DOE/NV/25946--1484

Ecological Monitoring and Compliance Program 2011 REPORT

July 2012

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Ecological Monitoring and Compliance Program

2011 REPORT

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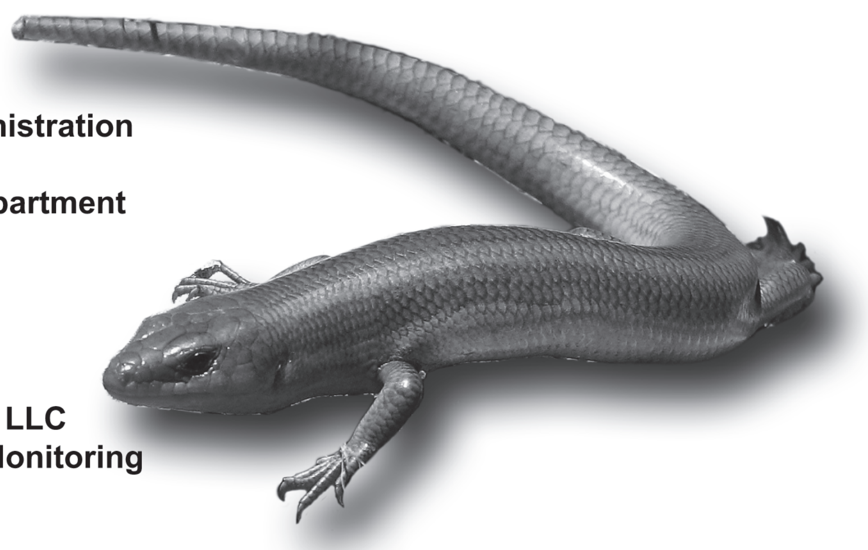
July 2012

Work performed under contract number:
DE-AC52-06NA25946



This report was prepared for:
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National Nuclear Security Administration
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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 2011. 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 2011, 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, 236 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 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 31 projects. A total of 230.21 hectares (ha) (568.86 acres [ac]) was surveyed for these projects. Sensitive and protected/regulated species and important biological resources found during these surveys included 1 desert tortoise, 15 desert tortoise burrows, 1 kit fox (*Vulpes velox macrotis*) burrow, 4 predator burrows, mature Joshua trees (*Yucca brevifolia*), Mojave Yucca (*Yucca schidigera*), 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 31 projects on the NNSS, 21 occurred within the range of the threatened desert tortoise. One desert tortoise was seen in a project area as it moved across a road. No desert tortoises were accidentally injured, killed, or captured during project activities. One desert tortoise was killed by a vehicle along a power line road in Jackass Flats in Area 25. Nine desert tortoises were removed from roads by NNSS personnel to avoid injury or death. In 2011, approximately 1.89 ha (4.68 ac) of desert tortoise habitat were disturbed. Projects paid mitigation fees of $95,375.94 for areas that were or will be disturbed in 2011–2012.

Since 1978, there has been an average of 11.7 wildland fires per year on the NNSS. The mean area burned per fire is 86.4 ha (213.4 ac). There were 20 wildland fires during 2011. Fourteen fires were caused by lightning, burning a total of 3,611 ha (8,923 ac); five fires were caused by ordnance associated with training exercises, burning a total of 24 ha (60 ac); and one fire (0.4 ha [1.0 ac]) was caused by a bird on a power line. Total area burned was approximately 3,636 ha (8,984 ac).

West Nile virus surveillance continued in 2011 with no mosquitoes testing positive for the virus. Habitat mapping efforts for reptiles and small mammals resulted in distribution maps for selected species. Elevation differences in distributions of some important species of reptiles, snakes, and mice are shown across the NNSS to illustrate the utility of the EMAC wildlife database.

Field surveys in 2011 focused on Kingston Mountains bedstraw (*Galium hilendiae* ssp. *kingstonense*) in the Kingston Mountains (San Bernardino County, California) and the Tongue Wash area of the NNSS, rock purpusia (*Ivesia arizonica* var. *saxosa*) at the type locality in the Pahroc Mountains (Lincoln County, Nevada) and south of Columbine Canyon on the NNSS, Pahute green gentian (*Frasera pahutensis*) north of the 19-01 Road, as well as Clokey eggvetch (*Astragalus oophorus* var. *clokeyanus*) at Tongue Wash. No long-term monitoring plots were established this year.

A survey in the Kingston Mountains for Kingston Mountains bedstraw showed that individuals at that site are very different from those found on the NNSS and may not be the same taxa. Plant collections from the NNSS will be sent to taxonomists familiar with this genus for positive identification. Additional populations of rock purpusia were found both north and south of the Columbine Canyon population. Several opportunistic sightings of Pahute green gentian were made north of the 19-01 Road in the eastern regions of Pahute Mesa. On 2 different days in July, over 200 individuals of Pahute green gentian were located in this area, which represents an extension to the north of the population of the species located in 2006. A population of 126 individuals of Clokey eggvetch was located in Tongue Wash this year. There is potential habitat for this species along the eastern slopes of Rainier Mesa north of Tongue Wash.

Surveys of sensitive and protected/regulated animals during 2011 focused on (1) western red-tailed skinks (*Plestiodon gilberti rubricaudatus*), (2) wild horses (*Equus caballus*), (3) mule deer (*Odocoileus hemionus*), and (4) mountain lions (*Puma concolor*). Five skinks were captured at four new locations. These new locations filled in distribution gaps both spatially and ecologically. The wild horse population is stable at about 37 individuals, with very few foals surviving through the year. Mule deer abundance and density measured with standardized deer surveys showed a very similar pattern to 2010. A total of 37 mountain lion images (i.e., photographs or video clips) were taken during 129,471 camera hours across all sites.

A mountain lion telemetry study continued in 2011 with the capture of a mature male mountain lion (NNSS3) in April. The male plus the two females (NNSS1 and NNSS2) captured in December 2010, were tracked using global positioning system satellite transmitters to determine food habits, home range, and habitat use during 2011. A total of 31 individual prey were found killed by NNSS1, including 13 desert bighorn sheep (*Orvis Canadensis nelsoni*) and 18 mule deer. These mountain lion kills are the first documented record of a reproducing population of desert bighorn sheep on the NNSS and warrant further elucidation. A rough estimate of NNSS1's home range is 917 square kilometers (354 square miles).

NNSS2 was only tracked for a short time. The only documented kill made was a coyote. NNSS2 was found on February 1 in the Thirsty Canyon area, west of the NNSS, and had apparently starved to death. NNSS3 spent most of its time off the NNSS in Death Valley National Park. Its home range was estimated at 3,844 square kilometers (1,484 square miles), which may be one of the largest documented home ranges of mountain lions. 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 2011. The cover cap on the U-3ax/bl disposal unit, revegetated in 1998, and the Control Point (CP) waterline, revegetated in 2009, were the restoration sites monitored on the NNSS. The Corrective Action Unit (CAU) 400-Five Points Landfill site, revegetated in 1997, and the CAU 407 Rollercoaster RADSAFE site, revegetated in 2004, were the restoration sites monitored on the TTR. Plant cover and density were recorded at the sites, where applicable reclamation success standards were evaluated.

One chemical spill test plan was reviewed in 2011, but no baseline monitoring was needed or conducted at NPTEC.

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ACRONYMS AND ABBREVIATIONS

ac	acre
AIC	Akiaki's Information Criterion
CAU	Corrective Action Unit
CI	Confidence Interval
cm	centimeter
CP	Control Point
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DTCC	Desert Tortoise Conservation Center
EEM	Ecological and Environmental Monitoring
EGIS	Ecological Geographic Information System
ELUs	Ecological Landform Units
EM	Environmental Monitor
EMAC	Ecological Monitoring and Compliance
ESA	Endangered Species Act
ESW	effective strip width
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
ICR	San Diego Zoo Institute for Conservation Research
in	inch
km	kilometer
km^2	square kilometer
m	meter
m^2	square meter
mi	mile
mi^2	square mile
N	sample size
NAC	Nevada Administrative Code

ACRONYMS AND ABBREVIATIONS (continued)

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
RNCTEC	Radiological/Nuclear Countermeasures Test and Evaluation Complex
NPTEC	Nonproliferation Test and Evaluation Complex
NSTec	National Security Technologies, LLC
SNHD	Southern Nevada Health District
SOC	Special Operations Center
spp.	Species
ssp.	subspecies
TBD	To be determined
TTR	Tonopah Test Range
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 2011, 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 2011. Monitoring tasks during 2011 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 species that are 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 (NNHP, 2012) and bat species ranked as moderate or high in the Nevada Bat Conservation Plan Bat Species Risk Assessment (Bradley et al., 2006). 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 2011, biological surveys for 31 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 230.21 hectares (ha) (568.86 acres [ac]) for the projects (Table 2-2). Twenty-one projects were within the range of the threatened desert tortoise (*Gopherus agassizii*). Sensitive and protected/regulated species and important biological resources found included 1 desert tortoise, 15 desert tortoise burrows, 4 predator burrows, 1 kit fox (*Vulpes velox macrotis*) burrow, Joshua trees (*Yucca brevifolia*), Mojave yuccas (*Yucca schidigera*), 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). All desert tortoise burrows were flagged and avoided during project activities.

2.2 Potential Habitat Disturbance

Surveys are conducted for all activities that would disturb habitat, including new projects, routine maintenance activities, or cleanup activities at old industrial or nuclear weapons testing sites. These surveys are required whenever vegetation has re-colonized old disturbances and sensitive or protected/regulated species are known to occur in the area. For example, desert tortoises may move through revegetated earthen sumps and may be concealed under vegetation during activities where heavy equipment is used. Biological surveys and tortoise clearance 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 surveys are conducted to ensure that adults, eggs, and nestlings are not harmed.

Of the 31 projects surveyed, 24 were within sites previously disturbed (e.g., road shoulders, old building sites, industrial waste sites, or existing well pads) (Table 2-2). Seven projects were located totally or partially in areas that had not been previously disturbed. These projects could potentially disturb 55.40 ha (136.25 ac) of land that were previously considered undisturbed (some projects have been proposed, but the construction activity has not yet occurred). Three 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		
Plestiodon gilberti rubricaudatus	Western red-tailed skink	S, IA
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, IA
Toxostoma 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

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]
Lasionycteris noctivagans	Silver-haired bat	M, 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

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

NP - Nevada Protected, species protected under NAC 503
G - Regulated as game species under NAC 503
F - Regulated as fur-bearer species under NAC 503

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

The Revised 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.

Sources used: NNHP, 2012; NNPS, 2012; NAC, 2012; U.S. Fish and Wildlife Service (FWS), 2012; Bradley et al., 2006

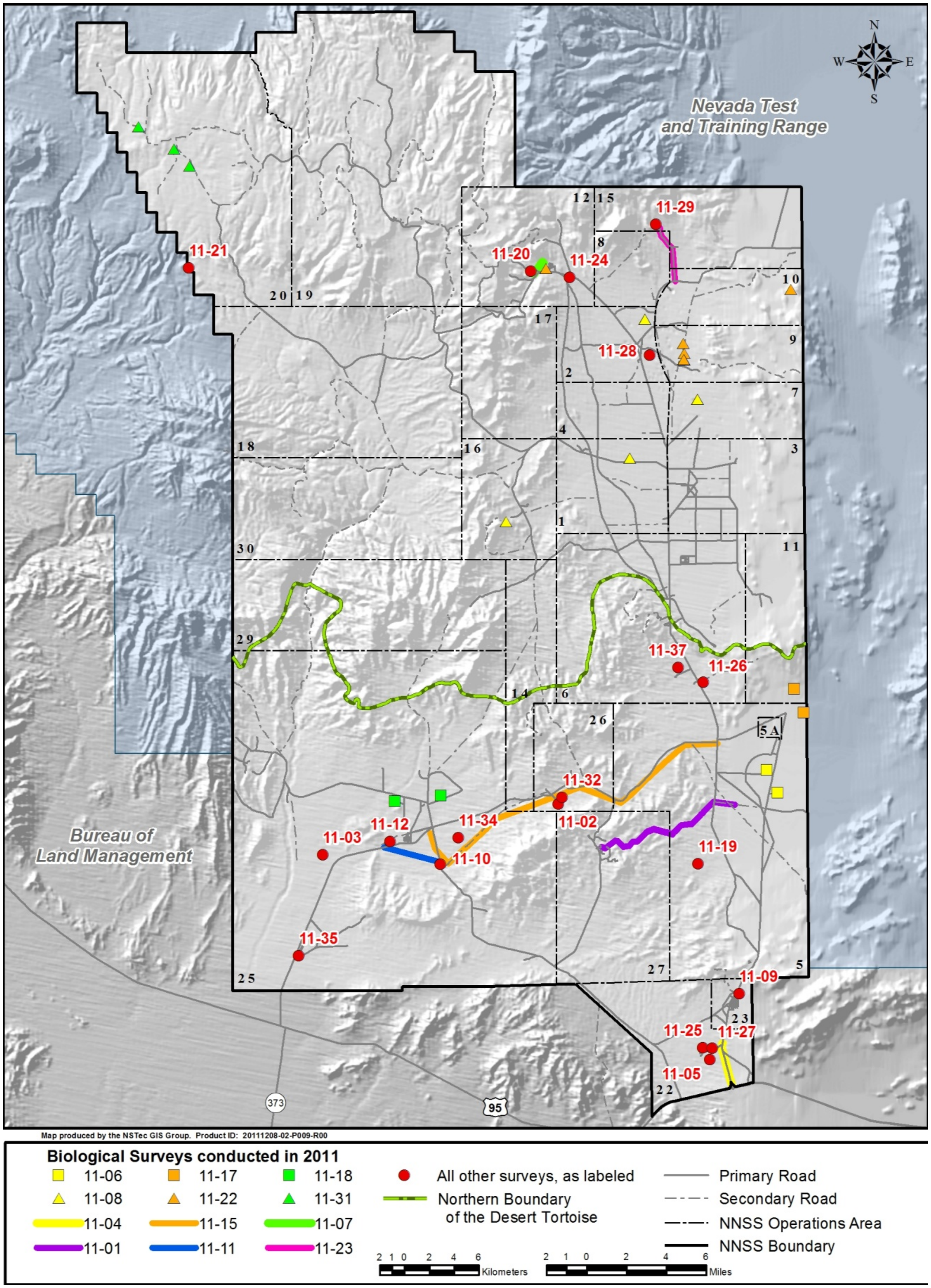

Figure 2-1. Biological surveys conducted on the NNSS during 2011

Table 2-2. Summary of biological surveys conducted on the NNSS during 2011

Project No.	Project	Important Species/Resources Found	Area Surveyed in ha (ac)	Proposed Project Area in Undisturbed Habitat in ha (ac)	Mitigation Recommendations
11-01	Fiber Optic Cable to Area 27	Possible tortoise burrow	32.20 (79.57)	0	Environmental monitor (EM) needed avoid burrow
11-02	Port Gaston Observation Area	None	0.84 (2.08)	0.11 (0.27)	Mitigation required, EM needed
11-03	Area 25 Waterline Break	None	0.05 (0.01)	0	None
11-04	Creech Fiber Optic Line	None	6.58 (16.26)	0.06 (0.15)	Mitigation required, EM needed
11-05	Army Well #6 Borehole Plug	Mojave yuccas	0.80 (1.98)	0	Avoid yuccas if possible
11-06	Corrective Action Unit (CAU) 106	None	1.00 (2.47)	0	None
11-07	U12u Tunnel Pole Line	None	2.94 (7.26)	2.08 (5.14)	None
11-08	Borehole Plugging	None	3.19 (7.88)	0	None
11-09	CAU 561 Corrective Action Site (CAS) 23-21-04	None	0.02 (0.05)	0	EM needed
11-10	Area 25 Telephone Splice	None	0.06 (0.15)	0	EM needed
11-11	Power Line Maintenance	None	0.63 (1.56)	0	EM needed
11-12	Maverick Constellation	None	0.10 (0.25)	0	None
11-15	Jackass Fiber Optic Run	3 predator burrows, 7 potential tortoise burrows	57.00 (140.85)	0	EM needed, avoid burrows
11-17	Environmental Restoration Wells	None	3.00 (7.41)	0	EM needed
11-18	CAU 561, CAS 25-05-02 CAS 25-23-21	None	1.55 (3.83)	0	EM needed
11-19	Trailer Pad – Area 5	None	0.21 (0.52)	0	EM needed

Table 2-2. Summary of biological surveys conducted on the NNSS during 2011 (continued)

Project Number	Project	Important Species/ Resources Found	Area Surveyed in ha (ac)	Proposed Project Area in Undisturbed Habitat in ha (ac)	Mitigation Recommendations
11-20	Area 12 Monitoring Stations	None	10.50 (25.95)	0	None
11-21	Well ER-20-11	None	11.60 (28.66)	4.50 (11.12)	None
11-22	CAU 548 Waste Piles	None	0.60 (1.48)	0	None
11-23	10-02 Road Shoulder Maintenance	Joshua trees, kit fox burrow	5.28 (13.05)	0	Avoid Joshua trees and burrow if possible
11-24	Area 12 Burrow Pit	None	5.10 (12.60)	0	None
11-25	Desert Rock Airport (DRA) Soil Pits	None	1.00 (2.47)	0	None
11-26	RNCTEC expansion	2 possible tortoise burrows	47.75 (117.99)	47.75 (117.99)	Mitigation required, EM needed
11-27	DRA Fiber Optic Line	None	1.33 (3.29)	0	None
11-28	CAU 547 CAS 02-37-02	Predator burrow	1.47 (3.63)	0	None, avoid burrow if possible
11-29	Special Physics Experiments Drill sites	None	3.00 (7.41)	0	None
11-31	Borehole Plugbacks U20	None	0.27 (0.67)	0	None
11-32	Port Gaston Drying Area	None	2.00 (4.94)	1.72 (4.25)	Mitigation required, EM needed
11-34	BREN Tower demo	5 tortoise burrows	17.00 (42.01)	TBD	Mitigation required, EM needed
11-35	UML	None	10.94 (27.03)	0	None
11-37	Device Assembly Facility (DAF) Substation	Joshua trees	2.20 (5.44)	TBD	Mitigation required, EM needed; avoid Joshua trees if possible
		Totals in ha (ac)	**230.21 (568.86)**	**55.14 (136.25)**	

Table 2-3. Total area disturbed in hectares (acres) within important habitats in 2011 and over the past 12 years

Project No.	Project Name	Pristine Habitat	Unique Habitat	Sensitive Habitat	Diverse Habitat
11-02	Port Gaston Observation Area	0	0	0.11 (0.27)	0
11-07	U12u Tunnel Power Pole Line/Pad	0	0	2.08 (5.14)	0
11-37	DAF Substation	0	0.95 (2.35)*	0	0
	2011 Total: 3.14	**0**	**0.95**	**2.19**	**0**
	(7.77)	**(0)**	**(2.35)**	**(5.42)**	**(0)**
	1999–2011 Grand Total: 445.11	**9.46**	**12.80**	**337.02**	**85.83**
	(1,099.91)	**(23.37)**	**(31.63)**	**(832.80)**	**(212.11)**

* This is the total projected area to be disturbed; actual area disturbed may be less. This will be updated in 2012.

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 2011 projects is 3.14 ha (7.77 ac) (Table 2-3). Since 1999, the total area of important habitat disturbed by NNSA/NSO activities is 445.11 ha (1,099.91 ac). This tally is used to document the loss of important habitat.

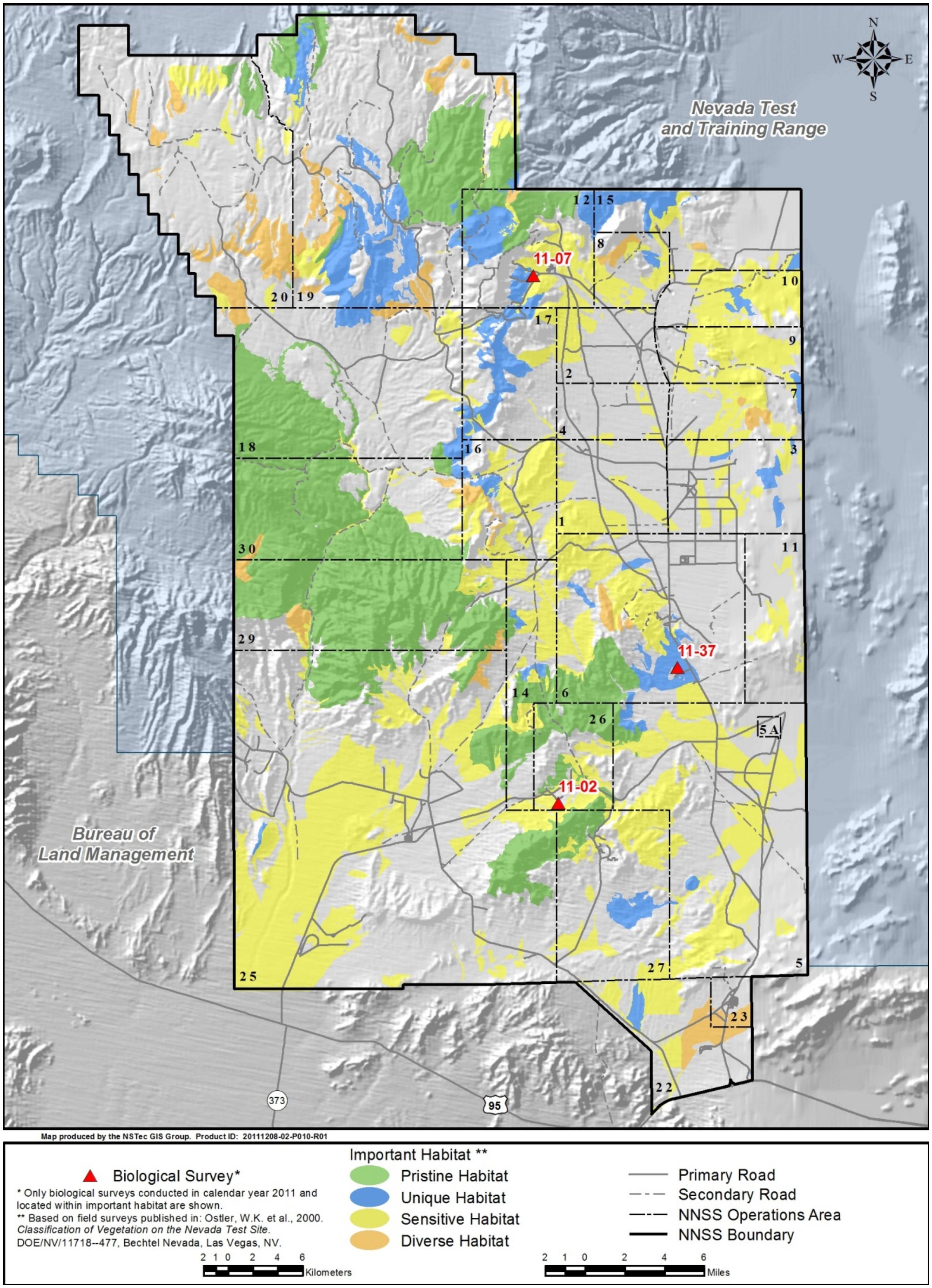

Figure 2-2. Biological surveys conducted in important habitats of the NNSS during 2011

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* (ESA). 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 FWS in August 1996 (FWS, 1996). On July 2, 2008, NNSA/NSO provided 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 (FWS, 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. All of the terms and conditions listed in the Opinion were implemented by NSTec staff biologists in 2011, including (a) conducting clearance surveys at project sites within 1 day from the start of project construction, (b) ensuring that project managers have environmental monitors 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 2011, biologists conducted biological and desert tortoise clearance surveys prior to ground-disturbing activities for 21 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 observed as it moved from a project area, and 15 tortoise burrows were found during tortoise clearance surveys (Table 2-2). These tortoise burrows (Project No. 11-01, 11-15, 11-26, and 11-34) were flagged and avoided (or will be avoided) during project activities.

Three projects were initiated that disturbed previously undisturbed desert tortoise habitat. Projects 11-02 and 11-32 disturbed 1.83 ha (4.53 ac) of desert tortoise habitat (Table 3-1). These projects are located east of Port Gaston in Area 26. Project 11-04 disturbed 0.06 ha (0.15 ac) of previously undisturbed habitat in Area 22. Project 11-26 is anticipated to disturb as much as 47.75 ha (118.00 ac) of undisturbed habitat at the Radiological/Nuclear Countermeasures Test and Evaluation Complex (RNCTEC) and the RNCTEC expansion area east of Mercury Highway in Area 6. This project has just started initial ground-disturbing activities, so the final total area disturbed will be included in the 2012 report. NSTec Ecological Services instructed project managers that onsite construction monitoring was required and should be conducted by a designated environmental monitor at all sites where desert tortoise clearance surveys are performed.

Post-activity surveys to quantify the acreage of tortoise habitat actually disturbed were conducted for 17 projects during this reporting period (Table 3-1). Post-activity surveys are generally 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 2011, a total of 1.89 ha (4.68 ac) of tortoise habitat was disturbed (Table 3-1).

Table 3-1. Summary of tortoise compliance activities conducted by site biologists during 2011

Project Number	Project	Compliance Activities 100% Coverage Clearance Survey	Tortoise Habitat Disturbed ha (ac)
11-01	Fiber Optic Cable to Area 27	Yes, post-activity survey completed	0 (0)
11-02	Port Gaston Observation Area	Yes, post-activity survey completed	0.11 (0.27)
11-03	Area 25 Waterline Break	Yes, post-activity survey completed	0 (0)
11-04	Creech Fiber Optic Line	Yes, post-activity survey completed	0.06 (0.15)
11-05	Army Well Borehole Plugging	Yes, post-activity survey completed	0 (0)
11-06	CAU 106 Sites 106-7 GZ	Yes, post-activity survey completed	0 (0)
11-09	CAU 561 CAS 23-21-04	Yes, post-activity survey completed	0 (0)
11-10	Area 25 Telephone Splice	Yes, post-activity survey completed	0 (0)
11-11	Power Line Maintenance	Yes, post-activity survey completed	0 (0)
11-12	Maverick Constellation	Yes, post-activity survey completed	0 (0)
11-15	Jackass Fiber Optic Run	Yes, post-activity survey completed	0 (0)
11-17	Environment Restoration Wells	Yes, post-activity survey completed	0 (0)
11-18	CAU 561	Yes, post-activity survey completed	0 (0)
11-19	Area 5 Trailer	Yes, post-activity survey completed	0 (0)
11-25	DRA Soil Pits	Yes, post-activity survey completed	0 (0)
11-26	RNCTEC expansion	Project ongoing	TBD
11-27	DRA Fiber Optic Line	Yes, post-activity survey completed	0 (0)
11-32	Port Gaston Drying Area	Yes, post-activity survey completed	1.72 (4.25)
11-34	BREN Tower demo	Project not yet started	TBD
11-35	UML	Yes*	0 (0)
11-37	DAF Substation	Project not yet started	TBD
		Total	**1.89 (4.68)**

*Post-activity survey was unnecessary because the project was located within previously disturbed tortoise habitat.
TBD = to be determined

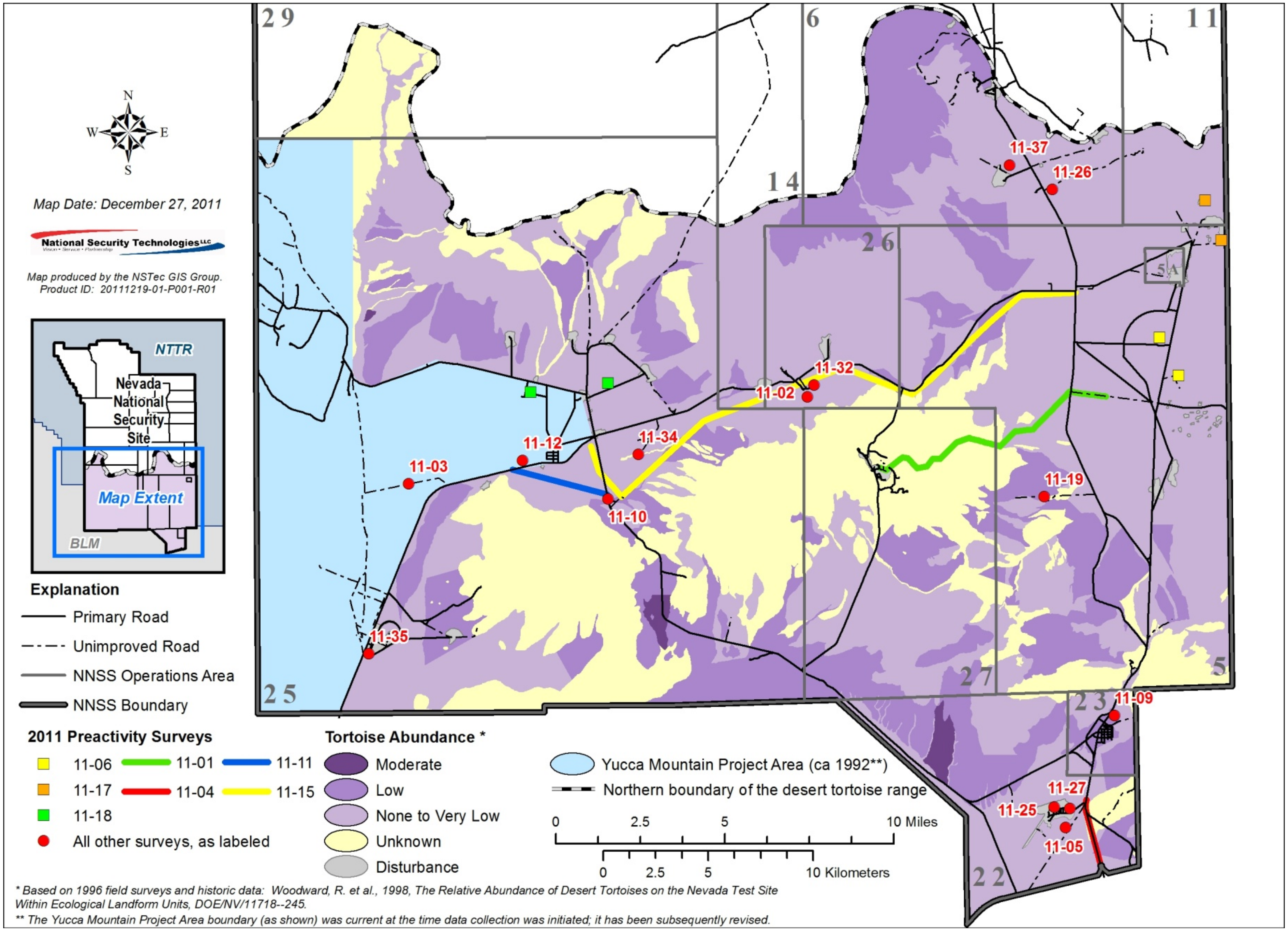

Figure 3-1. Biological surveys conducted in desert tortoise habitat on the NNSS during 2011

In January 2011, the annual report that summarized tortoise compliance activities conducted on the NNSS from January 1 through December 31, 2010 was submitted to the FWS. 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 that should be measured and monitored annually. During this calendar year, 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 observed as it moved out of a project site. One desert tortoise was killed by a vehicle along a Jackass Flats power line maintenance road in Area 25 in 2011. Nine tortoises were removed from roads to avoid being killed or injured and are reported in the "Other" column of Table 3-2. This brings the total number of tortoises taken under the "Other" category to 27 for the 3 years under the current Opinion.

Table 3-2. Cumulative incidental take (2009–2011) and maximum allowed take for NNSA/NSO programs

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	11.46* (500)	0 (1)	0 (10)
Infrastructure Development	0.15 (100)	0 (1)	0 (10)
Roads	0 (0)	4 (15)	27 (125)
Totals	**17.22 (2,710)**	**4 (22)**	**27 (194)**

*One project is not yet completed but is anticipated to disturb 118.0 acres. The actual amount disturbed will be reported in the 2012 report.

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 one of two mitigation options: (a) pre-pay funds into the Desert Tortoise Mitigation Funds (current 2011 rate is $1,941.42 per ha [$786 per 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. Four projects (11-02, 11-04, 11-26, and 11-32) paid mitigation funds in 2011. A total of $95,375.94 was paid into the Desert Tortoise Mitigation Fund to mitigate the 49.64 ha (122.67 ac) of land that has been or will be disturbed in 2011–2012.

3.3 Coordination with Other Biologists and Wildlife Agencies

The 9 ha (22 ac) circular enclosures in Rock Valley were visited in 2011 with Phil Medica of the U.S. Geological Survey (USGS) to search for desert tortoises in the fenced plots. Two tortoises are still not accounted for in the enclosures. No marked desert tortoises were found above ground.

During February 18–20, 2011, two site biologists attended the Desert Tortoise Council's 36th annual meeting and symposium. This meeting was held in Las Vegas, Nevada, and included numerous presentations on desert tortoise biology, ecology, and recovery efforts.

On November 1, 2011, NNSA/NSO staff and a site biologist contacted FWS to propose that funds being paid by NNSS projects be used to mitigate impacts of vehicles on desert tortoises at the NNSS. The ideas discussed led to a meeting on November 29 with FWS scientists and San Diego Zoo Institute for Conservation Research (ICR) scientists. The focus of the meeting was to evaluate the potential use of the NNSS as a translocation research site for tortoises being held at the Desert Tortoise Conservation Center (DTCC). On December 6, three scientists from NSTec and NNSA/NSO staff visited the DTCC and discussed collaborative research projects on the NNSS. On December 15, scientists from the FWS and ICR toured the NNSS to determine which areas may be suitable for research studies, including translocation areas and road mitigation areas. NNSA/NSO will continue to work with the FWS and the ICR on collaborative desert tortoise studies on the NNSS.

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4.0 ECOSYSTEM MONITORING

Ecological Services began comprehensive mapping of plant communities and wildlife habitat on the NNSS in 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 site 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 2011.
- **Wildland fire fuels surveys –** A vegetation survey was conducted in the spring to determine wildland fire hazards due to the accumulation of woody and fine fuels.
- **West Nile virus (WNV) surveillance** – From a total of 11 sites on the NNSS, 146 mosquitoes were surveyed and analyzed for WNV.
- **Habitat mapping** – Three maps were prepared to show the range of selected species of small mammals and reptiles.
- **Natural wetlands monitoring** – Eleven natural wetlands were monitored in 2011.
- **Constructed water source monitoring** – Thirty-five sites containing constructed water sources were monitored in 2011.
- **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). Costs incurred from the Egg Point Fire in August 2002 (121 ha [300 ac]) were well over $1 million to replace 1 mile of burned power poles, and more than $200,000 for soil stabilization and revegetation of the burned area.

There has been an average of 11.7 wildland fires per year on the NNSS since 1978 with an average of about 86.4 ha (213.4 ac) burned per fire (Table 4-1; Hansen, 2011). Historically most wildland fires are caused by lightning and do not occur randomly across the NNSS but occur more often in particular vegetation types (e.g., *Coleogyne ramosissima* [blackbrush] plant communities). These types have sufficient 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).

The year 2011 was above average for wildland fires, with 20 wildland fires on the NNSS (Table 4-2; Hansen, 2011). Fourteen fires were caused by lightning, burning a total of 3,611.8 ha (8,923 ac); five fires were caused by ordnance, burning a total of 24 ha (60 ac); and one fire was caused by a bird on a power line, burning less than 0.4 ha (1.0 acre). Fire names are assigned by the first firefighter to arrive at a fire and may be names of persons, places, areas, or simply left unnamed. The locations of some of the larger wildland fires on the NNSS in 2011 are shown in Figure 4-1. Not all fires had their locations mapped because they were inaccessible due to rugged terrain or lacked post-fire aerial photography to determine the global positioning system (GPS) coordinates of the fire perimeter.

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 2011 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.

Table 4-1. Number and area 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	<0.4	1.0
2011	20	3,636	8,984
34-Year Total	**399.0**	**34,450.0**	**85,128.0**
Average Per Year	**11.7**	**1,013.2**	**2,503.8**
Average Per Fire		**86.4**	**213.4**

Source: Hansen, 2011

Table 4-2. Date, location, acreage, and cause of wildland fires on the NNSS in 2011

Incident No.	Date-Time	Location (Name of Fire)	Hectares (ac) Burned	Cause
11-096	02/07/11-2320 hrs	Area 23, WSI Range “C”	<0.4 (<1)	Ordnance
11-213	06/03/11-1641 hrs	Area 1, 1 ½ mile N. of U1A	2.4 (6)	Lightning
11-219	06/09/11-1427 hrs	Area 4, BEEF Complex	23.9 (59)	Ordnance
11-236	06/23/11-2237 hrs	Area 23, WSI Range “C”	<0.4 (<1)	Ordnance
11-250	07/03/11-2339 hrs	Area 30 (Briley)	123.8 (306)	Lightning
11-272	07/20/11-0430 hrs	Area 6, near 06-619	<0.4 (<1)	Bird on line
11-278	07/04/11-1516 hrs	Area 30/18 (Timber)	1,349.2 (3,334)	Lightning
11-279	07/05/11-0926 hrs	Area 25/29 (Weston)	563.7 (1,393)	Lightning
11-281	07/12/11-1319 hrs	Area 19 (Gritty Gulch)	12.1 (30)	Lightning
11-287	07/29/11-0952 hrs	Area 30 (Calico Hills)	404.7 (1,000)	Lightning
11-288	07/29/11-1353 hrs	Area 10 (Sedan)	105.2 (260)	Lightning
11-289	07/29/11-1707 hrs	Area 11 (Tweezer)	84.6 (209)	Lightning
11-290	07/29/11-1709 hrs	Area 1 (Shaker Plant)	<0.4 (<1)	Lightning
11-317	08/16/11-1441 hrs	Area 30, Cat Canyon	<0.4 (<1)	Ordnance
11-330	08/27/11-1925 hrs	Area 18 (Buckboard Mesa)	894.4 (2,210)	Lightning
11-331	08/27/11-2108 hrs	Area 18, N. of Pahute Check Point	<0.4 (<1)	Lightning
11-342	09/09/11-0955 hrs	Area 30 (40 Mike)	30.4 (75)	Lightning
11-352	09/15/11-1449 hrs	Area 4, E. of Tippipah Hwy	<0.4 (<1)	Lightning
11-357	09/24/11-1410 hrs	Area 18 (Castle Rock)	40.5 (100)	Lightning
12-011	10/04/11-1503 hrs	Area 26, Port Gaston	<0.4 (<1)	Ordnance

Source: Hansen, 2011 — **Total ha (ac) Burned** 3,635.7 (8,984)

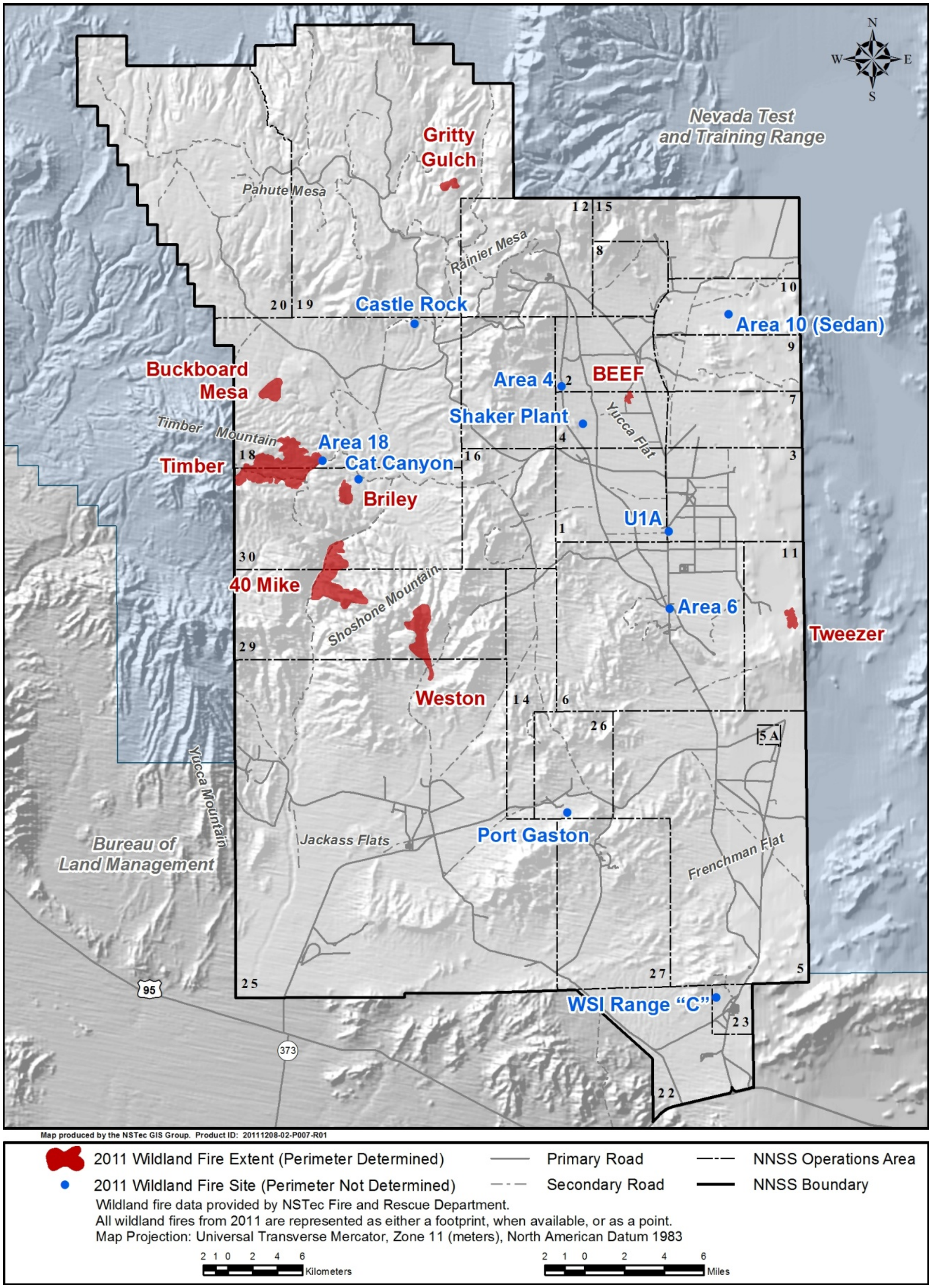

Figure 4-1. Location of wildland fires on the NNSS during 2011

4.1.2 Survey Results

4.1.2.1 Climate

There are 17 rain gauges on the NNSS (Hansen and Ostler, 2004) that are used to measure precipitation. Data from these weather station gauges extends back more than 30 years (National Oceanic and Atmospheric Administration, Air Resources Laboratory/Special Operations and Research Division, 2011). In order to determine whether the year was relatively wet, normal, or dry, a simple measure of precipitation was needed. The precipitation during the months of January, February, March, and April was selected because of its simplicity and ease of calculation. While it is recognized that precipitation from other months is also important (and in some cases may be more important), as is the influence of temperature, winds, and relative humidity, these months represent the period of most plant growth observed along the survey route during the spring and before the beginning of the fire season in June. During many years, the mean precipitation during these 4 months appears to be correlated with production of vegetation that produces most fine and some 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 2011 the mean precipitation of all 17 rain gauge stations on the NNSS during January–April was 4.60 centimeters (cm) (1.81 inches [in.]), or about 51.9% of the normal amount (i.e., the average precipitation for the last 30 years—8.86 cm [3.49 in.]). Temperatures were also cooler than normal during these months.

4.1.2.2 Fuels

Because of the unusually high precipitation in December 2010 (six times the normal amount), there was an increase in the amount of annual invasive plant seeds that germinated during the winter. This increased germination resulted in greater density of plants contributing to fine fuels. These plants were spaced rather uniformly on the ground, but much shorter in height than plants from previous years with normal precipitation. Because of this increased precipitation in 2010, there were slightly more fine fuels by May 2011, despite the fact that precipitation was subnormal for January through April 2011. Of the fine fuels observed during the survey, only minor amounts of residual fine fuels persisted from previous years.

Table 4-3 shows the mean index values by year for woody fuels, fine fuels, and the combined fuels index for 2004–2011. There was a slight decrease in the woody fuels index value in 2011 (2.58) compared to 2010 (2.61), as foliar canopy cover decreased slightly, perhaps in response to the decreased precipitation that occurred during January through April 2011. The fine fuels index was higher in 2011 (2.56) compared to 2010 (2.27), ranking the second highest since 2004 when index values were computed.

The combined index values (fine fuels plus woody fuels) for 2011 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 2011 was 5.14 (see Hansen et al. [2011] for a discussion of values in previous years). The combined index was the third highest since 2004 (Table 4-3), suggesting above-average potential for wildland fires. This projection was confirmed by the actual number and area of fires that occurred in 2011 (see Tables 4-1 and 4-2 shown previously).

Table 4-3. Woody fuels, fine fuels, and combined fuels index values for 2004–2011

Year	Woody Fuels Index	Fine Fuels Index	Combined Fuels Index
2004	2.75	2.13	4.88
2005	2.80	2.83	5.64
2006	2.80	2.46	5.26
2007	2.62	1.52	4.13
2008	2.59	2.23	4.81
2009	2.63	1.95	4.52
2010	2.61	2.27	4.89
2011	2.58	2.56	5.14

Figure 4-2 shows a comparison in trends of mean precipitation and mean combined fuel index values. The drought of 2007–2009 significantly reduced fine fuels and to a lesser extent woody fuels in 2010, but above-average precipitation in 2010 aided little in residual fine fuels in 2011.

The locations of the 106 survey stations on the NNSS inspected during 2011 are shown in Figures 4-3, 4-4, and 4-5. The figures show average fine fuels, woody fuels, and combined fuels index values by NNSS operational area. High index values occurred in Fortymile Canyon, Mid Valley, Big Burn Valley, and at moderate elevations and slopes around Yucca Flat.

Photographs were taken from permanent locations for all 106 sites during the past 8 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 dominated with *Coleogyne ramosissima* (blackbrush) and annual grasses appeared to respond to precipitation with greater variation in the amount of fine fuels and woody fuels than other vegetation community types (e.g., *Larrea tridentata* [creosote bush] or *Pinus monophylla*/*Juniperus osteosperma* [pinyon/juniper communities]), resulting in increases in fine fuels at these sites more than sites in the Mojave Desert (southern one-third of the NNSS) or the Great Basin Desert (northern one-third of the NNSS).

Fine fuels in 2011 were about 2 to 3 weeks delayed in maturing in most areas of the NNSS, due in part 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, 2009, and 2010. The hazards of fuels contributing to wildland fires were higher 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 2011.

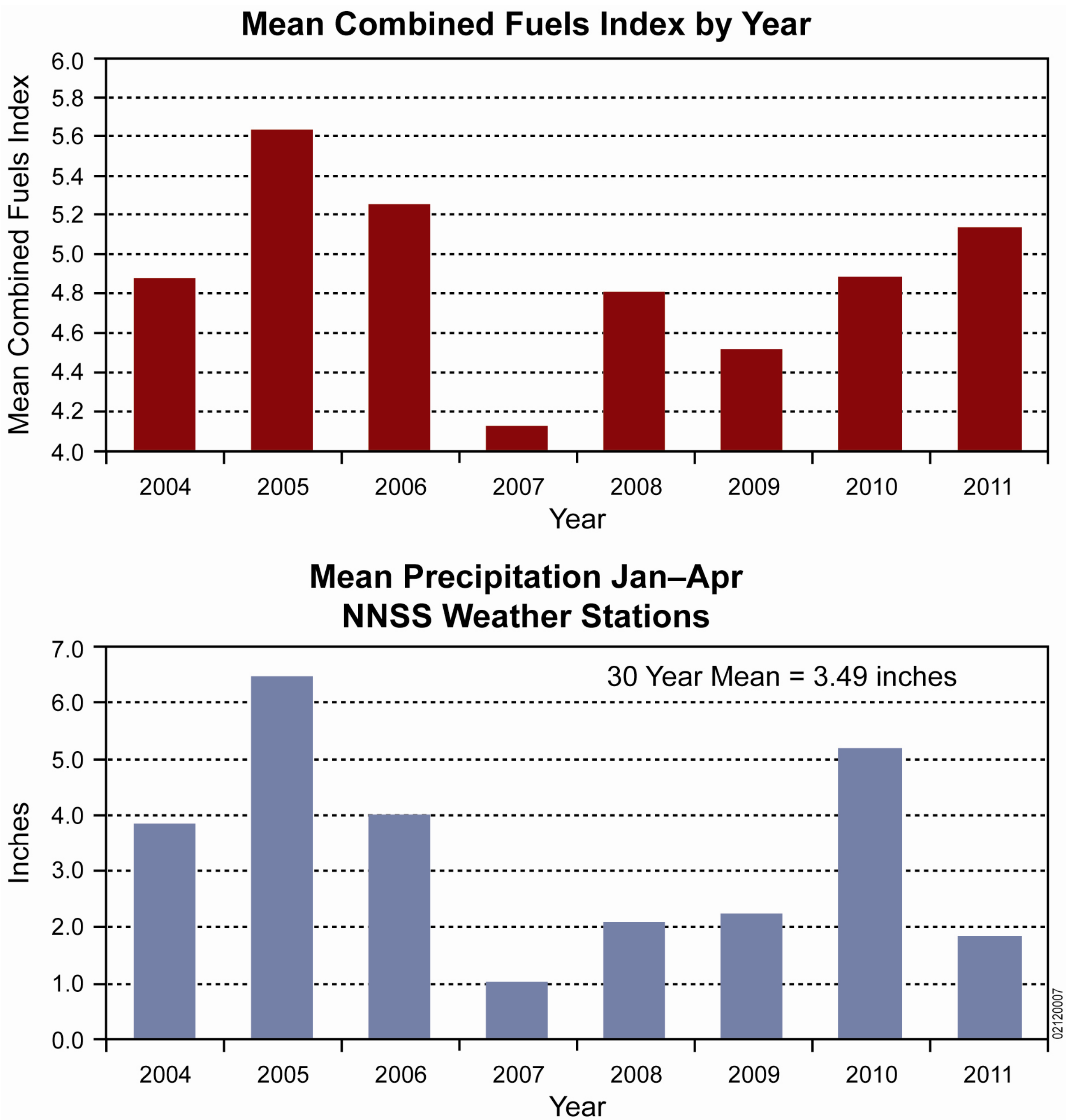

Figure 4-2. Mean combined fuels index (top) and mean precipitation for January through April (bottom) for the years 2004 to 2011

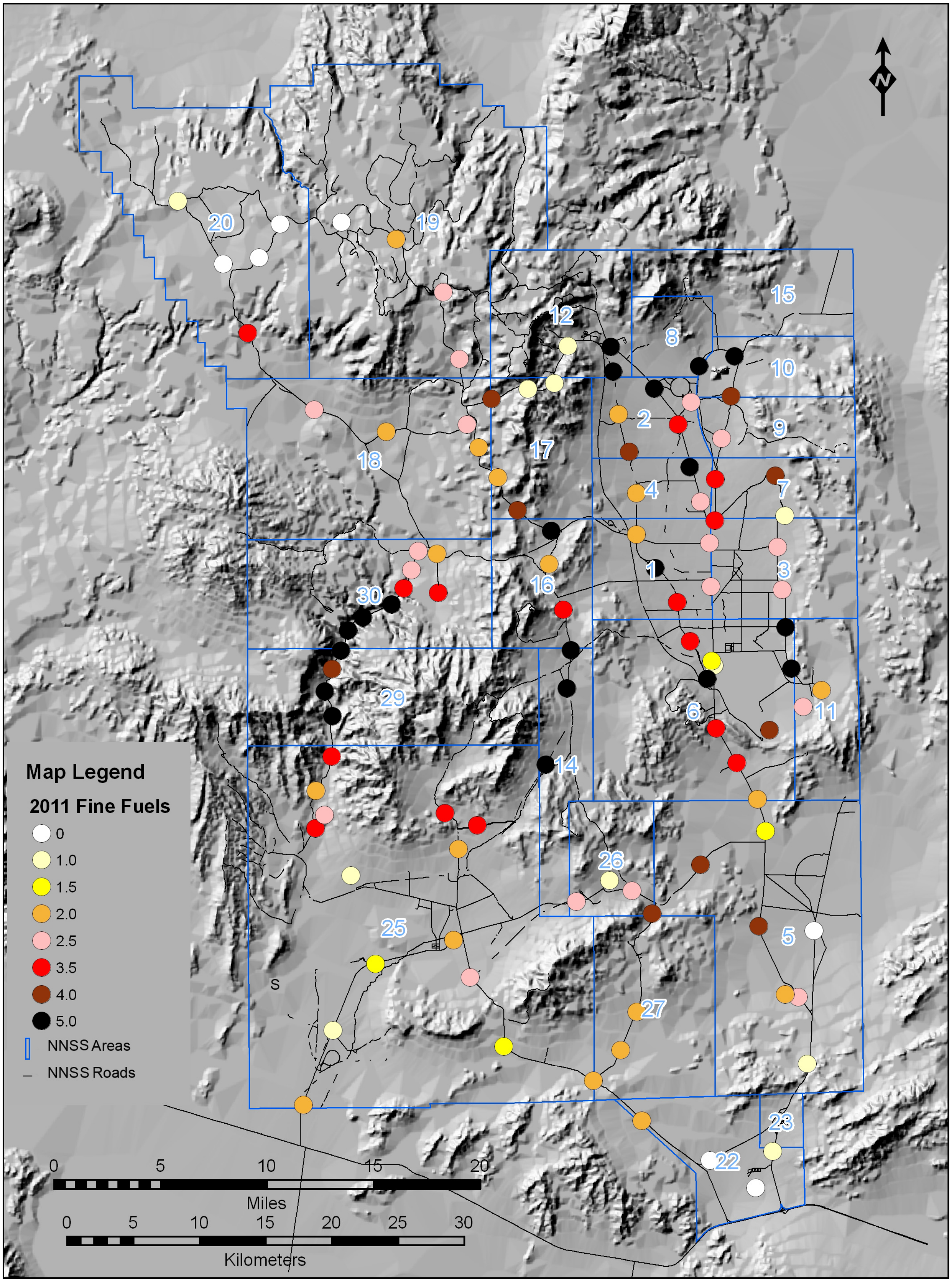

Figure 4-3. Index of fine fuels for 106 survey stations on the NNSS during 2011

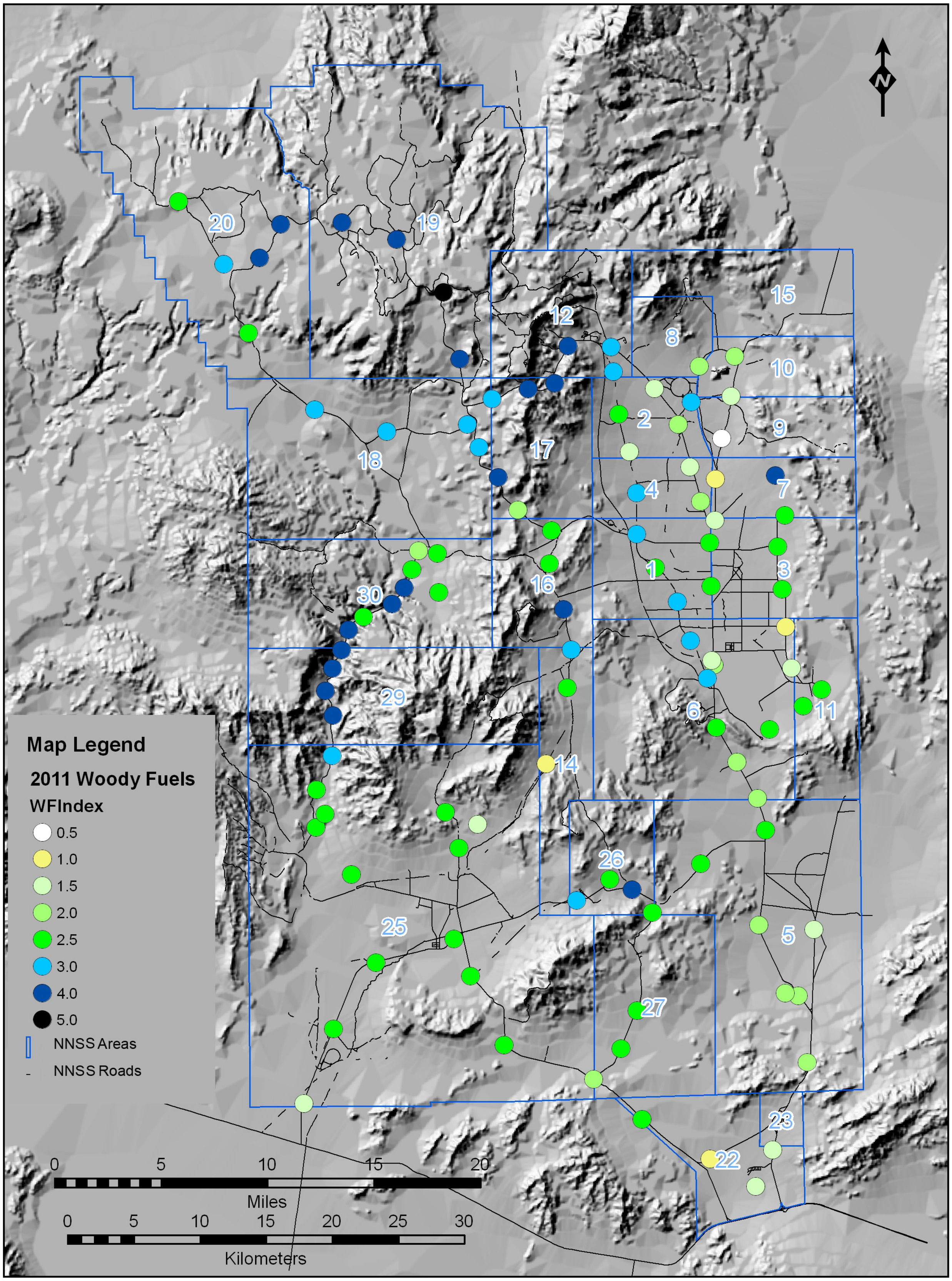

Figure 4-4. Index of woody fuels for 106 survey stations on the NNSS during 2011

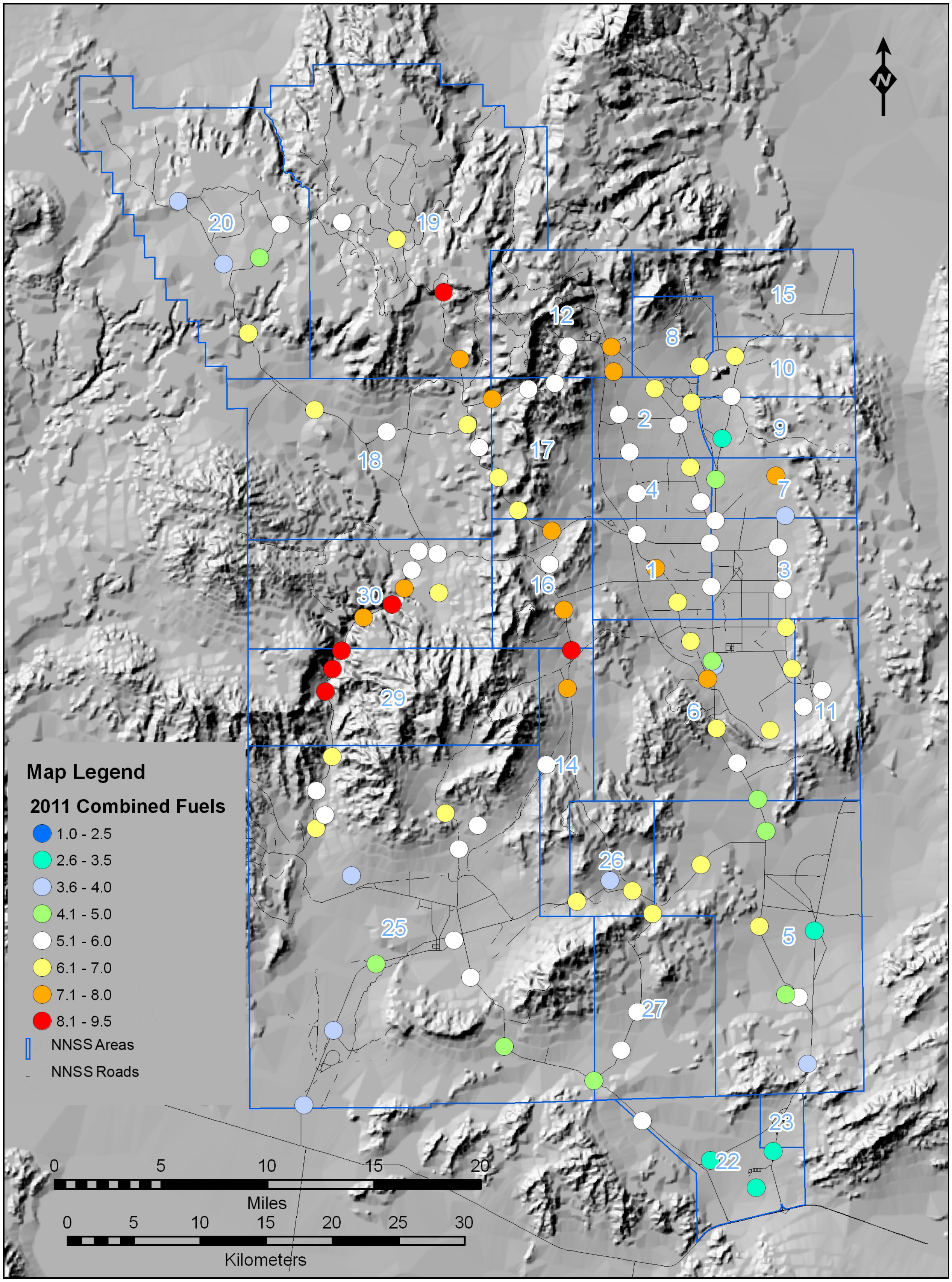

Figure 4-5. Index of combined fine fuels and woody fuels for 106 survey stations on the NNSS during 2011

4.1.2.3 Invasive Plants

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 4-4). Precipitation history (Figure 4-2, shown previously) is also important in determining the percent presence of species across the NNSS. During periods of low precipitation, most annual species had low percent presence (i.e., the number of sites in which the plant was observed to be present and growing). Percent presence was generally greatest during periods of high precipitation, and appears to be a good indication of germination. Higher percent presence is also expected to occur when regional storms provide precipitation to a greater number of operational areas on the NNSS. However, response of some species, both invasive and native species, suggest that other variables, such as the timing of when precipitation occurs or what temperatures are required for germination, may also be contributing to plant response. For example, *Mentzelia albicaulis* (whitestem blazingstar) had only 8.1% presence in 2005 (the wettest year), but 51.9% presence in 2010, even though there was less precipitation during the same time period of that year, suggesting that temperature patterns may have been different in the 2 years.

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. *C. ramosissima* vegetation types appear to be the most vulnerable plant communities to fire, followed by *P. monophylla*/*J. osteosperma*/*Artemisia* spp. 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.

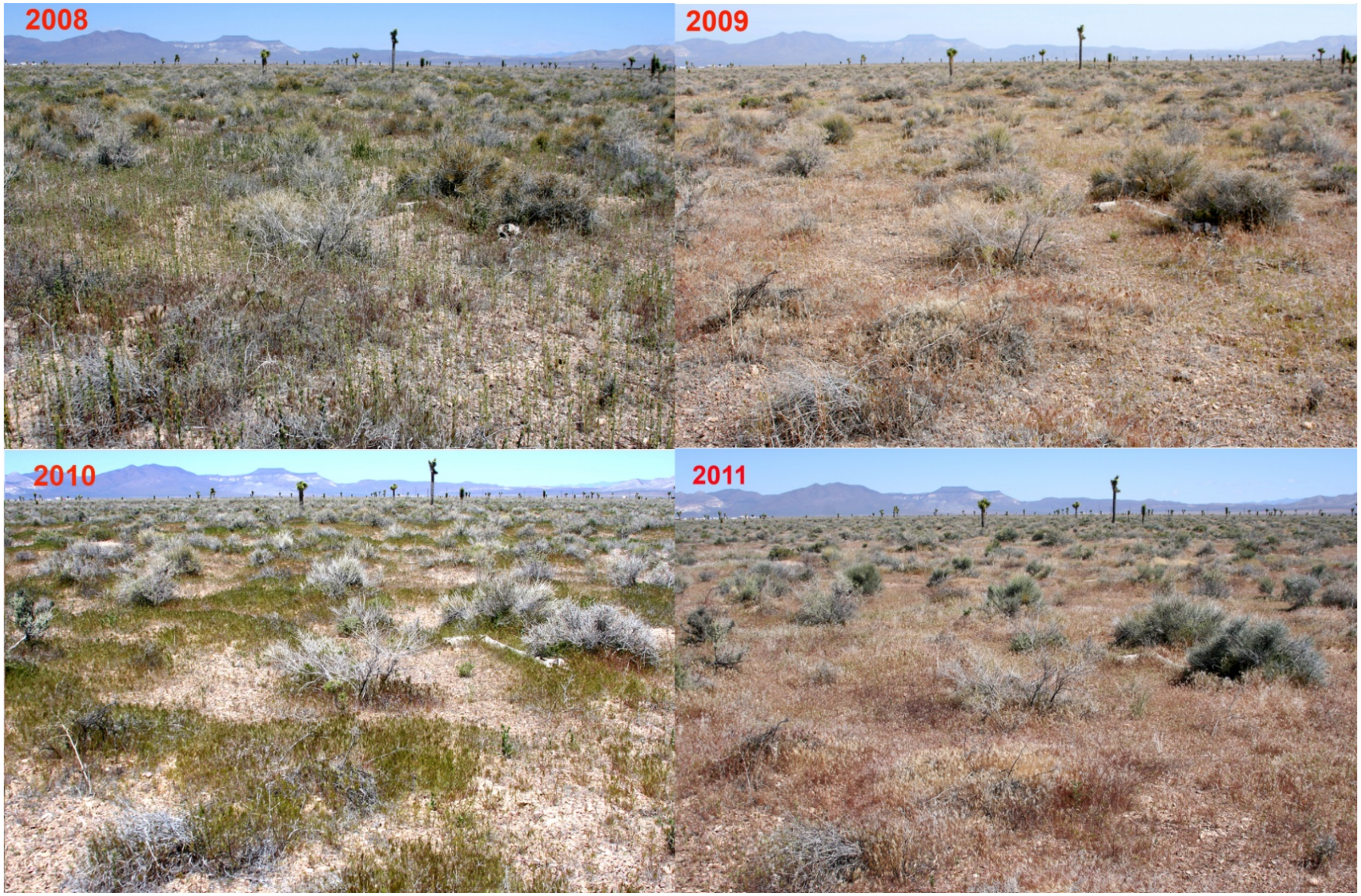

Figure 4-6. Site 99 on the west side of Yucca Flat in 2008–2011
(Photos by W. K. Ostler, April 10, 2008 [top left]; April 30, 2009 [top right]; May 3, 2010 [bottom left]; and April 26, 2011 [bottom right]

Table 4-4. 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	2011
	cm (in.)							
Mean 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)	4.60 (1.81)
Invasive Introduced Species	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
	percent presence							
Bromus rubens (red brome)	51.7	64.4	67.8	0	63.0	63.2	58.5	62.3
Bromus tectorum (cheatgrass)	40.3	54.0	60.7	0	59.2	66.0	67.0	79.2
Erodium cicutarium (filaree or redstem stork's bill)	5.2	6.2	24.6	0	21.3	27.4	33.0	42.4
Schismus arabicus (Arabian schismus)	4.7	2.8	5.2	0	11.4	9.4	3.8	11.3
Native Species	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
	percent presence							
Amsinckia tessellata (bristly fiddleneck)	34.0	62.0	16.1	0	63.0	48.1	67.9	63.2
Mentzelia albicaulis (whitestem blazingstar)	49.8	8.1	0	0	2.4	18.9	51.9	16.0
Chaenactis fremontii (pincushion flower)	27.0	8.0	0	0	1.4	11.3	13.2	0.5

*30-year mean precipitation for the 17 rain gauges on the NNSS for the period of January–April is 8.86 cm (3.49 in.).

Germination of fine fuels produced by invasive, introduced annual species (especially *B. tectorum*) and other native annual species was higher in 2011 than in 2010. This increase in germination of invasive species (with a corresponding decrease in native species) and the residual fine fuels from 2010 created a relatively uniform distribution of fine fuels on the ground and increased the likelihood of fire spreading once ignition occurred. The increase in germination and the increase fine fuels index occurred despite the lower mean precipitation during January–April. This increase in the fine fuels likely occurred because of the unusually high precipitation received in December 2010.

4.2 West Nile Virus Surveillance

WNV is a potentially serious illness that spreads 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 on the NNSS continued in 2011 for the eighth consecutive year. WNV surveillance consists of setting mosquito traps baited with dry ice overnight at sites where standing water provides potential breeding sites for mosquitoes (Figure 4-7). As the dry ice sublimates, it produces carbon dioxide, which attracts mosquitoes. Eleven sites were sampled during 15 surveys (Table 4-5). Mosquitoes collected during the surveys were taken to the Southern Nevada Health District (SNHD) for species identification and WNV testing. In 2011, 146 mosquitoes representing three species were captured and analyzed (Table 4-5). Most of these were captured at the Well 5B Pond in September. This is the highest number of individuals captured so far on the NNSS in a single year. No new species were recorded. 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.

Figure 4-7. Mosquito trap set at J11 Pond, Area 25 in Jackass Flats
(Photo by D. B. Hall, September 22, 2010)

Table 4-5. Results of West Nile virus surveillance on the NNSS in 2011

Location	Date	Number Captured	Species	WNV
Topopah Spring, Area 29	5/24/11	1	*Culiseta inornata*	Negative
J11 Pond, Area 25	5/24/11	0	NA	NA
Mercury SOC Park, Area 23	5/24/11	0	NA	NA
Tippipah Spring, Area 16	6/22/11	0	NA	NA
Camp 17 Pond, Area 18	6/22/11	0	NA	NA
Yucca Playa Pond, Area 6	6/22/11	2	*Culex tarsalis*	Negative
Camp 17 Pond, Area 18	7/19/11	0	NA	NA
Well 5B Pond, Area 5	7/19/11	13	*Culex tarsalis*	Negative
LANL Pond, Area 6	7/19/11	5	*Culex tarsalis*	Negative
Shaker Plant, Area 1	8/17/11	0	NA	NA
Well C1 Pond, Area 6	8/17/11	13	*Culex tarsalis*	Negative
Mercury Sewage Lagoons, Area 23	8/17/11	0	NA	NA
LANL Pond, Area 6	9/12/11	1	*Anopheles franciscanus*	Negative
LANL Pond, Area 6	9/12/11	13	*Culex tarsalis*	Negative
Well 5B Pond, Area 5	9/12/11	1	*Anopheles franciscanus*	Negative
Well 5B Pond, Area 5	9/12/11	97	*Culex tarsalis*	Negative
Mercury SOC Park, Area 23	9/12/11	0	NA	NA

LANL: Los Alamos National Laboratory
SOC: Special Operations Center
WNV: West Nile virus

4.3 Habitat Mapping – Species Distribution of Selected Reptiles and Small Mammals

In an attempt to fill data gaps in species distribution, site biologists collected numerous records of reptile, small mammal, and bird species from 2006 to 2011. This included trapping new locations and observing wildlife during other studies (see Section 6.5.1, Motion-Activated Cameras). Approximately 9,200 new species location records were documented on the NNSS during this time. This includes new records for 6,000 mammals, 2,800 reptiles, and 400 birds. In addition, thousands of other records since 1960 from various studies have been included. Presently the NNSS wildlife database contains approximately 13,680 mammal records, 8,900 bird records, 5,760 reptile records, and >1,000 invertebrate location records (a combined total of almost 30,000 records). From these data, more detailed species habitat maps can be developed for the NNSS.

A map of all historical sampling locations for reptiles on the NNSS is shown in Figure 4-8. This allows for the evaluation of potential locations where data gaps for some species remain and where more sampling may be needed at the NNSS. Figure 4-9 shows the distribution of two widespread species, the Western fence lizard (*Sceloporus occidentalis*) and the desert spiny lizard (*Sceloporus magister*). They have complementary distributions with the majority of records for western fence lizard in higher elevations, while most records of the desert spiny lizard occur at lower to mid-elevations of the NNSS. Species overlap occurs at numerous sites (n=31) at mid-elevation (1,219–1,829 meters (m) [4,000–6,000 feet (ft)]) areas (Figure 4-9). Only two sites on Pahute Mesa had both species. These species are important consumers of insects and other small invertebrates and provide a food source for larger lizards, snakes, birds, and some mammals. They are often sympatric with skinks.

Figure 4-10 depicts distribution of two important snake species, the red racer (*Masticophis flagellum*) and the striped whipsnake (*Masticophis taeniateus)*, which occupy different regions of the NNSS. The striped whipsnake occurs at higher elevations of the NNSS, and the red racer occurs mostly at lower elevations of the NNSS (Figure 4-10). Note that there are only three areas of clear species overlap (200 m or less [656 ft] distance apart) (Figure 4-10). These snakes are important predators of rodents and lizards on the NNSS.

A map depicting the distribution of four species of murid rodents on the NNSS is shown in Figure 4-11. Repeated sampling shows that the deer mouse (*Peromyscus maniculatus*) is widespread throughout the NNSS but is more abundant in the northern reaches of the NNSS (Hunter, 1994; 1995). It is the only rodent known to carry hantavirus on the NNSS, although it has been found at very low rates in pinyon (*P. truei*), canyon (*P. crinitus*), and cactus mice (*P. eremicus*) in California and other parts of Nevada. Prevalence of hantavirus varies spatially and temporally on the NNSS (see Section 4.4, Hantavirus Sampling, of Hansen et al. [2011]). Two other species of *Peromyscus*, the pinyon mouse and the canyon mouse appear to be much more habitat specific. Pinyon mice are known to occur primarily in pinyon/juniper habitats at higher elevations and canyon mice occur in rugged or rocky outcrop areas at middle to lower elevations (Figure 4-11). Fewer records exist for the cactus mouse; however, it was encountered more frequently between elevations of 914 and 1,524 m (3,000–5,000 ft).

4.4 Natural Water Source Monitoring

Locations of natural water sources on the NNSS are shown in Figure 4-12. Water sources were monitored this year to characterize seasonal baselines and trends in physical and biological parameters. Eleven water sources were visited at least once during 2011 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 estimated by collecting a known volume of water from a permanently installed pipe over a known time period. 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 Spring, Pahute Mesa Pond, and Yucca Playa Pond. Flow occurs as seepage through the local sediments or by overland flow into the pond collection area. Because monitoring of wetlands is qualitative, the objectives are to identify large or obvious changes over time. Smaller, subtle changes in flow are not readily detectable from this method.

Sizes of the water sources monitored varied greatly from very small areas (<1 square meters (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 [301,389 ft^2]). Surface flow rates were typically low (<5 liters per minute [1.3 gallons per minute]) at most water sources where flow was measurable (Table 4-6). Disturbance from horses was noted at two sites and some forms of natural change (sedimentation and dense spread of wetlands plants) at two other sites. Mule deer (*Odocoileus hemionus*) use at Twin Spring was heavy and vegetation was completely trampled.

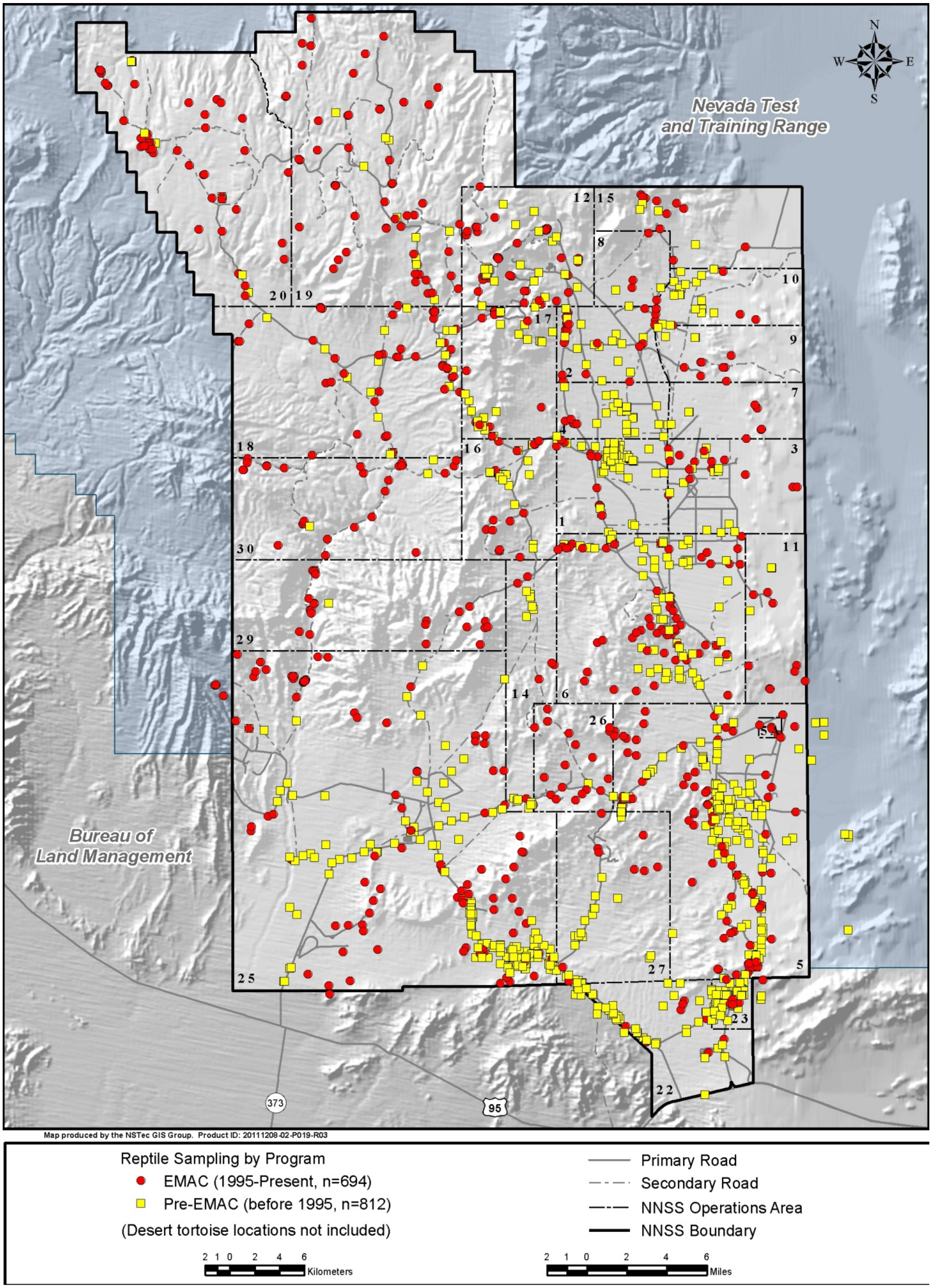

Figure 4-8. Locations for reptile sampling and observations on the NNSS

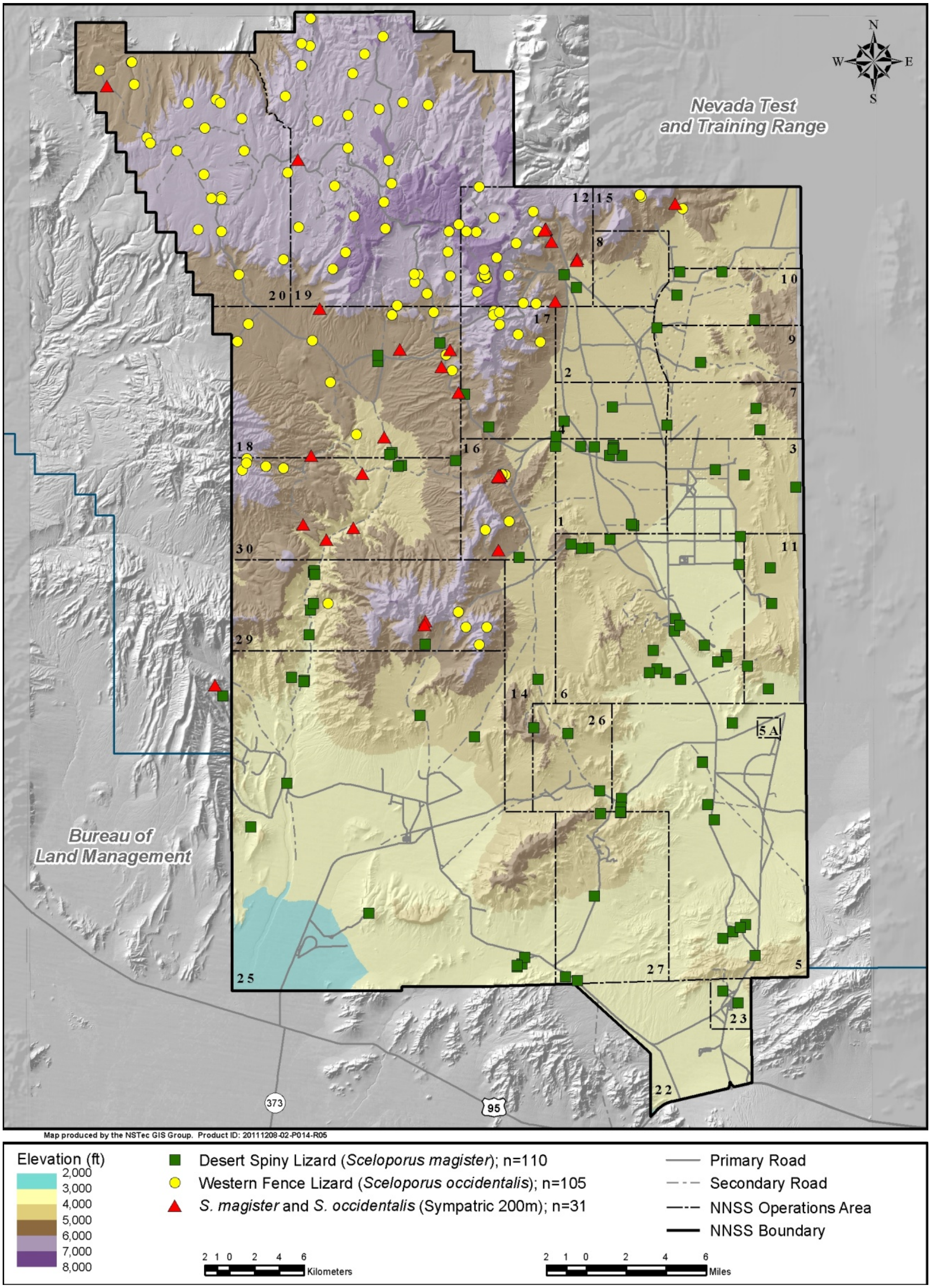

Figure 4-9. Distribution of desert spiny and western fence lizards on the NNSS

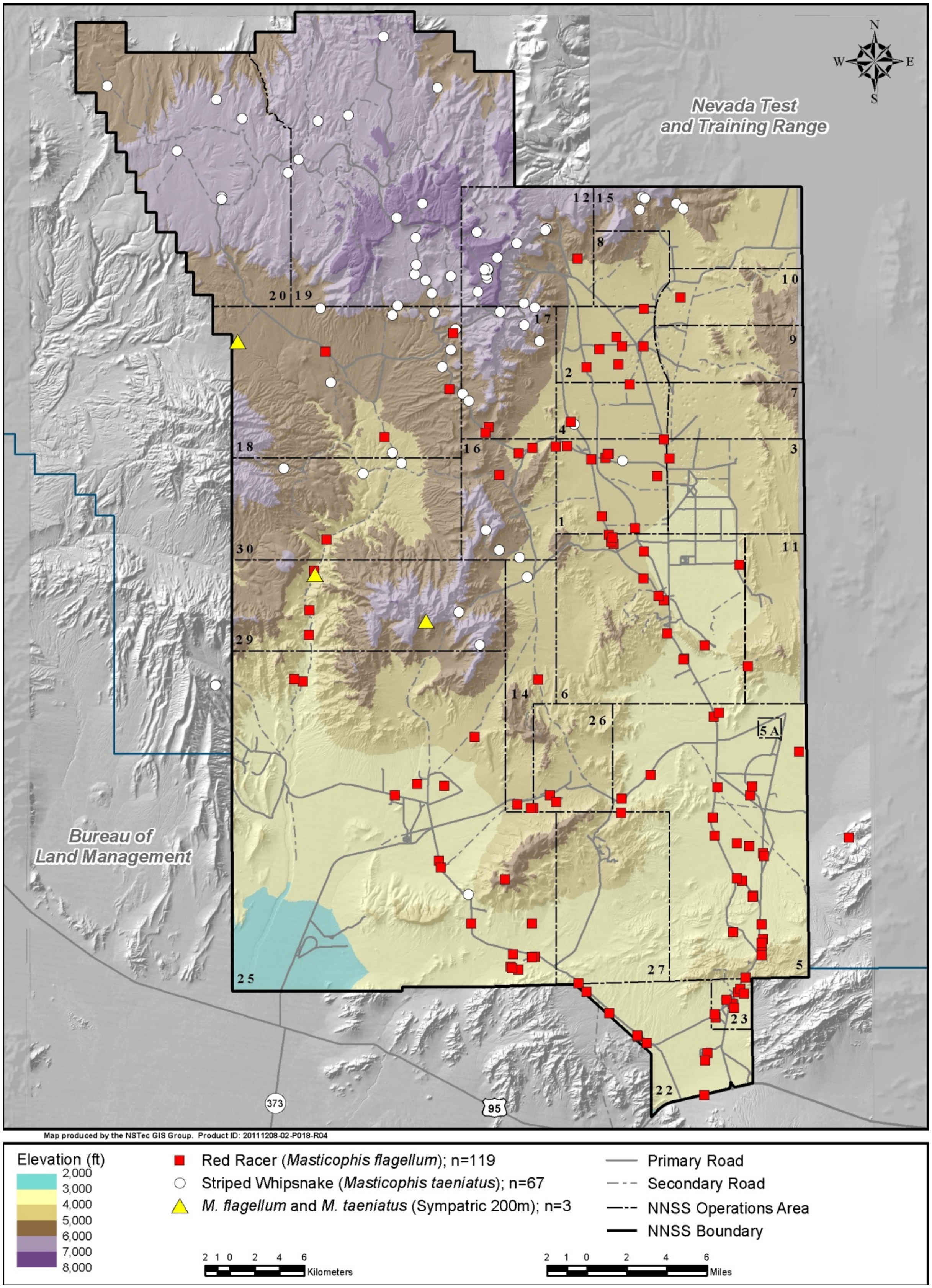

Figure 4-10. Distribution of the red racer and striped whipsnake on the NNSS

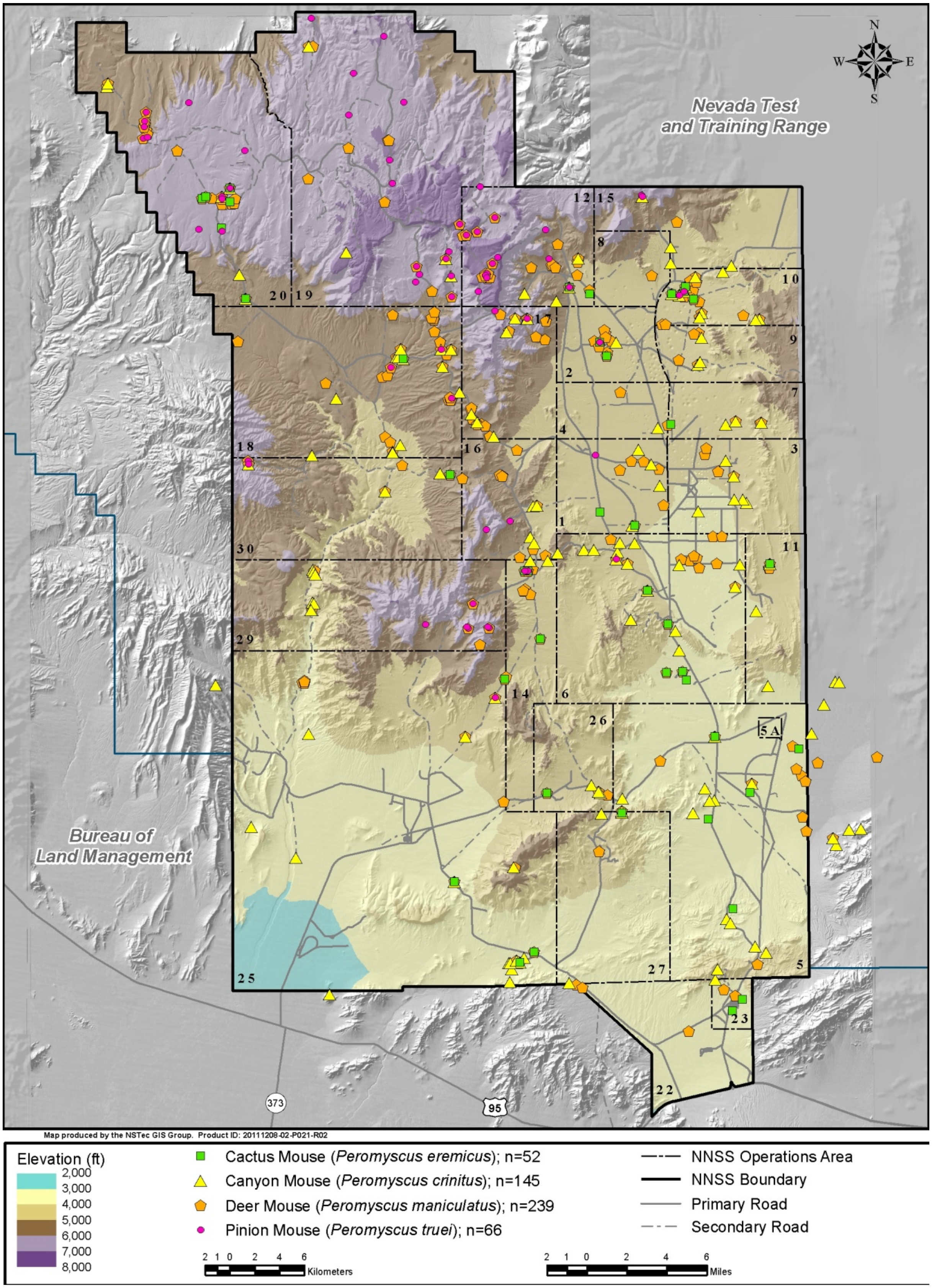

Figure 4-11. Distribution of four species of murid rodents on the NNSS

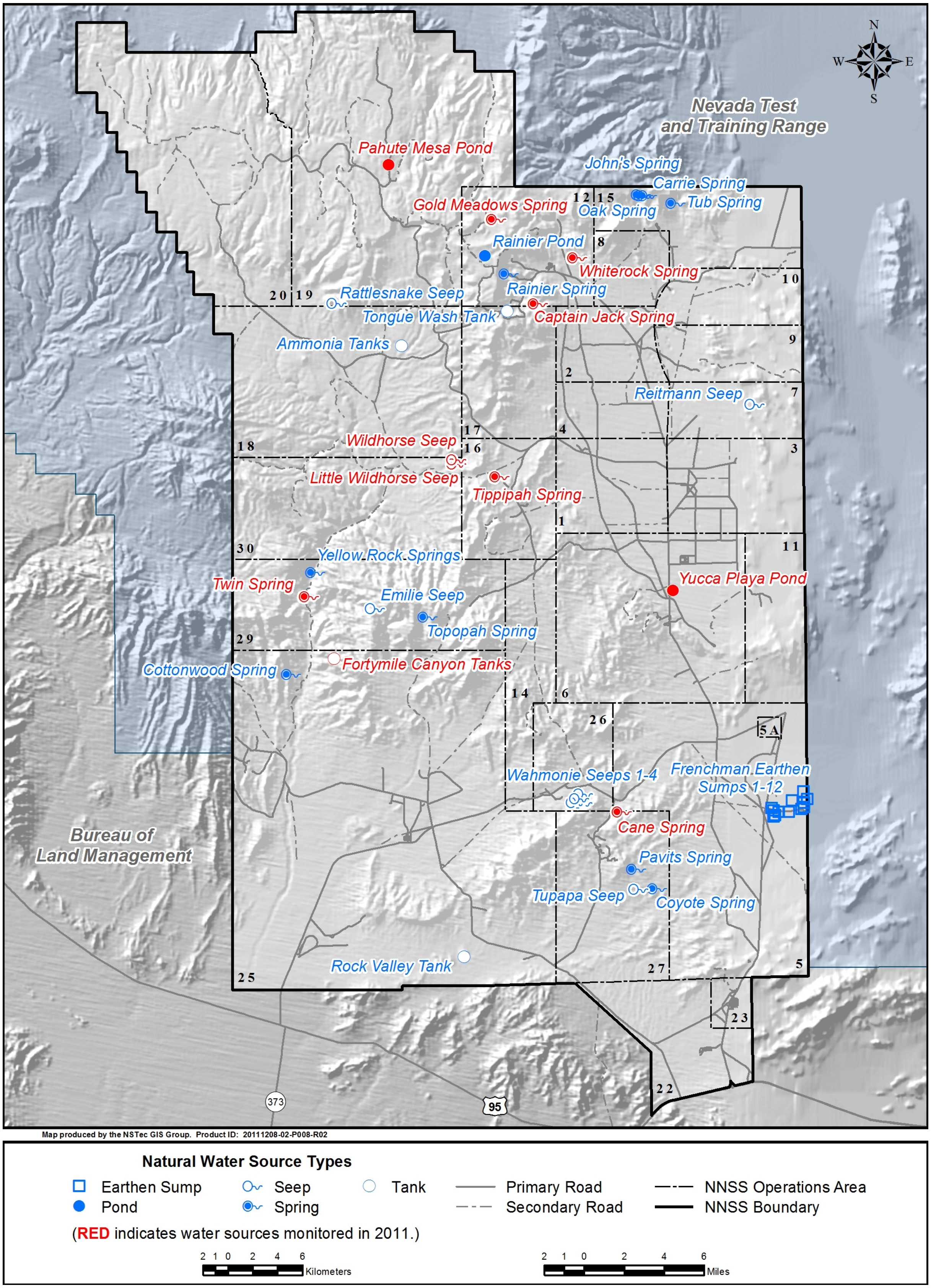

Figure 4-12. Natural water sources on the NNSS, including those monitored in 2011

Table 4-6. Hydrology and disturbance data recorded at natural water sources on the NNSS during 2011

Spring	Date	Surface Area of water (m^2)	Flow rate (L/min)	Impacts at Spring
Cane Spring	12/14/2011	41	1	Heavy growth of cattails
Captain Jack Spring	12/19/2011	10	1	None
Fortymile Canyon Tanks	3/15/2011	30	NA	None
Gold Meadows Spring	3/9/2011	300	NA	Horse grazing and trampling of vegetation
Gold Meadows Spring	9/12/2011	100	NA	Horse grazing and trampling of vegetation
Gold Meadows Spring	12/19/2011	0	NA	Horse grazing and trampling of vegetation
Little Wildhorse Seep	11/29/2011	0	NA	None
Pahute Pond	4/14/2011	3,000	NA	None
Pahute Pond	9/14/2011	0	NA	None
Tippipah Spring	8/25/2011	160	NM	None
Tippipah Spring	12/19/2011	160	NM	None
Twin Spring	11/17/2011	0.1	NA	Mule deer trampling of vegetation
Whiterock Spring	8/17/2011	6	NM	None
Whiterock Spring	12/15/2011	8	1.5	None
Wildhorse Seep	11/29/2011	5	NA	Horse grazing and trampling of vegetation
Yucca Playa Pond	6/8/2011	28,000	NA	None
Yucca Playa Pond	10/5/2011	0	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. Mule deer, antelope (*Antilocapra americana*), and horses (*Equus caballus*) benefit significantly from the use of the water sources. Typically, small birds benefit greatly from small water sources in the desert. At the NNSS, few birds were observed at springs in 2011. Chukar (*Alectoris chukar*) were numerous at one site, and mourning doves (*Zenaida macroura*) were rather rare throughout the NNSS in 2011 (Table 4-7). The use of motion-activated cameras provides more detailed information than site visits alone (see Section 6.5.1, Motion-Activated Cameras).

Table 4-7. Number of wildlife species observed or inferred at NNSS natural water sources in 2011

	Natural Water Sources												
Wildlife Species Observed at NNSS	**Cane Spring**	**Captain Jack Spring**	**Fortymile Canyon Tanks**	**Gold Meadows Spring**	**Little Wildhorse Seep**	**Pahute Pond**	**Tippipah Spring**	**Tippipah Spring**	**Twin Spring**	**Whiterock Spring**	**Whiterock Spring**	**Wildhorse Seep**	**Yucca Playa Pond**
Date Observed (month/day) of 2011:	**12/14**	**12/19**	**3/15**	**9/7**	**11/29**	**9/29**	**7/21**	**12/19**	**11/17**	**9/15**	**12/15**	**11/29**	**6/8**
Mammals													
Bobcat (*Lynx rufus*)											P		
Coyote (*Canis latrans*)	P	P	P	P	P	P	P	P	P	P	P	P	P
Feral horse (*Equus caballus*)				P	P							P	
Mule deer (*Odocoileus hemionus*)	P	P	P	P	P	P	P	P	P	P	P	P	P
Birds													
Sage sparrow (*Amphispiza bellii*)								1					
Chukar (*Alectoris chukar*)	P	15			35		15					10	
Common raven (*Corvus corax*)			1					1		1			
Loggerhead Shrike (*Lanius ludovicianus*)								1			1		
Long-eared owl (*Asio otus*)										1			
Mourning dove *(Zenaida macroura)*										1			>3
Cooper's hawk (*Accipiter cooperi*)											1		
Numbers of bird species detected:	**1**	**1**	**1**	**0**	**1**	**0**	**1**	**3**		**3**	**2**	**1**	**1**

P = Species presence inferred from sign

4.5 Constructed Water Source Monitoring

Site biologists conducted quarterly monitoring of constructed water sources. These sources, located throughout the NNSS (Figure 4-13), include plastic-lined sumps at about 20 sites. Several ponds or sumps may be 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 have drowned under certain conditions in steep-sided plastic-lined sumps from entrapment. Therefore, ponds have been monitored to assess their use and impacts to wildlife. Over time, mitigation measures, such as the emplacement of sediment mounds, have been recommended to prevent them from causing entrapment or significant harm to wildlife.

During March, July, October, and December 2011, 35 constructed water sources (Table 4-8) were visited. 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 also been installed at many plastic-lined sumps. The presence, absence, and condition of these structures were also noted. All dead animals in or adjacent to a human-made water source were recorded (Table 4-8). Monitoring frequency was decreased in 2011 because many of the older sumps appear to have very low risk of entrapping animals. Older liners become less slippery over time due to weathering, thus allowing animals to escape. During 2011, no dead animals were detected in sumps on the NNSS.

Most sumps were dry from midsummer in 2011 until late October when rains occurred. Most sumps fill with water from the first snows in mid–late December. Use is limited to common species of passerine birds, ducks, and shorebirds.

Table 4-8. Wildlife mortality at plastic-lined sumps on the NNSS for 2011

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	2	1	300	2	0
April–June	7	2	260	3	0
July–September	10	0	0	0	0
October–December	16	11	3,700	8	0

Sediment ramps are still missing in many sumps on the NNSS. Where they have been installed, they have been very effective in allowing animals to exit sumps under conditions of deep water. Sediment ramps that are used by wildlife (typically coyotes and deer) have fresh tracks. In the future, sediment ramps should be emplaced in new sumps when they are constructed, especially if water is deep.

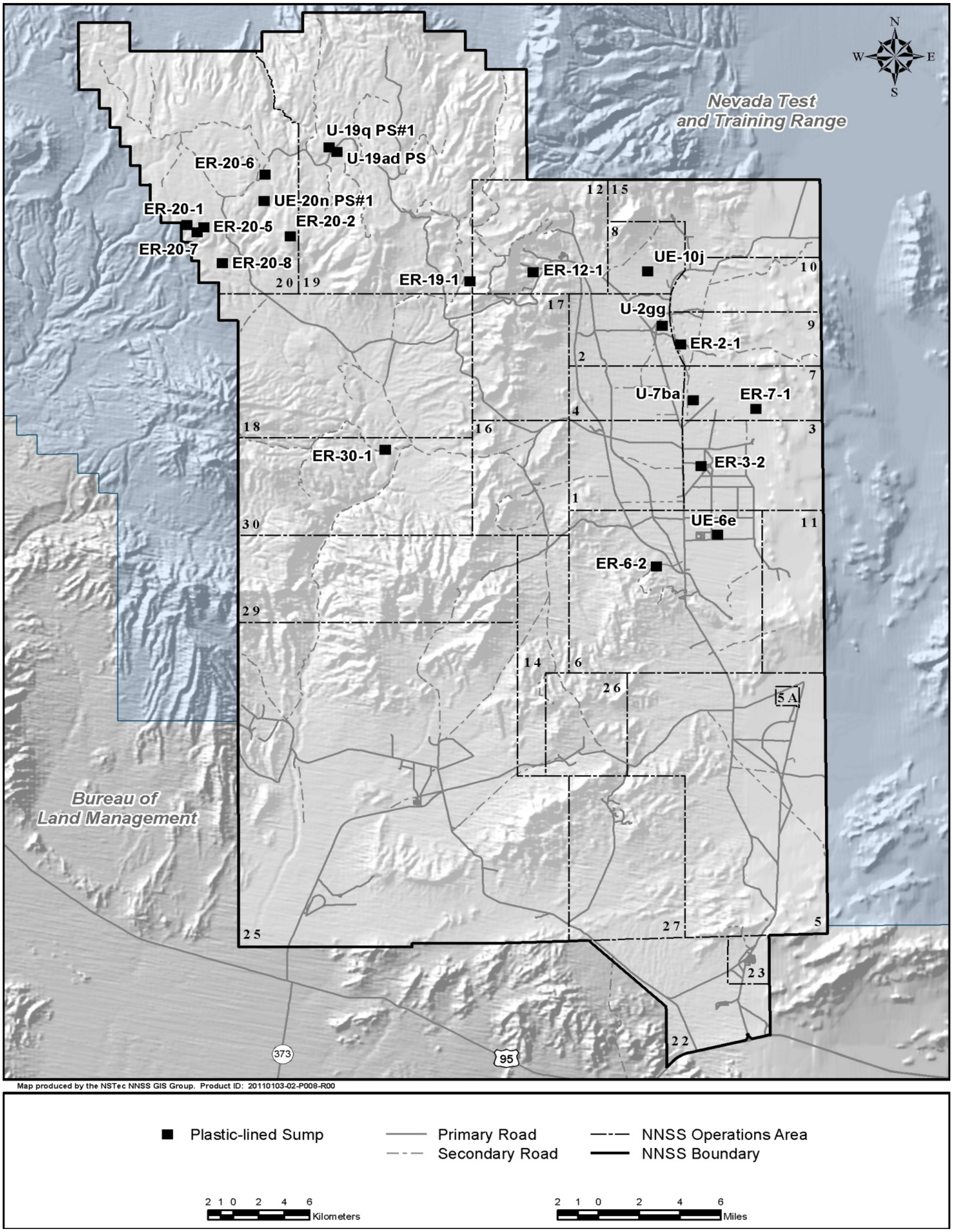

Figure 4-13. Constructed water sources monitored for wildlife use and mortality on the NNSS during 2011

4.6 Coordination with Scientists and Ecosystem Management Agencies

Site biologists interfaced with other scientists and ecosystem management agencies in 2011 for the following activities:

- Participated in a meeting of the Mojave Desert Initiative designed to address research needs in the areas of wildfires and reclamation of Mojave Desert lands.
- Assisted field crews from the Rocky Mountain Research Station (Ogden, Utah) in conducting forest inventory and analysis for the U.S. Forest Service.
- Assisted Dr. Paula Cushing of the Denver Museum of Science and Nature in setting up and harvesting Solifugae (sun spiders) at four locations on the NNSS.

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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. 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

There were no changes to the list of sensitive plants on the NNSS in 2011. One species, *Galium hilendiae* ssp. *kingstonense*, is being evaluated to determine whether the species of *Galium* found on the NNSS is indeed *G. hilendiae* ssp. *kingstonense*, which will need to be further evaluated by experts in taxonomy of the genus.

5.2 Program Awareness

The annual Rare Plant Workshop, sponsored by NNHP and NNPS, was held April 6 and 7, 2011, in Reno, Nevada. A site biologist attended the 2-day meeting and presented a summary of the sensitive plant monitoring program on the NNSS. There were no actions or recommendations from the participants of the workshop that affected the sensitive plants that are listed for the NNSS.

5.3 Long-Term Monitoring

No long-term monitoring for sensitive plants on the NNSS was conducted in 2011. Monitoring was scheduled for *Astragalus funereus* and *Eriogonum concinnum* this year; however, growing conditions were less than optimal, and few, if any, plants of these two species were found during reconnaissance surveys. Monitoring will be conducted when growing conditions improve for these species.

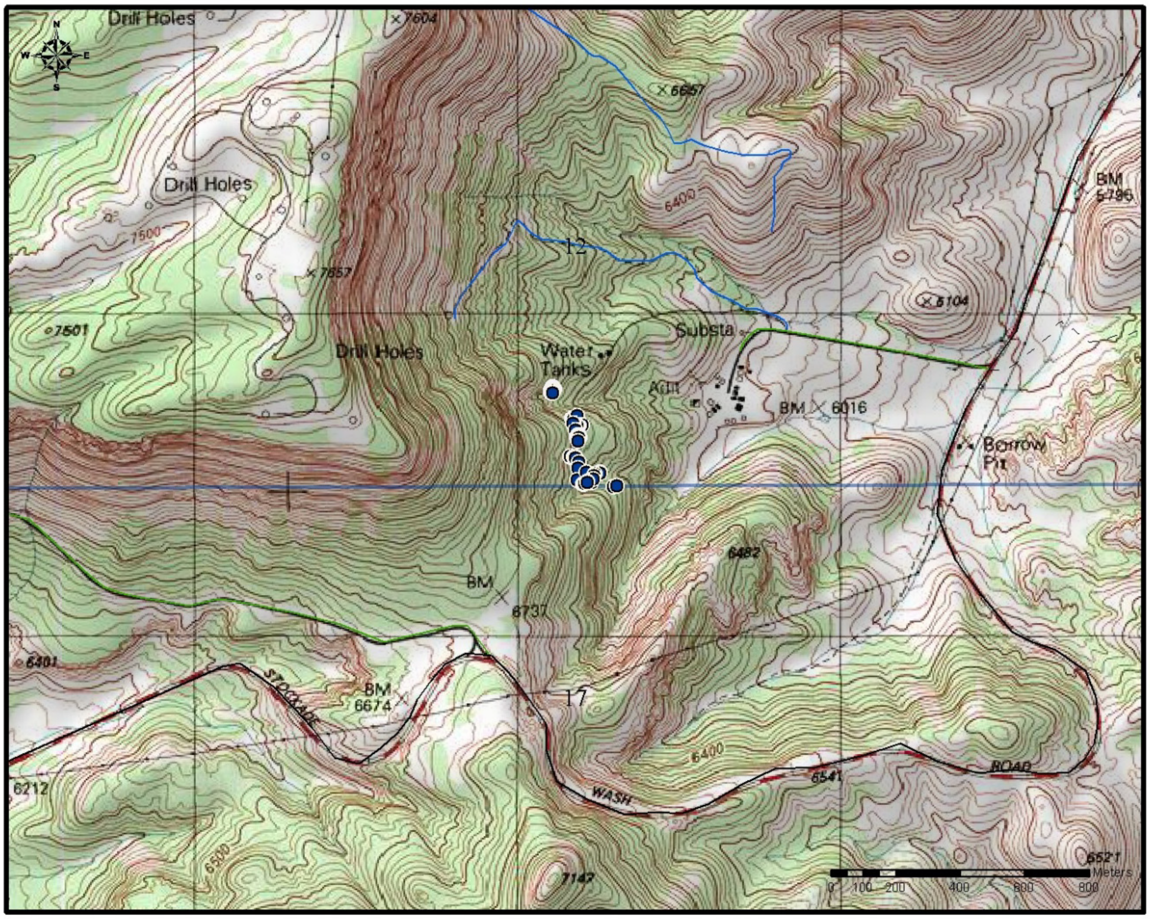
5.4 Field Surveys

Field surveys on the NNSS in 2011 included searches for *Astragalus oophorus* var. *clokeyanus* in the Tongue Wash area and for *Ivesia arizonica* var. *saxosa* in potential habitat on Pahute Mesa and at a previously reported location in the Pah Canyon area. Surveys were conducted for *G. hilendiae* ssp. *kingstonense* at a known location of this subspecies in the Kingston Mountains (San Bernardino County, California) and for *I. arizonica* var. *saxosa* at an historic location of this variety at reported locations in the Pahroc Mountains (Lincoln County, Nevada). There were opportunistic sightings of *Frasera pahutensis* on Pahute Mesa during activities associated with the mountain lion monitoring project on the NNSS. The results of the field surveys and opportunistic sightings are presented in this section.

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

In 2009, two previously unreported locations of *A. oophorus* var. *clokeyanus* were identified. One location was found in the Tongue Wash area and the other was in a drainage flowing into Cat Canyon (Hansen et al., 2010). The Cat Canyon site was surveyed in 2010. The Tongue Wash location was not surveyed until this year. The area surveyed was 0.8 to 1.2 ha (2 to 3 ac) in size. A total of 126 individuals were located. The extent of the population of *A. oophorus* var. *clokeyanus* in the Tongue Wash area is shown in Figure 5-1.

This population of *A. oophorus* var. *clokeyanus* is along the eastern slopes of Rainier Mesa. A population has been known for several years east of Tongue Wash, east and west of Captain Jack Spring. This new location represents the first location west of Tongue Wash. *A. oophorus* var. *clokeyanus* could potentially be found at other locations further north along the eastern slopes of Rainier Mesa. This will be the focus of field surveys for this species in future years.



● Locations of *A. oophorus* var. *clokeyanus*

Figure 5-1. Locations of *A. oophorus* var. *clokeyanus* recently found in the Tongue Wash area along the eastern slopes of Rainier Mesa

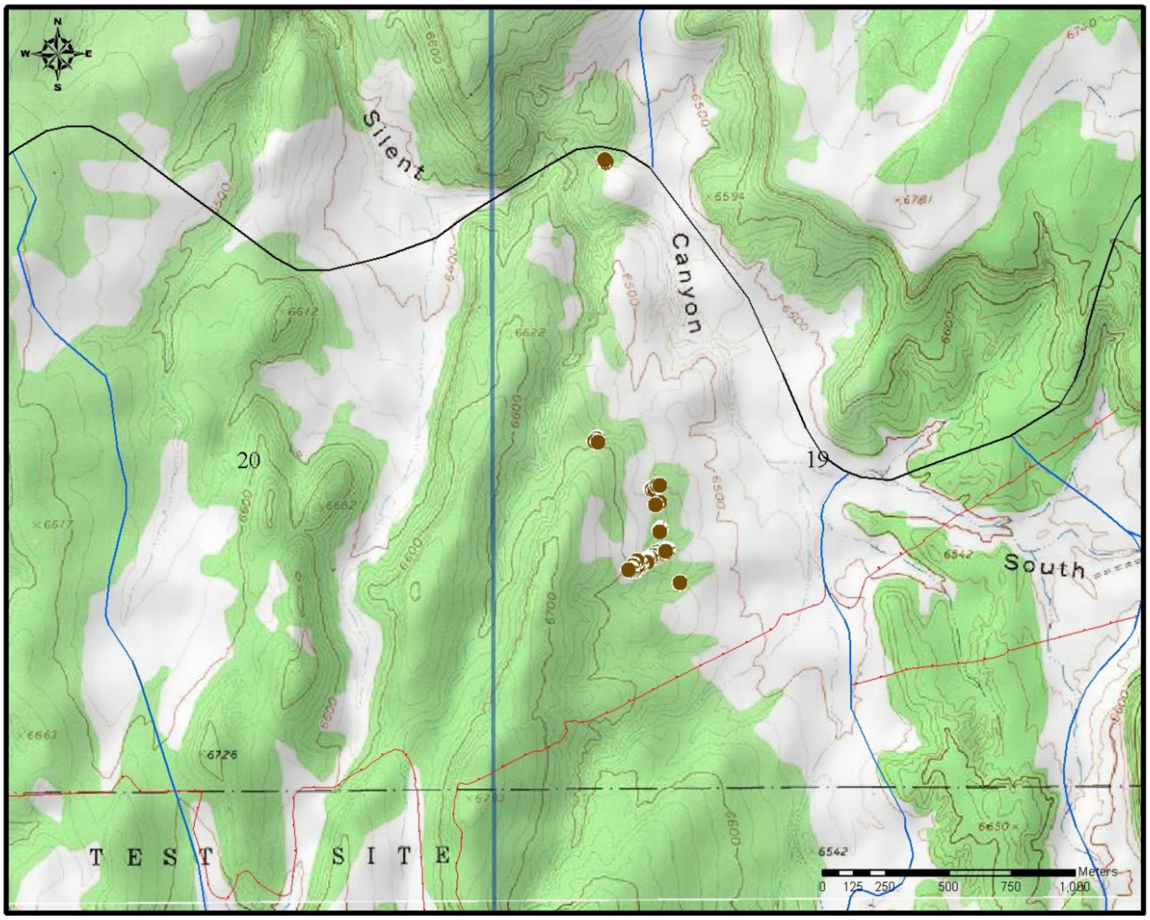
5.4.2 Ivesia arizonica *var.* saxosa*, Rock Purpusia*

I. arizonica var. *saxosa* was first collected in 1898 just south of the Pahroc Summit Pass in Lincoln County, Nevada, by Carl A. Purpus. This is the type locality for the species. In recent conversations with Nevada taxonomists, a new location for this species was reported in the northern Pahroc Mountains. Site biologists visited the type location at Pahroc Summit Pass to verify the location, assess morphological characteristics, and determine habitat preferences, as it appears to be at a much lower elevation (1,524 m or 5,000 ft) than those on the NNSS (1,950–2,011 m [6,400–6,600 ft]). On June 8, 2011, this site was visited and several plants were found, typically on north-facing cliffs and rock crevices of boulders just south of Highway 93 at Pahroc Summit Pass between Hiko and Caliente. Its growth and tuffacious rock substrate preference are very similar to that on the NNSS. An area was also surveyed on the North Pahroc Range where it was reportedly collected by David Charlet, a botanist with the College of Southern Nevada. Site biologists surveyed from Pahroc Spring east up a valley into the mountains where several populations of this species were found along the cliffs at elevations from 1,790 to 1,860 m (5,873 to 6,102 ft) (Figure 5-2). Photographs and GPS locations were taken, which will be sent to the NNHP for inclusion in the state-wide database of rare species.

Figure 5-2. Typical habitat of *I. arizonica* var. *saxosa* in the North Pahroc Range
(Photo by D. C. Anderson, June 8, 2011)

On June 30, 2011, a small area was searched for *I. arizonica* var. *saxosa* south of the Pahute Mesa road and just west of the 19-03 Road intersection (Figure 5-3). In this area, there were several north-facing cliff faces of non-welded tuff that supported a population of *I. arizonica* var. *saxosa*. The total population size was between 100 and 200 plants, and they were in full flower on June 30. This area is 300 m (984 ft) north of the population in Columbine Canyon.

On July 21, 2011, field surveys were conducted for *I. arizonica* var. *saxosa* in the area between Columbine Canyon and south to a power line road in Area 19 on Pahute Mesa. Plants were found in several rock outcrops of non-welded tuff along the eastern slopes of a north-south trending ridge (Figures 5-3 and 5-4). Approximately 500–700 plants were found in several scattered populations in this area, but more may be found since the area was not searched completely. There is still about 1 kilometer (km) (0.62 mile [mi]) between the northernmost site at this location and the southernmost population of Columbine Canyon, so there may be more individuals found that would connect these two populations.



● Locations of *I. arizonica* var. *saxosa*

Figure 5-3. New locations of *I. arizonica* var. *saxosa* found in 2011 in the vicinity of Columbine Canyon

On March 3, 2011, non-flowering individuals of *I. arizonica* var. *saxosa* were found at the head of Pah Canyon on Shoshone Mountain. Plants were found on northwest facing cliffs at the head of the canyon at 1,981 m (6,500 ft) elevation. Less than 30 individual plants were found at this site, and although none was in flower, vegetative characteristics were similar to those of plants found at Columbine Canyon. On July 5, 1997, *I. arizonica* var. *saxosa* plants with white flowers were collected from this same location. Janice Beatley reports this species from southwestern Shoshone Mountain (Beatley, 1976), but the exact location is unknown. Surveys for this species will focus on this area in the future.

Figure 5-4. Typical habitat for *I. arizonica* var. *saxosa* in the vicinity of Columbine Canyon
(Photo by D. C. Anderson, Area 19, June 2006)

5.4.3 Galium hilendiae *ssp.* kingstonense*, Kingston Mountain Bedstraw*

Galium hilendiae ssp. *kingstonense* was reported from the Tub Spring area in Area 15 of the NNSS in 1967 (Cochrane, 1979). Since its original sighting, a species of *Galium* similar to the species found at Tub Spring was located at Oak Spring Butte and Tongue Wash. These areas have been intensely surveyed and plant boundaries well defined over the last few years. However, it has not been confirmed that the plants found at these locations are indeed *G. hilendiae* ssp. *kingstonense*.

The type locality for *G. hilendiae* ssp. *kingstonense* is in the Kingston Mountains located just across the Nevada-California border in San Bernardino County, California. In 1994, surveys were conducted in the vicinity of the type locality in an attempt to verify that the species of *Galium* found on the NNSS is indeed the rare species *G. hilendiae* ssp. *kingstonense.* The survey in 1994 was unable to locate the subspecies *kingstonense*. In 2010, the same area was surveyed, but the surveys were late in the season and although a species of *Galium* was found, it could not be confirmed to be *G. hilendiae* ssp. *kingstonense*.

In 2011, plant collection records and plant database records were searched, and specific locations for *G. hilendiae* ssp. *kingstonense* were found in the Kingston Mountain area. A field survey was completed in the spring north of Excelsior Mine Road and west of Tecopa Pass, a recent documented location for *G. hilendiae* ssp. *kingstonense*. Approximately 60 individuals were found during the survey.

The species of *Galium* found in the Kingston Mountains in 2011, which is assumed to be *G. hilendiae* ssp. *kingstonense*, appears to be different from the species found on the NNSS. Plants on the NNSS thought to be *G. hilendiae* ssp. *kingstonense* are herbaceous, less than 30 cm (12 in.) in height, with little, if any, plant material persisting from year to year. The habitat for the species on the NNSS is rather sandy soils and typically found in the understory of trees or large shrubs. Plants found in the Kingston Mountains were more woody than herbaceous, typically in heights exceeding 30 cm (12 in.), some reaching 76 cm (30 in.) and in open spaces. The base of the plant was the persisting plant growth from previous years, and plants were found on dry, northwest-facing talus slopes.

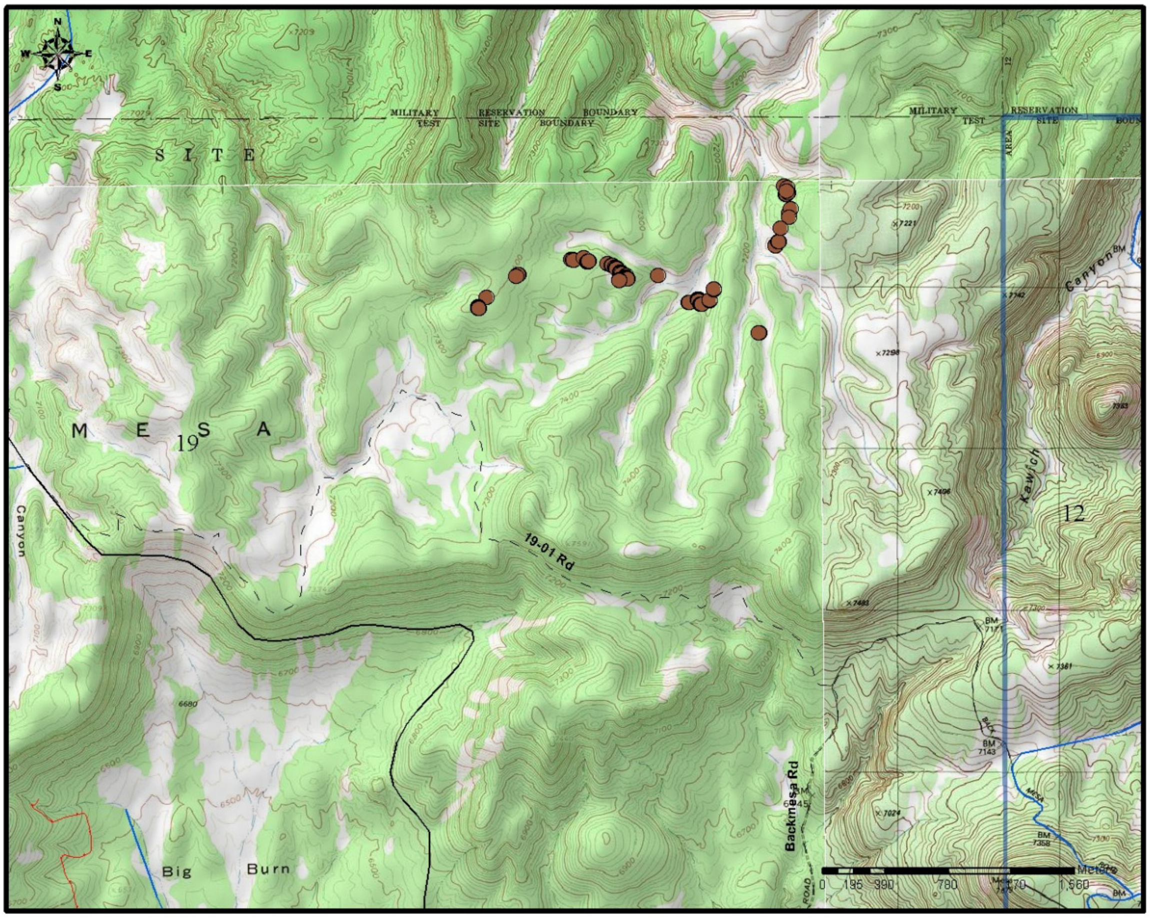
The presence of *G. hilendiae* ssp. *kingstonense* on the NNSS is unconfirmed at this point. Such a determination will require the expertise of a plant taxonomist specializing in *Galium*. Work will continue with this issue in the future.

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

F. pahutensis is known from two different areas on the NNSS. The first reported location for this species was along the 19-01 Road on Pahute Mesa (Beatley, 1976). In 1997, another population was documented (NSTec herbarium database) in the Gold Meadows region on Rainier Mesa. The boundaries of these two populations have been well defined during field surveys in recent years, and both locations are part of the sensitive plant monitoring program on the NNSS.

When the population of *F. pahutensis* on Pahute Mesa was surveyed in 2006, close to 300 individuals were located. Most were found in an open sagebrush shrubland along the 19-01 Road. Further east along the 19-01 Road and north of the road individuals of *F. pahutensis* were infrequently found in a pinyon-juniper woodland, particularly along ridge tops. It was observed at that time that much of this region, especially to the north of the 19-01 Road, represented potential habitat for this species.

In 2011, several opportunistic sightings of *F. pahutensis* were made north of the 19-01 Road in the eastern regions of Pahute Mesa. On 2 different days in July, over 200 individuals of *F. pahutensis* were located in this area, which represents an extension to the north of the population of *F. pahutensis* located in 2006 (Figure 5-5). Similar to observations made in 2006, most plants were scattered along the ridge tops and the upper slopes and were uncommon. Habitat similar to that surveyed this year will continue to be the focus for future field surveys for *F. pahutensis*.



Locations of *F. pahutensis*

Figure 5-5. New locations of *F. pahutensis* north of the 19-01 Road and along ridges of the eastern region of Pahute Mesa

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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 being considered to be listed as Threatened under the *Endangered Species Act*, but a final decision by FWS on May 12, 2011, removed it from being considered. 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 2011 focused on (1) western red-tailed skinks (*Plestiodon gilberti rubricaudatus*), (2) bats, (3) wild horses, (4) mule deer, 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 were completed in 2011.

Figure 6-1. Western red-tailed skink (*Plestiodon gilberti rubricaudatus*)
(Photo by D. B. Hall, July 28, 2011)

While the main focus of these surveys is to determine distribution and abundance of western red-tailed skinks. Secondary objectives during 2011 included documenting captures of other species, including the Great Basin skink (*Plestiodon 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 O19). Cells to be sampled in 2011 were selected mainly based on data gaps where skinks had not been captured, including several sites that had been sampled in previous years. 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; 2011). 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.

Five western red-tailed skinks were captured during 5,981 trap days (0.1% or 1 skink/1,196 trap days) at 4 of 27 sites (Table 6-1; Figure 6-2). Fewer skink captures this year may be partially attributed to trapping at less than optimal sites to fill in data gaps, especially during May and early June. At Site #115, two skinks were captured. Three of the four 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 there and were not captured. Captures this year filled in several distribution gaps both spatially and ecologically including Shoshone Mountain (Site #83 and Site #157), the south slope of Pahute Mesa (Site #115), and Whiterock Spring (Site #29) (Figure 6-2). Site #83 is the southeastern-most location documented, and Whiterock Spring is one of the lowest elevation sites recorded. The habitat where the skink was captured was on the roadway in a dense rubber rabbitbrush (*Ericameria nauseosa*) patch with few rocks. This suggests that dense vegetation with lots of litter may be suitable skink habitat without the need for large rocky areas. Perennial water nearby at the spring may also be an important habitat feature at this site.

During the 6 years of trapping (2006–2011), 45 captures of 40 individuals were documented over 33,851 trap days. These are more western red-tailed skink records than have previously been documented in Nevada. Western red-tailed skinks were captured at 29 of 168 sites sampled and primarily occur in the Great Basin Desert ecoregion (Figure 6-3).

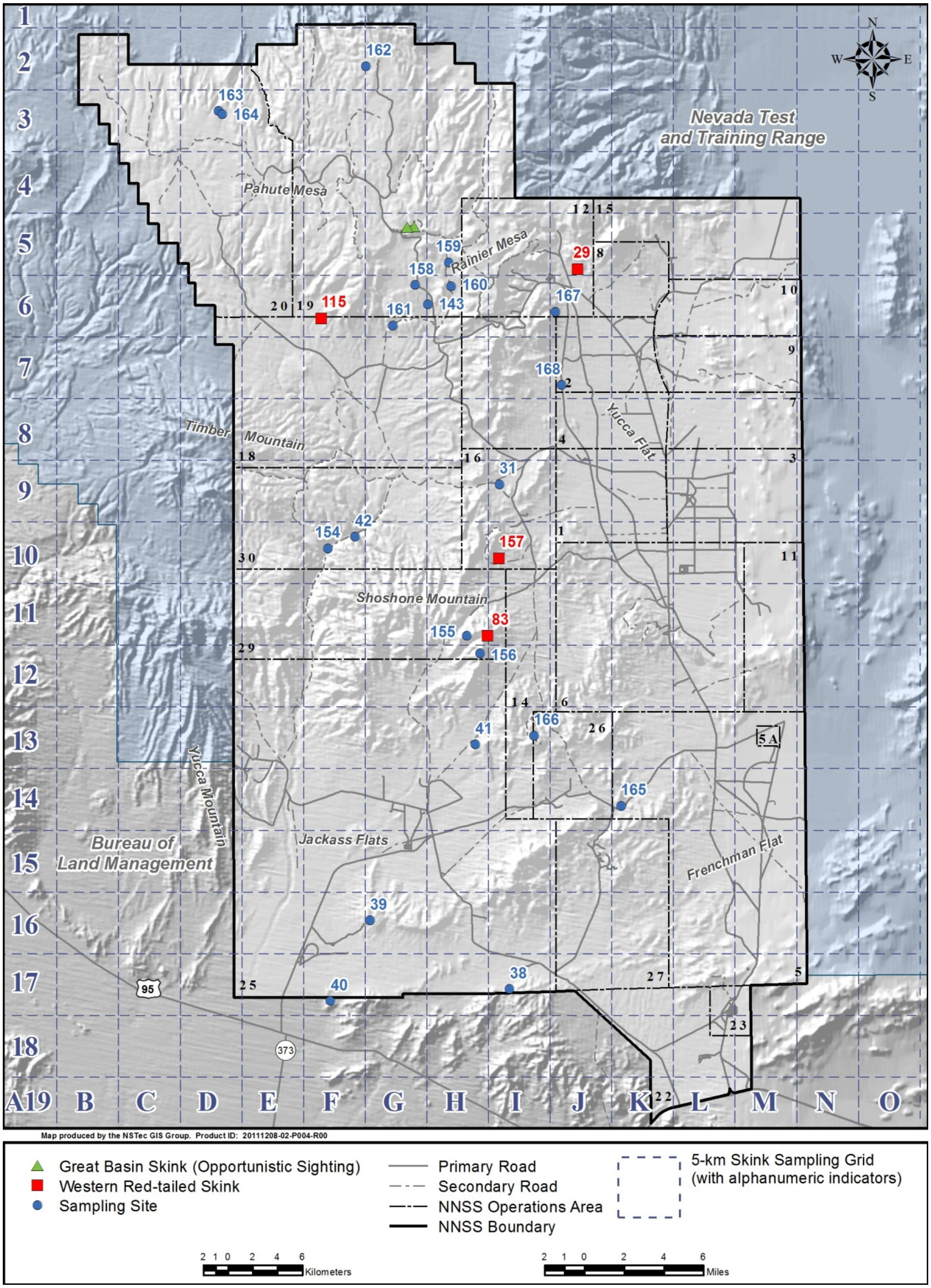

Figure 6-2. Western red-tailed and Great Basin skink sampling locations on the NNSS in 2011

Table 6-1. Number of skink and other reptile captures by NNSS area, site, and survey period (P = species observed but not captured)

				Lizards/Tortoise												Snakes								
Site Number	NNSS Area	Dates in 2011	Trap Days	*Callisaurus draconoides*	*Cnemidophorus tigris*	*Coleonyx variegatus*	*Crotaphytus bicinctores*	*Plestiodon gilberti*	*Gambelia wislizenii*	*Gopherus agassizii*	*Phrynosoma platyrhinos*	*Sauromalus obesus*	*Sceloporus magister*	*Sceloporus occidentalis*	*Uta stansburiana*	*Chionactis occipitalis*	*Crotalus mitchellii*	*Lampropeltis getula*	*Masticophis flagellum*	*Masticophis taeniatus*	*Pituophis catenifer*	*Salvadora hexalepis*	**Total**	**Percent Trap Success**
38	25	5/9-5/12; 5/16-5/19; 5/23-5/26	270		19		1			P					9							1	**30**	**11.1**
39	25	5/9-5/12; 5/16-5/19; 5/23-5/26	270	P[a]	16		1						10		12								**39**	**14.4**
40	Off NNSS	5/9-5/12; 5/16-5/19; 5/23-5/26	271		7	1	2					1			22								**33**	**12.2**
41	25	5/9-5/12; 5/16-5/19; 5/23-5/26	270		2								4		4	1			1		1		**13**	**4.8**
42	30	5/31-6/9	270		11								3	6	9								**29**	**10.7**
154	30	5/31-6/9	270	P	7								7	3	2			1	1		1	1	**23**	**8.5**
76	6	5/31-6/9	270		7						P		6		8				3				**24**	**8.9**
56	6	5/31-6/9	270		3		1						7		2								**13**	**4.8**
155	29	6/13-6/16; 6/20-6/23	180											4							1		**5**	**2.8**
156	29	6/13-6/16; 6/20-6/23	180											13						2			**15**	**8.3**
83	29	6/13-6/16; 6/20-6/23	180					1						20									**21**	**11.7**
157	16	6/13-6/16; 6/20-6/23	180		1			1					1	1	2		1	1		1			**9**	**5.0**
158	19	6/27-6/30; 7/6-7/9; 7/18-7/21; 7/25-7/28	360											12	1					1			**14**	**3.9**
159	19	6/27-6/30; 7/6-7/9	186		1									7	1								**9**	**4.8**
160	19	6/27-6/30; 7/6-7/9; 7/18-7/21; 7/25-7/28	360		1		1							11	1		1			3	1		**19**	**5.3**
115	18	7/18-7/21; 7/25-7/28	180		2			2						2						2			**8**	**4.4**
29	12	8/8-8/11; 8/15-8/18	180					1					2	3	4				1				**11**	**6.1**
161	18	8/8-8/11; 8/15-8/18	218		1									7	2		P			1			**11**	**5.0**
31	16	8/22-8/25; 8/29-9/1	180		1								9	5	7								**22**	**12.2**
162	19	8/22-8/25; 8/29-9/1	180											1	P								**1**	**0.6**
163	20	8/22-8/25; 8/29-9/1	180		1									3			1			1			**6**	**3.3**
164	20	8/22-8/25; 8/29-9/1	180		1				P					5	1								**7**	**3.9**
165	5	9/6-9/9; 9/12-9/15	180										8		1				1				**10**	**5.6**
143	19	9/6-9/9; 9/12-9/15	180											1	P								**1**	**0.6**
166	14	9/6-9/9; 9/12-9/15	180		P		P						3		P						P		**3**	**1.7**
167	12	9/6-9/9; 9/12-9/15	176		1								5	P	2								**8**	**4.5**
168	2	9/6-9/9; 9/12-9/15	180		P										1								**1**	**0.6**
		Total	**5981**		**82**	**1**	**6**	**5**				**1**	**65**	**104**	**91**	**1**	**3**	**2**	**7**	**11**	**4**	**2**	**385**	**6.4**
Number of sites species was found				**2**	**19**	**1**	**6**	**4**	**1**	**1**	**1**	**1**	**12**	**18**	**22**	**1**	**4**	**2**	**5**	**7**	**5**	**2**		
[a]=Observed on 5/4/11 while staging traps																								

6.1.2 Other Species

A total of 11 of the 16 known lizards and 7 of the 17 known snake species on the NNSS were captured or observed in 2011, including 355 captures of lizards and 30 captures of snakes (Table 6-1). Desert tortoise scat and burrows were observed at one site (Site #38, Rock Valley). Western fence lizards, side-blotched lizards (*Uta stansburiana*), western whiptails (*Cnemidophorus tigris*), and desert spiny lizards were the most abundant species captured, with side-blotched, western whiptail, and western fence lizards being the most ubiquitous.

No Great Basin skinks were captured. However, two opportunistic observations of Great Basin skinks were made in Area 19 (Pahute Mesa) during mountain lion monitoring and are included in Figure 6-2. The first was seen on July 21 and the second was observed on September 27. Figure 6-3 shows the locations of historic and current (2006–2011) Great Basin skink captures (15 captures at 10 new sites). Great Basin and western red-tailed skinks occupy different habitats with Great Basin skinks occupying the higher elevation, moister habitats on Pahute and Rainier Mesas (average elevation 2,105 m [6,906 ft]; range 1,963 to 2,244 m [6,440 to 7,362 ft]) and western red-tailed skinks occupying mid-elevation, drier habitats (average elevation 1,727 m [5,666 ft]; range 1,310 to 2095 m [4,298 to 6,873 ft]).

Other noteworthy reptile records included a juvenile chuckwalla (*Sauromalus obesus*) (Figure 6-4) capture at Site #40, 11 captures of striped whipsnakes at seven sites, a western shovel-nosed snake (*Chionactis occipitalis*) capture at Site #41, and two western patch-nosed snake (*Salvadora hexalepis*) captures at Site #38 and Site #154 (Table 6-1 and Figure 6-2).

Overall trap success for reptiles was 6.4% (385 captures/5,981 trap days) compared to a high of 8.8% (538 captures/6,092 trap days) in 2006 and a low of 3.6% (162 captures/4,517 trap days) in 2007. Trapping results indicate that percent trap success was highest during the first part of the trapping season (mean = 8.6 captures/trap day through June 23) versus the latter part of the year (mean = 4.1 captures/trap day after June 23) (Table 6-1). Possible reasons for this are that reptiles are more active above ground during this time, or that mortality is high and there are fewer reptiles to capture later in the season. Additionally, two to five 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 105 captures of 12 small mammal species were recorded. These captures included a rare capture of a desert shrew (*Notiosorex crawfordi*) and observations of eight additional mammal species or their sign (e.g., tracks, scat) most notably mule deer, desert bighorn sheep (*Ovis canadensis nelsoni*), bobcat (*Lynx rufus*), wild horses, and wild burros (*Equus asinus*). In addition, nine species of birds were detected audibly or by sight, including one capture of a black-throated sparrow (*Amphispiza bilineata*). These data expand the knowledge of the distribution of wildlife across the NNSS, especially in areas not previously sampled.

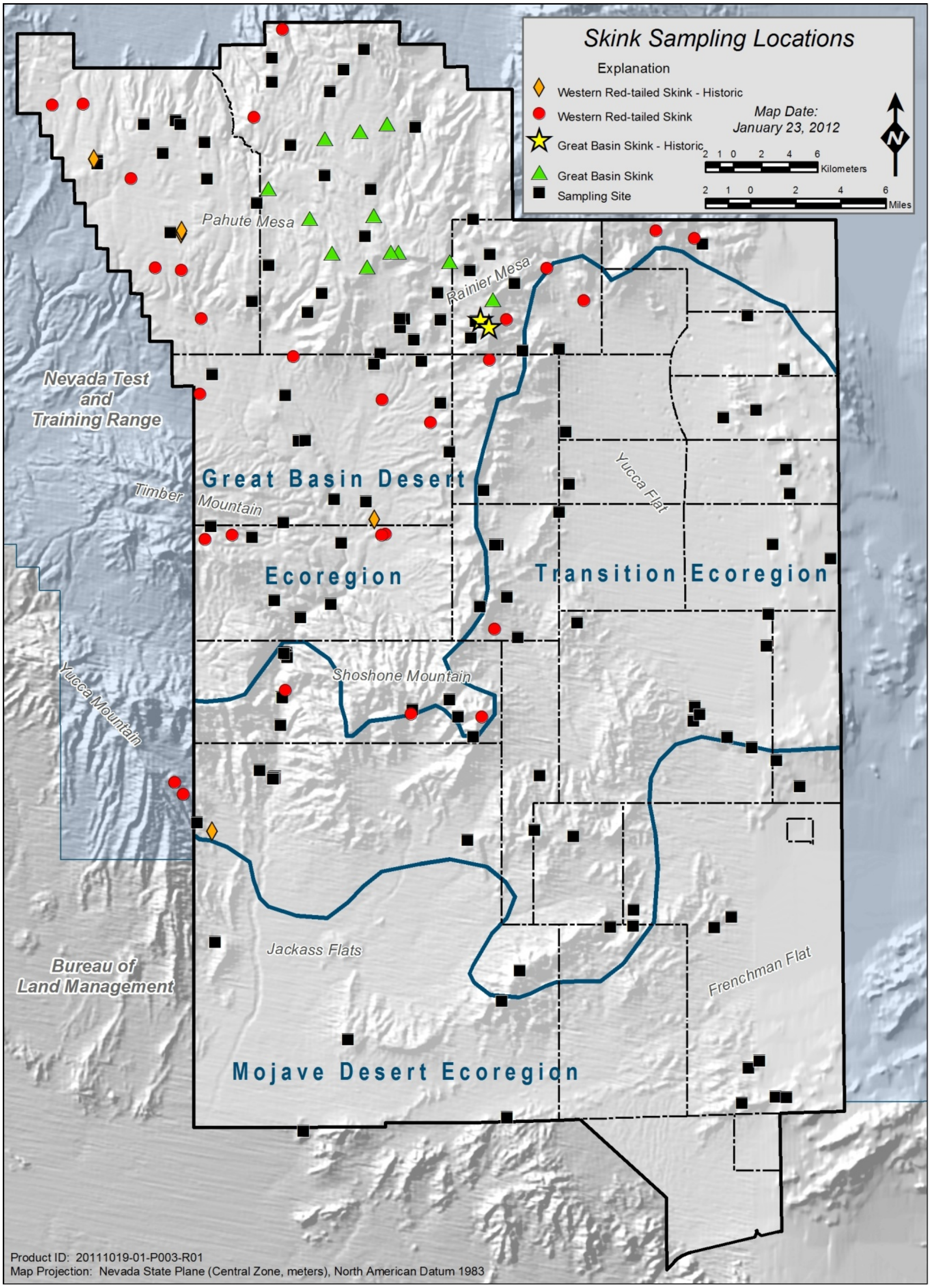

Figure 6-3. Western red-tailed and Great Basin skink distribution and skink sampling locations on the NNSS (2006–2011)

Figure 6-4. Juvenile chuckwalla captured in the Striped Hills
(Photo by D. B. Hall, May 12, 2011)

6.1.3 Skink Genetics

Tissue samples of four captured western red-tailed skinks were sent to Dr. Jonathan Richmond (U.S. Geological Survey [USGS], Western Ecological Research Center) for genetic testing. No sample was taken from Site #83. Results were consistent with previous years' results (Hansen et al., 2009; 2010; 2011) 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 noteworthy because other western red-tailed skink samples collected by Dr. Richmond in 2008 in the Spring Mountains (Willow Creek area, about 66 km [40 mi] southeast of Site #154) belong to the Southwest Clade, which is a different evolutionary lineage than the Inyo Clade.

6.2 Bat Surveys

In 2011, bat monitoring focused on passive acoustic monitoring of bat activity at Camp 17 Pond, and removing bats from buildings and documenting bat roosts.

6.2.1 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 being analyzed by O'Farrell Biological Consulting as funding becomes available. Bat vocalizations and climatic data (e.g., temperature, humidity, wind, barometric pressure) were recorded again in 2011, but no analysis was performed due to a limited budget.

6.2.2 Bats at Buildings

During 2011, site biologists responded to eight nuisance bat calls. Six were at buildings in Mercury (four at Building 23-652, one at the Mercury cafeteria, and one at the fuel station) and two were at buildings in Area 6 (CP-50 and 6-908). Four of the bats were documented as California myotis (*Myotis californicus*). One bat was found dead, having been crushed by the door, and the other bats were removed and released or flew off on their own. 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. Annual monitoring of individual horses at NNSS began in 1989 and has continued through 2011. In 2011, site 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 2011 to assess their influence on horse distribution and movements and to document the impact horses are having on NNSS 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 2011, counts of horses were made during 18 non-consecutive days between May and November. A standard road course was driven to locate and identify horses (see Section 6.5.1, Motion-Activated Cameras). Motion-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. There were 37 horses counted in 2011, excluding foals. This is a close approximation to the actual number of horses that are present. About eight horse bands were detected, which were composed of stallions, subordinate males, females, and their offspring. The NNSS horse population in 2011 is stable at about 37 individuals. Survival of yearlings and foals was low in 2011, as in previous years (Figure 6-5).

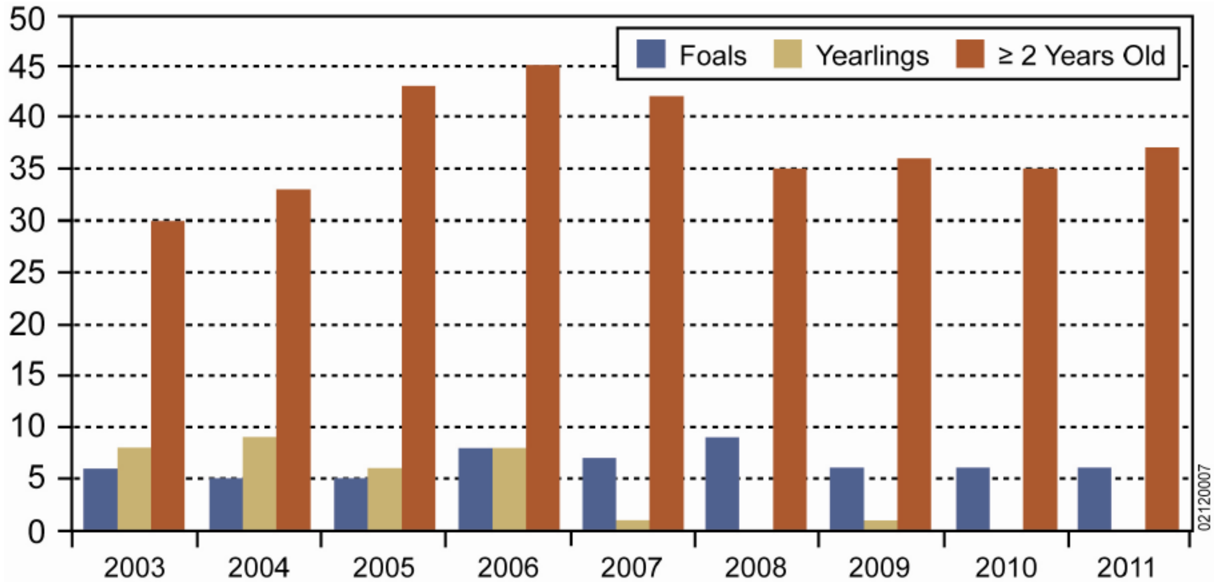

Figure 6-5. Trends in the age structure of the NNSS horse population from 2003 to 2011

Observations and photos taken indicate numerous foals were born in 2011 as in other years, but most disappeared during the summer. Only one large foal was observed remaining in the herd near Camp 17 Pond in November. 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 the NNSS. Only six foals were observed this year, most on opportunistic occasions (Figure 6-6). The horse population has declined in size by about 40% since 1989 when horse population monitoring began on the NNSS.

Figure 6-6. Horse #96 (named Fawn) and newborn foal in Area 18 in the spring of 2011
(Photo by P. Greger, Spring 2011)

6.3.2 Annual Range Survey

During 2011, selected roads were driven within the NNSS, and all band sightings and fresh sign (estimated to be <1 year old) were recorded (Figure 6-7).

Horse sign data collected during the road and walking surveys indicate that the horse range on the NNSS included Gold Meadows, Eleana Range, the southwest foothills of the Eleana Range, the Echo Peak region of Pahute Mesa, and Wildhorse Seeps in Area 30 (Figure 6-7). Overall, the estimated annual horse range in 2011 (236 square kilometers [km^2] [91 square miles (mi^2)]) is somewhat smaller than 2010. The horse range on the NNSS is characterized by rather rugged topography and 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. Horse activity was most heavy along roads from Camp 17 Pond in all directions shown by the concentration of points (Figure 6-7). The preferred horse range seems to be above 1,524 m (5,000 ft) elevation, especially during the summer months. The horse range boundary line was approximated using the horse sign documented for 2011.

6.3.3 Horse Use of Water Sources

Some NNSS springs used by horses are ephemeral in nature such as the wildhorse seeps and Gold Meadows Spring. The wildhorse seeps in Area 30 are temporary water sources in slick rock areas (Figure 6-8) containing several water tanks in the southern edge of the horse range. They are used mostly in fall and winter. Captain Jack Spring was not used by horses during 2011 and only rarely in 2010. One human-made pond (Camp 17 Pond in Area 18) was used heavily this year as in past years. Seasonal horse use at Camp 17 Pond generally begins in March and extends through November. None of the plastic-lined sumps within or near the horse range were used by horses this year, as in past years.

Figure 6-8. Wildhorse seep area is an important watering area for horses in fall and winter
(Photo by P. Greger, December 30, 2009)

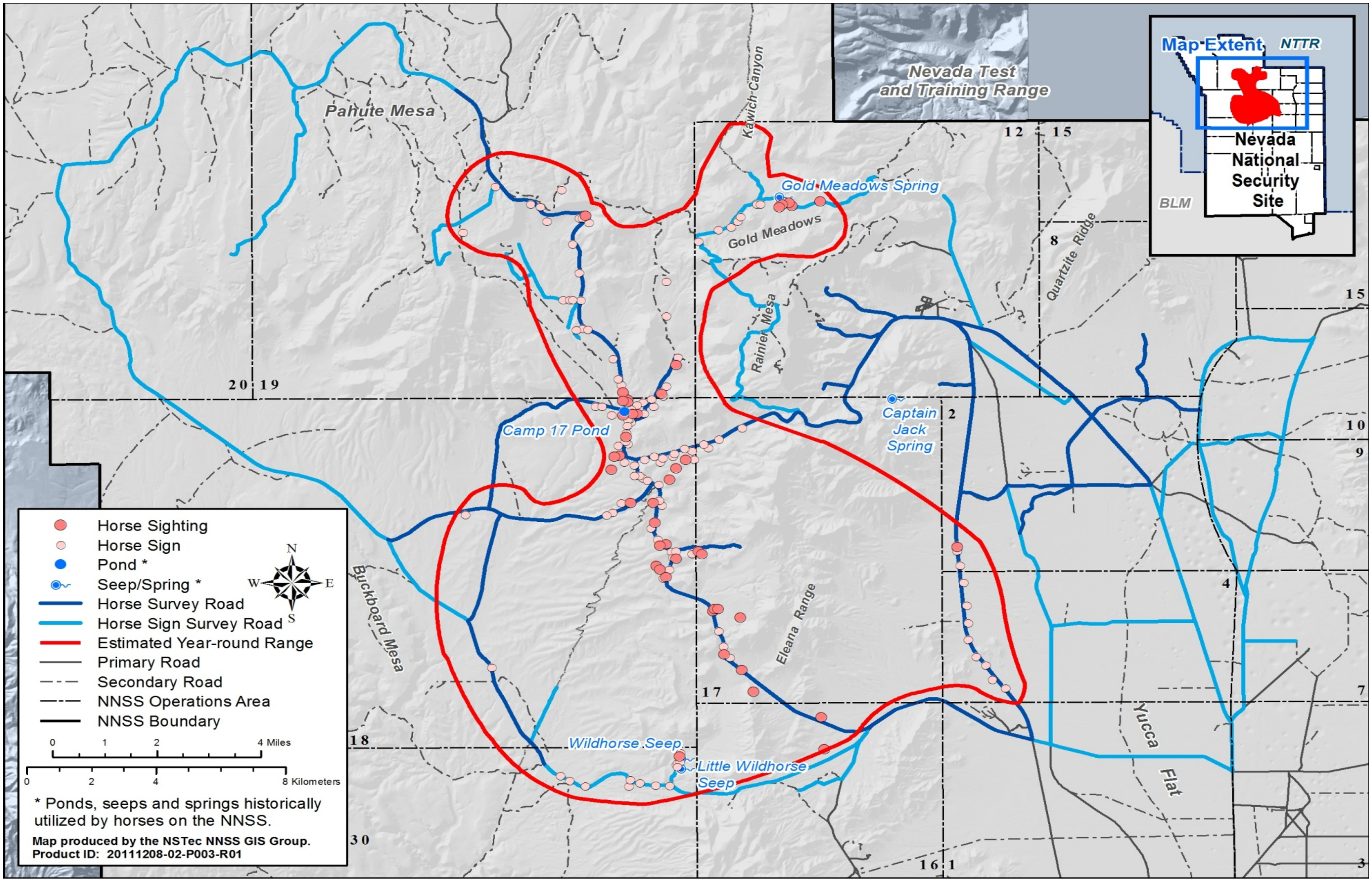

Figure 6-7. Feral horse sightings and horse sign observed on the NNSS during 2011

6.4 Mule Deer

Initial studies of mule deer on the NNSS were conducted by Giles and Cooper (1985). Spotlighting surveys for deer were made from 1989 through 1994 and showed an effect of drought on deer numbers. Deer surveys were not conducted in 1995–1998 and 2001–2005 because of a shift in program priorities. More recently, deer surveys were continued yearly from 2006 to the present.

6.4.1 Mule Deer Abundance

Mule deer abundance on the NNSS was measured by driving two standardized (74 km [44 mi] total length) road courses (Figure 6-9) to count and identify mule deer. One route was centered around Rainier Mesa and the second was centered around Pahute Mesa, following advice that there are two main deer herd components in these regions on the NNSS (Giles and Cooper, 1985).

Locations of mule deer and selected predators 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. Locations of deer groups were displayed using GIS methodology (see Hansen et al., 2009).

During 2011, total observations were made of 477 deer during the 12 surveys. The deer counts in 2011 were similar to the counts in 2010. However, deer numbers in the last 2 years appear to be in the moderate range (40 deer/night) for the NNSS, similar to 1989, the post drought years 1992–1993, and 2008. There appears to be no distinctive long-term trend in deer numbers on the NNSS (Figure 6-10). Note that the absence of data for some years on Figure 6-10 indicates that sampling was not conducted in those years.

Overall, from 2006 to 2011, there were significantly higher deer numbers detected per distance (Anova, $F = 15.6$, 113 d.f., $P=0.0001$) on the Rainier Mesa herd section than on Pahute Mesa herd section of the deer routes (Figure 6-11). More deer were counted per night on average on the Rainier Mesa road survey in recent years (2006–2011) compared to earlier count periods (1989–2000) (mean of 19.6 vs. 6.7 deer per night—a significant difference). Methods have been consistent across years and route length is equivalent. Either deer numbers are actually higher on Rainier Mesa now or deer are more detectable. This may be possible if deer avoided detection in past years when activities at NNSS in forward areas were more common (i.e., deer avoided the roads due to work activity), and deer are now more visible along the route because of less work activity.

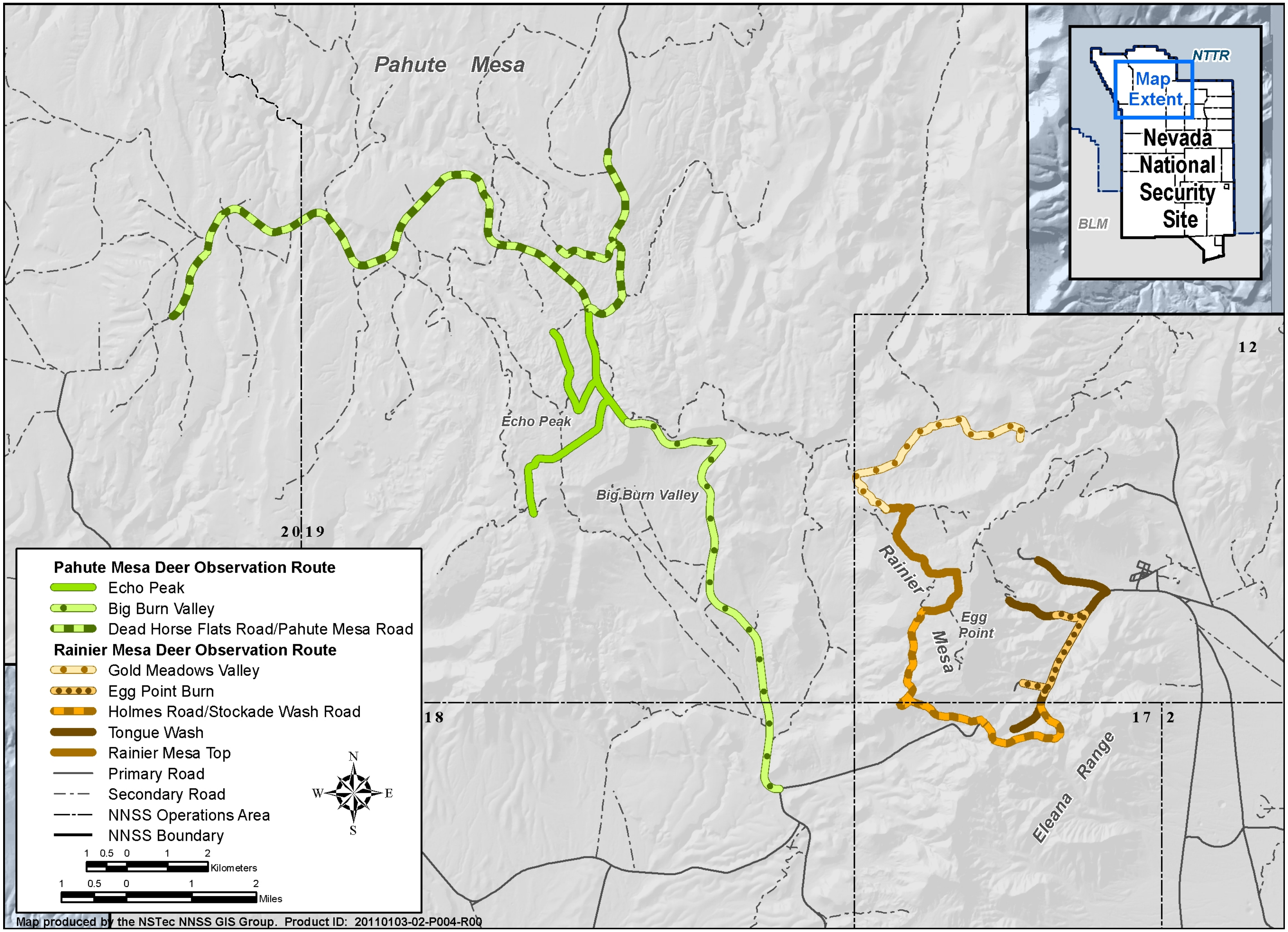

Figure 6-9. Road routes and sub-routes of two NNSS regions driven to count deer

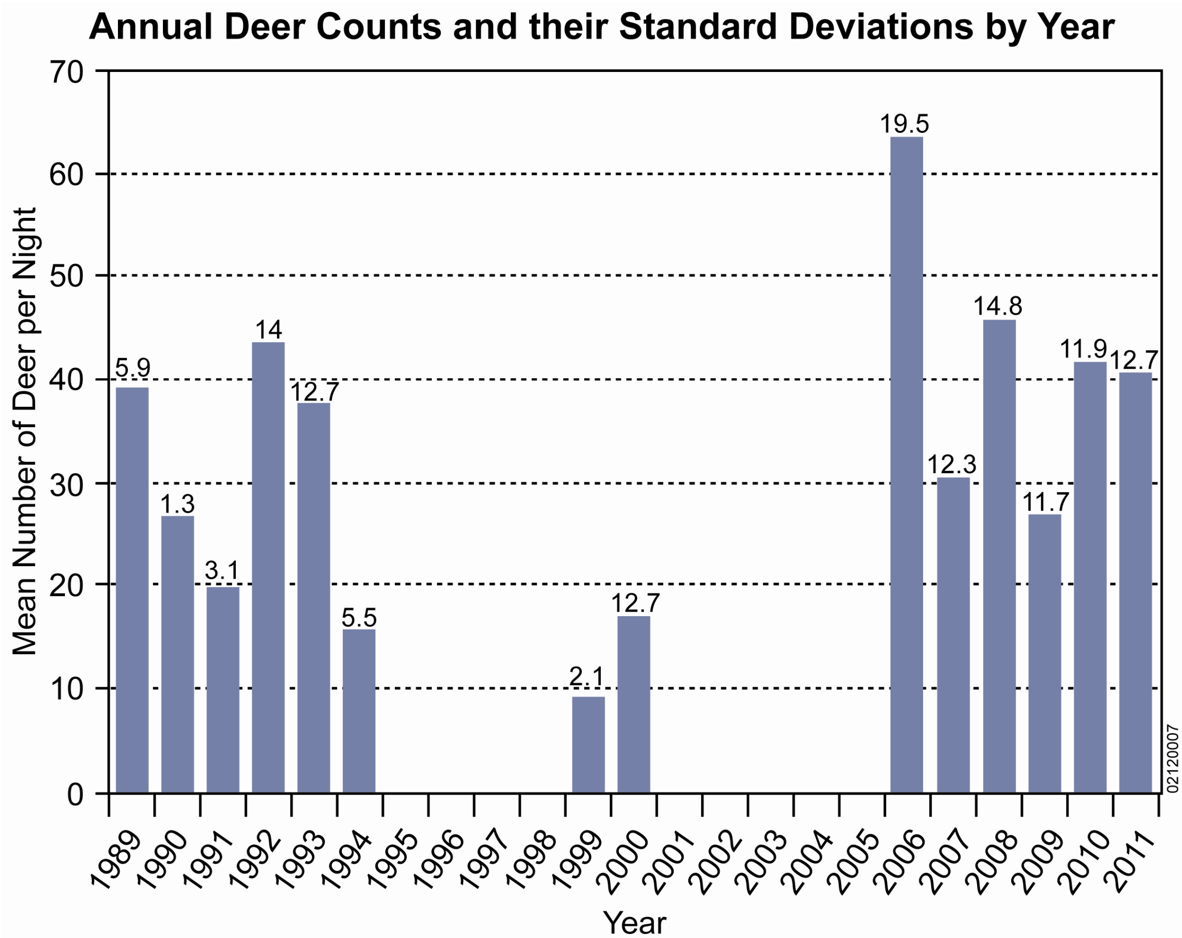

Figure 6-10. Trends in total deer count per night from 1989 to 2011 on the NNSS

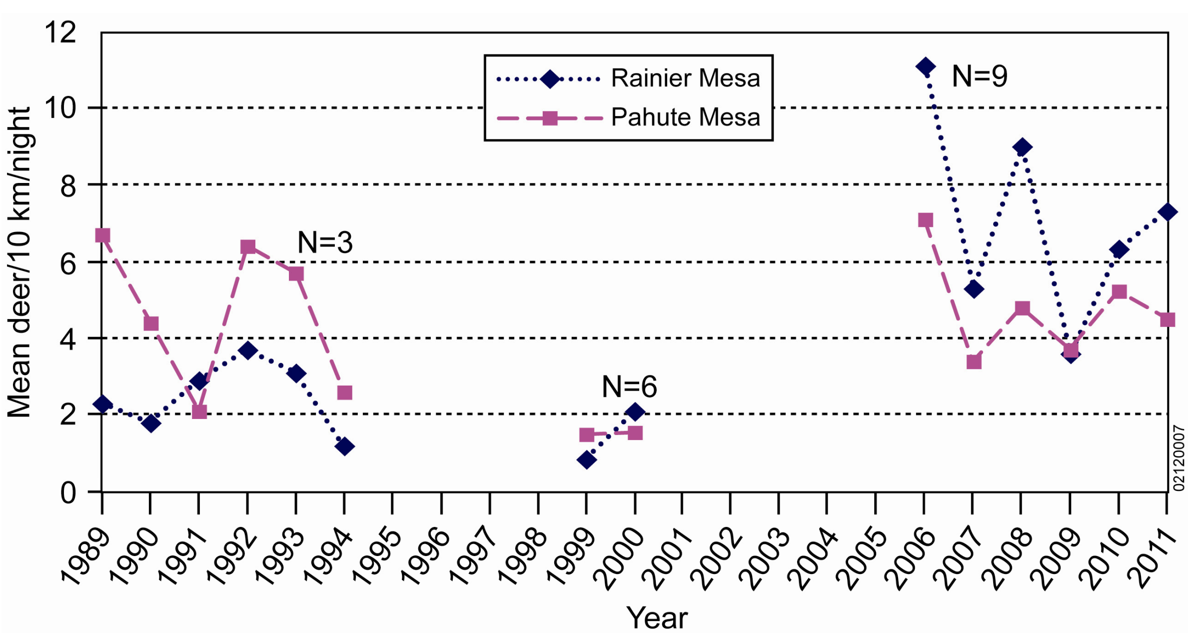

Figure 6-11. Mean number of mule deer per 10 km per night, counted from two regions of the NNSS (N=number of survey nights; for 2011, N=12)

6.4.2 Mule Deer Density

Densities of deer were calculated using the software program DISTANCE (Thomas et al., 2006) on two routes and several sub-routes (Figure 6-9). Stratification of the data was based mostly on differences in topography and elevation. A statistic called Akiake's Information Criterion (AIC) is used to assess model fit. The procedure involves running several models simultaneously on the data set and choosing the model with the lowest AIC to calculate density. A series of tests such as likelihood ratios and goodness of fit tests are also used along with visual inspection to evaluate the overall fit. In DISTANCE, the model fit closest to the centerline is the most important area to be concerned about, and agreement here allows the best fit (i.e., lowest AIC value).

The effective strip width (ESW) or (half width) is an important parameter in DISTANCE that is used to calculate **density (D)**, with n= the number of animals counted (mean cluster size × cluster density) in area (A) sampled, **A= 2 × ESW × L,** with L as the transect length.

Following the recommendations by Buckland et al. (2001), the farthest 10% of deer location data in 2011 were removed from the data set prior to model selection.

A total of 250 observations (deer groups) were detected during 12 survey dates in August, September, and October 2011. Overall, group size varied from 1 to 12 animals, and mean cluster size was 2.2 and 1.4 deer, respectively, for Rainier Mesa and Pahute Mesa regions. Density estimates are shown for the Pahute Mesa transect and Rainier Mesa transect and sub-transects (Table 6-2). Overall densities were low on the NNSS averaging about 2 deer per km^2. There were few significant differences in density between any transect or sub-transect (most 95% confidence intervals overlapped). As in previous years the two areas with the highest deer density were Echo Peak and Gold Meadows (6.0 and 5.1 deer per km^2, respectively), which stand out as being higher deer density areas. Some areas with very low sample size had very high coefficients of variation (Table 6-2).

Table 6-2. Deer density estimates, confidence intervals, and other parameters for two transect regions and sub-transects of the NNSS in 2011

Survey Transects	Transect length (Km)	Total Observations	Deer density D[a], n/Km^2	95% lower confidence interval of D	95% upper confidence interval of D	Coefficient of variation of D
Pahute Mesa Total	**45.5**	**126**	**1.5**	1.1	1.9	0.13
Big Burn Valley	13.0	15	0.6	0.2	1.4	0.45
Echo Peak	10.0	114	6.0	4.3	8.2	0.16
Dead Horse Flat Road/Pahute Mesa Road	22.5	15	0.4	0.2	0.7	0.32
Rainier Mesa Total	**28.5**	**99**	**2.2**	1.5	3.4	0.21
Tongue Wash Area	4.9	16	2.7	1.1	6.9	0.48
Eggpoint Burn	3.7	15	2.3	0.8	6.5	0.54
Holmes Road/Stockade Wash Road	7.5	4	0.5	0.1	2.2	0.73
Rainier Mesa Top	5.8	8	0.8	0.4	1.8	0.43
Gold Meadows	6.6	58	5.1	3.1	8.3	0.24

[a] Conventional distance sampling with major key, with cosine adjustments, 1 observer, and 1 parameter, right truncation 10%; number of transects is 12 for all estimates

Roads and trails have numerous blind areas near the centerline; when surveys are conducted in these areas, animals will generally be undercounted (Buckland et al., 2001). This can result in an underestimate of density. If possible, causes of data problems should first be handled by making adjustments in the field. However, in the data analysis phase, left data truncations and interval size changes have been used to adjust for some data problems (Buckland et al., 2001). Inspection of DISTANCE deer detection curves in 2011 and previous years at the NNSS suggest that undercounting of deer near the centerline is likely. In other words, the number of deer counted near the centerline is consistently lower than expected. A possible reason to suspect undercounting bias is that asphalt roads (10–15 m [33–49 ft] width) are not typical deer habitat and may be avoided by deer.

Along the deer routes in many regions of the NNSS, blind spots occur. The blind spots are often related to natural gullies along the road and thick vegetation that occurs 20–30 m (66–98 ft) from the centerline of the road. Some sub-transects with the lowest density on the NNSS also have the most obstructive cover and potential blind spots (namely, Holmes Road/Stockade Wash Road, Rainier Mesa Top and Big Burn Valley, Table 6-2). Field surveys to document the location and extent of blind spots and poor visibility areas may be useful in stratifying deer data in the future to avoid undercounting of deer and underestimation of density.

6.4.3 Sex and Fawn/Doe Ratios

The sex of some deer could not be determined during surveys. The percentage of deer whose sex could not be determined ranged from 15% in 2009 to 21% in 2007; therefore, calculated sex ratios are not completely accurate. Sex ratios (number of males/female) have fluctuated from 0.89 in 2010 to 2.18 in 2007 (Table 6-3). Generally, deer populations in hunted areas in the West have much lower number of males compared to females in the population than we have 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 in 2011 was very low, as in previous years, despite early surveys conducted in August. 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 determined in recent deer counts from 2006 to 2011 on the NNSS (0.0 to 0.32; Table 6-3).

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
2011	189	184	67	1.03	37	0.19

6.4.4 Mule Deer Habitat Use

Shrublands and woodlands vegetation associations and alliances described by Ostler et al. (2000) were used to describe deer habitat use. The locations of all deer groups recorded at the road centerline were corrected to their appropriate positions in the habitat using the perpendicular distanced recorded from the range finder. 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 (ARCView). The lengths of deer transects (km) in each habitat type were measured by route intersection analysis, and percentages of available habitat in each distinct vegetation type were estimated (Table 6-4) from these data. 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 use 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, w_i, were calculated after Krebs (1999) to examine statistical differences (Table 6-4).

Two woodland associations, *Pinus monophylla*/*Artemisa tridentata* Woodland (PIMO/ARTR) and *Pinus monophylla*/*Artemisa 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. However, *Coleogyne ramosissima–Ephedra nevadensis* Shrubland (CORA-EPNE) and the Eggpoint Burn comprised minor components of the habitats on the deer transects (Table 6-4). 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 2011

Habitat	Km 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	18.20	24.50	54.00	21.60	0.88	0.68, 1.1
PIMO/ARNO Woodland	12.70	17.10	25.00	10.00	0.60	0.38, 0.82*
Artemisia spp. Alliance[1]	21.60	29.00	126.00	50.40	1.74	1.51, 1.93*
Miscellaneous-disturbed	14.90	20.00	26.00	10.40	0.52	0.33, 0.71*
CORA-EPNE Shrubland	3.80	5.10	4.00	1.60	0.31	0.01, 0.68*
Eggpoint Burn	3.20	4.30	15.00	6.00	1.40	0.7, 2.1
Total	**74.4**	**100**	**250**	**100**		

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

* Habitats are denoted by an asterisk where selection is significant from 1.0 (i.e., confidence intervals [CI] did not include 1.0).

Overall, habitat selection/use was very similar in 2011 compared to 2010. The most heavily used habitat for deer was the *Artemisia* spp. Alliance. Habitat selection coefficients calculated suggest that significant selection (w_i >1.0) by deer probably occurred in the *Artemisia* spp. Alliance habitat (Table 6-4). *CORA-EPNE* Shrubland, Miscellaneous-disturbed, and *PIMO/ARNO* Woodland habitats appeared to be avoided (w_i <1.0) relative to availability. It is noteworthy that meadows in the *Artemisia* spp. Alliance and *PIMO/ARTR* woodland habitats are closely juxtaposed in particular at Echo Peak (Figure 6-11). Deer occur along habitat ecotones in this region, and discerning use between these habitats is not possible at this time.

Vegetation along the deer transect may be further investigated in the future to improve interpretations of deer habitat preference. One method would be to estimate overall visibility in the habitat by taking repeated measurements of distance to the nearest closed canopy cover from the centerline of the deer route. This can be done with a rangefinder, and could explain some of the variation in counts (i.e., low counts in areas with short obstructed views and high counts in unobstructed view areas on the transect). Another technique would be to do a more specific vegetation census at regular intervals along the route, to determine presence/absence of typical deer forage such as *Purshia* spp. and correlate that variable with deer sightings. Presently our vegetation maps on the NNSS are limited for any detailed deer habitat selection analysis, due primarily to map scale issues (e.g., LANDSAT imagery was used in mapping with a pixel size of 30 m [98 ft]) and ability to discern smaller differences in vegetative composition.

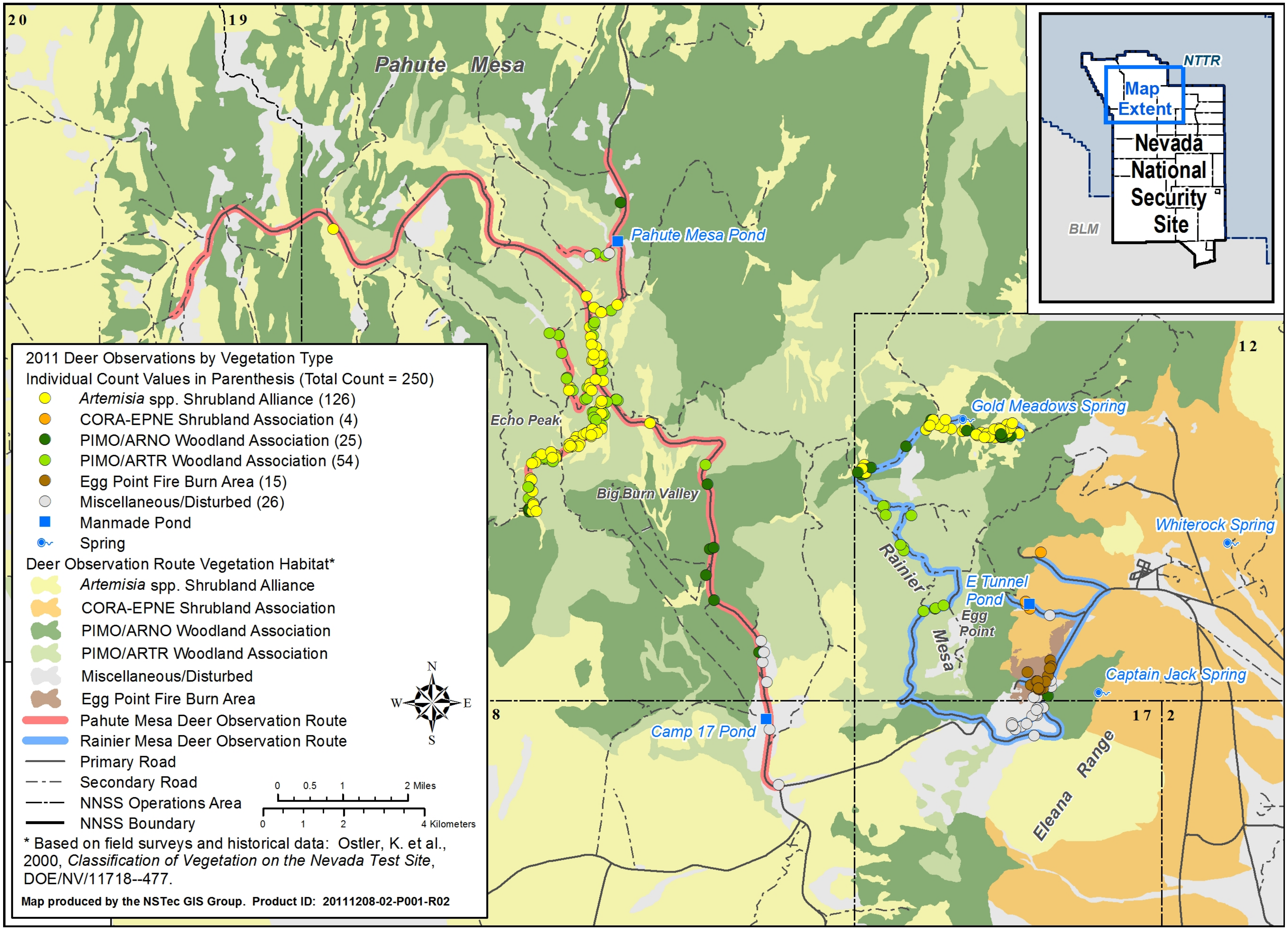

Figure 6-12. Mule deer observations by vegetation type on the NNSS

6.5 Mountain Lion Monitoring

6.5.1 Motion-Activated Cameras

Little data exist for mountain lion numbers and their distribution in southern Nevada, including the NNSS. Since 2006, site 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. Cameras used this way are referred to as camera traps. Camera traps have also been used the last couple of years to assist with the capture effort for the telemetry study by identifying where mountain lions occur as well as the frequency of occurrence at those sites. Opportunistic sightings of mountain lions or their sign on the NNSS were also recorded to help determine their distribution, abundance, and to help with the capture effort.

In 2011, 12 locations of opportunistic sightings of mountain lions or their sign were documented (Figure 6-13, #23–#34). Most of these locations were found while working on the telemetry study during either capture efforts or "kill-site" investigations. One sighting involved a report of a young mountain lion in an old piece of equipment at the Shaker Plant in Area 1. Biologists investigated but did not see any sign of mountain lions. Remote, motion-activated cameras were used at 22 sites (4 new sites and 18 sites from 2010) (Figure 6-13 and Table 6-5). Sites were selected at locations with previous or new mountain lion sighting or sign, on roads that were potential movement corridors from one area to another, or in areas of good mule deer habitat (mule deer are the primary mountain lion prey species during summer and fall).

A total of 37 mountain lion images (i.e., photographs or video clips) were taken during 129,471 camera hours across all sites. This equates to about 0.3 mountain lion images per 1,000 camera hours (Table 6-5). Mountain lions were detected at 10 of the 22 sites including four dirt roads, one paved road, three springs, and two canyons (Figure 6-13).

Table 6-6 illustrates the camera trap results by month and location. A male with a unique notch in its right ear was photographed six times during 4 months at two different sites, indicating its presence in the area over a several month period. NNSS1, a radio-collared female, was photographed at least twice during June on Rainier Mesa (Site #1) and again on December 7 at Rattlesnake Ridge Gorge (Site #20). It is difficult to tell individual mountain lions apart in the images and thus determine the number of mountain lions on the NNSS. However, based on radio-collared and uniquely marked mountain lions (e.g., notch-eared male), at least five subadults or adults and one 2-week-old cub were detected on the NNSS during 2011.

In order to investigate temporal activity of mountain lions, camera detection data from all 6 years (2006–2011) were combined. Mountain lions were detected in every month with peak occurrences in November (64 images). The next most common months of occurrence were September (39 images) and August (38 images) (Figure 6-14). Mountain lions were detected regularly between late afternoon and early morning with a peak between 2000 and 2100 hours Pacific Standard Time. Only a few images were taken during midmorning through early afternoon (Figure 6-15).

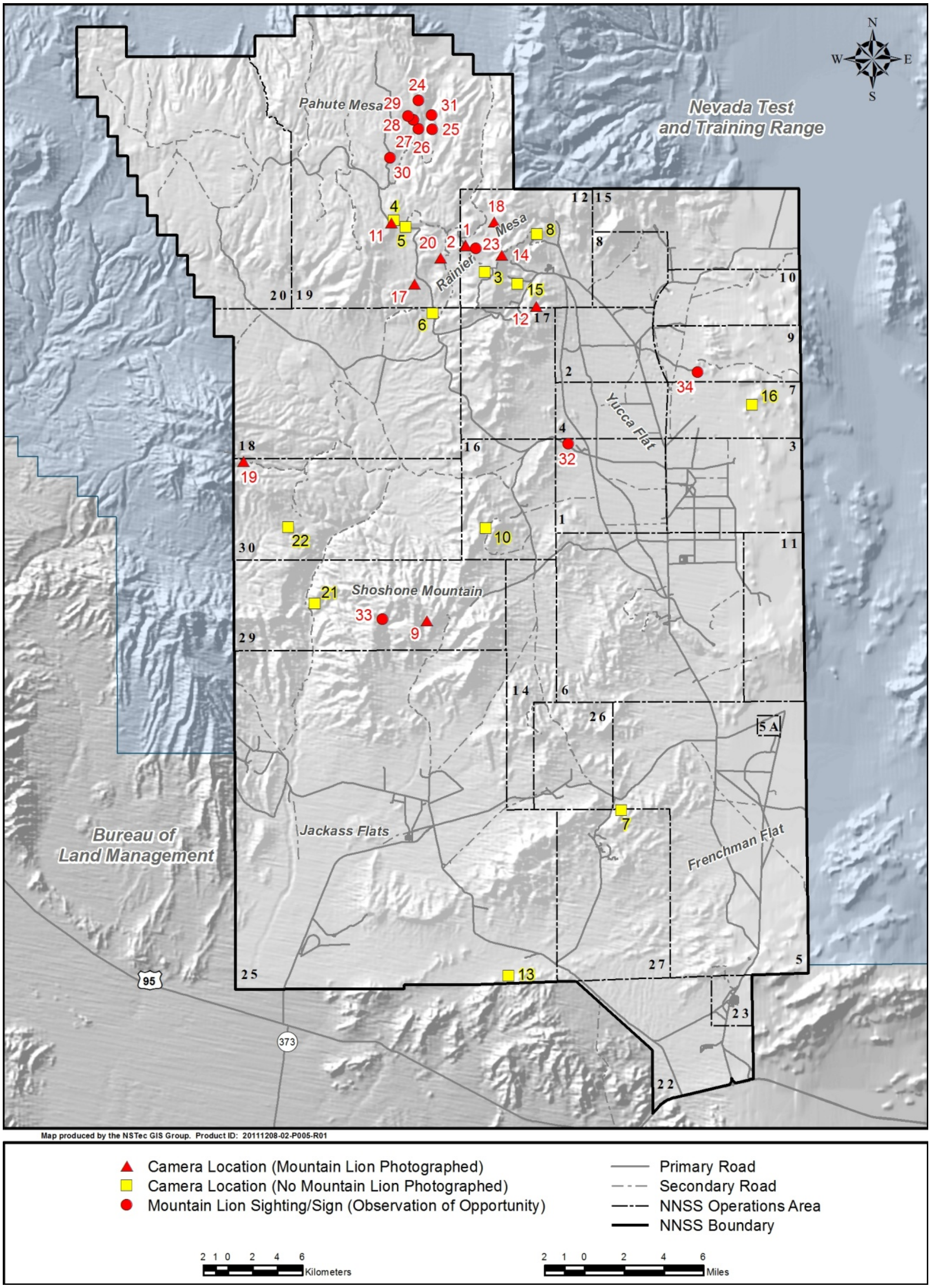

Figure 6-13. Locations of opportunistic mountain lion sightings and sign, mountain lion photographic detections, and motion-activated cameras on the NNSS during 2011

Table 6-5. Results of mountain lion camera surveys during 2011

Location (Site Number)	Dates Sampled	Camera Hours	Mountain Lion Images (Number of images per 1,000 camera hours)	Other Observations (Number of Images)
Rattlesnake Ridge Gorge (#20)	1/17/11–12/21/11	8,114	9 (1.1)	Bobcat (1), gray fox (1), rock squirrel (3), mourning dove (1)
12T-26, Rainier Mesa (#1)	12/14/10–12/19/11	8,882	7 (0.8)	Bobcat (5), coyote (20), mule deer (24), black-tailed jackrabbit (50), rock squirrel (2), cottontail rabbit (3)
Pahute Mesa Summit, Road (#11)	12/14/10–-12/20/11	8,928	5 (0.6)	Bobcat (2), coyote (13), pronghorn antelope (1), mule deer (64), horse (10)
Water Bottle Canyon (#17)	12/10/10–12/20/11	9,005	4 (0.4)	Bobcat (1), gray fox (4), mule deer (4), cliff chipmunk (1)
Gold Meadows Spring (#18)	12/14/10–12/19/11[b]	7,944	3 (0.4)	Coyote (12), pronghorn antelope (5), mule deer (355), horse (126), black-tailed jackrabbit (6), rabbit (2), golden eagle (1), common raven (4)
Rainier Mesa Top, Above B Tunnel (#14)	12/14/10–12/19/11	8,882	3 (0.3)	Bobcat (2), gray fox (29), coyote (4), mule deer (24), black-tailed jackrabbit (4)
East Cat Canyon (#19)	1/4/11–1/2/12[b]	6,583	2 (0.3)	Coyote (4), mule deer (15), wildland fire (11)
12T-26B, Rainier Mesa[a] (#2)	12/14/10–12/19/11[b]	4,818	2 (0.3)	Bobcat (1), gray fox (2), coyote (6), mule deer (29), common raven (1)
Topopah Spring (#9)	1/10/11–12/21/11[b]	6,215	1 (0.2)	Bobcat (3), gray fox (3), coyote (1), desert bighorn sheep (35), mule deer (173), bat (1), common raven (1), chukar (178), mourning dove (5), wildland fire (2)
Captain Jack Spring (#12)	2/3/11–12/19/11[b]	6,631	1 (0.2)	Bobcat (7), gray fox (2), coyote (23), mule deer (1,469), rock squirrel (2), chukar (1), common raven (1), pinyon jay (2), mourning dove (8), hawk (1), common flicker (1)
19-01 Road, Pahute Mesa[a] (#4)	12/14/10–11/29/11[b]	4,389	0	Gray fox (1), mule deer (3), black-tailed jackrabbit (2)

Table 6-5. Results of mountain lion camera surveys during 2011 (continued)

Location (Site Number)	Dates Sampled	Camera Hours	Mountain Lion Images (Number of images per 1,000 camera hours)	Other Observations (Number of Images)
19-01 Road, 19T-47, Pahute Mesa (#5)	11/29/11–12/20/11	507	0	None
Dick Adams Cutoff Road, Rainier Mesa (#3)	12/14/10–12/19/11	8,881	0	Bobcat (1), coyote (1), mule deer (14), black-tailed jackrabbit (1), rock squirrel (2), cliff chipmunk (1)
Road above T Tunnel (#8)	12/14/10–12/19/11	8,882	0	Bobcat (1), coyote (4), mule deer (43)
Camp 17 Pond[a] (#6)	1/4/11–12/21/11[b]	3,579	0	Coyote (2), mule deer (605), horse (119), bat (5), great blue heron (2), turkey vulture (32), pinyon jay (2), common raven (12), accipiter (5), duck (1)
ER 12-1 Sump Canyon (#15)	1/12/11–12/19/11	8,186	0	Bobcat (1), gray fox (5), coyote (8), mule deer (62), chukar (1)
Reitmann Seep (#16)	1/11/11–5/25/11[b]	2,350	0	Bobcat (3), coyote (13), mule deer (17), white-tailed antelope ground squirrel (1)
Shoshone Mountain, Tippipah Point Road (#10)	1/4/11–5/25/11[b]	2,784	0	None
Cane Spring (#7)	1/4/11–12/21/11[b]	7,386	0	Bobcat (2), coyote (7), mule deer (112), chukar (1), mourning dove (2)
Rock Valley (#13)	1/4/11–3/17/11[b]	543	0	Coyote (1), kit fox (1), black-tailed jackrabbit (1), kangaroo rat (8)
Chukar Canyon (#22)	10/19/11–1/2/12	1,826	0	Desert bighorn sheep (1), chukar (3)
Twin Spring (#21)	5/5/11–1/2/12[b]	4,156	0	Coyote (4), mule deer (884), chukar (1)

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

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

Table 6-6. Number of mountain lion images taken with camera traps by month and location

Camera Location (Site number)	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11
12T-26, Rainier Mesa (#1)							4**			1	1	1	
12T-26B, Rainier Mesa (#2)										1	1		
Captain Jack Spring (#12)				1									
Pahute Mesa Summit Road (#11)								1	1	2	1		
Topopah Spring (#9)					1								
Gold Meadows Spring (#18)	1								2				
Above B Tunnel (#14)				1								2	
East Cat Canyon (#19)				1	1								
Water Bottle Canyon (#17)			1*		1*				2*				
Rattlesnake Ridge Gorge (#20)						2*	6						1**

* notch-eared male

** NNSS1 (3 of 5 photos)

Mountain lion detected and number of mountain lion images

Camera operational, no mountain lions detected

Camera not operational

A secondary objective of the camera surveys is to detect other species using these areas to better define species distributions on the NNSS. Images (4,770) of at least 25 species other than mountain lions were taken during 129,471 camera hours across all sites (Table 6-5). This is about 37 images per 1,000 camera hours. The most prevalent species photographed (82% of all images) was mule deer (3,897 images at 17 of 22 sites). Some of the rarer, more elusive species documented during camera surveys were desert bighorn sheep, bobcat (found at 13 of 22 sites), gray fox (*Urocyon cinereoargenteus*), kit fox (*Vulpes macrotis*), and great blue heron (*Ardea herodias*). Most (86%) of the photos (4,104 images) were taken at five sites: Gold Meadows Spring (#18), Topopah Spring (#9), Captain Jack Spring (#12), Twin Spring (#21), and Camp 17 Pond (#6). A majority of images were taken during the summer and fall, which emphasizes the importance of these water sources for several wildlife species, especially during the drier months.

Two separate wildland fires, one on Timber Mountain and one near Topopah Spring, were ignited by lightning in early July. Unfortunately, the fires damaged two of the cameras (East Cat Canyon and Topopah Spring), and these were replaced with new ones in early October. Fortunately, the images on the data card were still good and some amazing images were taken of the wildland fire advancing toward the East Cat Canyon camera and consuming a large Utah juniper tree right in front of the camera before the camera lens melted from the intense heat.

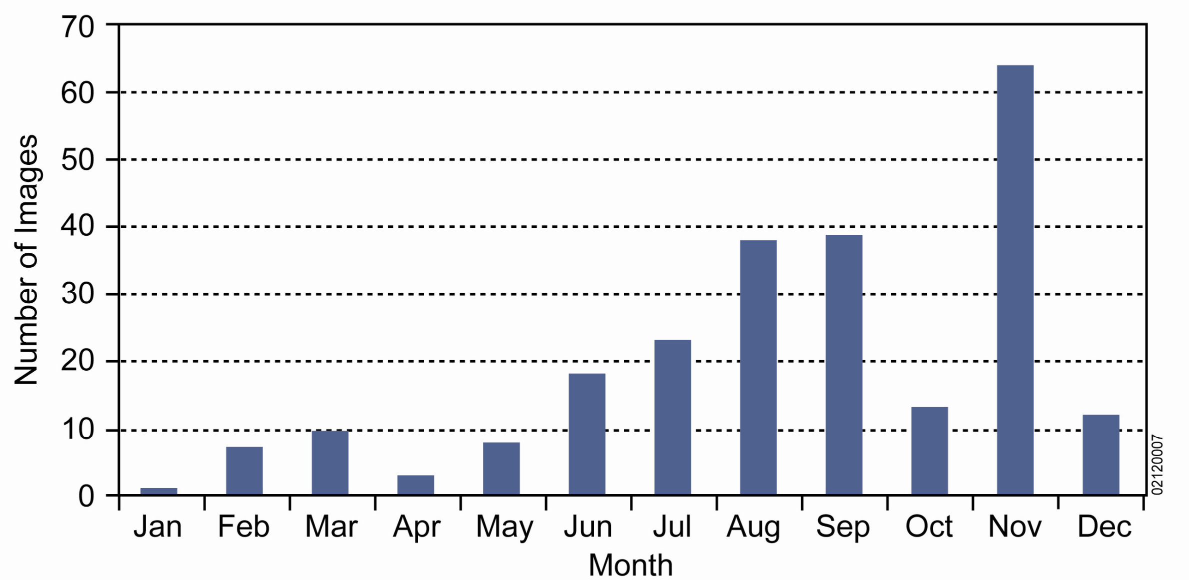

Figure 6-14. Numbers of mountain lion images by month for camera sites where mountain lions were detected from 2006 through 2011 (N=236)

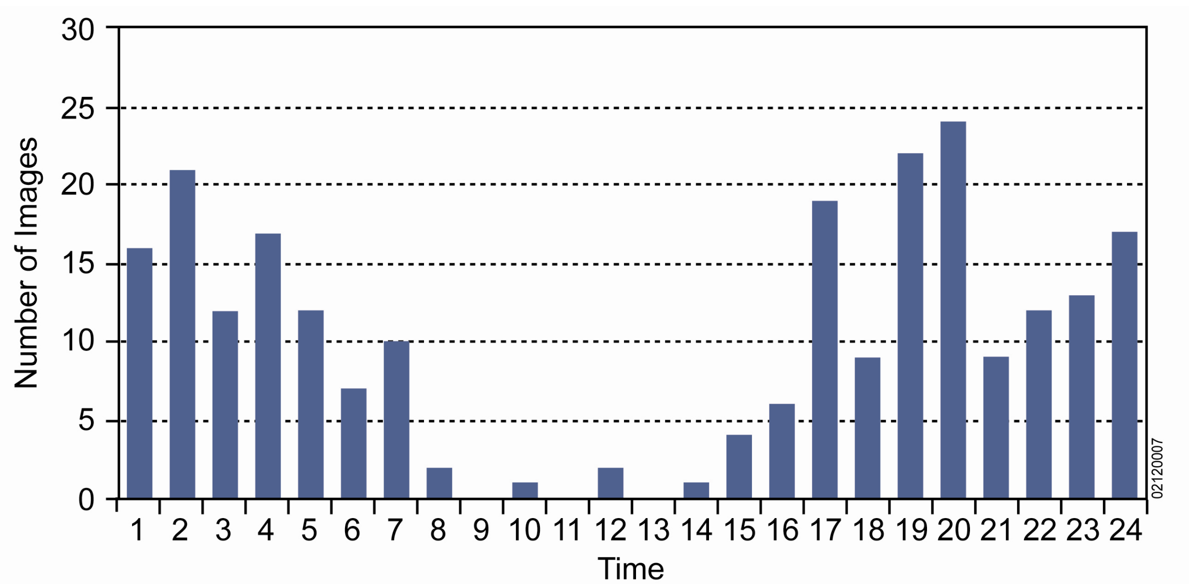

Figure 6-15. Numbers of mountain lion images by time of day (Pacific Standard Time) for camera sites where mountain lions were detected from 2006 through 2011 (N=236)

6.5.2 Mountain Lion Telemetry Study

A collaborative effort between Dr. David Mattson (USGS) and site biologists continued in 2011 to provide information to assess the risk of human encounters with mountain lions on the NNSS and to determine what mountain lions are eating and where they make their kills. Information from this effort helps us learn about their natural history and ecology. The NNSS and surrounding areas encompassing the Nevada Test and Training Range, Tonopah Test Range, and Desert National Wildlife Range constitute one of the largest areas (over 15,540 km^2 [6,000 mi^2]) in North America where human-caused mountain lion mortality is extremely low, and the size of area is large enough to allow for the emergence of population dynamics likely to typify an unexploited population of lions. This area is also located in some of the driest ecosystems in North America with relatively low prey densities. The goal for 2011 was to capture and radio-collar four mountain lions and track them for approximately 1 year.

Brian and Lisa Jansen, professional mountain lion trappers, and their four hound dogs were on the site for two trapping sessions during 2011. The trapping effort included about 600 trap-nights over 7 to 8 weeks during April–May and October–November. Efforts were primarily on Timber Mountain, Shoshone Mountain, Eleana Range, Rainier Mesa, and Pahute Mesa. Mountain lions were also tracked on several occasions using the hounds when the dogs caught the scent of a lion.

One mountain lion (NNSS3, Figure 6-16) was captured during 2011. It was a 5–6-year-old male that weighed 63 kilograms (138 pounds). It was captured on April 19, 2011, on Timber Mountain. A radio collar set to record six locations per day (every 4 hours starting at noon) was fitted on the animal. Body measurements, blood and hair samples (DNA and radiological testing), and a Nebuto strip sample (plague testing) were also taken.

Figure 6-16. Mature male mountain lion (NNSS3)
(Photo by W. K. Ostler, April 19, 2011)

During 2011, the two mountain lions, NNSS1 (2–3-year-old female) and NNSS2 (5–6-year-old female), that were captured during December 2010 and the newly captured NNSS3 were tracked using the satellite GPS radio collars. Locations were recorded by the GPS unit on the radio collar and uploaded via satellite during a certain window of time each day. The data were processed and then sent to site biologists via email. Data were converted to Universal Transverse Mercator coordinates and plotted in ArcMap Version 10.0. Data were searched to identify clusters of locations that were within 100 meters of each other over a minimum 24-hour period, which usually indicates a kill site. Coordinates and maps were printed and taken to the field to search for kill sites. For purposes of this report, a kill site is defined as the area where a mountain lion killed and/or cached its prey. It was difficult to ascertain the exact spot where the prey was killed, but evidence of the kill such as burial sites, the carcass, bone fragments, rumen contents, and hair quite often remained. Once a kill site was found, information about the kill, such as prey species, sex, age, amount consumed, marrow color and consistency, number of burial sites, and dimensions of burial sites, was recorded. Habitat data such as elevation, aspect, slope, landscape position, vegetative cover, and dominant plant species were documented. The number of latrines, scats, and beds was also recorded. A field sketch was made detailing where key features were located, and any other pertinent notes were made.

6.5.2.1 NNSS1

NNSS1's movements were tracked from December 13, 2010, to September 18, 2011 (Figure 6-17), when the radio collar presumably malfunctioned. It spent about a week on Timber Mountain following its capture and then headed south. From mid-December to late April, it spent time at Fortymile Canyon/Calico Hills, Yucca Mountain, Bare Mountain, and Shoshone Mountain. It went north and spent nearly 2 weeks at Rainier Mesa and Gold Meadows from April 23 to May 4 (presumably hunting mule deer), and then went back to Shoshone Mountain and Fortymile Canyon until May 23. Then it traveled back north and stayed on Rainier Mesa and Pahute Mesa from May 24 through at least September 18. It is interesting to note that it used the Eleana Range as a movement corridor both times, spending less than 24 hours there each time it moved through the area. Further, based on its movement patterns, it did not stay in one place very long. It made repeated visits to some areas but was constantly on the move. On September 27, site biologists were investigating kill sites and found a den site with a 2-week-old cub (Figure 6-18) present, presumably belonging to NNSS1. The GPS unit on NNSS1's collar malfunctioned or the battery died and data collection ceased on September 18, 2011. On December 7, 2011, NNSS1 was photographed (with the collar on) with a motion-activated camera in a gorge north of Rattlesnake Ridge, about a week prior to the time when the collar was programmed to automatically drop off. This happened to be the same site where NNSS2 was captured nearly a year before.

Based on NNSS1's locations, it spent much of its time in rugged, remote areas. One notable exception occurred during mid-March when it left Shoshone Mountain and moved south on a 40 km (24 mi) hunt. It passed by the Port Gaston facility in Area 26 around 0400 hours on March 20, spent the day on Skull Mountain, crossed Jackass Flats near Area 25 Field Operations Center and Reactor Control Point after 2000 hours, and moved into the Calico Hills by midnight on March 21. It was later learned that piles of animal manure had been placed on pads around the Port Gaston facility around that same time, which explains why NNSS1 was drawn to that area. It apparently smelled the manure possibly as far as 17 km (10 mi) away. Other NNSS1 locations near active projects or facilities included a few locations near the Calico Hills firing range in Area 25, a few around V and G tunnels in Area 12, and several locations near communication towers and power substations in Area 19 (Echo Peak, Pahute Mesa), Area 12 (DOE point), and Area 29 (Shoshone Mountain). It did not appear that NNSS1 was targeting these areas because of human presence; rather these facilities just happen to be located in prime mountain lion habitat due to the presence of mule deer and rugged topography. The overall risk of human encounters with mountain lions on the NNSS appears to be quite low. Personnel who work in the remote areas (e.g., communication and power system maintenance workers, military personnel), especially at night, are most at risk and should be aware that mountain lions do occur in those areas. This risk assessment is based on the results of tracking the movements of only one mountain lion, and more data are necessary to thoroughly evaluate the risk.

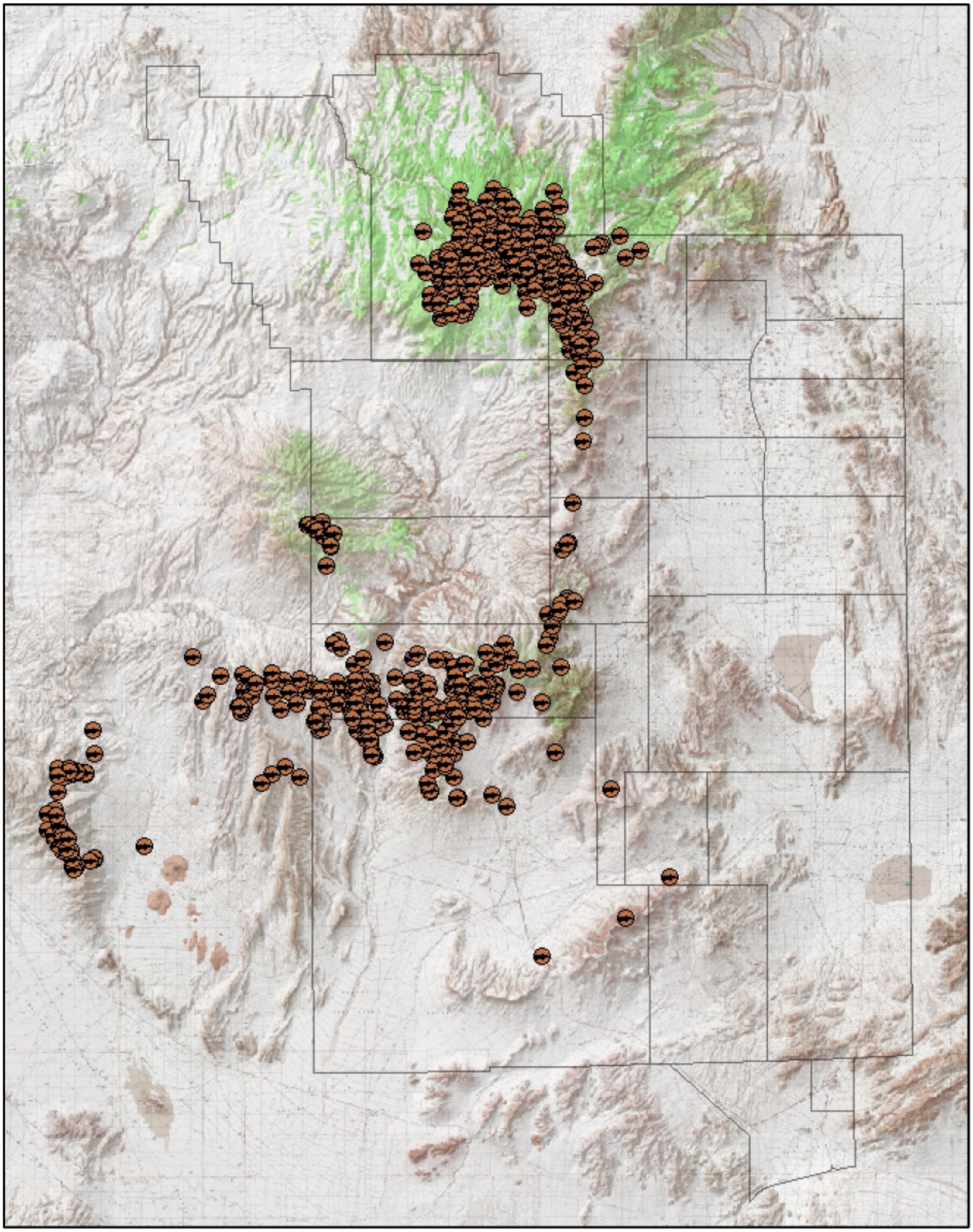

Figure 6-17. Documented locations of NNSS1, December 13, 2010, to September 18, 2011

Figure 6-18. NNSS1's 2-week-old cub near its den site in Area 19
(Photo by D. B. Hall, September 27, 2011)

Of 44 clusters investigated, prey remains were found at 28 sites (Figure 6-19). No prey remains were found at 16 sites, one of these sites being the aforementioned den site. A total of 31 individual prey were found, including 13 desert bighorn sheep (6 lambs, 1 yearling, 3 ewes, 3 rams) (Figure 6-20) and 18 mule deer (12 fawns, 2 does, 2 bucks, 2 unknown) (Figure 6-21) over a 279-day period from December 13, 2010, to September 18, 2011. This equates to an average of one kill every 9 days with time between kills ranging from 3 to 24 days. At three sites, a mother and young were both killed, twice with desert bighorn sheep and once with mule deer. Desert bighorn sheep were taken exclusively between late December and mid-May and mule deer between late May and mid-September, which mostly coincided with the habitat NNSS1 occupied (Figure 6-19). During the summer and fall months, NNSS1's home range overlapped prime mule deer habitat on the highest, most productive portions of the NNSS on Pahute Mesa and Rainier Mesa. During the winter and spring, NNSS1 spent most of its time in desert bighorn sheep habitat in Fortymile Canyon, Calico Hills, Yucca Mountain, and Bare Mountain (west of the NNSS). It also spent some time on Shoshone Mountain where both desert bighorn sheep and mule deer habitat occur and in Fortymile Canyon where mule deer occur, but only desert bighorn sheep were found eaten. NNSS1 appeared to prefer young mule deer fawns, although it ate some adult deer as well. It ate nearly an equal number of adult and young desert bighorn sheep. Its timing and movement patterns suggest that it knew when and where to go to capitalize on lambs and fawns being born and reared, making both the young and their mothers vulnerable to predation.

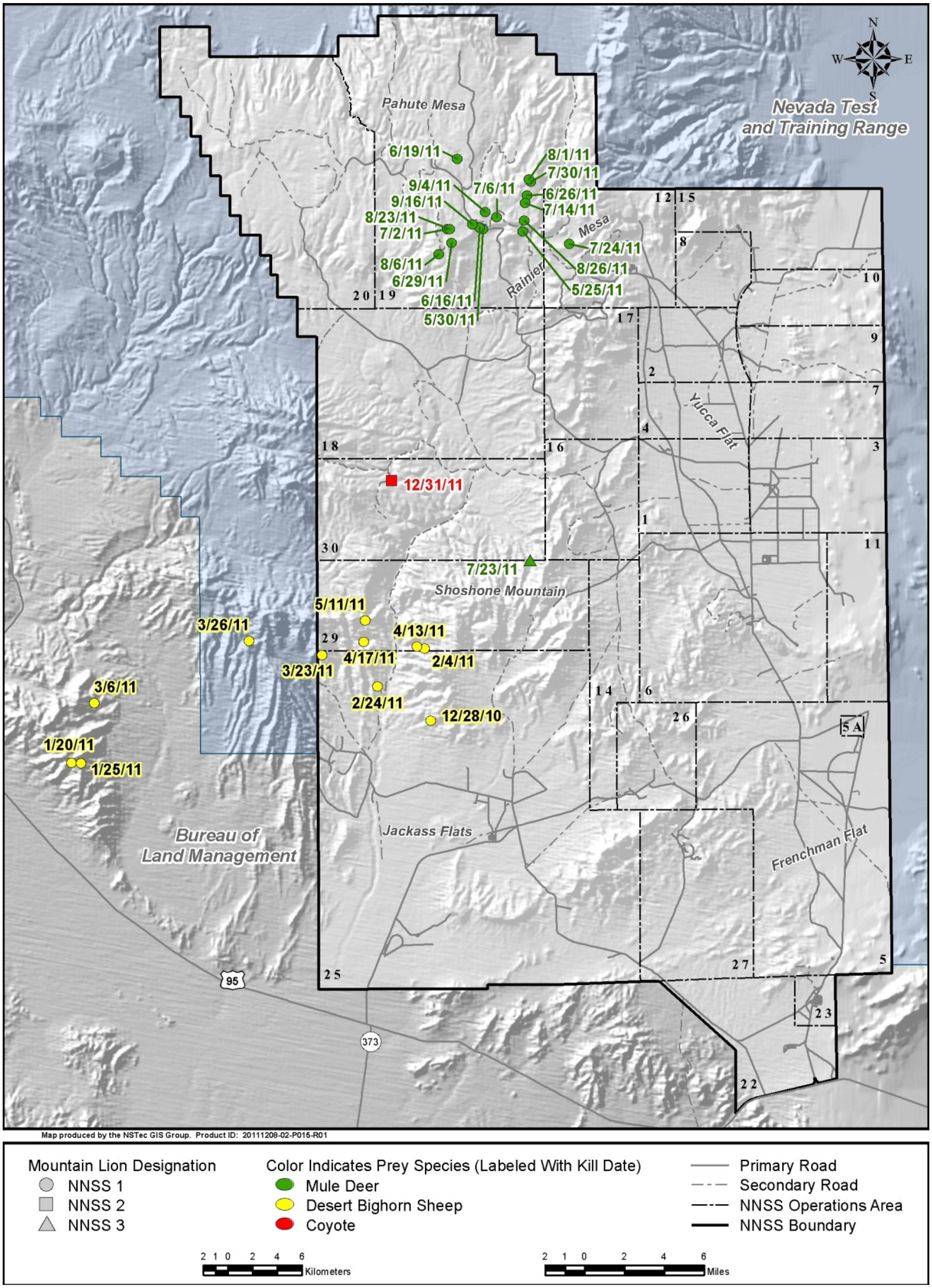

Figure 6-19. Kill site locations for NNSS1, NNSS2, and NNSS3 by prey type

Figure 6-20. Desert bighorn sheep remains at mountain lion kill site, Fortymile Canyon, Area 29
(Photo by D. B. Hall, June 7, 2011)

Figure 6-21. Mule deer fawn remains at mountain lion kill site, Big Burn Valley, Area 19
(Photo by D. B. Hall, June 4, 2011)

The 15 sites where the remains of prey were not found included mostly two- to four-point clusters. Early on, these small clusters were investigated to see if smaller prey items (e.g., coyotes, bobcats) could be detected. After checking 13 small clusters with no kills found, site biologists stopped investigating them. Two larger clusters were also checked, and no prey remains were found. Mountain lion sign such as bed sites, latrines, scrapes, or tracks were found at about half of the sites. At several locations, it appeared that NNSS1 was hunting, because the site was elevated with a good view of the surrounding landscape where prey was likely to pass through.

Detailed analyses of habitat use and home range have not been completed yet. However, a rough estimate of NNSS1's home range is 917 km^2 (354 mi^2). A study conducted in eastern Nevada between 1972 and 1982 found an average home range size of 181 km^2 (70 mi^2) for females (Ashman et al., 1983). NNSS1's home range is about five times greater than the average found in eastern Nevada, suggesting mountain lions in drier environments with lower prey densities have to cover more ground to stay alive. More animals need to be tracked to see if this pattern holds true. In addition, it would be valuable to track an individual mountain lion for multiple years to see if home range changes across years or remains similar from year to year.

6.5.2.2 NNSS2

NNSS2's movements were tracked from December 24, 2010, to February 1, 2011 (Figure 6-22). It stayed within 3.0 km (1.8 mi) of its capture site around Rattlesnake Ridge (near Camp 17 Pond) for 4 days and then moved to Timber Mountain where it stayed for about 11 days. On January 9, 2011, it traveled west-northwest into the Thirsty Canyon area west of the NNSS where it stayed until it was found dead on February 1, 2011. Based on the GPS locations and times, biologists believe it died on January 29, 2011. It was emaciated and apparently had starved to death. This was supported by data from 11 GPS clusters that site biologists investigated. The only kill biologists found was a coyote. The trappers found NNSS2 on a fresh coyote kill on December 31, 2010, and subsequent GPS locations were documented near the kill site on January 2, 5, 6, 7, and 8, 2011. Other than the coyote kill site and the site where it was found dead, clusters did not exceed two to three GPS locations. Latrines or beds were found at four sites, and it appeared it was hunting at a minimum of two sites. Site biologists were not able to follow it long enough to calculate a home range, but it did travel a substantial distance, about 80 km (48 mi), in a relatively short time period. Based on the habitat it traveled through and sign observed while checking clusters, potential large prey included mule deer, bighorn sheep, and wild burros.

6.5.2.3 NNSS3

NNSS3's movements were tracked from April 19 to September 10, 2011 (Figure 6-23). NNSS3 left the NNSS on April 20 the day after it was captured and headed west. By April 28, it was on the west side of Death Valley National Park in California, about 106 km (66 mi) straight-line distance from the capture site on Timber Mountain. It remained in Death Valley, mainly in the Cottonwood Mountains and Grapevine Mountains, with a foray out of the park as far north as Gold Mountain, until July. It returned to the NNSS from July 11 to July 27 and then went back to Death Valley where it stayed until the GPS collar failed on September 10. Its last known location was near the bottom of Dry Bone Canyon in the Cottonwood Mountains in extremely rugged terrain (Figure 6-24). A site biologist, assisted by two National Park Service personnel, hiked to the last known location on September 19, but failed to pick up a signal from the very high frequency collar or find any evidence of NNSS3. Two GPS clusters were checked in the Grapevine Mountains, Phinney Canyon area (Figure 6-25), on September 20.

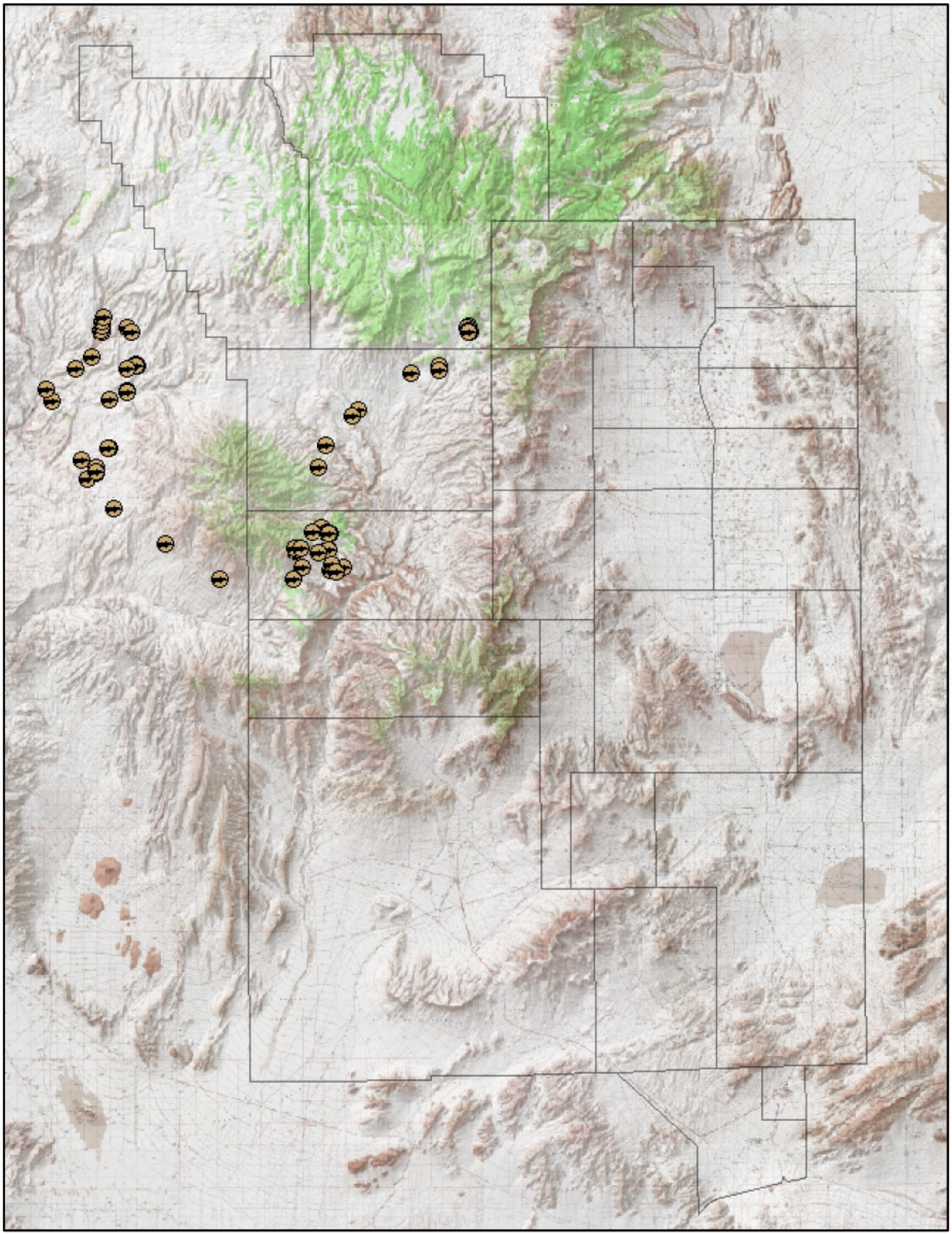

Figure 6-22. Documented locations of NNSS2, December 24, 2010, to February 1, 2011

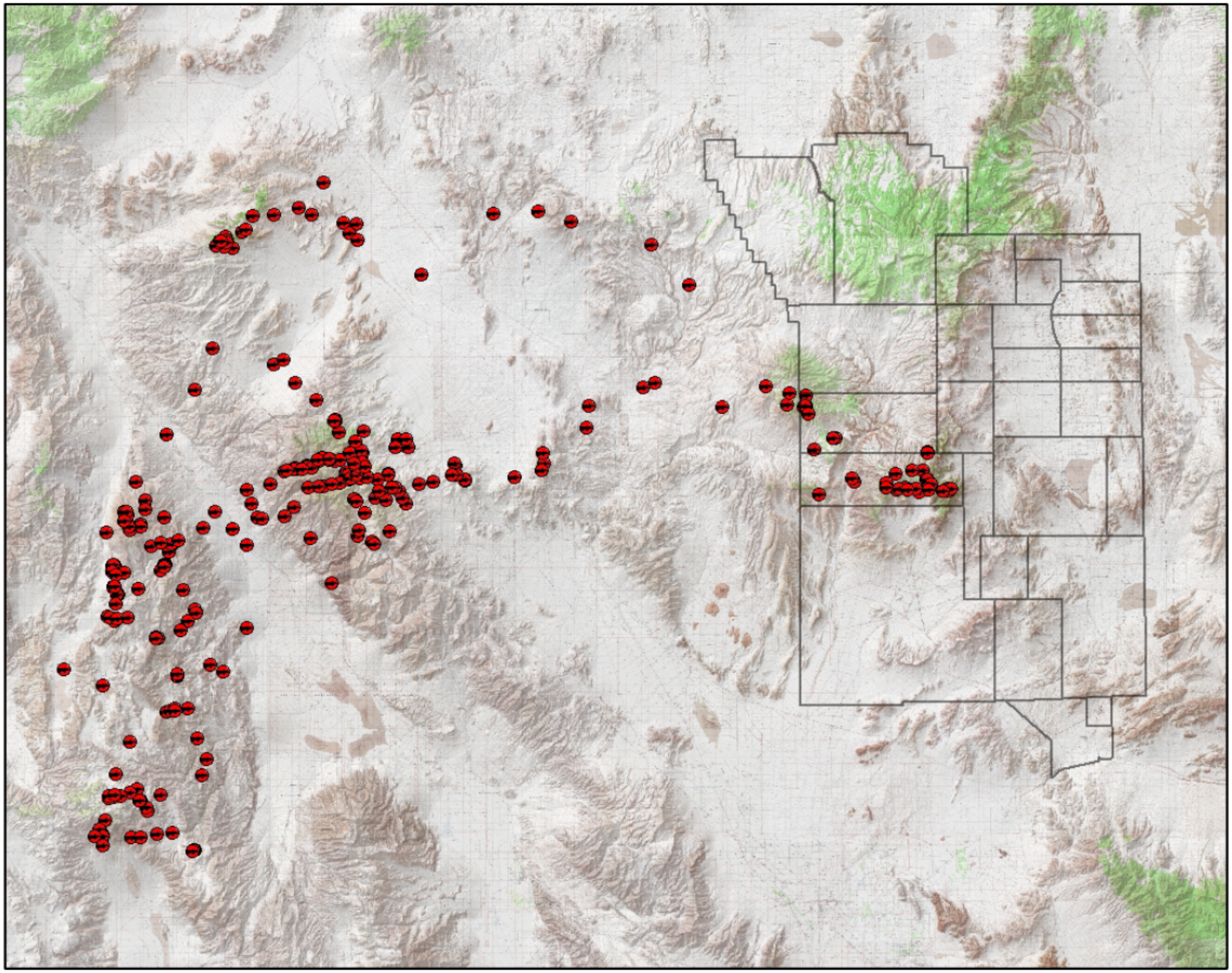

Figure 6-23. Documented locations of NNSS3, April 19, 2011, to September 10, 2011

Figure 6-24. Dry Bone Canyon, California, Death Valley National Park
(Photo by D. B. Hall, September 19, 2011)

Figure 6-25. Grapevine Mountains, Nevada, Death Valley National Park
(Photo by D. B. Hall, September 20, 2011)

A latrine was found at one cluster, and two mule deer carcasses were found at two older kill sites not associated with NNSS3. Mule deer sign and some seeps in the canyon bottom were discovered, which helps explain why NNSS3 was present in the area. Based on the habitat, NNSS3 appeared to be hunting desert bighorn sheep and mule deer while it was off the NNSS. Two GPS clusters located on the NNSS were checked, and a mule deer buck was found killed at a cluster in Piapi Canyon (Area 29) (Figure 6-26).

A rough estimate of NNSS3's home range is 3,844 km^2 (1,484 mi^2). This may be one of the largest documented home ranges of a mountain lion. Ashman et al. (1983) in eastern Nevada found an average home range size of 580 km^2 (224 mi^2) for males. NNSS3's home range is six to seven times greater than the average found in eastern Nevada. The home range of NNSS1 (a female) was also larger than the average home range for females found in eastern Nevada. Males typically have home ranges that overlap several female's home ranges, so if female home ranges are larger in drier environments with lower prey densities, it stands to reason that male home ranges would be larger than normal as well. Additional animals need to be tracked to validate this pattern of larger home ranges.

Figure 6-26. Mature buck killed by NNSS3, Piapi Canyon (Area 29)
(Photo by D. B. Hall, July 27, 2011)

6.5.2.4 Plague and Radiological Testing

Bubonic plague can be a serious health issue if people are exposed to it. Mountain lions are known to carry the disease and, on rare occasions, have transmitted it to humans. In order to determine if mountain lions on the NNSS carried plague, Nebuto strips blotted with blood taken from NNSS1, NNSS2, and NNSS3 were submitted to the SNHD for plague testing. All samples tested negative for plague.

Blood samples from all three mountain lions were also tested for the presence of tritium, a man-made radionuclide persisting in some portions of the NNSS as a result of nuclear weapons testing. Site biologists wanted to know if mountain lions were being exposed to harmful doses of radiation on the NNSS and the potential dose to a human in the event the mountain lion left the NNSS and was shot and eaten. The tritium analysis was performed by multiple commercial laboratories. Detectable levels of tritium were found in NNSS1 and NNSS2, although at very low levels. Muscle tissue was collected from a doe at Kill Site NNSS1-27 and analyzed for tritium. Detectable levels of tritium were found in the sample. This may explain why NNSS1 had tritium in it. Potential sources for uptake of tritium for a mule deer may be from drinking from E Tunnel Ponds, or foraging in contaminated areas such as Little Feller (Area 18) or Buggy (Area 30). The potential dose both to the animal itself or a person eating it is well below any level considered to be harmful and does not pose a threat to either the animal or people.

6.6 Raptors and Birds Mortality

6.6.1 Raptors

Historically, 16 species of raptors have been recorded on 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 and Compliance with the Migratory Bird Treaty Act

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. Workers are relied on in part to observe and report mortalities. Historically, reported deaths of birds are sometimes numerous, with episodes of predation and disease outbreaks involving larger numbers of dead birds during wet years (Figure 6-27). There were 10 bird mortalities detected in 2011. Seven red-tailed hawks [*Buteo jamaicensis*] and two great horned owls [*Bubo virginianus*]) were electrocuted. One common poorwill (*Phalaenoptilus nuttallii*) was killed by a vehicle.

A meeting was conducted with site biologists and personnel from the NSTec Power group on June 23 in Mercury, Nevada, because of some unusual damage that was reported to have occurred to power equipment (line, transformers, and poles) from birds during 2011. The purpose of the meeting was to improve future communication and documentation of bird damage to site biologists by other NSTec personnel. The meeting noted that several small fires were caused by birds arcing across electrical elements. Damage and electrical failures were caused by the accumulation of bird feces on some insulators. Also addressed were concerns of how raptors could be prevented from nesting and perching on electrical equipment. Biologists noted the importance of recordkeeping and prompt reporting of such incidents, which can be handled on a case-by-case basis by biologists who commonly make site visits to remove nests or other obstructions. It was concluded that pole lines could be surveyed for bird use prior to the nesting season to help prevent problems from nesting alone. The future use of anti-perching devices was also discussed. Site biologists may report bird damage findings to the FWS field office in Sacramento, California, for consideration if incurred costs continue and are significant. 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.

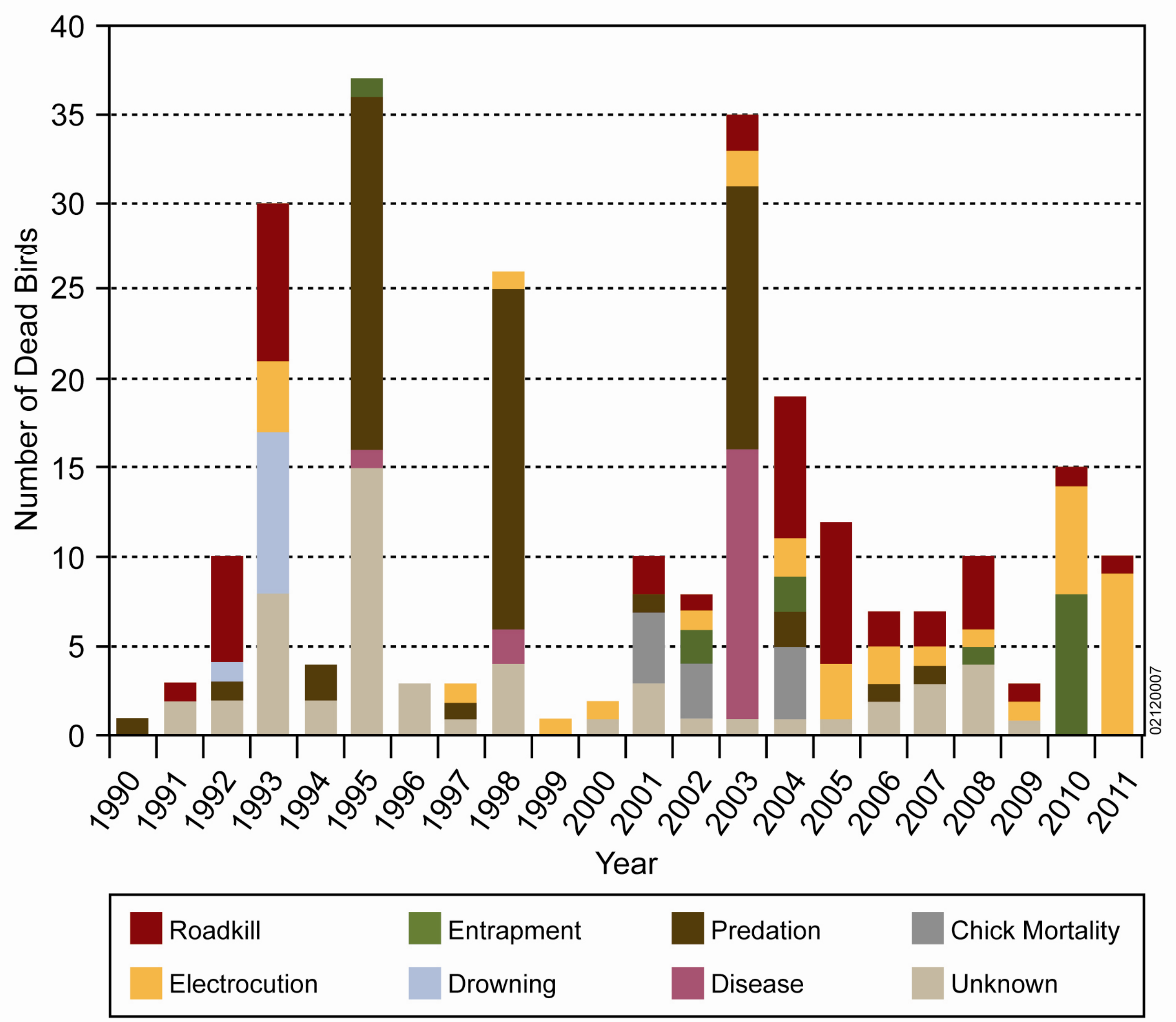

Figure 6-27. Historical records of reported bird deaths on the NNSS through 2011

6.7 Desert Bighorn Sheep and Elk Sightings

Desert bighorn sheep occur on the Specter Range, south of the NNSS, and at other locations west and north of the NNSS. However, 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) in 2009 to monitor mountain lions, photographed at least three rams 127 times between June and November in 2009 and 2010. During 2011, two rams were photographed 25 times on July 3 and 4 right before a wildland fire burned the area around the spring and destroyed the camera on July 5. A new camera was set on October 4, and 10 photographs of one ram were taken between November 17 and December 6 (Figure 6-28; Table 6-5). Another motion-activated camera at the head of Chukar Canyon (Area 30) photographed a ram on October 26. Additionally, data from the mountain lion telemetry study (see Section 6.5.2) documented the presence of ewes and lambs in the Yucca Mountain and lower Fortymile Canyon area, which suggests there is a previously undetected, resident, reproducing herd of desert bighorn sheep on the NNSS. A mature ewe killed by a mountain lion was found near Fortymile Canyon Tank during a search for another kill site. The kill was older and could not be attributed to NNSS1.

In the future, surveys may be conducted to census the population and determine the residency status of this species on the NNSS. Periodic population counts after getting the baseline population can be used to determine trends in desert bighorn sheep. Desert bighorn sheep are a major game species in Nevada, and hunting units are in close proximity to the NNSS. Characterizing radionuclide burdens of sheep found on site and determining their movement patterns off site into huntable areas is important to assess as a potential dose pathway to man.

During 2009 and 2010, a Rocky Mountain elk bull was observed or photographed at several locations on and around Rainier Mesa and Pahute Mesa. However, during 2011 no elk or elk sign were documented suggesting the lone bull was a transient animal. Further monitoring will be conducted to determine if elk return to the NNSS.

Figure 6-28. Desert bighorn sheep ram at Topopah Spring
(Photo by motion-activated camera, November 28, 2011)

6.8 Nuisance and Potentially Dangerous Wildlife

During 2011, site biologists responded to 23 calls regarding nuisance, injured, or potentially dangerous wildlife in or around buildings, power lines, and work areas. Problem or injured animals included bats (eight calls), birds (six calls), coyotes (three calls), snakes (three calls), small rodents (two calls), and a mountain lion (one call). Mitigation measures taken usually involved 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.

6.9 Coordination with Biologists and Wildlife Agencies

A site biologist attended the 2011 Biennial Meeting of the Western Bat Working Group in Las Vegas and gave a presentation on bat-compatible closures that have been constructed on the NNSS. He is also serving on the White Nose Syndrome Committee of the Western Bat Working Group, which is implementing an action plan to try to prevent White Nose Syndrome from spreading to the western United States. He is also a member of the Nevada Bat Working Group and participated in a 3-day bat blitz in September sponsored by this group. The blitz was held at Pahranagat National Wildlife Refuge, and the objective was to capture as many bats as possible at several water sources in this region to assess bat health and species composition in an area where these data are lacking. The blitz was very successful with nearly 1,000 bats captured. More than 20 people from various federal and state wildlife and land management agencies participated. Affiliation with these groups keeps site biologists informed of the latest issues regarding bats and provides an opportunity to share data and lessons learned from bat monitoring on the NNSS.

Site biologists attended the 18th Annual Meeting of The Wildlife Society and presented a paper on western red-tailed skink distribution on the NNSS. A paper on wildlife monitoring on the NNSS was presented at the Nevada Chapter meeting of The Wildlife Society in Reno, Nevada, in January, and a paper on the mountain lion radio-tracking project on the NNSS was presented at the Annual Site Environmental Workshop in October 2011. Site biologists coordinated with Linda Manning at Death Valley National Park to share information about a radio-collared male mountain lion (NNSS3) that spent several months in the park. Ms. Manning was very helpful in facilitating the field visit to investigate the location of NNSS3. Jeremy Stoltzfus and David Robertson assisted in the search. Their efforts are very much appreciated.

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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 2011, but two sites on the NNSS and two sites 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 2011 are described in NSTec (2007). Specific standards have not been required 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 – U-3ax/bl

The cover cap for Corrective Action Unit (CAU) 110, U-3ax/bl, located in Area 3 of the NNSS, was completed in the fall of 2000. Following construction, actions were taken to reestablish a cover of native vegetation. Revegetation activities were completed by the end of December 2000. The plant community on the cover cap has been monitored annually since the spring of 2001. Monitoring is performed to document the establishment of a native plant community and to identify any remedial actions that may be necessary to ensure the plant community persists. The main purpose of the vegetative cover at this site is to remove precipitation from the site by evapotranspiration so it does not infiltrate into the buried radioactive waste.

7.1.1 Plant Cover

Plant cover on the cover cap this year was 21% (Table 7-1). *Atriplex confertifolia* (shadscale saltbush) cover was 9%, which was the highest of any species and was about 43% of the total cover. The only other perennial species that contributed to overall plant cover was *Ephedra nevadensis* (Nevada jointfir). Cover for the three most common forbs this year *Eriogonum deflexum* (flatcrown buckwheat), *Cryptantha micrantha* (red root cryptantha), and *Mentzelia albicalis* (whitestem blazingstar) combined for about 6%, or about one-fourth of the total cover. Cover from invasive weeds, mainly *Bromus tectorum*, was over 3%.

Plant cover on the reference site this year was 28%. There were six species of shrubs that made up a total of 15% cover. As on the cover cap, there were no perennial grasses that contributed to plant cover. Unexpectedly, forbs did not contribute to plant cover; however, invasive species, mainly *Bromus rubens*, made up 13% or almost half of the total plant cover.

Total plant cover has exceeded 20% in 3 of the last 5 years. The primary component of overall plant cover is mainly *A. confertifolia*. Shrub cover ranges from 10% to 15%. This year it was just 10%, which is the lowest recorded over the last 5 years. Last year shrub cover was 15%, the highest it has been since 2006. Forbs typically make up less than 20% of the total plant cover, but this year it was a little higher.

The forb cover this year (8%) was about 35% of the total plant cover. In 2008, forbs made up about 27% of the cover, which compares to less than 1% in 2007 and 2009. Forb cover continues to fluctuate in relation to the current year's precipitation amounts and patterns. The most consistent forb over the last 5 years has been *E. deflexum*. Last year *Chaenactis stevioides* (Esteve's pincushion) was common but this year there were very few plants. Instead, *C. micrantha* and *M. albicaulis* were common although absent last year. Invasive species show an upward trend over the last 5 years, mainly due to the increasing presence of *B. tectorum*.

Table 7-1. Percent plant cover and plant density on the U-3ax/bl cover cap in 2011

Plant Species		Cover			Density in plants/m² (plants/yd²)		
		Cap	Reference	Standard	Cap	Reference	Standard
Shrubs	*Picrothamnus desertorum* (bud sagebrush)	0.0	3.0		0.0	0.2 (0.1)	
	Atriplex canescens (fourwing saltbush)	0.0	4.0		0.0	0.05 (0.04)	
	Grayia spinosa (spiny hopsage)	0.0	3.0		0.0	0.1 (0.1)	
	Ephedra nevadensis (Nevada jointfir)	1.2	1.0		0.4 (0.3)	0.0	
	Atriplex confertifolia (shadscale saltbush)	9.0	0.0		1.0 (0.8)	0.0	
	Lycium andersonii (waterjacket wolfberry)	0.0	3.0		0.0	0.3 (0.2)	
	Krascheninnikovia lanata (winterfat)	0.0	1.0		0.01 (0.01)	0.1 (0.1)	
	Total Shrub Cover	**10.2**	**15.0**	**10.5**	**1.4 (1.2)**	**0.8 (0.5)**	**0.5 (0.4)**
Perennial Grasses	*Achnatherum hymenoides* (Indian ricegrass)	0.00	0.00		0.00	0.2 (0.1)	
	Elymus elymoides (squirreltail grass)	0.00	0.00		0.00	0.1 (0.1)	
	Total Grass Cover	**0.0**	**0.0**	**0.0**	**0.0**	**0.3 (0.2)**	**0.2 (0.1)**
Forbs	**Total Forb Cover**	**7.6**	**0.0**	**0.0**	**19.4 (16.3)**	**16.0 (13.4)**	**11.2 (9.4)**
Invasive weeds	*Salsola kali* (prickly Russian thistle)	0.0	0.0		0.1 (0.1)	0.0	
	Halogeton glomeratus (halogeton)	0.6	0.0		2.8 (2.4)	0.5 (0.4)	
	Bromus tectorum (cheatgrass)	2.8	2.0		13.2 (11.1)	6.8 (5.6)	
	Bromus rubens (red brome)	0.0	11.0		0.0	19.3 (16.1)	
	Total Weed Cover	**3.4**	**13.0**		**16.1 (13.5)**	**26.6**	
TOTAL PLANT COVER		**21.2**	**28.0**	**19.6**	**36.9 (31.0)**	**43.7 (36.3)**	**30.4 (25.4)**
Bare Ground		62.8	39.0				
Litter		16.0	33.0				

7.1.2 Plant Density

There was an average of 37 plants/m^2 (31 plants/yd^2) on the cover cap in 2011 (Table 7-1). The majority (96%) were annual forbs and invasive weeds. There was an average of 1.4 shrubs/m^2 (1.2 shrubs/yd^2) on the cover cap representing three species, *A. confertifolia*, *E. nevadensis*, and *K. lanata*. Four forbs, *M. albicaulis*, *C. stevioides*, *E. deflexum*, and *C. micrantha*, made up 95% of the 19 forbs/m^2 (16 forbs/yd^2). *B. tectorum* had the highest density of any of species (13 plants/m^2 [11 plants/yd^2]) and along with *H. golomeratus* accounted for 43% of total plant density.

Plant density on the reference area was 43 plants/m^2 (36 plants/yd^2) (Table 7-1). The density of perennial plants was 1 plant/m^2 (0.7 plant/yd^2). Species encountered included five perennial shrubs, *L. andersonii*, *P. desertorum* (the most abundant shrubs), *G. spinosa*, *K. lanata*, and *A. canescens*, and two perennial grasses (*Achnatherum hymenoides* and *Elymus elymoides*). The average density of forbs was 16/m^2 (13/yd^2). Of the 13 different forb species, *Eriophyllum pringlei* (Pringle's woolly sunflower) and *Amsinckia tessellata* (bristly fiddleneck) were the most common. The density of invasive species on the reference area was 27 plants/m^2 (22 plants/yd^2), which is about 60% of the total plant density. The most abundant species were *B. rubens* and *B. tectorum*.

7.1.3 Revegetation Success

Total plant cover on the reference site this year was 28%, which met the standard (20% plant cover) for determining reclamation success. There was no grass or forb cover this year on the reference area, so no standard could be established for those two life forms. The amount of cover from invasive weedy species this year on the reference site was 13%, which is nearly four times the amount of cover for invasive weedy species on the cover cap. The primary component of invasive weedy plant cover on the cover cap is *B. tectorum.* On the reference area, it is a combination of *B. tectorum* and *B. rubens*.

Based on overall plant cover, the 21% cover on the cover cap exceeds the standard of 20% total plant cover. Because there were no grasses or forbs this year, the only category that can be used to assess reclamation success was shrub cover, which was a few tenths of a percent below the standard of 10.5%. The 3% cover from invasive weedy species on the cover cap, which is about one-fourth of the cover of invasive weedy species on the reference area (13%), suggests the establishment of a stable plant community on the cover cap.

The standard for reclamation success for total plant density is 30 plants/m^2 (25 plants/yd^2), for shrubs 0.5 shrubs/m^2 (0.4 shrubs/yd^2), for perennial grasses 0.2 grasses/m^2 (0.2 grasses/yd^2), and forbs 11 forbs/m^2 (9 forbs/yd^2). Shrub density is more than double the standard. There were no grasses on the cover cap, so reclamation success does fall short when considering perennial grasses. Forb density, like shrub density, surpasses the standard. In comparison, but not as a goal, the density of invasive weeds was lower on the cover cap than on the reference area. Excluding the invasive weedy species, total plant density on the cover cap is about twice the plant density on the reference area.

The plant community that has established on the CAU 110 U-3ax/bl cover cap appears to be stable and comparable to an undisturbed native plant community. There have been no dramatic changes in the amount of plant cover or the density of perennial plants on the cover cap over the last 5 years. When subjected to reclamation success criteria, cover and density estimates for the cover cap exceed the standards for success. The only deficiency is with perennial grasses, which were present the first few years after the site was revegetated, but have not persisted through several years of below-normal precipitation.

The cover and density of forbs on the cover cap increase and decrease commensurate with the annual precipitation patterns. Certain species native to the area do persist from year to year, indicating the stability of the plant community on the cover cap

Invasive weeds are becoming more common on the cover cap. *B. tectorum* was more common this year than it ever has been. Other weedy species such as *S. kali* and *H. glomeratus* (halogeton) persist from year to year, but do not appear to be increasing in either cover or density.

7.2 NNSS Control Point (CP) Waterline

An underground waterline was installed in 2009 in Area 6 on the NNSS, which resulted in a linear disturbance covering approximately 2.8 ha (7 ac) (see Figures 7-1 and 7-2). The western section of the waterline was revegetated in December 2009, which was approximately 0.4 ha (1 ac). Linear transects were sampled this year, and the data collected were used to estimate seedling density. No cover data will be taken until 2014.

7.2.1 Plant Density

E. fasciculatum (Eastern Mojave buckwheat), *K. lanata*, and *E. nevadensis* were the most common shrubs encountered on the revegetated site. Other shrubs that were less common include *Ericameria nauseosa* (rubber rabbitbrush), *Chrysothamnus greenei* (Green's rabbitbrush), *Hymenoclea salsola* (burrobrush), *A. canescens*, and *A. confertifolia* (Table 7-2).

The most common perennial grass was *E. elymoides* with a density of 4.4 plants/m^2 (3.7 plants/yd^2), which is higher than the density of *A. hymenoides*, the only other perennial grass on the site (Table 7-2).

There are eight different species of forbs present on the site, including five species that were included in the seed mix and three species that were not included but are commonly found on the NNSS. The most abundant species of forbs were *Eriogonum* spp. and *Gilia* spp. Both species are common in plant communities at the lower elevations of the NNSS. There were two invasive weeds found on the site this year, *B. tectorum* and *H. glomeratus* (Table 7-2).

Table 7-2. Plant density expressed as plants/m^2 (plants/yd^2 in parentheses) of seeded species on the CP Waterline in Area 6 of the NNSS

	Plant Species	2010	2011	Non-Seeded
Shrubs	*Atriplex.canescens* (fourwing saltbush)	3.3 (2.7)	2.1 (1.8)	0
	Atriplex confertifolia (shadscale saltbush)	3.1 (2.6)	3.9 (3.3)	1.0 (0.8)
	Eriogonum fasciculatum (buckwheat)	9.0 (7.6)	6.5 (5.4)	0
	Ephedra nevadensis (Nevada jointfir)	7.9 (6.6)	7.5 (6.3)	0
	Ericameria nauseosa (rubber rabbitbrush)	3.7 (3.1)	2.1 (1.8)	0
	Hymenoclea salsola (burrobrush)	0	1.0 (0.8)	1.0 (0.8)
	Grayia spinosa (spiny hopsage)	1.0 (0.8)	0	0
	Krascheninnikovia lanata (winterfat)	4.4 (3.7)	5.2 (4.3)	0
	Chrysothamnus greenei (Green's rabbitbrush)	0.0 (0.0)	2.1 (1.8)	0
	Total Shrub Density	**32.4 (26.3)**	**30.4 (25.5)**	**2.0 (1.7)**
Perennial Grasses	*Achnathrum hymenoides* (Indian ricegrass)	11.0 (9.2)	2.8 (2.4)	1.0 (0.8)
	Elymus elimoides (squirreltail grass)	5.3 (4.4)	4.4 (3.7)	0
	Total Grass Density	**16.3 (13.7)**	**7.2 (6.0)**	**1.0 (0.8)**
Forbs	*Bailyea multiradiata* (desert marigold)	1.3 (1.1)	1.0 (0.8)	1 (0.8)
	Chenopodium alba (lambsquarters)	1.0 (0.8)	0	0
	Cryptantha spp. (cryptantha)	1.0 (0.8)	0	1 (0.8)
	Erodium cicutarium (filaree)	2.6 (2.2)	0	2.5 (2.1)
	Eriogonum spp. (Annual buckwheat)	2.6 (2.2)	6.5 (5.5)	9.4 (7.9)
	Eschscholzia californica (California poppy)	4.1 (3.5)	1.0 (0.8)	0
	Gilia spp. (gilia)	3.8 (3.2)	4.5 (3.8)	18 (15.1)
	Lepidium perfoliatum (pepperweed)	4.4 (3.7)	2.3 (2)	0
	Linum lewisii (Lewis' flax)	2.5 (2.1)	5.6 (4.7)	0
	Erigeron concinnus (tansyaster)	2.5 (2.1)	0	1 (0.8)
	Penstemon palmeri (Palmer's penstemon)	1.0 (0.8)	1.0 (0.8)	0
	Sphaeralcea ambigua (desert globemallow)	1.0 (0.8)	1.0 (0.8)	0
	Total Forb Density	**27.8**	**22.0**	**32.9 (26.8)**
Invasive weeds	*Bromus* spp. (Brome grass)	4.0 (3.4)	9.1 (7.6)	3.5 (2.9)
	Halogeton glomeratus (Halogeton)	1.0 (0.8)	3.0 (2.5)	14.6 (12.3)
	Salsola kali (prickly Russian thistle)	2.0 (1.7)	0.0 (0.0)	3.7 (3.1)
	Total Invasive Weed Cover	**7.0 (5.9)**	**12.0 (10.1)**	**21.8 (18.3)**
TOTAL PLANT DENSITY		**83.5 (76.8)**	**72.4 (68.4)**	**57.7 (47.6)**

7.3 TTR CAU 400 – Five Points Landfill

CAU 400, Five Points Landfill, located on the east side of Cactus Flats, was remediated and revegetated in the fall of 1997. The site was flooded in 2003 and again in 2004, which has resulted in the deposition of 25–45 cm (10–18 in.) of sediment in the bottom areas of the site. The reference area, the staging area, and the flooded area have been independently sampled since 1998. Monitoring this year was performed on June 9, 2011.

Plant cover on the staging area was a mix of perennial shrubs and grasses, and annual forbs (Table 7-3). *A. canescens* was the single shrub species and made up approximately 59% of total plant cover. Two perennial grasses, *A. hymenoides* and *E. elymoides*, made up approximately 23% of total plant cover. Two forbs, *Machaeranthera canescens* (hoary tansyaster) and *M. albicaulis*, made up the remaining 18% of total plant cover. Plant cover on the reseeded area was less than 6% and was made up of one perennial shrub, *A. canescens*.

The 9-year average for plant cover on the reference area is 17%, which includes 8% shrubs, 5% grasses, and 4% forbs. Two shrubs contributed to cover, *C. greenei* and *A. canescens.* Shrubs made up approximately 47% of total plant cover. *A. hymenoides*, the only grass, made up 28% of total plant cover. Non-invasive forbs made up 23% of total plant cover. Twelve non-invasive forbs contributed to total plant cover. *M. albicaulis, C. stevioides*, and *Gilia nyensis* (Nye gilia) were the most common and made up two-thirds of the total forb cover. *S. kali* was the only invasive weed and accounted for approximately 2% of total plant cover.

Figure 7-1. Overview of the site looking east to Yucca Lake in May 2010 (left) and May 2011 (right)
(Photos by D. C. Anderson, May 2010 and May 2011 in Area 6)

Figure 7-2. Seedlings present on the site in May 2010 (left); 1-year-old plants in May 2011 (right)
(Photos by D. C. Anderson, May 2010 and May 2011 in Area 6)

Table 7-3. Percent plant cover on CAU 400, Five Points Landfill, in 2011

Plant Species		Staging	Re-Seeded	Reference	Standard
Shrubs	*Atriplex canescens* (fourwing saltbush)	8.13	5.83	1.60	
	Chrysothamnus greenei (Greene's rabbitbrush)	0.00	0.00	6.60	
	Total Shrub Cover	**8.13**	**5.83**	**8.20**	**5.74**
Perennial Grasses	*Achnatherum hymenoides* (Indian ricegrass)	2.50	0.00	4.90	
	Elymus elymoides (squirreltail grass)	0.63	0.00	0.00	
	Total Grass Cover	**3.13**	**0.00**	**4.90**	**3.43**
Forbs	*Eriogonum* spp. (buckwheat)	0.00	0.00	0.20	
	Cryptantha spp. (Cryptantha)	0.00	0.00	0.20	
	Eriastrum eremicum (desert woollystar)	0.00	0.00	0.10	
	Nama pusillim (eggleaf fiddleleaf)	0.00	0.00	0.20	
	Chaenactis stevioides (Esteve's pincushion)	0.00	0.00	1.00	
	Eriogonum deflexum (flatcrown buckwheat)	0.00	0.00	0.10	
	Machaeranthara canescens (hoary tansyaster)	1.25	0.00	0.00	
	Lupinus spp. (lupine)	0.00	0.00	0.10	
	Gilia nyensi (Nye gilia)	0.00	0.00	0.60	
	Cymopterus spp. (springparsley)	0.00	0.00	0.10	
	Oenothera caespitosa (tufted evening primrose)	0.00	0.00	0.30	
	Descurainia pinnata (western tansymustard)	0.00	0.00	0.10	
	Mentzelia albicaulis (whitestem blazingstar)	1.25	0.00	1.10	
	Total Forb Cover	**2.50**	**0.00**	**4.10**	**2.87**
Invasive Weeds	*Salsola kali* (prickly Russian thistle)	0.00	0.00	0.30	
	Total Invasive Weed Cover	**0.00**	**0.00**	**0.30**	
TOTAL PLANT COVER		**13.8**	**5.83**	**17.5**	**12.3**
Bare Ground		70.6	82.5	68.0	
Litter		15.6	11.7	14.5	

7.3.1 Plant Density

Plant density on the staging area was 5.9 plants/m^2 (4.9 plants/yd^2), which included 0.78 shrubs/m^2 (0.65 shrubs/yd^2), 0.5 grasses/m^2 (0.4 grasses/yd^2), 4.2 forbs/m^2 (3.5 forbs/yd^2), and 0.41 invasive weeds/m^2 (0.3 invasive weeds/yd^2) (Table 7-4). There were four perennial species, including two shrubs *(A. canescens* and *P. desertorum*) and two grasses (*A. hymenoides* and *E. elymoides*). Forb density was higher than shrub and grass density. *M. albicaulis* had the highest density, followed by *Eriastrum eremicum* (desert woollystar) and *Lactuca serriola* (small wirelettuce). These three forbs accounted for approximately 96% of total forb density. *S. kali* was the only invasive weed and had a density of 0.43 plants/m^2 (0.3 plants/yd^2).

Plant density on the reseeded area was 0.1 plants/m^2 (0.09 plants/yd^2). Shrub density was 0.07 plants/m^2 (0.06 plants/yd^2). There were no perennial grasses and 0.03 forbs/m^2 (0.03 forbs/yd^2). There was one shrub (*A. canescens*), one forb (*C. stevioides*), and one noxious weed (*Salsola kali,* prickly Russian thistle).

Plant density on the reference area was 25.8 plants/m^2 (21.6 plants/yd^2). There were 0.8 shrubs/m^2 (0.7 shrubs/yd^2) *C. greenei* had the highest density, followed by *A. canescens*, and *K. lanata*. Perennial grass density was 1.61 grasses/m^2 (1.3 grasses/yd^2) and was mostly made up of *A. hymenoides* with a few isolated plants of *E. elymoides* and *Pleuraphis jamesii* (galleta grass). Forb density was 21.7 forbs/m^2 (18.1 forbs/yd^2). The most common species was *C. stevioides*, followed by *M. canescens*, *Ambrosia* spp. (ragweed), *C. micrantha*, *G. nyensis*, *Nama pusillim* (eggleaf fiddleleaf), and *C. circumscissa* (cushion cryptantha).

Table 7-4. Plant density expressed as plants/m^2 (plants/yd^2 in parentheses) on CAU 400, Five Points Landfill, in 2011

Plant Species		Staging	Reseeded	Reference	Standard
Shrubs	*Picrothamnus desertorum* (bud sagebrush)	0.05 (0.04)	0.00	0.00	
	Atriplex canescens (fourwing saltbush)	0.73 (0.61)	0.07 (0.6)	0.13 (0.11)	
	Chrysothamnus greenei (Greene's rabbitbrush)	0.00	0.00	0.65 (0.54)	
	Krascheninnikovia lanata (winterfat)	0.00	0.00	0.02 (0.02)	
	Total Shrub Density	**0.78 (0.65)**	**0.07 (0.06)**	**0.80 (0.67)**	**0.56 (0.47)**
Perennial Grasses	*Achnatherum hymenoides* (Indian ricegrass)	0.33 (0.28)	0.00	1.57 (1.31)	
	Pleuraphis jamesii (Galleta grass)	0.00	0.00	0.01 (0.01)	
	Elymus elymoides (squirreltail grass)	0.15 (0.13)	0.00	0.02 (0.02)	
	Total Grass Density	**0.48 (0.40)**	**0.00**	**1.60 (1.34)**	**1.12 (0.94)**
Forbs	**Total Forb Density**	**4.16 (3.48)**	**0.03 (0.03)**	**21.7 (18.14)**	**15.2 (12.71)**
Invasive Weeds	*Halogeton glomeratus* (halogeton)	0.00	0.00	0.07 (0.06)	
	Salsola kali (prickly Russian thistle)	0.43 (0.36)	0.01 (0.01)	1.65 (1.38)	
	Total Invasive Weed Density	**0.43 (0.36)**	**0.01 (0.01)**	**1.72 (1.44)**	
TOTAL PLANT DENSITY		**5.85 (4.89)**	**0.11 (0.09)**	**25.8 (21.57)**	**18.1 (15.13)**

7.3.2 Revegetation Success

Staging Area – The plant community on the Five Points Landfill staging area appeared stable in 2011. Total plant cover was close to 14%, less than 2009 and 2010, but similar to 2007 and 2008. Shrub cover was 8%, similar to the previous 4 years. Perennial grasses continued to struggle. Perennial grass cover was close to 5% in 2006, dropped to 0% in 2008 and 2010, and increased to 3% this year. Forbs are typically abundant, but forb cover was less than 3% this year, as in 2007 and 2009. Total plant cover exceeded the standard due to consistency of shrubs and increase in grass cover. Shrub cover was higher than the standard, but grass and forb covers were below standards (Hansen et al., 2011).

Perennial plant density on the staging area was the second lowest in 5 years. Shrub density ranged from a low of 0.6 shrubs/m^2 (0.5 shrubs/yd^2) in 2007 to a high of 1.0 shrubs/m^2 (0.8 shrubs/yd^2) in 2008. Perennial grass density has shown a similar pattern, ranging from a high of 1.4 grasses/m^2 (1.1 grasses/yd^2) in 2007 to a low of 0.2 grasses/m^2 (0.2 grasses/yd^2) in 2008 and 2010. The average grass density over the last 5 years was 0.5 grasses/m^2 (0.4 grasses/yd^2), which was close to this year. Forb density was the second lowest recorded in 5 years. In 2010, 58.3 forbs/m^2 (49.0 forbs/yd^2) was the highest recorded in 5 years. There continued to be a small number of invasive weeds.

Of the parameters used to evaluate revegetation success, only plant cover and shrub density exceeded the standard, but grass and forb density did not.

Reseeded Area – Plant cover on the reseeded area was the second lowest in 4 years due to the lack of grasses and forbs. Shrub cover was the second highest recorded since 2008 and almost twice the shrub cover in 2009 and 2010. *A. canescens* continued to be the only shrub found on the reseeded area. The density of perennial grasses dropped to its lowest in 5 years. *A. hymenoides* and *E. elymoides*, two native grasses, were present in previous years, but only a few *E. elymoides* plants were found this year. There were no forbs on the site this year.

The reseeded area was deficient in plant cover and density. Plant cover has fluctuated from no cover in 2007, after the area was submerged by runoff during the summer of 2006, to a high of 23% last year. This year was close to 6% total plant cover, which was approximately 50% of the standard. Shrub cover met the standard, but there was no perennial grass or forb cover.

7.4 TTR CAU 407 – Rollercoaster RADSAFE Area

The CAU 407 Rollercoaster RADSAFE cover cap was originally seeded 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, located in a northwest to southwest direction on the cover cap, were sampled in 2011 to estimate plant cover and density.

7.4.1 Plant Cover

Plant cover on CAU 407 was approximately 16% (Table 7-5). Shrub cover was approximately 14%. *A. confertifolia* was the most common at approximately 13%. *A. canescens* was less common at approximately 1% cover. *C. stevioides*, an annual forb, accounted for less than 1% cover, and *H. glomeratus*, an invasive weed, made up about 2% cover.

Average total plant cover on the reference area was approximately 13%. Shrub cover was 9.4%, perennial grass cover was 1.8%, forb cover was 1.9%, and invasive weed cover was 0.1%. *P. desertorum,* the most common species, accounted for over half of total shrub cover. *A. canescens* accounted for 40% of total shrub cover. Grass on the reference area was a good mix of species. *P. jamesii*, the most common, accounted for over half of total grass cover. *A. hymenoides* accounted for 40% of total grass cover. Three forbs contributed to plant cover on the reference area. As on the cover, *C. stevioides* was the most common. *H. glomeratus*, an invasive weed, was present at 0.1% cover.

7.4.2 Plant Density

Plant density on CAU 407 was 12.7 plants/m^2 (10.7 plants/yd^2) and was made up of shrubs and an invasive weed (Table 7-6). The most abundant species was *A. confertifolia*, followed by *H. glomeratus, A. canescens*, and *P. desertorum*. Forbs and grasses were not encountered.

Average plant density on the reference area was 16 plants/m^2 (13 plants/yd^2). There was a more even distribution of life forms on the reference area than on the cover cap. There were 4 shrubs/m^2 (3 shrubs/yd^2), 1.7 grasses/m^2 (1.4 grasses/yd^2), and 9.8 forbs/m^2 (8.2 forbs/yd^2). The most abundant shrub was *P. desertorum* followed by *A. confertifolia*. *P. jamesii* was the most common grass species followed by *Erioneuron pulchellum* (woolly tuftgrass) and *A. hymenoides. C. stevioides* had the highest density of all species.

Table 7-5. Percent plant cover on CAU 407 in 2011

Plant Species		Cover	Reference	Standard
Shrubs	*Picrothamnus* desertorum (bud sagebrush)	0.00	5.30	
	Atriplex canescens (fourwing saltbush)	0.80	3.80	
	Atriplex confertifolia (shadscale saltbush)	13.3	0.00	
	Chrysothamnus viscidiflorus (yellow rabbitbrush)	0.00	0.10	
	Krascheninnikovia lanata (winterfat)	0.00	0.20	
	Total Shrub Cover	**14.1**	**9.40**	**6.58**
Perennial Grasses	*Achnathrum hymenoides* (Indian ricegrass)	0.00	0.70	
	Erioneuron pulchellum (woolly tuftgrass)	0.00	0.10	
	Pleuraphis jamesii (galleta grass)	0.00	1.00	
	Total Grass Cover	**0.00**	**1.80**	**1.26**
Forbs	**Total Forb Cover**	**0.40**	**1.90**	**1.33**
Invasive Weeds	*Halogeton glomeratus* (halogeton)	1.70	0.10	
	Total Invasive Weed Cover	**1.70**	**0.10**	
TOTAL PLANT COVER		**16.2**	**13.2**	**9.24**
Bare Ground		63.8	69.6	
Litter		20.0	17.2	

Table 7-6. Plant density expressed as plants/m^2 (plants/yd^2 in parentheses) on CAU 407 in 2011

Plant Species		Density	Reference	Standard
Shrubs	*Picrothamnus desertorum* (bud sagebrush)	0.10 (0.08)	3.10 (2.59)	
	Atriplex canescens (fourwing saltbush)	0.50 (0.42)	0.00	
	Atriplex confertifolia (shadscale saltbush)	10.2 (8.53)	0.80 (0.67)	
	Grusonia puchella (sagebrush cholla)	0.00	0.03 (0.03)	
	Krascheninnikovia lanata (winterfat)	0.00	0.10 (0.08)	
	Total Shrub Density	**10.8 (9.03)**	**4.03 (3.37)**	**2.82 (2.36)**
Perennial Grasses	*Achnathrum hymenoides* (Indian ricegrass)	0.00	0.40 (0.33)	
	Erioneuron pulchellum (woolly tuftgrass)	0.00	0.40 (0.33)	
	Elymus elymoides (squirreltail grass)	0.00	0.04 (0.03)	
	Pleuraphis jamesii (galleta grass)	0.00	0.90 (0.75)	
	Total Grass Density	**0.00**	**1.74 (1.45)**	**1.22 (1.02)**
Forbs	**Total Forb Density**	**0.00**	**9.84 (8.23)**	**6.89 (5.76)**
Invasive Weeds	*Halogeton glomeratus* (halogeton)	1.90 (1.59)	0.30(025)	
	Total Invasive Weed Cover	**1.90 (1.59)**	**0.30 (0.25)**	
TOTAL PLANT DENSITY		**12.7 (10.62)**	**15.9 (13.29)**	**11.1 (9.28)**

7.4.3 Revegetation Success

Success standards were established using data collected over the last 9 years from the reference area. Total plant cover exceeded the standard (Table 7-5). Shrub cover was more than twice the standard. The lack of perennial grasses is a concern. Grass cover was approximately 1% in 2008 and 2009, but there has been no grass cover for 2 years (Hansen et al., 2011). The first year after revegetation, there was an abundance of grasses, but grasses have not survived the relatively dry conditions, and grass cover did not meet the standard. Forb cover was made up of *H. glomeratus* this year. An invasive weed, such as *H. glomeratus*, is not considered when evaluating revegetation success, so the standard for forbs was not achieved.

Total plant density, not including invasive weeds, was 10.8 plants/m^2 (9.0 plants/yd^2), which was below the standard (10.93 plants/m^2 [9.1 plants/yd^2]) (Table 7-6). Shrub density declined, but shrub cover increased, suggesting fewer but larger plants on the site. *A. confertifolia* continued to be the most abundant species. *P. desertorum* and *A. canescens* were encountered this year but in lower numbers. Perennial grass density declined over the last 5 years to the point where no grasses were found at this site in 2011.

The presence and abundance of forbs fluctuates based on the timing and amount of precipitation. Precipitation events did not favor forb growth this year. As a result there was only one forb, an invasive weed (*H. glomeratus*), present on the site. This species was abundant the last 2 years, but its density this year was about 25% of what it was last year. Over time, the abundance of this species is expected to decline as perennial shrubs and grasses become established. Perennial grass and forb densities did not meet the revegetation success standard.

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8.0 MONITORING THE NPTEC

8.1 Task Description

Biological monitoring at 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 Directorate has requested that site biologists to monitor any test that may influence plants or animals downwind of the playa. A biological monitoring plan for NPTEC was prepared in fiscal year (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.

Site 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 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

Site biologists reviewed one test plan during 2011. Baseline monitoring was not conducted at established control-treatment transects near NPTEC in 2011 because no test-specific monitoring was required due to small quantities and low concentration levels.

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