14/10[b]	7,802	1 (0.1)	Bobcat (5), gray fox (12), coyote (6), Rocky Mountain elk (1), mule deer (20), black-tailed jackrabbit (64), rabbit (3), common raven (2)
Topopah Spring	1/5/10–1/10/11[b]	8,616	1 (0.1)	Bobcat (6), gray fox (12), coyote (30), desert bighorn sheep (42), mule deer (70), bat (1), rock squirrel (9), Cooper's hawk (2), greater roadrunner (1),chukar (464), mourning dove (716), black-headed grosbeak (7), Lazuli bunting (1), scrub jay (6), pinyon jay (1), lizard (3)
ER 12-1 Sump Canyon[a]	1/6/10–1/12/11[b]	7,990	0	Bobcat (1), gray fox (3), coyote (6), mule deer (47), black-tailed jackrabbit (10)

Table 6-5. Results of mountain lion camera surveys during 2010 (continued)

Location	Dates Sampled	Camera Hours	Mountain Lion Photos/Video clips (Number of photos/video clips per 1,000 camera hours)	Other Animals (Number of photos/video clips)
Camp 17 Pond[a]	1/5/10–1/4/11[b]	6,582	0	Coyote (8), mule deer (489), horse (337), bat (5), golden eagle (5), turkey vulture (38), pinyon jay (5), common raven (21)
Pahute Mesa Pond Area[a]	1/6/10–11/29/10[b]	7,390	0	Coyote (1), mule deer (4)
Captain Jack Spring[a]	1/6/10–1/11/11[b]	6,730	0	Bobcat (3), gray fox (1), coyote (2), mule deer (386), horse (2), cliff chipmunk (1), rock squirrel (2), golden eagle (1), raptor (5), mourning dove (62), scrub jay (2), pinyon jay (29)
E Tunnel Road[a]	1/6/10–6/3/10	3,549	0	Gray fox (1)
12-4 Sump Canyon	6/3/10–12/14/10[b]	4,198	0	Bobcat (1), gray fox (2), mule deer (4), cliff chipmunk (1), scrub jay (1)
Water Bottle Canyon	6/24/10–12/10/10[b]	3,625	0	Bobcat (1), gray fox (4), black-tailed jackrabbit (1), rock squirrel (1)
Road above T Tunnel	1/7/10–12/14/10[b]	7,221	0	Bobcat (1), mule deer (60)
Rainier Mesa top, Above B Tunnel[a]	1/7/10–12/14/10[b]	6,671	0	Bobcat (3), gray fox (9), mule deer (19), black-tailed jackrabbit (1), rabbit (1), lizard (2)
Reitmann Seep	3/4/10–1/1/11[b]	6,743	0	Bobcat (20), coyote (118), badger (2), mule deer (21), bat (1), white-tailed antelope ground squirrel (5), golden eagle (3), chukar (60), mourning dove (47), house finch (4), common raven (1)
Shoshone Mountain, Tippipah Point Road	1/5/10–1/4/11[b]	8,310	0	Mule deer (14)

Table 6-5. Results of mountain lion camera surveys during 2010 (continued)

Location	Dates Sampled	Camera Hours	Mountain Lion Photos/Video clips (Number of photos/video clips per 1,000 camera hours)	Other Animals (Number of photos/video clips)
Shoshone Mountain, Topopah Pass	1/5/10–5/27/10	3,406	0	Bobcat (1), coyote (1), black-tailed jackrabbit (5)
Behind CP6, near 6-4C Barricade[a]	1/5/10–5/27/10[b]	713	0	Mule deer (1)
Cane Spring	3/2/10–1/4/11[b]	6,912	0	Bobcat (4), coyote (1), mule deer (243), Costa’s hummingbird (1), mourning dove (4)
Rock Valley	1/5/10–1/4/11[b]	5,219	0	Coyote (5), kit fox (1), black-tailed jackrabbit (6), kangaroo rat (12), bat (1)

[a]Camera hours not known for some time periods.

[b]Non-continuous operation due to camera problems, dead batteries, full memory cards, etc.

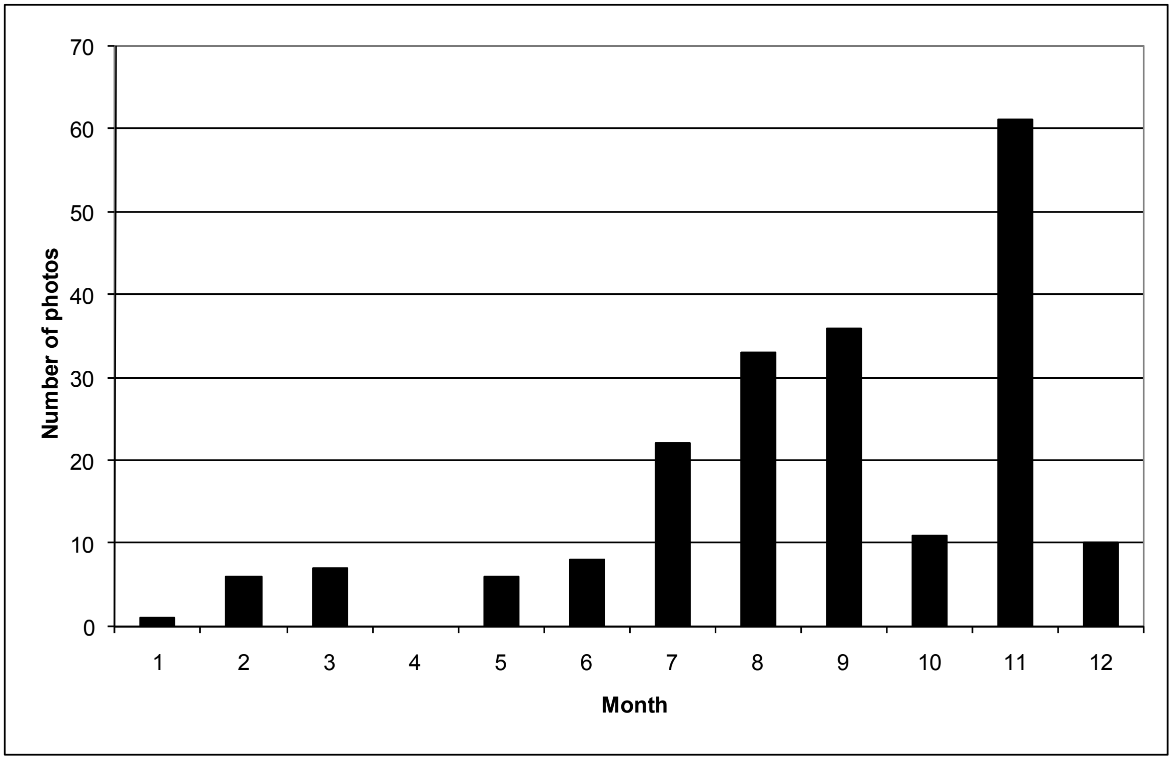

Figure 6-18. Numbers of mountain lion photographs/video clips by month for camera sites where mountain lions were detected during 2006 through 2010 (N=201)

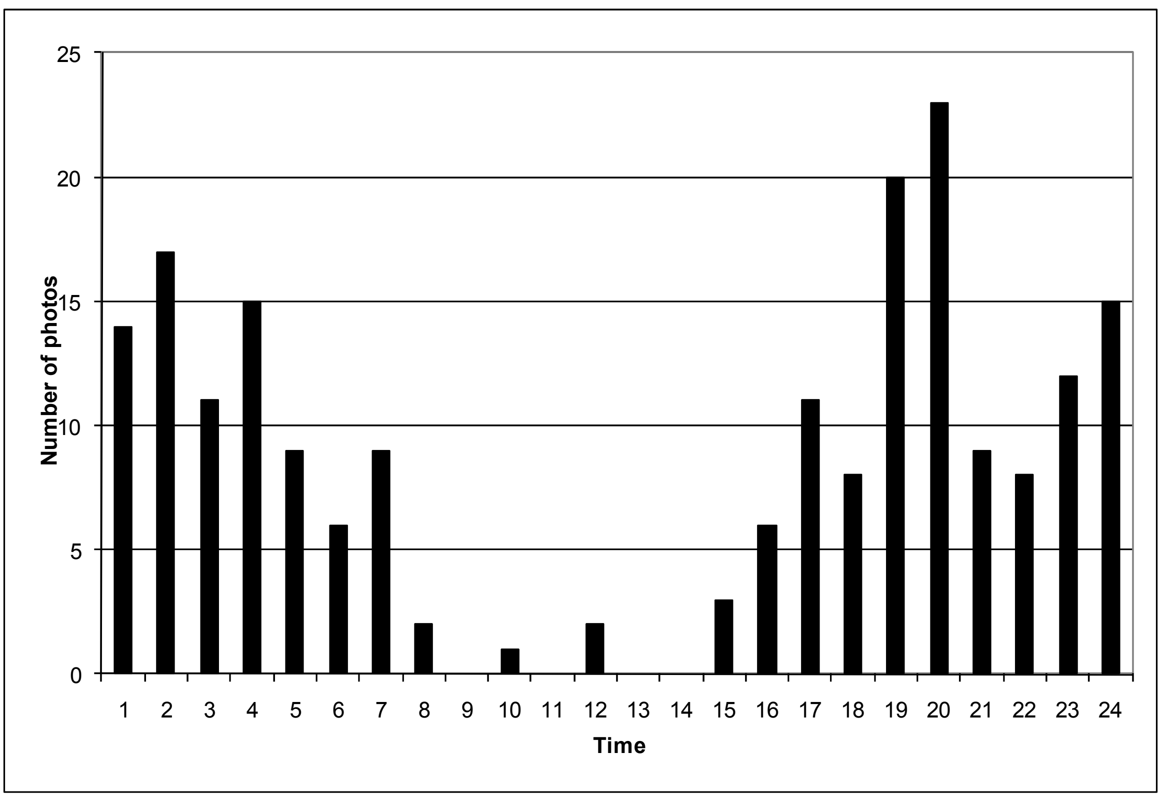

Figure 6-19. Numbers of mountain lion photographs/video clips by time of day for camera sites where mountain lions were detected during 2006 through 2010 (N=201)

A majority of these were taken during the summer and fall, which emphasizes the importance of these water sources for several wildlife species, especially during the drier months. Bird activity at Topopah Spring during June, July, and August was especially high with nearly 1,200 photos of at least 10 bird species. Photos of mourning doves (*Zenaida macroura*) and chukar (*Alectoris chukar*) were particularly high (Table 6-5).

6.5.2 Mountain Lion Telemetry Study

A collaborative effort between Dr. David Mattson (USGS) and NSTec biologists began during 2010 to investigate the movements, habitat use, and food habits of mountain lions on and around the NNSS. The goal was to capture and radio collar four mountain lions and track them for a year.

Three trapping sessions (April 7–21, 2010; June 23–July 2, 2010; December 6–24, 2010; January 1–17, 2011) occurred. Six sites were trapped during the April session (56 trap nights), 11 sites were trapped during the June session (58 trap nights), and 14 sites were trapped during December and January (194 trap nights) (Figure 6-20). A cage trap was set using a dead coyote for bait for several nights during June at Camp 17 Pond and 12-2C. All other traps were leg-hold snares (Figure 6-21) usually set in areas where mountain lions or their sign (e.g., scrapes, latrines, photographs) had been observed. Prey distress calls were used at several snare sets to attract mountain lions. Dogs were used during December and January to track mountain lions in the snow.

Two mountain lions were captured during December. NNSS001 was captured on December 13 in a snare trap near the western boundary of the NNSS on Timber Mountain. She was a 2–3-year-old female and weighed 34.3 kilograms (76.0 pounds). NNSS002 (Figure 6-22) was captured on December 24 in a snare trap near Rattlesnake Ridge, Area 19 (Figure 6-20). She was a 5–6-year-old female and weighed about 39.6 kilograms (87.4 pounds). Each lion was fitted with a radio collar set to record six locations per day (every 4 hours starting at noon) and a uniquely colored ear tag. Body measurements, blood and hair samples (DNA and radiological testing), and a Nebuto strip sample (plague testing) were also taken. The collars were programmed to attempt a satellite link upload during a certain window of time each day. The data are processed and then locations are sent to NSTec biologists via email. Data are converted to Universal Transverse Mercators and then plotted in ArcMap™ 10. Figure 6-23 shows the locations for NNSS001 and NNSS002 from date of capture through December 31. NNSS001 moved approximately 27 km from Timber Mountain south to the Calico Hills. NNSS002 moved approximately 23 km from Rattlesnake Ridge to the east flank of Timber Mountain. When a cluster of locations is detected within 100 meters (328 feet) of each other over a couple of days, it can mean the lion is on a kill. Kill-site investigations began during January 2011 and will continue for about a year from date of capture when the collars are set to automatically drop off. Additional trapping is planned during 2011 to acquire the desired number (n = 4) of radio-collared mountain lions.

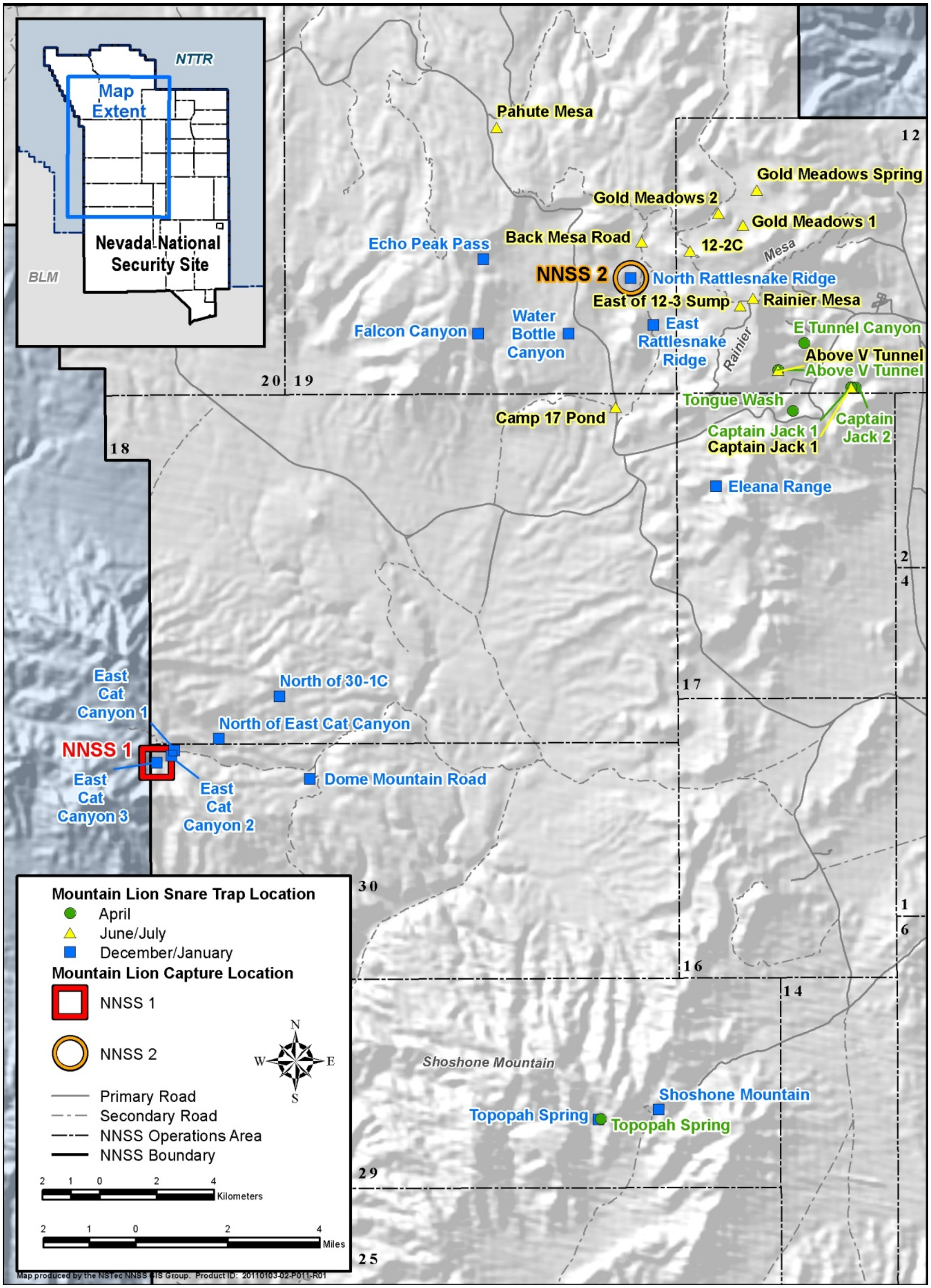

Figure 6-20. Mountain lion trap and capture locations during 2010

Figure 6-21. Snare trap in Falcon Canyon
(Photo by D. B. Hall, December 10, 2010)

Figure 6-22. NNSS002 captured on December 24, 2010
(Photo by B. Jansen, December 24, 2010)

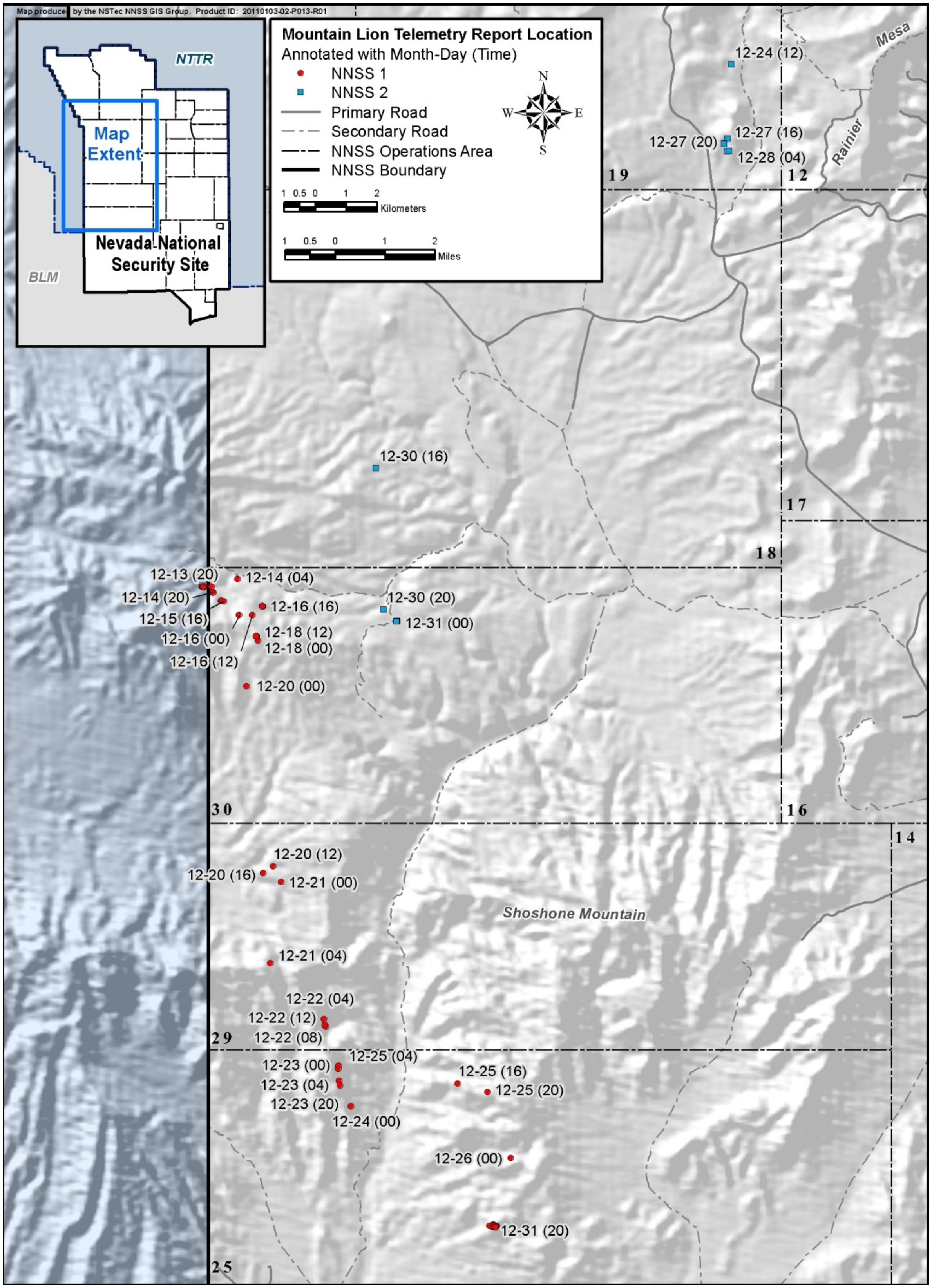

Figure 6-23. Recorded locations, including date and time, of NNSS001 (red) and NNSS002 (blue) through December 31, 2010

6.6 Raptors and Bird Mortality

6.6.1 Raptors

Historically, 16 species of raptors have been recorded for the NNSS. Raptors include vultures, hawks, kites, eagles, ospreys, falcons, and owls. All are protected/regulated under the *Migratory Bird Treaty Act* and/or Nevada State law. Because these birds occupy the higher trophic levels of the food chain, they are regarded as indicators of ecosystem stability and health. There are nine raptor species known to breed on the NNSS, including the western burrowing owl (Hunter, 1994).

6.6.2 Bird Mortality

Bird mortality is a measure of impacts that NNSA/NSO activities may have on protected bird species. NNSA/NSO activities that have affected birds typically have been of three types: collisions with buildings, electrocution from power lines, and vehicle mortalities. Presently, there are no large-scale activities on the NNSS that might harm birds. Workers are relied on to observe and report mortalities. Few bird deaths were reported in 2010 or previous years. Historically, reported deaths of birds are sometimes numerous, with episodes of predation and disease outbreaks involving larger numbers of dead birds during wet years. The most common causes of bird mortality from onsite activities in 2010 were electrocutions and entrapment. There were 15 bird mortalities detected in 2010: six bird mortalities were from electrocutions, eight were from entrapment , and one was from road kill (Figure 6-24).

Three brown-headed cowbirds (*Molothus ater*) were entrapped in a collection basin at the Engine Maintenance, Assembly, and Disassembly (EMAD) facility, and five red-shafted flickers (*Colaptes auratus*) were entrapped in a container at U19AD. Both entrapment basins were mitigated to prevent any further mortalities.

Overall, few impacts to birds were observed and few mortalities were reported from onsite project activities. Impacts to bird populations from NNSA/NSO activities at the NNSS appear to be low.

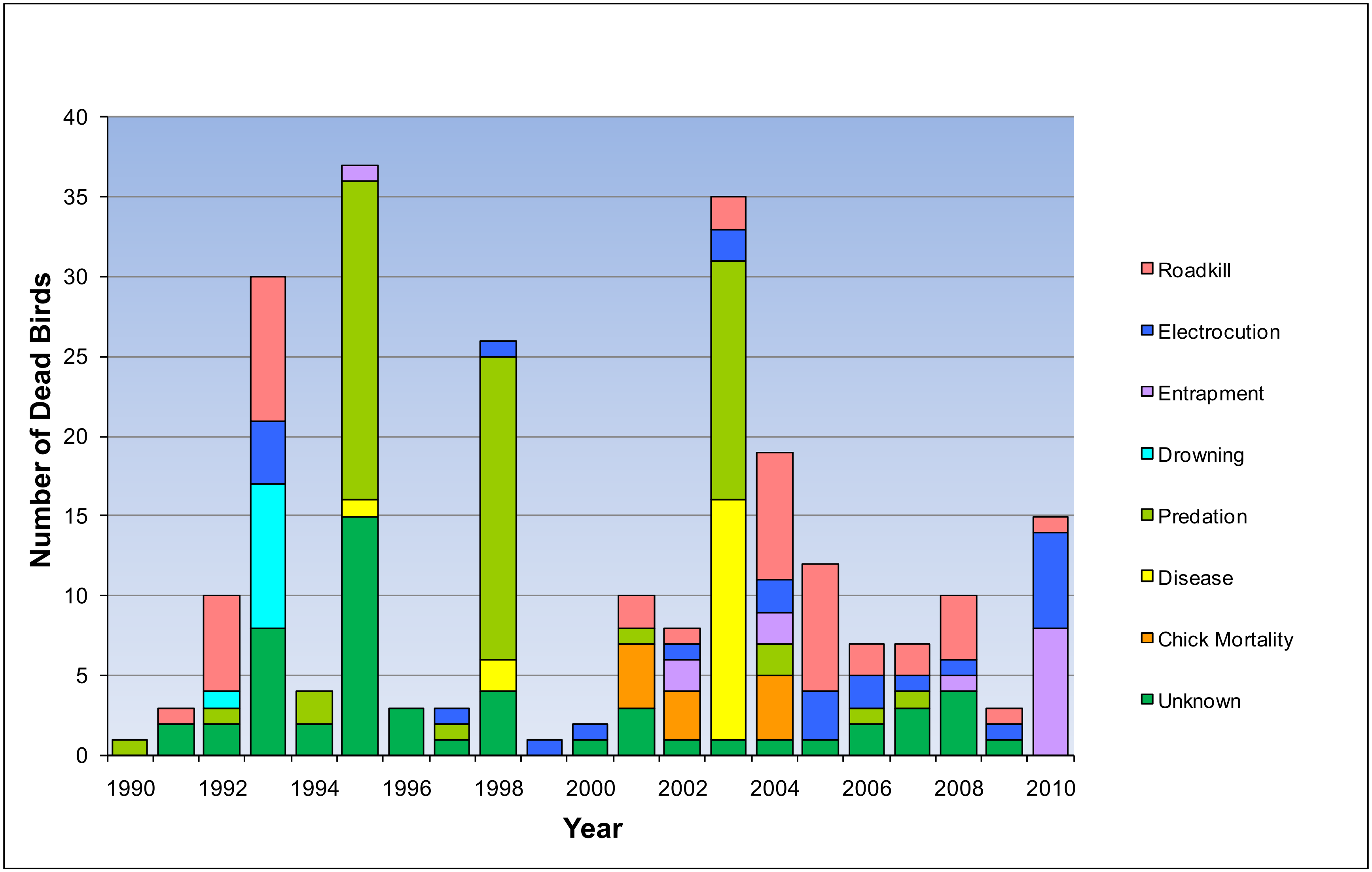

Figure 6-24. Historical records of reported birds deaths on the NNSS

6.7 Desert Bighorn Sheep and Elk Sightings

Desert bighorn sheep sightings are rare on the NNSS with only eight recorded observations of their presence on or near the NNSS between 1963 and 2009. These have been in the southern part of the NNSS (Areas 5, 23, and 25). A motion-activated camera, set at Topopah Spring (Area 29) to monitor mountain lions during 2009, photographed at least three rams 85 times between June 28 and November 3. During 2010, at least three rams were photographed 42 times at Topopah Spring between June and the end of November (Figure 6-25), indicating bighorn sheep are still using this site. There is an established population of desert bighorns on the Specter Range, south of the NNSS, and other populations west and north of the NNSS. It is unknown if the rams at Topopah Spring are from the Specter Range or other populations or if there is animal movement between these distant populations. The NNSS may provide a suitable corridor for movement between these populations or may provide suitable habitat for resident bighorn sheep.

Figure 6-25. Two desert bighorn sheep rams at Topopah Spring
(Photo by motion-activated camera, July 18, 2010)

During 2010, Rocky Mountain elk or their sign were documented at several locations on the NNSS, primarily on and around Rainier Mesa and Pahute Mesa. Motion-activated cameras used for mountain lion monitoring documented several photographs/video clips of elk at Gold Meadows Spring (n = 11), Pahute Mesa Road Summit (n = 5), Dick Adams Cutoff Road (n = 3), and the road off of Rainier Mesa into Gold Meadows (n = 2). Elk scat was found at Camp 17 Pond and in the wash near Plateau Road (Area 19), and tracks were observed along Holmes Road (Area 12). It appears from photographs/video clips that the same bull elk observed in 2009 was observed during June, July, August, and September 2010. At Gold Meadows Spring, interactions between the elk and pronghorn antelope, mule deer, and wild horses were observed. One sequence of photos depicts the elk charging towards several wild horses and scaring them away from the water source (Figure 6-26).

Figure 6-26. Bull elk chasing wild horses away from Gold Meadows Spring
(Photo by motion-activated camera, August 27, 2010)

6.8 Nuisance and Potentially Dangerous Wildlife

During 2010, NSTec biologists responded to 30 calls regarding nuisance, injured, or potentially dangerous wildlife in or around buildings and work areas. Problem or injured animals included coyotes (*Canis latrans*) (10 calls), bats (5 calls), snakes (7 calls), and birds (8 calls). Mitigation measures taken usually entailed moving the animal away from people or disposing of dead animals. Notices were also communicated via radio, e-mail, safety meeting presentations, and various company publications to alert people to potentially dangerous situations involving wildlife and to remind employees not to feed wild animals on the NNSS.

In addition, a notification card was developed by NSTec biologists in response to a safety suggestion. The card fits in a badge holder and contains contact information of who to call when workers encounter wildlife that they believe may pose a safety risk. The cards were given to housing and custodial employees and will be made available to other employees upon request.

6.9 Coordination with Biologists and Wildlife Agencies

NSTec biologists attended meetings of the Nevada Partners in Flight and provided input into the new Nevada Comprehensive Bird Conservation Plan (Great Basin Bird Observatory, 2010), which was completed in December 2010. NSTec biologists also attended a 2-day symposium in Pahrump, Nevada, that summarized research on many aspects of the biota at the Ash Meadows National Wildlife Refuge, which is located just south of the NNSS.

An NSTec biologist attended the annual Nevada Bat Working Group meeting in Reno and gave a summary of bat monitoring efforts on the NNSS during 2010. He is also serving on the White Nose Syndrome committee of the Western Bat Working Group and helped develop an action plan to try to prevent White Nose Syndrome from spreading to the western United States. Affiliation with these groups is important to keep informed of the latest issues regarding bats and share data and lessons learned from bat monitoring on the NNSS. He also attended a four-day training course in the use of the Anabat® acoustic monitoring system, including the use of species filters, how to use Analook® software for analyzing echolocation calls, and how to summarize and present data.

An NSTec biologist was part of an assessment team that evaluated the environmental monitoring program at the Idaho National Laboratory (INL) near Idaho Falls, Idaho. Valuable information was shared between biologists at both INL and NNSS. Suggestions for improvement to INL's monitoring program were made based on work performed at NNSS.

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7.0 HABITAT RESTORATION MONITORING

The revegetation of new disturbances and the evaluation of previous revegetation efforts make up the habitat restoration program on the NNSS. When requested by project managers, recently disturbed areas are revegetated. No sites were revegetated in 2010, but two sites on the NNSS and two on the Tonopah Test Range (TTR) were monitored.

Typically, reference areas are also sampled to provide a standard for determining revegetation success. The plant community on the reference site represents the type of vegetation that occurred prior to the disturbance and is a standard for determining revegetation success. Plant cover and density provide a means of quantifying reclamation success. Methods used for estimating plant canopy cover and density in 2010 are described in Hansen et al. (2007). Specific standards have not been set for any of the sites presented in this report. However, an arbitrary standard for revegetation success of 70% of the plant cover and density on a reference site has been used on the NNSS.

7.1 NNSS CAU 110-Area U-3ax/bl

The closure cover for the Corrective Action Unit (CAU) 110 U-3ax/bl disposal unit, located in Area 3 of the NNSS, was completed and revegetated in the fall of 2000. The plant community on the closure cover has been monitored annually since the spring of 2001 with the objective of documenting the current status of the plant community and to identify remedial actions that may be necessary to ensure the plant community persists. A reference area was selected in 2010, and the data collected will be used as a standard for revegetation success.

7.1.1 Plant Cover

Shrub and forb cover on the closure cover this year was 20.2%, and cover of invasive weeds was 1.4% (Figure 7-1). Total plant cover this year on the non-seeded or periphery area was 28.1%, slightly higher than the plant cover on the closure cover. In contrast to the closure cover, plant cover on the periphery was a mix of native forbs and invasive weedy species; no perennial species were encountered. Total plant cover on the reference area was 33%, which was the highest plant cover of the three areas sampled this year.

Six species of shrubs made up a total of 14% cover. As on the closure cover and the periphery area, there were no perennial grasses that contributed to plant cover. Plant cover has spiked every other year over the last 5 years (Figure 7-1, invasive weed cover is not included in total plant cover), primarily a result of fluctuations in forb cover. Shrub cover has been relatively stable. Shrub cover reached its highest in 2006, experienced a sharp decline from 2006 to 2007, but since then has ranged from a low of 11% in 2007 to 15% this year (Figure 7-1). Grasses have not contributed to total plant cover the last 5 years. Forb cover fluctuates with the amount and timing of annual precipitation. Forb cover was up this year from last year but is less than half of what it was 2 years ago. Invasive species show a trend similar to that demonstrated by native forbs.

Shrub and forb cover in 2010 exceeds the respective standards (Figure 7-1). Shrub cover is almost 150% of the standard, and forb cover is just slightly greater than the standard. There was no grass cover on the reference area this year, so the standard is 0%.

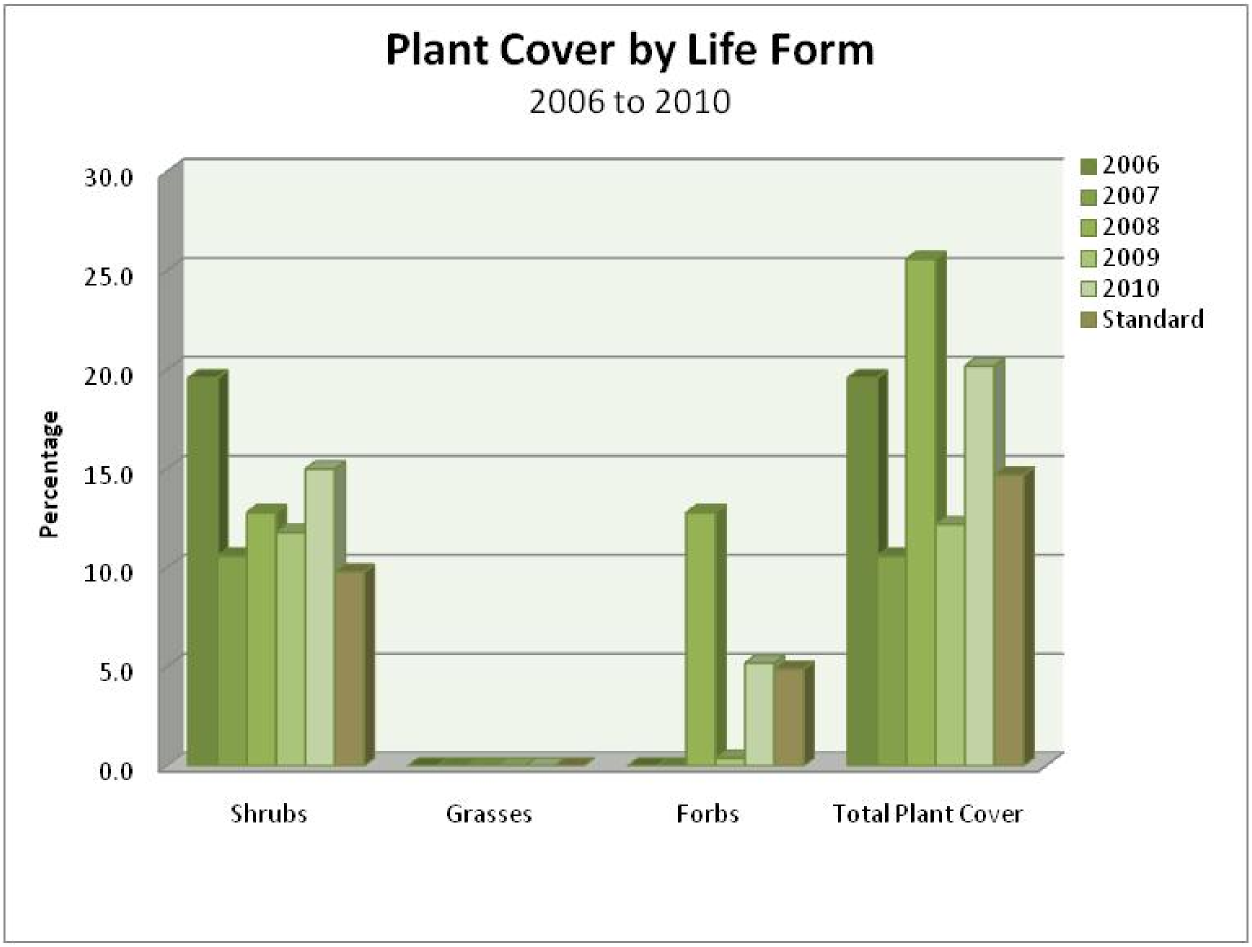

Figure 7-1. Plant cover on the U-3ax/bl closure cover over the last 5 years

7.1.2 Plant Density

Shrub and grass density declined from 2006 to 2008, and since then has remained about the same (Figure 7-2). There was an average of 1.3 shrubs/m^2 (1.1 shrubs/yd^2) on the closure cover this year. Shrub density has averaged just over 1 plant/m^2 the last 3 years. Grass density on the other hand has not recovered from the drop from 2006 to 2007. There have been no grasses encountered on the site the last 4 years. Forb density, just like forb cover, varies markedly from year to year. Over the last 5 years, forb density has ranged from 0 forbs/m^2 in 2007 to 41 forbs/m^2 (34 forbs/yd^2) in 2008, back down to 13 forbs/m^2 (11 forbs/yd^2) in 2009, and then reached an all time high this year of 107 forbs/m^2 (89 forbs/yd^2).

Total plant density on the reference area was about half of the plant density on the closure cover. The density of native forbs was about a fifth of what it was on the closure cover. The density of invasive species on the reference area was unexpectedly higher than on the closure cover.

Compared to the reference area, shrub density on the closure cover is higher (Figure 7-2). The 1.3 shrubs/m^2 (1.1 plants/yd^2) measured this year on the closure cover is more than double the standard of 0.5 shrubs/m^2 (0.4 plants/yd^2). Grass density is 0 grasses/m^2 (0 plants/yd^2) on the closure cap and 0.2 shrubs/m^2 (0.2 plants/yd^2) for the standard. Forb density on the closure cover was about eight times the standard for forb density.

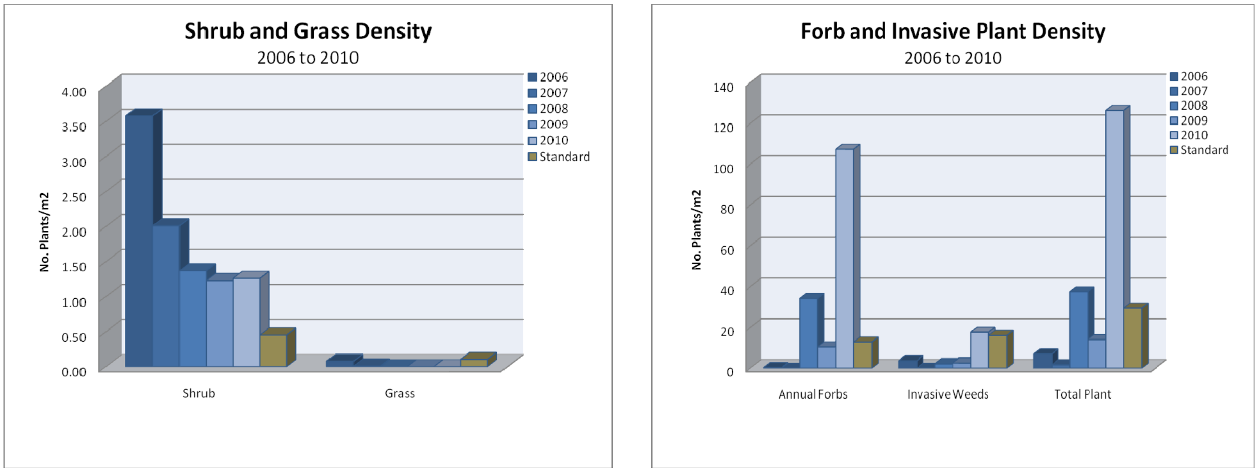

Figure 7-2. Shrub and grass density (left) and forb and invasive plant density (right) over the last 5 years on the U-3ax/bl closure cover

Excluding the annual invasive species, total plant density on the closure cover is about five times higher than as it is on the reference area (Figure 7-2). The ratio increases to more than eight when comparing it to the standard, which is 70% of the density reported for the reference area. Even without annual species and just comparing perennial plant density on the closure cover with the standard, perennial plant density is double the standard of 0.6 plants/m^2 (0.5 plants/yd^2).

The density of invasive species this year was the highest it has been over the last 5 years. Higher densities were experienced in 2004 and 2005 when there was a flush of *Salsola kali* (prickly Russian thistle), but this year's high was due to an increased density of *Bromus tectorum* (cheatgrass), which averaged over 12 plants/m^2 (34 forbs/yd^2).

7.1.3 Remedial Work

During efforts to correct subsidence on the cap, vegetation was removed from three small sites, which totaled approximately 0.06 ha (0.15 ac). Five species of shrub transplants, all native to the area, were planted on the disturbed areas in March 2010. As of December 2010, about 91% of the transplants had survived (Table 7-1). *Chrysothamnus viscidiflorus* (yellow rabbitbrush) had the best survival at 96% followed by *Krascheninnikovia lanata* (winterfat) with 95%. *Eriogonum fasciculatum* (Eastern Mojave buckwheat) and *Ephedra nevadensis* (Nevada jointfir) experienced the greatest mortality, averaging 85% survival. Both *C. viscidiflorus* and *Grayia spinosa* (spiny hopsage) were showing signs of drought stress, so survival numbers may drop in 2011.

Table 7-1. Number of transplants by species planted on the U-3ax/bl closure cover in March 2010. The number of plants alive as of May 23, 2010, is in parentheses.

Transplant Species	South	Middle	North	Total
Eriogonum fasciculatum (Eastern Mojave buckwheat)	5 (4)	13 (11)	2 (2)	20 (17)
Ephedra nevadensis (Nevada jointfir)	9 (8)	26 (24)	5 (5)	40 (37)
Grayia spinosa (spiny hopsage)	5 (5)	13 (11)	2 (1)	20 (17)
Krascheninnikovia lanata (winterfat)	5 (5)	13 (12)	2 (2)	20 (19)
Chrysothamnus viscidiflorus (yellow rabbitbrush)	6 (6)	16 (15)	3 (3)	25 (24)
Total Transplants	**30 (28)**	**81 (73)**	**18 (18)**	**125 (114)**

7.2 NNSS Control Point (CP) Waterline

An underground waterline was installed in 2009, which resulted in a linear disturbance covering approximately 2.8 ha (7 ac). The western section of the waterline was revegetated in December 2009, which was approximately 0.4 ha (1 ac). Two linear transects were sampled this year, and the data collected were used to estimate seedling density.

Coleogyne ramosissima (blackbrush) and *E. nevadensis* were the most common shrubs encountered on the revegetated site. Other shrubs that were less common but part of the seed mix included *Krascheninnikovia lanata* (winterfat), *Ericameria nauseosa* (rubber rabbitbrush), *Atriplex canescens* (fourwing saltbush) and *Atriplex confertifolia* (shadscale saltbush) (Table 7-2; Figure 7-3). All shrubs encountered during sampling are commonly found on the NNSS.

The most common perennial grass was *Achnatherum hymenoides* (Indian ricegrass). There were more plants of this species present than any other species. *Elymus elymoides* (squirreltail grass) density was about 5.3 plants/m^2 (4.4 plants/yd^2) which is about half the density of *A. hymenoides* (Table 7-2).

The twelve different forbs present on the site included five species that were included in the seed mix and seven forbs that were not included in the seed mix but are commonly found on the NNSS. The most abundant species were *Eschscholzia californica* (California poppy), a seeded species, and a *Gilia* spp. (gilia), a species common in plant communities at the lower elevations of the NNSS.

There were two invasive species, *B. rubens* and *S. kali,* found on the site, which are common on newly disturbed soils. The density of both of these species was 2.0 plants/m^2 (1.7 plants/yd^2) (Table 7-2).

Table 7-2. Density of seeded and non-seeded species on the CP Waterline in Area 6 of the NNSS

Common Name	Density Plants/m² (yd²)
Atriplex canescens (fourwing saltbush)-seeded	3.3 (2.7)
Atriplex confertifolia (shadscale saltbush)-seeded	3.1 (2.6)
Coleogyne ramosissima (blackbrush)-seeded	9.0 (7.6)
Ephedra nevadensis (Nevada jointfir)-seeded	7.9 (6.6)
Ericameria nauseosa (rubber rabbitbrush)-seeded	3.7 (3.1)
Grayia spinosa (spiny hopsage)-seeded	1.0 (0.8)
Krascheninnikovia lanata (winterfat)-seeded	4.4 (3.7)
Total Shrubs	**32.3 (27.1)**
Achnatherum hymenoides (Indian ricegrass)-seeded	11.0 (9.2)
Elymus elymoides (squirreltail)-seeded	5.3 (4.4)
Total Grasses	**16.3 (13.7)**
Baileya multiradiata (desert marigold)-seeded	1.3 (1.1)
Chenopodium alba (lambsquarters)-native annual	1.0 (0.8)
Cryptantha spp. (cryptantha species)-native annual	1.0 (0.8)
Erodium cicutarium (filaree)-non-native annual	2.6 (2.2)
Eschscholzia californica (California poppy)-seeded	4.1 (3.5)
Gilia spp. (gilia)-native annual	3.8 (3.2)
Lepidium spp. (pepperweed)-native annual	1.8 (1.5)
Linum lewisii (Lewis' flax)-seeded	2.5 (2.1)
Mentzelia albicaulis (whitestem blazingstar)-native annual	1.0 (0.8)
Camissonia boothii (desert suncup)-native annual	2.0 (1.7)
Penstemon palmeri (Palmer's penstemon)-seeded	1.0 (0.8)
Sphaeralcea ambigua (desert globe mallow)-seeded	1.0 (0.8)
Total forbs	**22.6 (19.0)**
Salsola iberica (prickly Russian thistle)-invasive weed	2.0 (1.7)
Bromus rubens (red brome)-invasive weed	2.0 (1.7)
Total Invasive Weeds	**6.6 (5.5)**
TOTAL PLANT DENSITY	**33.2 (29.7)**


Figure 7-3. Left: Seedlings present on the site in May 2010. Right: *E. nauseosa* (in center of photograph), *K. lanata* (upper right), and *E. nevadensis* (left of *E. nauseosa*) are three common shrubby species on the site in September 2010. *E. nauseosa* was in flower as were several other species on the revegetated site.
(Photos by D. C. Anderson, May and September 2010)

7.3 CAU 400-Five Points Landfill

CAU 400-Five Points Landfill is located on the east side of Cactus Flats on TTR. The site was flooded in late summer of 2003, resulting in 15–25 cm (6–10 in.) of sediment, which destroyed most of the vegetation in the central part of the site. Since then the same area has experienced several events, which resulted in the additional deposition of 10–20 cm (4–8 in.) of sediment and the mortality of most of the plants that had established on the site.

Plant cover and density were sampled in 2010 using one 80-meter and one 40-meter transect in the staging area, and one 120-meter transect in the reference area, as was done in previous years (Hansen et al., 2007).

7.3.1 Plant Cover

The 24% plant cover on the staging area this year was a representative mix of perennial shrubs and annual forbs (Figure 7-4). *A. canescens* was the single perennial species that made up about one-third (8%) of total plant cover. Perennial grasses did not contribute to total plant cover this year. Annual forbs, mainly *Chaenactis stevioides* (Steve's pincushion) and *Mentzelia albicaulis* (whitestem blazingstar), made up two-thirds (16%) of the cover. Smaller amounts of cover were from *Eriogonum deflexum* (flatcrown buckwheat) and *Cryptantha micrantha* (red root cryptantha).

Plant cover on the reference area was higher than on the staging area. The amount of annual forb cover was actually less. However, the amount of shrub cover and perennial grass cover was markedly higher. Shrub cover was 9%, just slightly higher than on the staging area. Most of the shrub cover was from *Chrysothamnus viscidiflorus* (Greene's rabbitbrush) and a lesser amount from *A. canescens*, the sole contributor to plant cover on the staging area. The most notable difference between the reference area and the staging area is the amount of grass cover. *A. hymenoides* was common and accounted for 5% cover. There is no grass cover on the staging area. *M. albicaulis* and *C. stevioides* made up most of the forb cover, as was the case on the staging area. *Gilia nyensis* (Nye gilia), *C. micrantha*, and a *Lupinus* spp. (lupine) species made up the rest of the forb cover. No weedy species contributed to total plant cover on the reference area.

Grass cover was about 1% the previous 2 years, but for the first time since the site was revegetated, there was no grass cover (Figure 7-4). The first year after revegetation, there was an abundance of grasses, mainly *E. elymoides*, but since then grasses have not survived the relatively dry conditions. There were a few individuals of *A. hymenoides* last year that contributed to overall plant cover, but there were no perennial grasses encountered this year.

The plant community that has established on the Five Points Landfill site appears to be viable, but there are a few areas where there are deficiencies. Total plant cover this year was 24%, which represents the second highest amount of plant cover over the last 5 years. There was an abundance of forbs this year just like there was in 2008 and 2006 when plant cover was also around 25%. This year more than half of the plant cover measured on the staging area was from forbs. Shrub cover was around 8%, which is about the average for the last 3 years. Grasses continue to struggle on the staging area. In 2006 grass cover was near 5%, which dropped to almost 0% in 2009, and was just less than 1% in 2010 (Figure 7-4).

7.3.2 Plant Density

The high density of plants on the staging area is somewhat misleading because 58 of the 59 plants/m^2 (71 plants/yd^2) were annual forbs. *A. canescens* and *Picrothamnus desertorum* (budsage) density combined was 0.7 plants/m^2 (0.8 plants/yd^2). These were the only two species of shrubs present on the staging area. The density of *A. hymenoides*, *Pleuraphis jamesii* (galleta), and *E. elymoides*, all native perennial grasses, combined was 0.2 plants/m^2 (0.2 plants/yd^2), which is equivalent to one plant within an area of 5 m^2.

Total plant density on the reference area was 47.5 plants/m^2 (56.9 plants/yd^2) (Figure 7-5), which was slightly lower than the plant density on the staging area. *C. viscidiflorus* had the highest density, followed by *A. canescens* and *K. lanata*. Grass density on the reference area was 1.2 plants/m^2 (1.4 plants/yd^2), which was almost all *A. hymenoides*. There were a few isolated plants of *E. elymoides* on the reference area. Forb density was high this year. The most common species were *G. nyensis*, *C. stevioides*, *C. circumscissa* (cushion cryptantha), and *M. albicaulis*.

The forbs with the highest density on the staging area were *C. stevioides*, *E. deflexum*, *M. albicaulis*, and *C. circumscissa*. These four forb species accounted for over 90% of the total forb density on the staging area. *S. kali* was the only noxious species found on the staging area with a density of 0.2 plants/m^2 (0.2 plants/yd^2).

Perennial plant density in 2010 was the lowest it has ever been on the staging area. Shrub density has decreased from about 1.5 shrubs/m^2 (1.9 shrubs/yd^2) in 2006 to 0.7 shrubs/m^2 (0.8 shrubs/yd^2) this year (Figure 7-5). There was actually a slight increase in the density of *P. desertorum*, but the density of *A. canescens*, the most common shrub present on the staging area, decreased from 0.8 plants/m^2 (1.0 plants/yd^2) in 2009 to 0.6 plants/m^2 (0.8 plants/yd^2) in 2010. Over the last 3 years, shrub density has experienced a gradual decline, but is still double the standard.

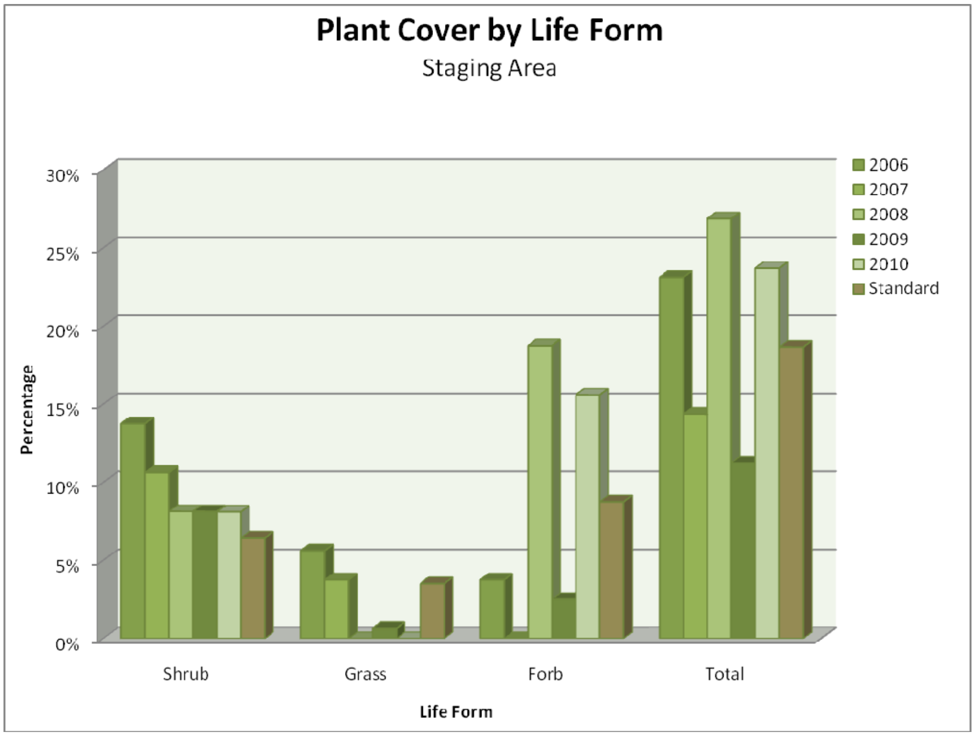

Figure 7-4. **Summary of plant cover by life form on the staging area at CAU 400-Five Points Landfill over the last 5 years**

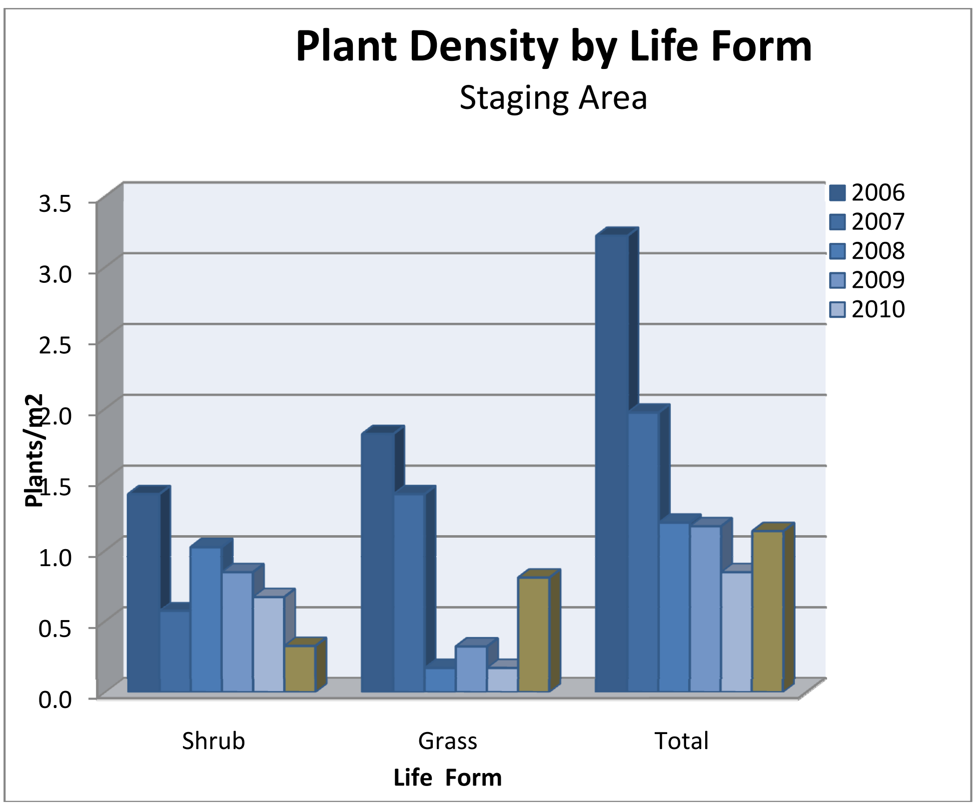

Figure 7-5. **Summary of perennial plant density by life form on the staging area at the CAU 400-Five Points Landfill site over the last 5 years**

Grass density has decreased from about 1.7 grasses/m^2 (2.0 grasses/yd^2) in 2006 to 0.3 grasses/m^2 (0.4 grasses/yd^2) this year. There was a decrease in both *A. hymenoides* and *P. jamesii* density from last year to this year. Of note this year was the presence of *E. elymoides* which has not been found on the staging area since 2007. Grass density however has declined over the last 3 years and this year was about 20% of the standard.

Forb density fluctuates with precipitation and does not provide a good indication of the stability of a plant community. Forb density this year was the second highest recorded to date on the staging area. Of note is the fact that the more commonly occurring forb species found on the staging area are native to the area and are commonly encountered on the adjacent undisturbed area.

7.3.3 Reclamation Success

Plant cover estimates this year exceeded revegetation success standards, and plant density estimates were about 96% of the success standard. Shrub cover was higher than the standard by a couple percentage points, but there was no grass cover on the staging area this year, and the standard of 3.5% was not met. Forb cover was 15.6%, which was almost double the standard of 8.7%.

Of the three parameters used to evaluate revegetation success, plant density is the only one that does not exceed success standards this year. Shrub density exceeds the standard (Figure 7-5), but grass density is only 40% of the success standard and forb density was slightly below the success standard (Figures 7-5). As with plant cover, shrub density has been relatively consistent over the last 5 years, whereas grass density declined from relatively high densities just 3 years ago.

7.4 TTR CAU 407-Rollercoaster RADSAFE Area

The CAU 407-Rollercoaster RADSAFE cover cap was originally reseeded in 2000. In 2004 remedial work was done on the site to fill in erosion gullies. Following the remediation work, the site was reseeded and an erosion netting installed to prevent erosion on the slopes of the cover cap and to reduce the potential of the formation of any gullies that would compromise the integrity of the site. Three transects were sampled in 2010 to estimate plant cover and density.

7.4.1 Plant Cover

Plant cover on the Rollercoaster RADSAFE cover cap was about 22% this year (Figure 7-6). *A. confertifolia* was the most common species, making up about 18% cover. *A. canescens* and *K. lanata* were less common, but together accounted for another 3% cover. The only other species that contributed to plant cover was *C. stevioides*, an annual forb, which accounted for the remaining 1% cover. No invasive species contributed to plant cover this year. Plant cover was higher in 2010 than in previous years suggesting that young plants are establishing and increasing in size.

The reference area for the RADSAFE cover cap was not sampled this year, but data collected over the last 9 years were summarized to calculate revegetation success standards. Plant cover on the reference area averaged a little over 13%. Shrub cover averaged 9.5%, grass cover 1.8%, forbs 2.1%, and invasive species contributed about 0.1%. *P. desertorum* is the most common species and makes up over half of the shrub cover. *A. confertifolia* makes up about 4% cover, and *K. lanata* accounts for less than 1%.

Grass cover is a mix of *P. jamesii* (the most common), *A. hymenoides*, and *Erioneuron pulchellum* (low woollygrass), the least common. Grass cover was about 1% the previous 2 years, but for the first time since the site was revegetated, there was no grass cover (Figure 7-6). The first year after revegetation, there was an abundance of grasses, mainly *E. elymoides*, but since then grasses have not survived the relatively dry conditions. There were a few individuals of *A. hymenoides* last year that contributed to overall plant cover, but no perennial grasses were encountered this year.

Four different forbs contributed to plant cover. *C. stevioides* was the most common. Three other forbs, *Astragalus* spp. (milkvetch), *Erodium cicutarium* (redstem stork's bill), and *S. ambigua* made up less than 1% cover. The invasive weed *Halogeton glomeratus* (halogeton) made up less than 1% of the total plant cover. This species was present on the cover cap but did not contribute to plant cover.

7.4.2 Plant Density

Plant density in 2010 was 36 plants/m^2 (43 plants/yd^2) and was characterized by a representative mix of shrubs and forbs but no grasses (Figure 7-7). The most abundant species was *C. stevoides*, followed by *A. confertifolia* and *H. glomeratus*. There were three other shrubs encountered on the cover cap this year, but densities were all less than 1 plant/m^2 (1 plant/yd^2). There were only two forbs encountered this year other than *C. stevoides*. An annual buckwheat, which was rarely encountered, and *H. glomeratus*, an invasive annual weed, was common. There were no grasses encountered on the Rollercoaster RADSAFE cover cap in 2010.

Average plant density for the reference area is 16 plants/m^2 (19 plants/yd^2). There is a more even distribution of plant density between life forms on the reference area than on the cover cap (Figure 7-7). There are about 4 shrubs/m^2 (5 shrubs/yd^2), 2 grasses/m^2 (2 grasses/yd^2), and 10 forbs/m^2 (12 forbs/yd^2). The most abundant shrub is *P. desertorum*, followed by *A. confertifolia* and *K. lanata.* All three species are also found on the cover cap. *P. jamesii* is the most common grass species followed by *E. pulchellum*, *A. hymenoides,* and *E. elymoides*. The plant with the highest average density of all life forms was *C. stevoides*.

Forb density reached a high of 15 plants/m^2 (18 plants/yd^2) this year, which is more than double the revegetation success standard for forbs. Of concern this year is the abundance of *H. glomeratus,* an invasive weedy species. This species was abundant last year and experienced an almost 50% increase in density from 2009 to 2010. This species has been present at other sites on the TTR that were revegetated, but over time (10 years) the abundance of this species declined as perennial shrubs and grasses became established.

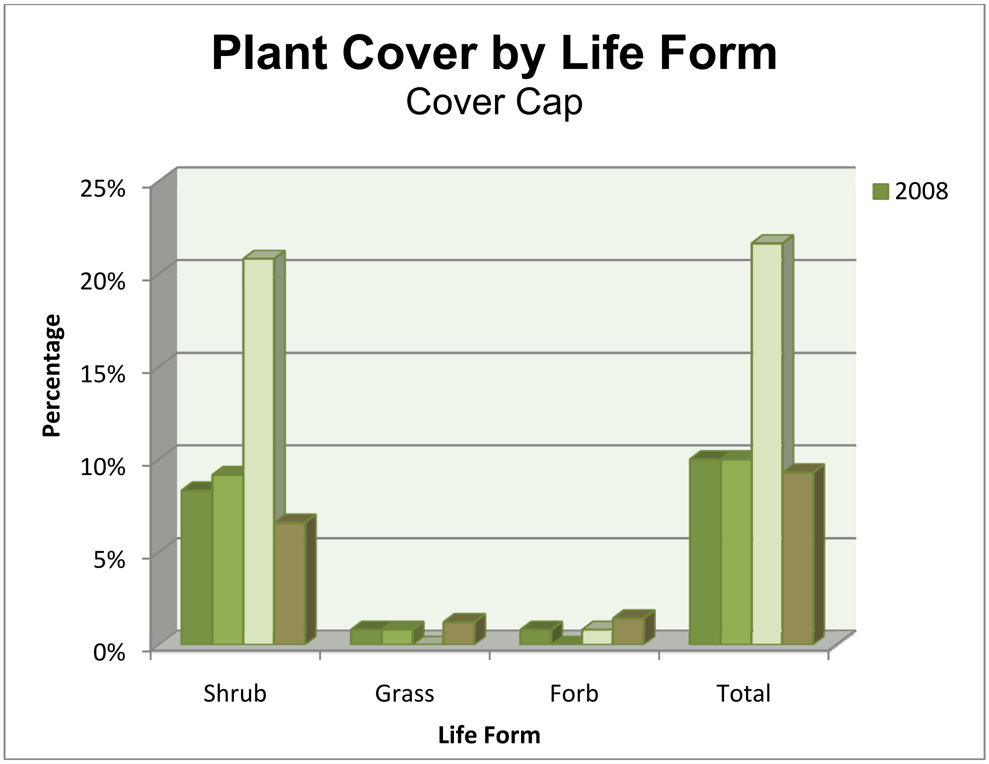

Figure 7-6. Plant cover on the staging area at CAU 407-Rollercoaster RADSAFE over the last 3 years

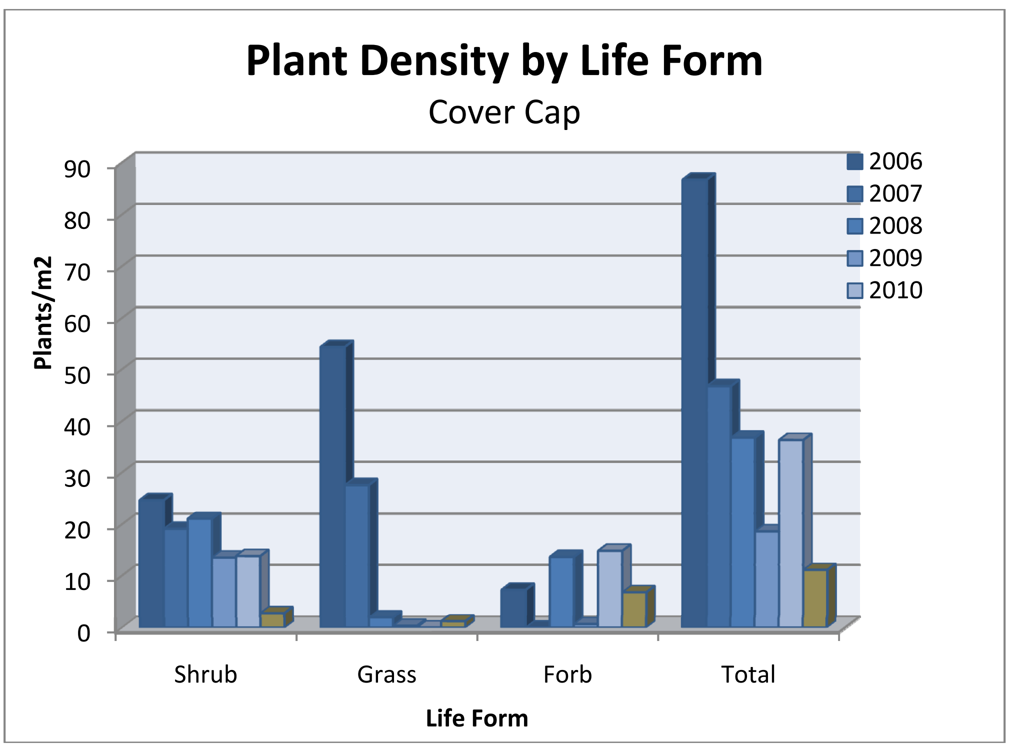

Figure 7-7. Plant density for the staging area at CAU 407-Rollercoaster RADSAFE over the last 5 years

7.4.3 Reclamation Success

Total plant cover is twice the revegetation success standard (arbitrarily set at 70% of the total plant cover on an adjacent undisturbed plant community). Revegetation success by life form, however, varies (Figure 7-6). Shrub cover on the cover cap is the highest it has ever been and is about three times the revegetation success standard. Shrub cover was about 16% the first year after revegetation occurred but that was the result of an abundance of young shrub seedlings. By 2008 shrub cover had dropped to 8%, increased to 9% in 2009, and then increased to 21% in 2010. This is not the result of more plants but the result of increased growth of the plants that have established on the site.

Shrub density the last 2 years is about five times the revegetation success standard. Shrub density is declining, but shrub cover is increasing, suggesting fewer but larger plants. The most abundant species on the cover cap is *A. confertifolia*. *P. desertorum*, *A. canescens*, and *K. lanata* are also encountered but in much lower numbers.

The less than 1% forb cover this year on the cover cap was a little more than half of the revegetation success standard of 1.4%. Forb cover has not exceeded 1% since the site was reseeded in 2005, and there was no forb cover in 2006 and 2009.

8.0 MONITORING THE NPTEC

8.1 Task Description

Biological monitoring at the NPTEC on the playa of Frenchman Lake in Area 5 is performed, if necessary, for certain types of chemical releases according to NPTEC's programmatic Environmental Assessment. In addition, the Environment, Safety, Health, and Quality Division has requested that NSTec monitor any test that may influence plants or animals downwind off the playa. A Biological Monitoring Plan for the NPTEC was prepared in FY 1996 and updated in FY 2002 (Bechtel Nevada, 2002). It describes how field surveys will be conducted to determine test impacts on plants and animals and to verify that NPTEC's program complies with pertinent state and federal environmental protection requirements.

NSTec biologists are asked by NPTEC personnel to review chemical release test plans to determine if field monitoring along the treatment transects is required for each test in accordance with the monitoring plan criteria. All test-specific field monitoring is funded through the NPTEC. Since 1996, the majority of chemical releases being studied at NPTEC have used such small quantities that downwind test specific monitoring has not been necessary.

8.2 Task Progress Summary

NSTec biologists did not review any chemical spill test plans during 2010. Baseline monitoring was not conducted at established control-treatment transects near the NPTEC in 2010 due to budget constraints and because no test-specific monitoring was required.

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