DOE/NV/25946--946

ECOLOGICAL MONITORING AND COMPLIANCE PROGRAM 2009 REPORT

July 2010

Prepared by
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Front Cover Picture: Desert bighorn sheep at Topopah Spring in Area 29 on the Nevada Test Site (photo by motion-activated camera, July 1, 2009).

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July 2010

Prepared for the
U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office
Environment, Safety and Health Division
P.O. Box 98518
Las Vegas, NV 89193-8518

WORK PERFORMED UNDER
CONTRACT NO. DE-AC52-06NA25946

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EXECUTIVE SUMMARY

The Ecological Monitoring and Compliance Program (EMAC), funded through the U.S. Department of Energy, National Nuclear Security Administration, Nevada Site Office (NNSA/NSO), monitors the ecosystem of the Nevada Test Site (NTS) and ensures compliance with laws and regulations pertaining to NTS biota. This report summarizes the program's activities conducted by National Security Technologies, LLC (NSTec), during calendar year 2009. Program activities included (a) biological surveys at proposed construction sites, (b) desert tortoise compliance, (c) ecosystem mapping and data management, (d) sensitive plant species monitoring, (e) sensitive and protected/regulated animal monitoring, (f) habitat monitoring, (g) habitat restoration monitoring, and (h) monitoring of the Nonproliferation Test and Evaluation Complex. During 2009, 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 NTS include 43 plants, 1 mollusk, 2 reptiles, 238 birds, and 27 mammals. These species are protected, regulated, or considered sensitive according to state or federal regulations and natural resource agencies and organizations. The threatened desert tortoise (*Gopherus agassizii*) is the only species on the NTS 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 437.58 hectares (ha) (1081.29 acres [ac]) was surveyed for these projects. Sensitive and protected/regulated species and important biological resources found during these surveys included active tortoise burrows, active kit fox (*Vulpes velox macrotis*) burrows, a predator burrow, mature Joshua (*Yucca brevifolia*) trees, Mojave yuccas (*Yucca schidigera*), possibly Tonopah milkvetch (*Astragalus pseudiodanthus*), Beatley milkvetch (*Astragalus beatleyae*), Cane Spring suncup (*Camissonia megalantha*), and cacti. NSTec provided a written summary report of all survey findings and mitigation recommendations, where applicable. All flagged tortoise burrows were avoided during project activities.

Of the 31 projects on the NTS, 24 projects occurred within the range of the threatened desert tortoise. NNSA/NSO must comply with the terms and conditions of the Biological Opinion rendered by the U.S. Fish and Wildlife Service (FWS) when conducting work in desert tortoise habitat. No tortoises were found in project areas, nor were any accidentally injured, killed, captured, or displaced during project activities. One desert tortoise was killed by a vehicle along the 5-05 Road in Area 5. Five desert tortoises were removed from roads by NTS personnel to avoid injury or death. In 2009, approximately 3.27 ha (8.08 ac) of tortoise habitat were disturbed. Two projects paid mitigation fees for areas that were disturbed in 2009.

On July 2, 2008, NNSA/NSO sent a Biological Assessment to the FWS and entered into formal consultation for a new programmatic opinion for the NTS. That consultation ended on February 12, 2009, when FWS sent the final Biological Opinion to NNSA/NSO. This Opinion covers anticipated activities at the NTS for the next 10 years.

There has been an average of 11.8 wildland fires per year on the NTS since 1978 with an average of about 81.6 ha (201.6 ac) burned per fire. In 2009, there were 17 wildland fires and a total of 95 ha (234.8 ac) burned. Approximately 82% of these fires (85.7 ha [211.8 ac]) were caused by ordnance associated with training exercises, and primarily confined to Cat Canyon in Area 30. Approximately 18% of the fires were caused by lightning. The largest fire was 9.3 ha (22.9 acres) in Area 16. Wildland fire fuel hazards were evaluated and categorized as fine fuels, woody fuels, and combined fuels.

There were no modifications in 2009 to the list of sensitive plants known to occur on the NTS. Field surveys focused on two species *Galium hilandiae* ssp. *kingstonense* and *Cymopterus ripleyi* var. *saniculoides*.

Populations of *G. hilandiae* ssp. *kingstonense* at Oak Spring and Tub Spring were surveyed and mapped this year. Several hundred individuals were found in flower and seed set at these two locations. Another population reported from Tongue Wash was surveyed but no plants were found.

The focus on *C. ripleyi* var. *saniculoides* this year was to resolve its taxonomy. The variety was named by R. C. Barneby in 1941 based on flower color, a dark-purple, as opposed to the cream-colored flowers of *C. ripleyi* var. *ripleyi*. Field surveys this year focused on the locations of both varieties to ascertain if there was a mixing of flower colors as had been previously reported. Results of the field surveys did not provide any evidence that both varieties are commonly or even occasionally found at the same location. There appears to be a clear definition of purple-colored flowers at lower elevations and cream-colored flowers at upper elevations. *C. ripleyi* var. *saniculoides* will continue to be considered a valid taxon and will be monitored along with other sensitive plants known to occur on the NTS.

A new location of *Hulsea vestita* var. *inyoensis* was found in the Tongue Wash area this year while conducting surveys for *G. hilandiae* ssp. *kingstonense*. Two new locations of *Astragalus oophorus* var. *clokeyanus* were also found, one on the eastern slopes of Timber Mountain and the other on the east slope of Rainier Mesa near Tongue Wash.

Surveys of sensitive and protected/regulated animals during 2009 focused on (1) western red-tailed skinks (*Eumeces gilberti rubricaudatus*), (2) small mammals including kangaroo mice (*Microdipodops* spp.), (3) bats, (4) wild horses (*Equus caballus*), (5) mule deer (*Odocoileus hemionus*), and (6) mountain lions (*Puma concolor*). Eight western red-tailed skinks were captured at six new locations in the northern part of the NTS. No kangaroo mice were captured. The wild horse population appears to be stable at around 35 horses. Mule deer abundance declined 40% from 2008. A total of 117 mountain lion photographs/video clips were taken with motion-activated cameras at seven sites across the NTS. Over 100 of these were taken at Topopah Spring. Noteworthy wildlife observations (e.g., Rocky Mountain elk [*Cervus elaphus*] and desert bighorn sheep [*Ovis canadensis nelsoni*]), bird mortalities, and a summary of nuisance animals and their control on the NTS were also recorded. West Nile virus surveillance was conducted at eight sites with no mosquitoes testing positive for the virus.

The habitat restoration program involves the revegetation of disturbances and the evaluation of previous revegetation efforts. Sites that have been revegetated are periodically sampled, and the information obtained is used to develop site-specific revegetation plans for future restoration efforts on the NTS.

In 2009 one disturbance resulting from the installation of an underground pipeline was revegetated and several previously revegetated sites on the NTS and the Tonopah Test Range were monitored. A waterline was installed this past year, which resulted in a rectangular disturbance covering approximately 2.8 ha (7 ac). The western section of the waterline (approximately 0.4 ha [1 ac]) was in steep terrain and susceptible to severe water erosion and was revegetated in the fall with a mix of native plant seed.

One previously revegetated area on the NTS and five on the Tonopah Test Range were monitored in 2009. A closure cover cap on the U-3ax/bl disposal unit was the only site monitored on the NTS. Total plant cover on the U-3ax/bl closure cover was 12%. *Atriplex confertifolia* made up 94% of the total cover, and *Ephedra nevadensis* and two annual *Eriogonum* species contributed equally to the remaining 6%. Plant cover on the peripheral area was only 4% in 2009 all from *Bromus tectorum,* an annual invasive weed.

Perennial plant density has declined over the last five years. In 2005 there were five perennial shrubs and two perennial grasses found on the closure cover. By 2009 there were only three shrubs and no grasses. Shrub density has declined from 4.7 plants/square meter (m^2) (3.9 plants/square yard [yd^2]) in 2005 to just 1.2 plants/m^2 (1.0 plants/yd^2) this year.

The plant community on the U-3ax/bl closure cover is characterized by a combination of native perennial shrubs and annual forbs. Weedy species are present occasionally but when present make up on average less than 6% of the total cover. Even though plant cover and density have declined over the last five years, a viable perennial plant community persists.

Five sites, located on the Tonopah Test Range were monitored this year. Four of the sites were revegetated in 1997 and one in 2004. Plant cover exceeded the reclamation success standards at four of the five sites. Plant cover on Corrective Action Unit (CAU) 400-Bomblet Pit was 85% of the standard, but at the other four sites, plant cover ranged from one and a half times the reclamation success standard at the CAU 400-Five Points Landfill to almost three times the standard at CAU 404-Rollercoaster Sewage Lagoons. Plant density at CAU 400-Five Points Landfill and the cover cap at CAU 426-Cactus Springs Waste Trenches was about 90% of the revegetation success standards for plant density. Plant density at the other sites ranged from one and a half times the standard at CAU 404-Rollercoaster Sewage Lagoons to more than four times the standard at CAU 426-Cactus Springs Waste Trenches staging area. Revegetation goals have been met at CAU 400-Bomblet Pit, CAU 426-Cactus Springs Waste Trenches and CAU 404-Rollercoaster Sewage Lagoons; these sites will not be monitored in the future.

There were no chemical spill test plans reviewed in 2009, and no baseline monitoring was conducted at the Nonproliferation Test and Evaluation Complex.

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ACRONYMS AND ABBREVIATIONS

ac	acre
CAU	Corrective Action Unit
CI	Confidence Interval
cm	centimeter
CV	coefficient of variation
CP	Control Point
DAF	Device Assembly Facility
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
EGIS	Ecological Geographic Information System
ELU	Ecological Landform Unit
EM	Environmental Monitor
EMAC	Ecological Monitoring and Compliance
ESA	*Endangered Species Act*
ft	feet
ft^2	square feet
FWS	U.S. Fish and Wildlife Service
FY	fiscal year
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare
in.	inch
kg	kilogram
km	kilometer
km^2	square kilometer
lb	pound
m	meter
mm	millimeter
m^2	square meter
mi	mile
mi^2	square mile
N	sample size

ACRONYMS AND ABBREVIATIONS (Continued)

NAC	Nevada Administrative Code
NNHP	Nevada Natural Heritage Program
NNPS	Nevada Native Plant Society
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NOAA ARL/SORD	National Oceanic and Atmospheric Administration/Air Resources Laboratory, Special Operations and Research Division
NPTEC	Nonproliferation Test and Evaluation Complex
NSTec	National Security Technologies, LLC
NTS	Nevada Test Site
PLS	Pure Live Seed
SD	Standard Deviation
SNHD	Southern Nevada Health District
SOC	Special Operations Center
ssp.	subspecies
spp.	species
TTR	Tonopah Test Range
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
var.	variety
WNV	West Nile virus
yd^2	square yard

1.0 INTRODUCTION

In accordance with U.S. Department of Energy Order DOE O 450.1A, "Environmental Protection Program," the Office of the Assistant Manager for Environmental Management of the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) requires ecological monitoring and biological compliance support for activities and programs conducted at the Nevada Test Site (NTS). National Security Technologies, LLC (NSTec), Ecological Services 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 NTS 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 2009, 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 2009. Monitoring tasks during 2009 included eight program areas: (a) biological surveys, (b) desert tortoise compliance, (c) ecosystem mapping and data management, (d) sensitive plant monitoring, (e) sensitive and protected/regulated animal monitoring, (f) habitat monitoring, (g) habitat restoration monitoring, and (h) biological monitoring at the Nonproliferation Test and Evaluation Complex (NPTEC). The following sections of this report describe work performed under these eight 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 and bat species ranked as moderate or high in the Nevada Bat Conservation Plan Bat Species Risk Assessment. Protected/regulated species are those that are protected or regulated by federal or state law. Many species are both sensitive and protected/regulated (Table 2-1). Important biological resources include cover sites, nest or burrow sites, roost sites, or water sources important to sensitive species. Survey reports document species and resources found and provide mitigation recommendations.

2.1 Sites Surveyed and Sensitive and Protected/Regulated Species Observed

During 2009, biological surveys for 31 projects were conducted on or near the NTS (Figure 2-1 and Table 2-2). For some of the projects, multiple sites were surveyed (Figure 2-1). Scientists surveyed a total of 437.58 hectares (ha) (1081.29 acres [ac]) for the projects (Table 2-2). A total of 24 projects were within the range of the threatened desert tortoise (*Gopherus agassizii*). Sensitive and protected/regulated species and important biological resources found included two desert tortoise burrows, one predator burrow, two kit fox (*Vulpes velox macrotis*) burrows, possibly Tonopah milkvetch (*Astragalus pseudiodanthus*), Beatley milkvetch (*Astragalus beatleyae*), Cane spring suncup (*Camissonia megalantha*), Joshua trees (*Yucca brevifolia*), Mojave Yucca (*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). The desert tortoise burrows were flagged and avoided during project activities. Disturbance of the kit fox burrows could not be avoided.

2.2 Potential Habitat Disturbance

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

Of the 31 projects for which surveys were conducted, 23 were within sites previously disturbed (e.g., road shoulders, old building sites, industrial waste sites, or existing well pads) (Table 2-2). Eight projects were located either partially or entirely in areas that had not been previously disturbed. These projects could have potentially disturbed 32.41 ha (80.09 ac) of land that were previously considered as undisturbed. Four projects occurred in areas designated as important habitats (Table 2-3 and Figure 2-2). During vegetation mapping of the NTS, Ecological Landform Units (ELUs) were evaluated; some 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), 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 NTS

Plant Species	Common Names	Status[a]
Moss Species		
Entosthodon planoconvexus	Planoconvex cordmoss	S, T, 5 years
Flowering Plant Species		
Arctomecon merriamii	White bearpoppy	S, W, 10 years
Astragalus beatleyae	Beatley milkvetch	S, W, 5 years
Astragalus funereus	Black woollypod	S, W, 5 years
Astragalus oophorus var. *clokeyanus*	Clokey eggvetch	S, W, 5 years
Camissonia megalantha	Cane Spring suncup	S, W, 10 years
Cymopterus ripleyi var. *saniculoides*	Sanicle biscuitroot	S, W, 10 years
Eriogonum concinnum	Darin buckwheat	S, W, 5 years
Eriogonum heermannii var. *clokeyi*	Clokey buckwheat	S, W, 5 years
Frasera pahutensis	Pahute green gentian	S, W, 10 years
Galium hilendiae ssp. *kingstonense*	Kingston Mountains bedstraw	S, T, 10 years
Hulsea vestita ssp. *inyoensis*	Inyo Hulsea	S, W, 10 years
Ivesia arizonica var. *saxosa*	Rock purpusia	S, W, 5 years
Penstemon fruticiformis ssp. *amargosae*	Death Valley beardtongue	S, T, 5 years
Penstemon pahutensis	Pahute Mesa beardtongue	S, W, 10 years
Phacelia beatleyae	Beatley Scorpionflower	S, W, 10 years
Phacelia filiae	Clarke Phacelia	S, W, 10 years
Phacelia mustelina	Weasel Phacelia	S, W, 10 years
Phacelia parishii	Parish Phacelia	S, W, 10 years
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 NTS (Continued)

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

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

Animal Species	Common Name	Status[a]
Lasiurus blossevillii	Western red bat	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	H, NP, A
Myotis yumanensis	Yuma myotis	M, A
Ovis canadensis nelsoni	Desert bighorn sheep	G, IA
Odocoileus hemionus	Mule deer	G, A
Pipistrellus hesperus	Western pipistrelle	M, A
Puma concolor	Mountain lion	G, A
Sylvilagus audubonii	Audubon's cottontail	G, IA
Sylvilagus nuttallii	Nuttall's cottontail	G, IA
Tadarida brasiliensis	Brazilian free-tailed bat	NP, A
Urocyon cinereoargenteus	Gray fox	F, IA
Vulpes velox macrotis	Kit fox	F, IA

[a]Status Codes:

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

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

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

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

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

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

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

Long-term Plant Monitoring Status for the NTS
5 years - Monitor a minimum of once every 5 years
10 years - Monitor a minimum of once every 10 years

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

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

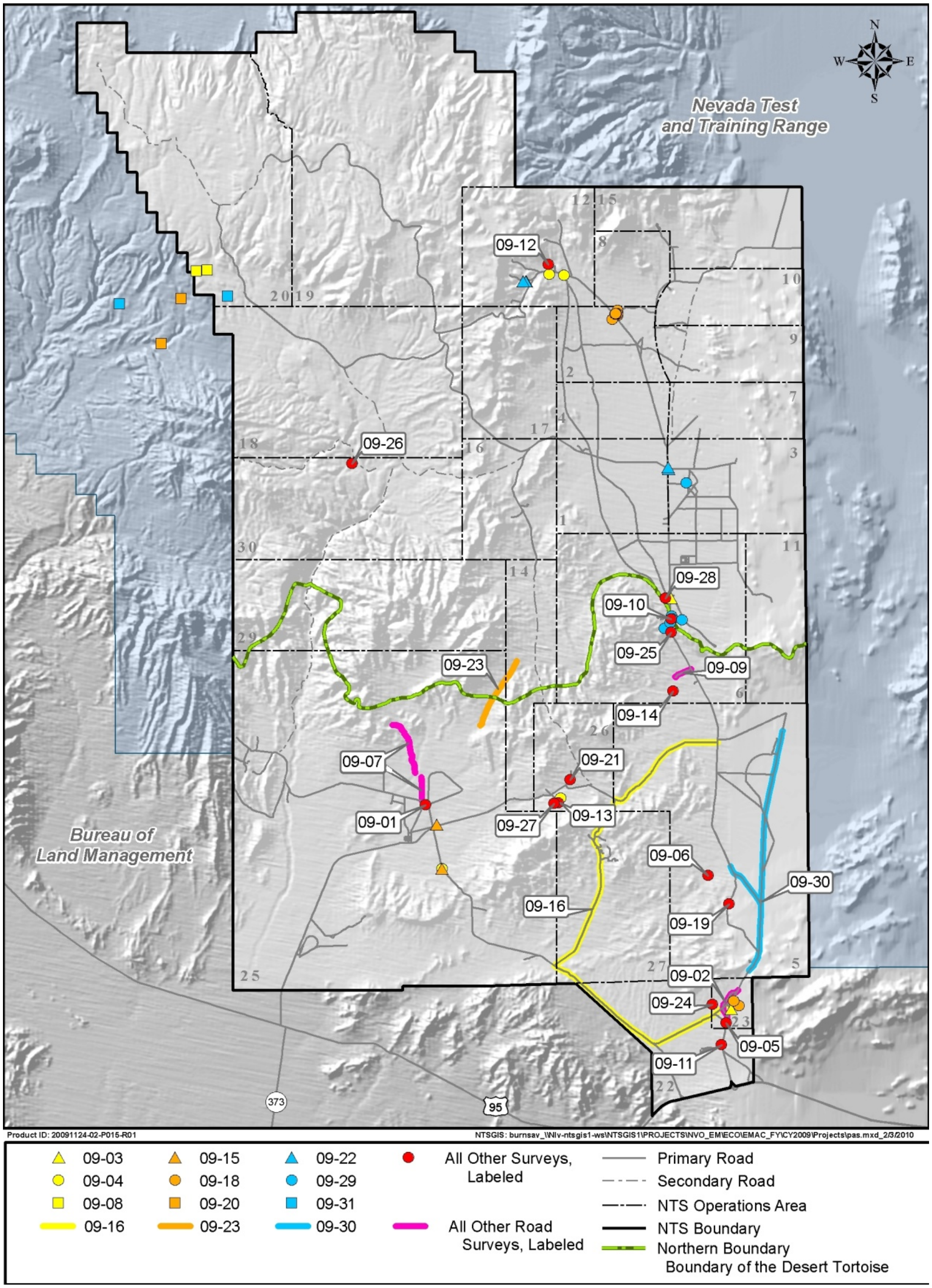

Figure 2-1. Biological surveys conducted on the NTS during 2009

Table 2-2. Summary of biological surveys conducted on the NTS during 2009

Project No.	Project	Important Species/ Resources Found	Area Surveyed in ha (ac)	Proposed Project Area in Undisturbed Habitat in ha (ac)	Mitigation Recommendations
09-01	Sewer line repair	None	0.48 (1.19)	0	Environmental monitor (EM) needed
09-02	Mercury bypass roadside mowing	None	11.60 (28.66)	0	EM needed
09-03	Fire Station #1 and #2	Yuccas and cacti	7.68 (18.98)	0	EM needed
09-04	Office of Surface Transportation	None	6.66 (16.46)	0	None
09-05	Army Well waterline	None	0.06 (0.15)	0	None
09-06	CAU 166	None	2.54 (6.28)	0	EM needed at CAS 05-19-02
09-07	Project 300 road grading	2 tortoise burrows	3.00 (7.41)	0	EM needed, avoid burrows
09-08	UGTA ER 20-8 borrow pits	2 Kit fox burrows, Joshua trees	5.00 (12.36)	3.92 (9.69)	Avoid burrows and Joshua trees if possible
09-09	DAF roadside grading	None	4.63 (11.44)	0	EM needed
09-10	CP 160 roadside grading	Joshua trees	2.74 (6.77)	0	EM needed
09-11	Bevatron Trailer drop area	None	0.50 (1.24)	0	None
09-12	Area 12 trailer pad	None	0.38 (0.94)	0	None
09-13	Port Gaston pad	None	6.30 (15.57)	1.00 (2.47)	EM needed, mitigation required
09-14	DAF trailer placements	Joshua trees	1.21 (2.99)	2.27 (5.61)	EM needed, mitigation required
09-15	Office of Surface Transportation	None	0.80 (1.98)	0	None
09-16	Cane Spring roadside blading	None	84.66 (209.20)	0	EM needed

Table 2-2. Summary of biological surveys conducted on the NTS during 2009 (Continued)

Project Number	Project	Important Species/ Resources Found	Area Surveyed in ha (ac)	Proposed Project Area in Undisturbed Habitat in ha (ac)	Mitigation Recommendations
09-17	CAU 408 TTR	Possible Tonopah milkvetch	172.88 (427.20)	2.0 (4.94)	Avoid Tonopah milkvetch
09-18	CAU 562	None	2.00 (4.94)	0	None
09-19	Security Exercise Burma Road	None	1.60 (3.95)	0	None
09-20	UGTA ER-EC wells	Possible Cane Spring suncup	24.15 (59.68)	15.15 (37.44)	Avoid Cane Spring suncup
09-21	Dave Aisle	None	0.25 (0.62)	0	None
09-22	CAU 563	None	2.20 (5.44)	0	None
09-23	Saddle Mountain road grading	None	20.86 (51.55)	0	EM needed
09-24	WSI training range	None	0.003 (0.01)	0	None
09-25	CAU 557	None	0..25 (0.62)	0	None
09-26	Cat Canyon road improvement	None	0.25 (0.62)	0.25 (0.62)	None
09-27	Port Gaston new pad, access road	None	4.00 (9.88)	1.57 (3.88)	EM and mitigation required
09-28	Tippipah Highway roadside blading	None	3.90 (9.64)	0	None
09-29	CAU 560	None	0.54 (1.33)	0	None
09-30	Mercury Highway 200 hill	Predator burrow	52.94 (130.82)	0	EM needed
09-31	UGTA ER 20-09, ER-EC-15	Possible Beatley milkvetch	13.52 (33.41)	6.25 (15.44)	Avoid Beatley milkvetch
		Totals in ha	**437.583**	**32.41**	
		(ac)	**(1081.29)**	**(80.09)**	

CAS: Corrective Action Site; CAU: Corrective Action Unit; DAF: Device Assembly Facility; TTR: Tonopah Test Range; UGTA: Underground Test Area

Table 2-3. Total area disturbed within important habitats in 2009 and over the past 11 years

Project No.	Project Name	Pristine Habitat	Unique Habitat	Sensitive Habitat	Diverse Habitat
09-13	Port Gaston pad	0	0	1.00 (2.47)	0
09-26	Cat Canyon road improvements	0.25 (0.62)	0	0	0
09-27	Port Gaston new pad	0	0	1.57 (3.88)	0
09-31	UTGA ER-20-09	0	0	0	3.66 (9.04)
	2009 Total: 6.48	**0.25**	**0**	**2.57**	**3.66**
	(16.01)	**(0.62)**	**(0)**	**(6.35)**	**(9.04)**
	1999–2009 Grand Total: 294.33	**9.46**	**11.85**	**187.19**	**85.83**
	(727.32)	**(23.37)**	**(29.28)**	**(462.56)**	**(212.11)**

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 2009 projects is 6.48 ha (16.01 ac) (Table 2-3). Since 1999, the total area of important habitat disturbed by NNSA/NSO activities is 294.33 ha (727.32 ac). This tally may be used to document the loss of important habitat.

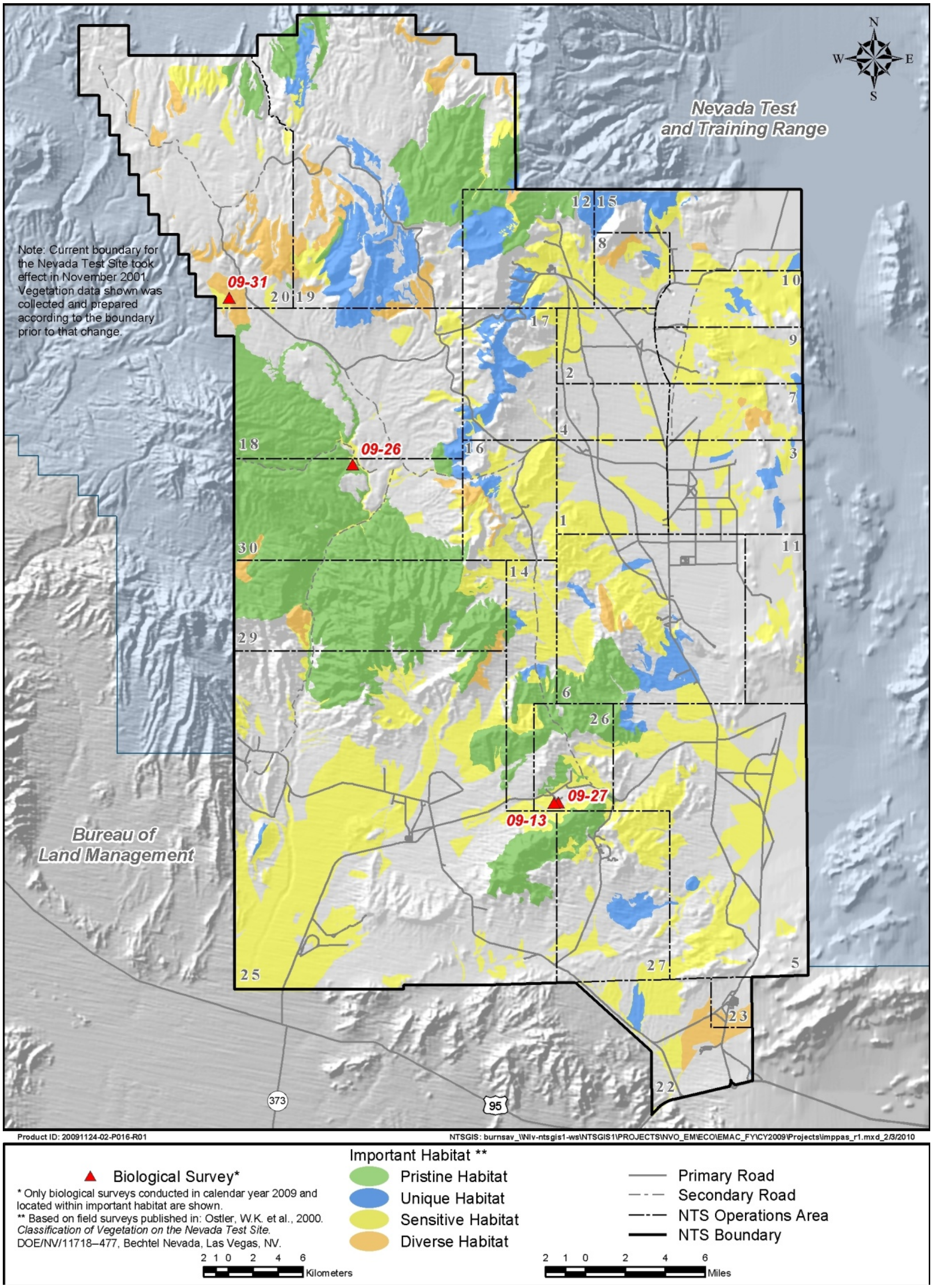

Figure 2-2. Biological surveys conducted in important habitats of the NTS during 2009

3.0 DESERT TORTOISE COMPLIANCE

Desert tortoises occur within the southern one-third of the NTS. 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 the U.S. Fish and Wildlife Service (FWS) in August 1996 (FWS, 1996). On July 2, 2008, NNSA/NSO provided FWS with a Biological Assessment of anticipated activities on the NTS for the next 10 years and entered into formal consultation with FWS to obtain a new Opinion for the NTS. NNSA/NSO received the final Opinion on February 12, 2009. This Opinion covers the anticipated activities at the NTS for the next 10 years.

The Desert Tortoise Compliance task of EMAC implements the terms and conditions of the Opinion, documents compliance actions taken by NNSA/NSO, and assists NNSA/NSO in FWS consultations. The terms and conditions that were implemented by NSTec staff biologists in 2009 included (a) conducting clearance surveys at project sites within one day from the start of project construction, (b) ensuring that environmental monitors are on site during heavy equipment operation, (c) developing training modules and ensuring that all personnel working on the NTS are trained in the new requirements of the Opinion, and (d) preparing an annual compliance report for NNSA/NSO submittal to the FWS.

3.1 Project Surveys and Compliance Documentation

During 2009, biologists conducted biological and desert tortoise clearance surveys prior to ground-disturbing activities for 24 proposed projects within the range of the desert tortoise on the NTS (Table 3-1 and Figure 3-1). Most of these projects were in, or immediately adjacent to, roads, existing facilities, or other disturbances. Two active tortoise burrows were found during tortoise clearance surveys (Table 2-2). These tortoise burrows (Project No. 09-07) were flagged and avoided during project activities.

Two projects were initiated that disturbed previously undisturbed desert tortoise habitat. Project 09-13 disturbed 1.0 ha (2.47 ac) of desert tortoise habitat (Table 3-1). This project is located south of Port Gaston in Area 26. Project 09-14 is anticipated to disturb approximately 2.27 ha (5.61 ac) of undisturbed habitat near the Device Assembly Facility (DAF) and west of the Mercury Highway in Area 6. This project is not yet complete, so the final total area surveyed and disturbed will be included in the 2010 report. NSTec Ecological Services ensured that onsite construction monitoring was conducted by a designated environmental monitor at all sites where desert tortoise clearance surveys were performed.

Post-activity surveys to quantify the acreage of tortoise habitat actually disturbed were conducted for five projects during this reporting period (Table 3-1). Post-activity surveys were not conducted if the projects were located within previously disturbed areas or if the environmental monitor documented that the project stayed within its proposed boundaries. In 2009, a total of 1.00 ha (2.47 ac) of tortoise habitat was disturbed although one project (9-14) is still ongoing (Table 3-1). It was anticipated that 2.27 ha (5.61 ac) would be disturbed by this project. The actual disturbed area will be included in the 2010 total.

Table 3-1. Summary of tortoise compliance activities conducted by NSTec biologists during 2009

Project Number	Project	Compliance Activities 100% Coverage Clearance Survey	Tortoise Habitat Disturbed ha (ac)
09-01	Sewer line repair	Yes*	0 (0)
09-02	Roadside mowing	Yes*	0 (0)
09-03	Fire Station #1	Yes*	0 (0)
09-04	Office of Surface Transportation	Yes, post-activity survey completed	0 (0)
09-05	Army Well waterline	Yes*	0 (0)
09-06	CAU 166, CAS 05-19-02	Yes, post-activity survey completed	0 (0)
09-07	Project 300	Yes*	0 (0)
09-09	DAF roadside grading	Yes*	0 (0)
09-10	CP 160 roadside grading	Yes*	0 (0)
09-11	Bevatron Trailer drop area	Yes, post-activity survey completed	0 (0)
09-13	Port Gaston pad clearing	Yes, post-activity survey completed	1.0 (2.47)
09-14	DAF trailer placements	Yes, project still active	TBD
09-15	Office of Surface Transportation	Yes, post-activity survey completed	0 (0)
09-16	Cane Spring roadside blading	Yes*	0 (0)
09-18	CAU 562	Yes*	0 (0)
09-19	Burma Road Security Exercise	Yes*	0 (0)
09-21	Dave aisle	Yes*	0 (0)
09-23	Saddle Mountain road grading	Yes*	0 (0)
09-24	WSI training range	Yes*	0 (0)
09-25	CAU 557, CAS 06-99-10	Yes*	0 (0)
09-27	Port Gaston new pad	Not yet started	TBD
09-28	Tippipah Highway roadside blading	Yes*	0 (0)
09-29	CAU 560, CAS 06-59-05	Yes*	0 (0)
09-30	Mercury Highway roadside blading	Yes*	0 (0)
		Total	**1.00 (2.47)**

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

TBD = to be determined

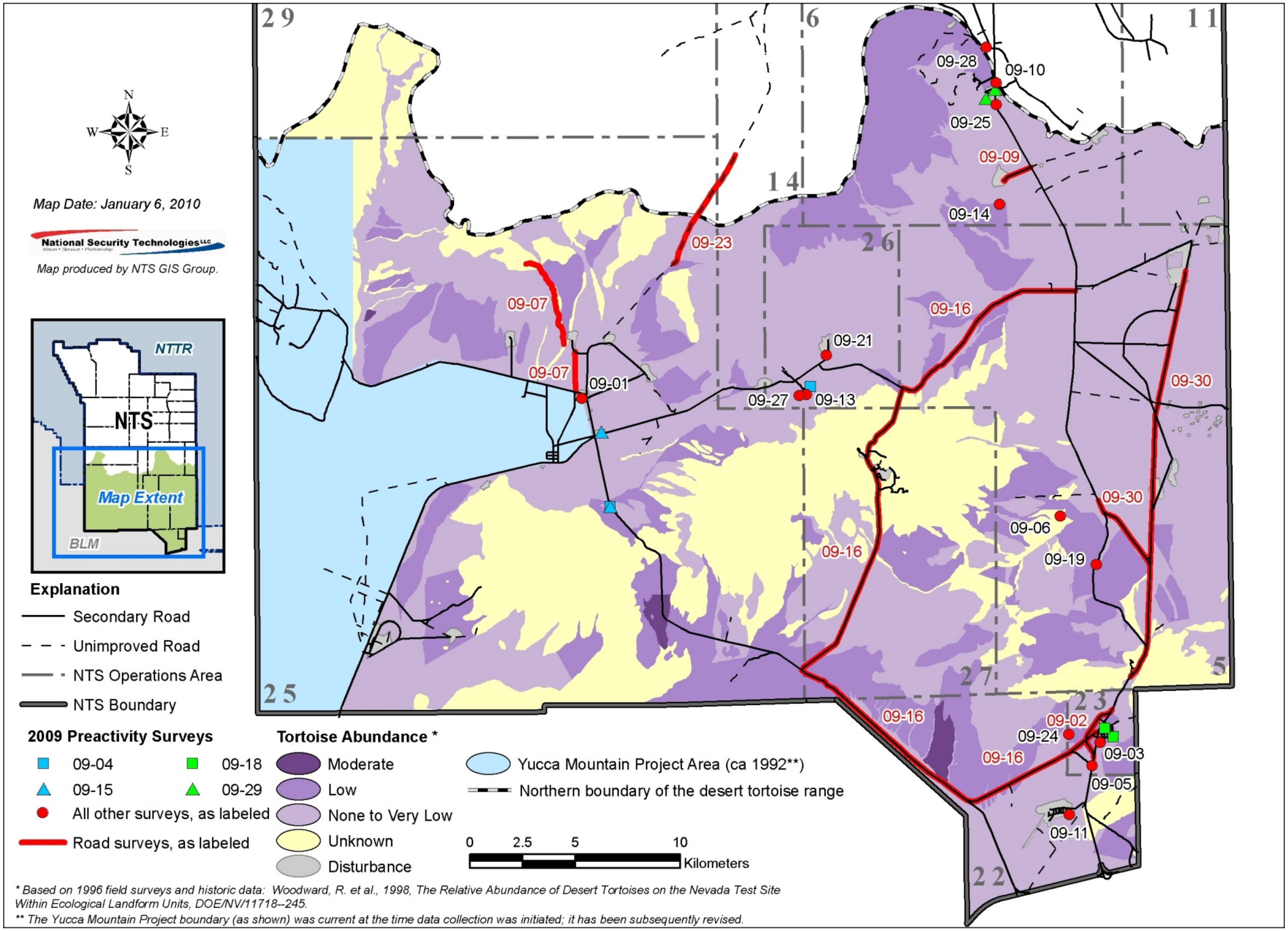

Figure 3-1. Biological surveys conducted in desert tortoise habitat on the NTS during 2009

In January 2009, NSTec submitted to NNSA/NSO the annual Opinion report that summarized tortoise compliance activities conducted on the NTS from January 1 through December 31, 2008. 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 NTS; and (d) a summary of construction mitigation and monitoring efforts.

Compliance with the Opinion ensures that the desert tortoise is protected on the NTS 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 NTS and the cumulative acreage of tortoise habitat disturbed on the NTS are parameters to 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, nor were any captured or displaced from project sites. One desert tortoise was killed by a vehicle along the 05-05 Road in Area 5 in 2009. Five tortoises were removed from roads to avoid being killed or injured and are reported in the "Other" column of Table 3-2.

Table 3-2. Parameters and threshold values for desert tortoise monitoring on the NTS

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	2.47 (500)	0 (1)	0 (10)
Infrastructure Development	0 (100)	0 (1)	0 (10)
Roads	0 (0)	1 (15)	5 (125)
Totals	**8.08 (2,710)**	**1 (22)**	**5 (194)**

*Estimated area, project is not yet completed.

3.2 Mitigation for Loss of Tortoise Habitat

Mitigation for the loss of tortoise habitat is required under the terms and conditions of the Opinion. The Opinion requires NNSA/NSO to perform either of two mitigation options: (a) pre-pay funds into the Desert Tortoise Mitigation Funds administered by Clark County (current 2009 rate is $1,862.38 per each ha [$754 for each ac] of habitat disturbed), or (b) prepay mitigation funds at the current rate, then revegetate disturbed habitat following specified criteria; once the revegetation is successful, the money paid for mitigation will be refunded. Two projects, 09-13 and 09-14, disturbed land in 2009. A total of $6,092.32 was paid into the Desert Tortoise Mitigation Fund to mitigate the 8.08 ac of land disturbed in 2009.

3.3 Coordination with Other Biologists and Wildlife Agencies

Three 8.5-ha (21-ac) circular enclosures in Rock Valley were constructed during 1962–1963 to study the effects of chronic, low-level ionizing radiation on the desert flora and fauna. Over the past decades, at least 24 tortoises have been found, individually marked, and periodically measured within these enclosures. In 2002, there were approximately 18 adult tortoises remaining in the enclosures; however, in 2003, Phil Medica of the U.S. Geological Survey (USGS) Las Vegas Office, NSTec biologists, and a team of volunteer biologists found the remains of seven tortoises of known age. Two additional desert tortoises within the enclosures were lost in 2004 presumably to mountain lion (*Puma concolor*) predation. These plots were revisited in the fall of 2009 with Phil Medica to observe desert tortoises in the fenced plots. No desert tortoises were found above ground this past year. Areas around the enclosures were searched, but no carcasses were observed. Two tortoises are still not accounted for in the enclosures.

During February 20–22, 2009, NSTec biologists attended the Desert Tortoise Council's 34th annual meeting and symposium. This meeting was held in Mesquite, Nevada, and included numerous presentations on desert tortoise biology, ecology, and recovery efforts.

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4.0 ECOSYSTEM MAPPING/DATA MANAGEMENT

Ecological Services began comprehensive mapping of plant communities and wildlife habitat on the NTS in fiscal year (FY) 1996. Data were collected describing selected biotic and abiotic habitat features within field mapping units called Ecological Landform Units (ELUs). ELUs are landforms (Peterson, 1981) with similar vegetation, soil types, slope, and hydrology. Boundaries of the ELUs were defined using aerial photographs, satellite imagery, and field confirmation. ELUs are considered by NTS 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 NTS were published and distributed (Ostler et al., 2000; Wills and Ostler, 2001). Ten vegetation alliances and 20 associations occur on the NTS.

Periodically, efforts are made to update and collect new habitat data when possible. Efforts generally focus on the following tasks in support of ecosystem mapping and data management of all NTS geospatial ecological data:

- **ELU sampling and photography –** No ecosystem mapping, sampling, or photography of ELUs was conducted in 2009 because of drought conditions and the poor growth of vegetation.
- **Wildland fire fuels surveys –** A vegetation survey was conducted in the spring to determine wildland fire hazards due to woody and fine fuels.
- **Evaluation of woody plant plots –** A total of 19 sagebrush woody plant plots were sampled in 2009 to document canopy cover, density, and composition during a droughty year.
- **Offsite Coordination –** Coordination was made with ecosystem management agencies and scientists.

4.1 No Resampling or Photography of ELUs in 2009

Because of below-average precipitation during the early part of 2009, much of the herbaceous vegetation failed to grow, and growth of perennial shrubs and trees was poor. Because of these conditions, no photographs of previously established ELUs were taken in 2009 nor were any ELUs resampled or remapped.

4.2 Vegetation Survey for Determining Wildland Fire Hazards

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

There has been an average of 11.8 wildland fires per year on the NTS since 1978 with an average of about 81.6 ha (201.6 ac) burned per fire (Table 4-1). These wildland fires do not occur randomly across the NTS, but occur more often in particular vegetation types that have sufficient fuels (woody and fine-textured fuels) that are conducive to ignition and spread of wildland fires.

Once a site burns, it is much more likely to burn again because of the invasive annual plants that quickly colonize these areas (Brooks and Lusk, 2008).

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

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
32-Year Total	**376.0**	**30,813.9**	**76,143.0**
Average Per Year	**11.8**	**962.9**	**2,379.5**
Average Per Fire		**81.6**	**201.6**

Source: Hansen, 2009

There were 17 wildland fires during 2009. Most of the fires were located in Cat Canyon in Area 30 of the NTS. Approximately 82% of these fires (212 ac [85.7 ha]) were caused by ordnance and associated with training exercises. Approximately 18% of the fires were caused by lightning; the largest fire (23 ac [9.3 ha]) was located in Area 16 (Hansen, 2009).

Beginning in 2004, and in response to DOE O 450.1A, surveys were initiated on the NTS to identify wildland fire hazards. Vegetation surveys were conducted in April and May at 211 sites located along and adjacent to major NTS 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.

4.2.1 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 NTS). Details of the methodology used to conduct the spring survey for assessing wildland fire hazards on the NTS 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 severity to indicate the hazards at various locations across the NTS.

4.2.2 Survey Results

Climate – There are 17 rain gauges on the NTS (Hansen and Ostler, 2004) that are used to measure precipitation. Precipitation during the months of January, February, March, and April is most correlated with production of vegetation that produces fine fuels and contributes to woody fuels. The total accumulated precipitation during this period was observed to be correlated with fine fuels biomass production during this winter/spring period as reported by Hansen and Ostler (2004). During 2009 the average precipitation of all 17 rain gauge stations on the NTS during January–April was 5.64 centimeters (cm) (2.22 inches [in.]), or about 61% of the average precipitation for this period (Table 4-2).

Invasives – The three most commonly observed invasive annual plants to colonize burned areas on the NTS are *Schismus arabicus* (Arabian schismus), found at low elevations; *B. rubens* (red brome), found at lower to moderate elevations; and *Bromus tectorum* (cheatgrass), found at middle to high elevations (Table 4-2). Colonization by invasive species increases the likelihood of future wildland fires because they provide abundant fine fuels that are more closely spaced than native vegetation. *Coleogyne ramosissima* (blackbrush) vegetation types appear to be the most vulnerable plant communities to fire, followed by pinyon-juniper/sagebrush vegetation types. Wildland fires are costly to control and to mitigate once they occur. Revegetation of severely burned areas is very slow without reseeding or transplanting with native species and other rehabilitation efforts. Untreated areas become much more vulnerable to future fires once invasive species, rather than native species, colonize a burned area. Because of the low amount of winter precipitation during 2009, fine fuels produced by invasive, introduced annual species and native species were low at the 106 sampling sites.

Table 4-2. 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**
	cm (in.)					
Precipitation* (January–April)	9.70 (3.82)	16.36 (6.44)	10.06 (3.96)	2.62 (1.03)	5.26 (2.07)	5.64 (2.22)
Invasive Introduced Species	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
	percent presence					
Bromus rubens (red brome)	51.7	64.4	67.8	0	63.0	63.2
Bromus tectorum (cheatgrass)	40.3	54.0	60.7	0	59.2	66.0
Erodium cicutarium (redstem stork's bill)	5.2	6.2	24.6	0	21.3	27.4
Schismus arabicus (Arabian schismus)	4.7	2.8	5.2	0	11.4	9.4
Native Species	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
	percent presence					
Amsinkia tessellata (bristly fiddleneck)	34.0	62.0	16.1	0	63.0	48.1
Mentzelia albicaulis (whitestem blazingstar)	49.8	8.1	0	0	2.4	18.9
Chaenactis fremontii (pincushion flower)	27.0	8.0	0	0	1.4	11.3

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

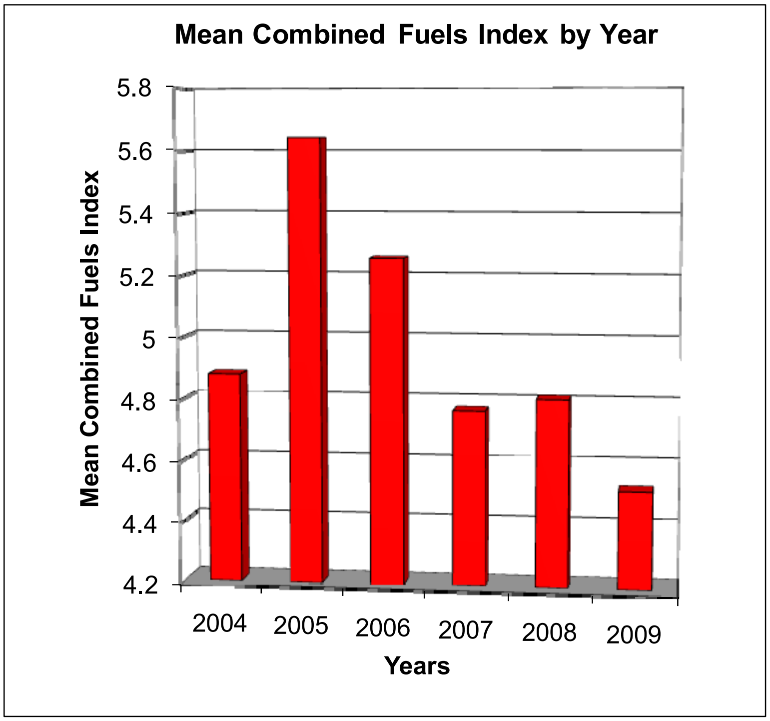
Fuels – In the past five years (2004–2008), 211 survey stations were photographed and inspected for abundance and condition of wildland fire fuels. In 2009 the field methodology was changed. The number of field sites visited during the year was reduced from 211 to 106 (using every other sampling station) in order to expedite field sampling and provide biologists more time to conduct other needed field activities. Additionally, changes were made in the level of detail recorded at each survey station. The number of dominant plant species recorded that contribute to fine fuels was increased from 3 to 10 species. Increasing the number of dominant species recorded will permit a more accurate projection of trends in the vegetation to be made (e.g., increases or decreases of less dominant species will now be detected earlier). It is believed that this reduced number of survey stations still adequately samples the response of vegetation to the precipitation received over the NTS, while increasing the efficiency and level of information collected as part of the fieldwork.

Because of the decreased precipitation in January, March, and April of 2009, there were low amounts of new fine fuels. February had higher than normal precipitation in 2009, but it apparently was not effective in producing new fine fuels. Fine fuels observed in 2009 represent little or no residual fine fuels from previous years. There was a slight decrease in woody fuels, as many old branches of shrubs and trees died and dried out in response to the low precipitation that occurred during the winter and spring months. The average combined index values (fine fuels plus woody fuels) for 2009 corresponds to the potential for fuels on the NTS to support wildland fires once fuels are ignited. The higher the index, the greater the potential for wildland fires to spread. The NTS average combined index value for fine fuels and woody fuels for 2009 was 4.52 compared to 4.81 in 2008, 4.77 in 2007, 5.26 in 2006, 5.64 in 2005 (a wet year), and 4.88 in 2004 (an average or normal precipitation year) (Hansen et al., 2008). Figure 4-1 shows a comparison in trends of mean precipitation and mean combined fuel index values. The continuing drought since 2007 has significantly reduced fine fuels and to a lesser extent woody fuels, and contributed to low moisture content in the fuels.

The location of the 106 survey stations on the NTS inspected during 2009, showing average fine fuels, woody fuels, and combined fuels index values by NTS operational area, are shown in Figures 4-2, 4-3, and 4-4, respectively. Highest index values occurred in Fortymile Canyon, Pahute Mesa, and at moderate elevations and slopes around Yucca Flat.

Photographs were taken for all 106 sites during the past six years and can be compared for visual changes in site conditions. For example, Figure 4-5 shows photographs of Site 99 in Yucca Flat for the last four years. As in past years, sites with blackbrush and annual grasses appeared to respond to higher precipitation, resulting in increases in fine fuels and increases in woody fuels more than sites in the Mojave Desert (southern one-third of the NTS) and the Great Basin Desert (northern one-third of the NTS).

Fine fuels in 2009 were well cured in most areas of the NTS. Shrubs and trees were relatively dry as they were in 2007 and 2008. The hazards of fuels contributing to wildland fires appeared to be lower than average and dependent on incidence of lightning and high winds and ordnance training-related activities. The rapid response by NTS Fire and Rescue after fires were ignited was a key factor in minimizing wildland fire spread and severity in 2009.



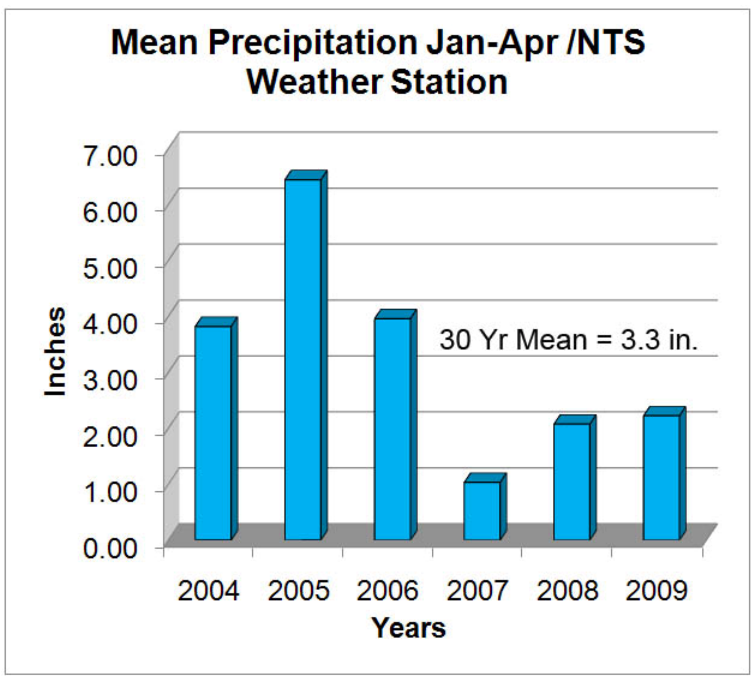


Figure 4-1. Mean combined fuels index (top) and percent of average precipitation for January through April (bottom) for the years 2004 to 2009

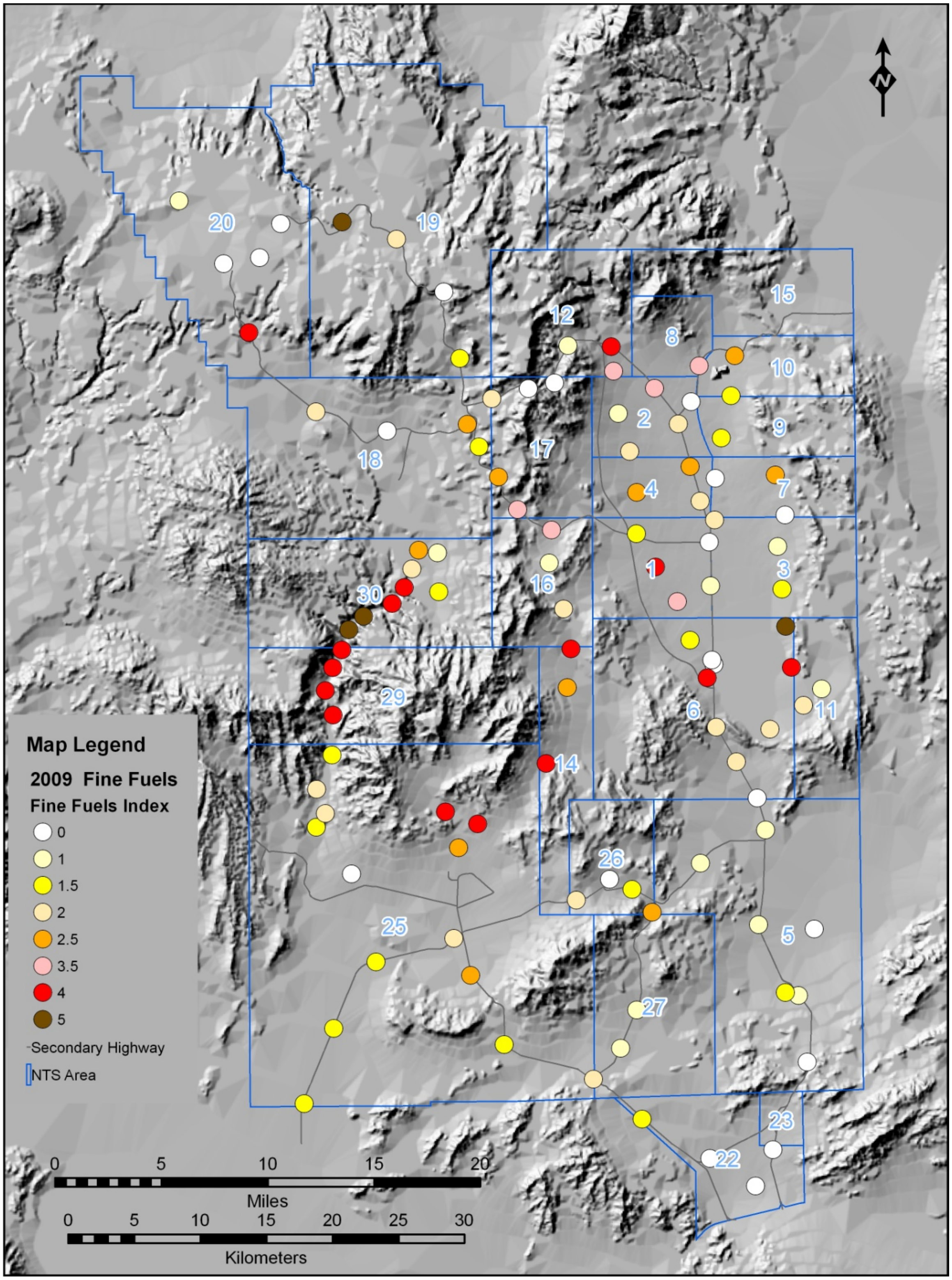


Figure 4-2. Index of fine fuels for 106 survey stations on the NTS during 2009

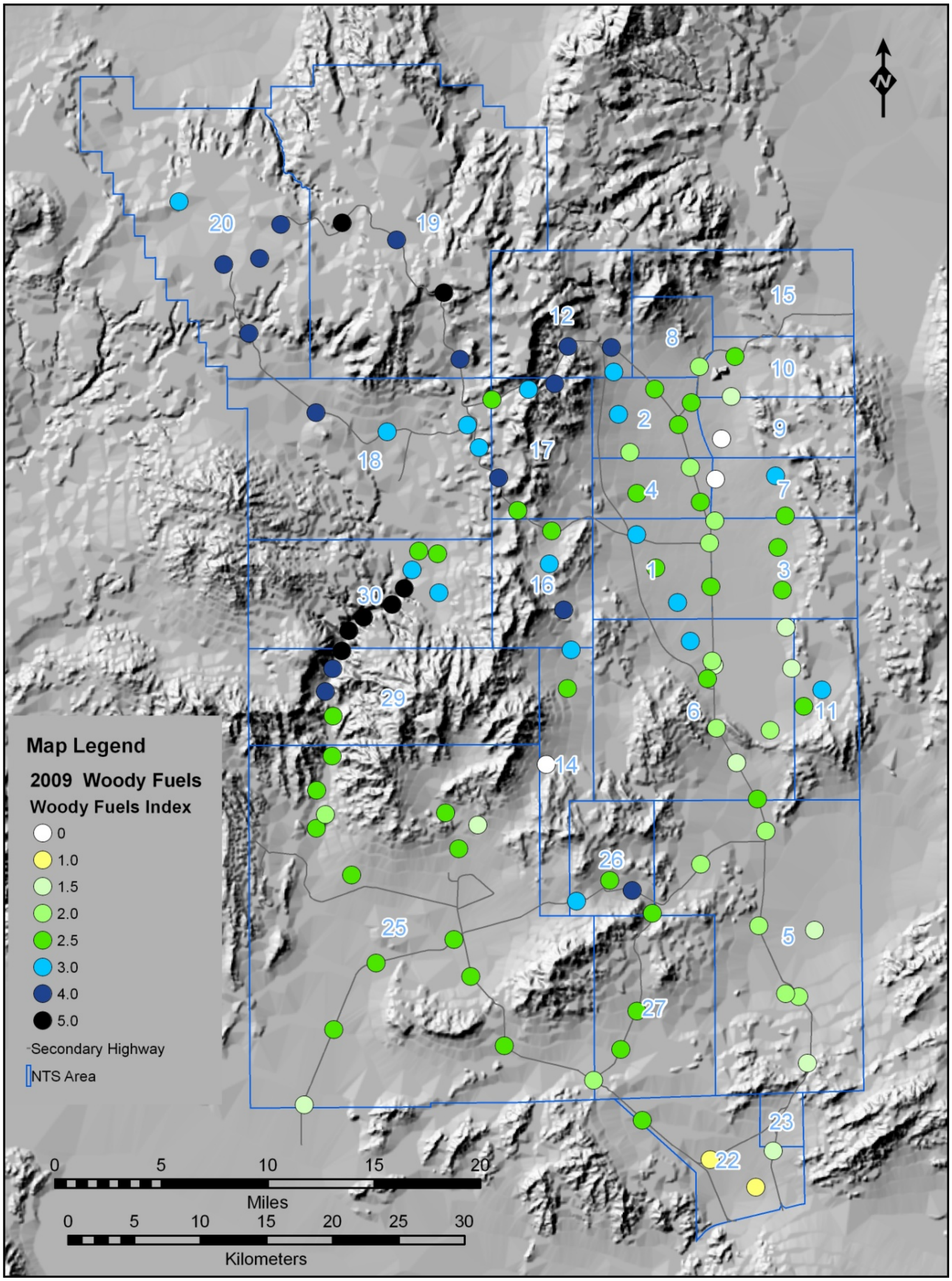


Figure 4-3. Index of woody fuels for 106 survey stations on the NTS during 2009

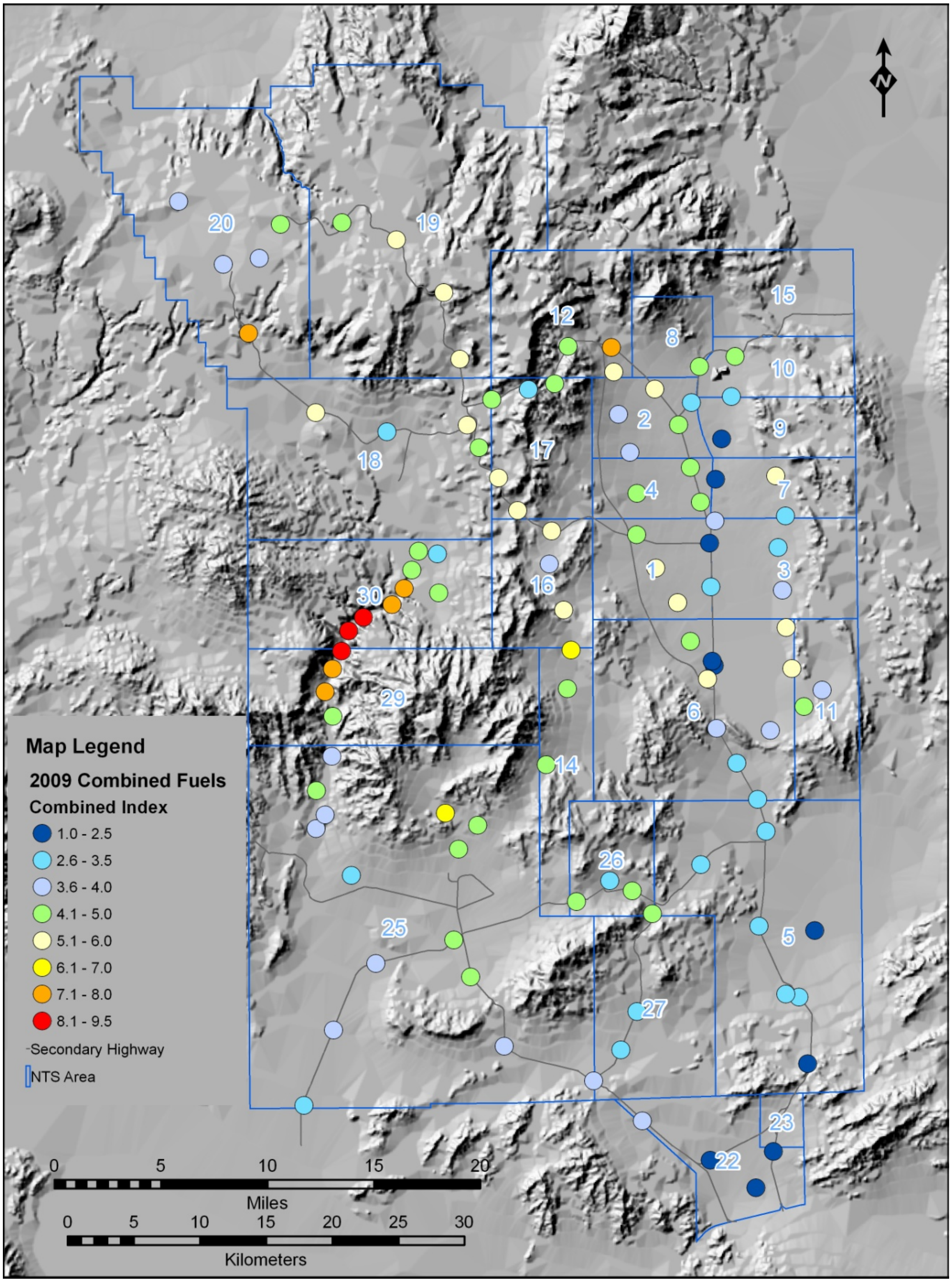


Figure 4-4. **Index of combined fine fuels and woody fuels for 106 survey stations on the NTS during 2009**

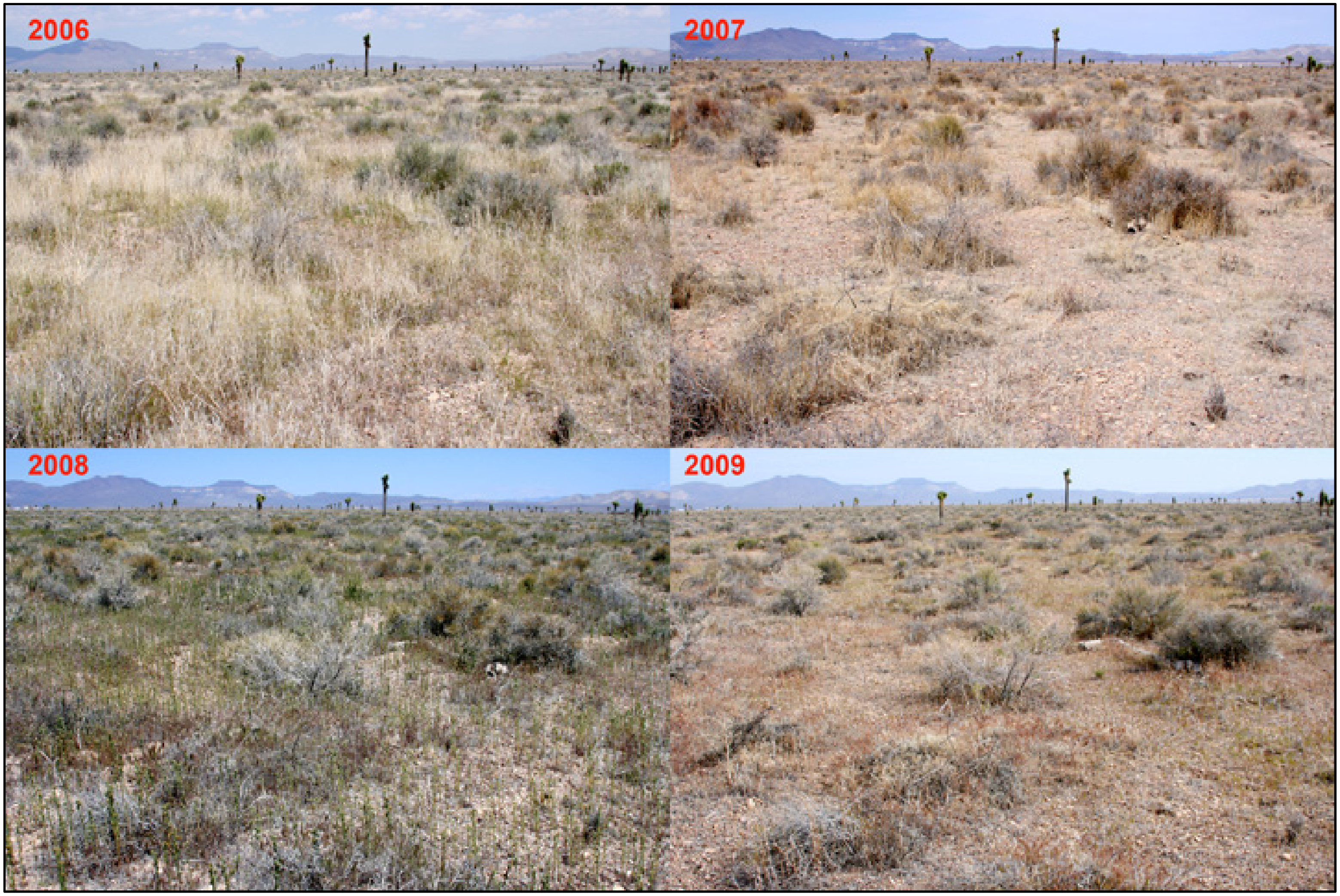


Figure 4-5. Site 99 on the West Side of Yucca Flat in 2006–2009
(Photos by W. K. Ostler, May 4, 2006 [top left]; April 19, 2007 [top right]; April 10, 2008 [bottom left]; and April 30, 2009 [bottom right])

4.3 Woody Plant Plots

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

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

In 2009, the black sagebrush and big sagebrush plots were sampled to determine cover and density during a year of drought. The pinyon/black sagebrush and pinyon/big sagebrush sites were not sampled in 2009, due to other monitoring priorities, but it is anticipated that they will be surveyed in 2010. Results of the surveys in 2009 and 2010 will be presented in future EMAC reports when data from all vegetation types have been collected.

4.4 Coordination with Scientists and Ecosystem Management Agencies

NSTec biologists interfaced with other scientists and ecosystem management agencies in 2009 for the following activities:

- Attended the Ash Meadows National Wildlife Refuge Symposium in Pahrump, Nevada.
- Participated in several meetings of the Mojave Desert Initiative designed to address research needs in the areas of wildfires and reclamation of Mojave Desert lands.

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5.0 SENSITIVE PLANT MONITORING

Under the NTS sensitive plant monitoring program, the status or ranking of sensitive plants known to occur on the NTS 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 the current growing season. Sensitive plant populations on the NTS are also routinely monitored to assess plant density, plant vigor, or identify any threats or impacts to the species. In 2009 new populations of five sensitive plant species were observed on the NTS. Two of these were part of the long-term monitoring efforts, and three were observed during other surveys or activities.

5.1 List of Sensitive Plant Species for the NTS

There were no modifications this year to the list of sensitive plants known to occur on the NTS. Field surveys conducted this year did not produce information that would suggest any changes. The annual Rare Plant Workshop, sponsored by NNHP and the NNPS, was not held this year, so there were no recommendations from that group.

5.2 Long-term Monitoring

Monitoring has been planned for the last several years for *Cymopterus ripleyi* var. *saniculoides* and *Galium hilendiae* ssp. *kingstonense*, but growing conditions have been poor and very few if any plants of either species have been found. This year both species were abundant in spite of the below average growing season precipitation (National Oceanic and Atmospheric Administration/Air Resources Laboratory, Special Operations and Research Division [NOAA ARL/SORD], 2010). Precipitation from September 2008 to June 2009 was 12.7 cm (5.0 in.), 80% of the 16.0 cm (6.3 in.) typically received during this period. Of the 12.7 cm (5.0 in.), 75% was received during winter months from November 2008 to February 2009. From March 2009 to June 2009 scattered light rains amounted to a little over a 1.3 cm (0.5 in.). This pattern of precipitation resulted in a mixed response from the vegetation. *C. ripleyi* var. *saniculoides* and *G. hilendiae* var. *kingstonense* were abundant; however, annual *Phacelias* were near absent from the spring flora. Other sensitive species were not as abundant as they have been in previous years.

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

Field surveys for *C. ripleyi* var. *saniculoides* have been scheduled for the last five years to obtain sufficient information to resolve an issue dealing with its taxonomy. However, because of the poor growing conditions, either no plants were found at historic locations of *C. ripleyi* var. *saniculoides*, or the number of plants found was so low that an adequate assessment could not be made.

Preliminary field surveys in April 2009 indicated an abundance of plants at several locations. Field surveys began April 12 and continued through the first week of May at locations in Yucca Flat, Rock Valley, Pink Holes, Horse Wash (west of the Sugar Loaves), Rattlesnake Ridge, and Stockade Wash. The primary objective of the surveys was to first verify the authenticity of two varieties of *C. ripleyi* on the NTS and, if indeed there were two distinct varieties, then accurately delineate their distribution on the NTS.

The taxonomy of *C. ripleyi* var. *saniculoides* has been under scrutiny for several years. The variety was named by R. C. Barneby in 1941 (Barneby, 1941) based on flower color, a dark-purple, as opposed to a cream-colored flower of *C. ripleyi* var. *ripleyi* (Figure 5-1). Geographic location was also a defining characteristic for the two species. *C. ripleyi* var. *saniculoides* was reported from lower elevations and *C. ripleyi* var. *ripleyi* from higher elevations. Beatley (1976) thought these characteristics to be "ill-defined" and attributed any differences between varieties to elevation and/or latitude. Neither *The Jepson*

Manual: Higher Plants of California (Hickman, 1993) nor the U.S. Department of Agriculture (USDA) PLANTS database (USDA, 2010) include varieties of *C. ripleyi*.

Figure 5-1. *C. ripleyi* var. *ripleyi* (top) with cream-colored flowers from Horse Wash and *C. ripleyi* var. *saniculoides* (bottom) with distinctive dark purple flowers from Camera Butte
(Photographs by D. C. Anderson, 2009)

A statement in Blomquist et al. (1995) suggesting "that plants of both varieties were found at the same location" is in part the basis for the taxonomic confusion. This statement supports the clinal relationship suggested by Beatley and the "not a valid taxon" declaration by plant taxonomists. To further clarify this issue, two major tasks were undertaken this year. First, the field notes kept during the 1992 to 1994 surveys were reviewed to ascertain where both varieties had been found together on the NTS. Second, those areas, as well as other reported locations for both varieties, then became the focus of field surveys.

For almost all of the locations of *C. ripleyi* encountered during the 1992–1994 surveys, the flower color was recorded. Field notes for observations made at Rattlesnake Ridge (1,890 meter [m] or 6,200 foot [ft] elevation), Stockade Wash (1,737 m or 5,700 ft elevation), and Horse Wash (also recorded as west of the Sugar Loaves at 1,707 m or 5,600 ft elevation) included "cream colored flowers." Notes for observations at Pink Holes (975 m or 3,200 ft elevation), at several locations in Yucca Flat (1,219–1,280 m or 4,000–4,200 ft elevation), at Camera Butte (1,311 m or 4,300 ft elevation), and along Papoose Lake Road (1,463 m or 4,800 ft elevation) included "purple flowers." There was one exception of an observation at a single location along the 4-04 Road in Yucca Flat. The field notes included the statement, "50% flowering in sandy wash approx. 20 plants most flowers dark purple some light colored." This is the only documented location where both varieties were found together during the 1992–1994 field surveys (Blomquist et al., 1995).

Surveys in 2009 focused on these same locations. Between 25 and 40 plants were observed at Horse Wash, 30 to 50 plants on the west slope of Rattlesnake Ridge, and another 30 to 50 plants at the west end of Stockade Wash. All flowers were cream colored. There were no purple-colored flowers at any of these locations as was the case reported from the 1992–1994 surveys.

At the lower elevations, over 100 plants of *C. ripleyi* were encountered at several locations in Yucca Flat, a few dozen east of the Pink Holes, over 100 plants in Rock Valley, another 150+ plants north of Camera Butte (west of Paiute Ridge), and a few plants along Papoose Lake Road (north of the Slanted Buttes). The location found in 1993 where there was a mix of "dark purple" and "light colored" flowers was revisited in 2009. There were 26 plants observed this year; like all other lower elevation locations, all had dark purple flowers.

There have been additional reports of light colored flowers at a few other lower elevations. One such plant was found this year in Yucca Flat along Orange Blossom Road (Figure 5-2). In 2008, there were two reports of the light colored flowers. One was south and west of Sedan Crater and the other in Scarp Canyon on the far eastern edge of the NTS. At the Sedan Crater site, a single plant was observed with light colored flowers. This site was surveyed intensely in 2009 where approximately 60 individuals of *C. ripleyi* var. *saniculoides* were found, but none had light colored flowers. In 2008, a single individual of *C. ripleyi* was found in the middle of the road in Scarp Canyon. The site was not surveyed in 2009 but will be in the near future.

Figure 5-2. Single individual plant of *C. ripleyi* var. *saniculoides* with cream-colored flowers along Orange Blossom Road on the eastern edge of Yucca Flat
(Photograph by W. K. Ostler, May 2009)

The habitat for the two varieties is equally different. Barneby reported that *C. ripleyi.*var. *ripleyi* occurred on "dunes or sandy flats," which is the habitat found at all of the higher elevation populations on the NTS. Plants appeared to be randomly distributed around the edges of trees (Figure 5-3, top), along sandy slopes, or in shrub interspaces, with no apparent affinity for washes or drainages.

The habitat for *C. ripleyi* var. *saniculoides* was described as "white ash deposits" (Barneby, 1941). Habitat at locations of *C. ripleyi* var. *saniculoides* in Yucca Flat, Rock Valley, Pink Holes, Camera Butte, and Papoose Lake Road were almost exclusively in drainage bottoms or within a few feet on either side of the drainage (Figure 5-3, bottom). Results of these analyses do not suggest a clinal relationship with these two varieties. If such a relationship existed, there should be a mix of flower colors along the elevational gradient sampled this year or at least at locations where the mixing had been observed previously. There appears to be a distinct elevational separation of the species. At locations from 975 to 1,463 m (3,200 to 4,800 ft) elevation, all flowers were purple, except the one plant near Orange Blossom Road. At elevations from 1,676 to 1,890 m (5,500 to 6,200 ft), all were cream-colored. There are a couple of populations reported along Gap Wash that bridge these two elevational-delineated groups, but no plants were found at these sites this year.

Figure 5-3. Top – Habitat of *C. ripleyi* var. *ripleyi* at Stockade Wash. Plants scattered among *Pinus monophylla* and *Artemisia tridentata*. Bottom – Typical habitat of *C. ripleyi* var. *saniculoides* along drainages. Vegetation includes *Larrea tridentata, Ambrosia dumosa, Coleogyne ramossisima, Lycium andersonii,* and *Hymenoclea salsola.*
(Photographs by D. C. Anderson, 2009)

Based on the review of previous field notes and the results of field surveys conducted this year, there is no evidence that both varieties are commonly or even occasionally found at the same location. There appears to be a clear definition of purple-colored flowers at lower elevations and cream-colored flowers at upper elevations, an observation made by Barneby some 70 years ago. In correspondence received from Dr. Barneby in 1993, he stated, "it is hardly worthwhile to continue recognizing two varieties." However, this statement was influenced by the report that "plants of both varieties were found at the same location" (Blomquist et al., 1995). After review of field notes, it was determined that at one location in Yucca Flat, in a population of about 20 plants, there were "some light colored" plants. In more recent surveys, three individuals were observed with light colored flowers. There have been no reports or observations of any purple-colored flowers at higher elevations where only cream-colored flowers were found.

Based on the lack of evidence that both varieties of C. *ripleyi* are occurring at the same location and the unique habitat preference for both varieties, *C. ripleyi* var. *saniculoides* will continue to be considered a valid taxon and will be monitored along with other sensitive plants known to occur on the NTS.

5.2.2 **Galium hilendiae *ssp.* kingstonense*, Kingston Mountain bedstraw***

The distribution of *G. hilendiae* ssp. *kingstonense* on the NTS was previously known from point locations at Oak Spring, Tub Spring, and around Tongue Wash on the eastern slope of Rainier Mesa (Figure 5-4). The only other known population of *G. hilendiae* ssp. *kingstonense* outside the NTS is in the Kingston Mountains in San Bernardino County, California, just south of Pahrump, Nevada. Because of its limited distribution, it is listed as threatened by the NNPS (see Table 2-1; NNPS, 2008).

Field surveys for *G. hilendiae* ssp. *kingstonense* were scheduled for the last several years; however, due to poor growing conditions, no plants were encountered during reconnaissance surveys. On June 1, 2009, a reconnaissance field survey was conducted in the Tub Spring area. Over 150 individuals were encountered with more than two-thirds of them at early seed set (Figure 5-5). Field surveys were conducted two days later in the Oak Spring and Oak Spring Butte area, west of Tub Spring. *G. hilendiae* ssp. *kingstonense* was found scattered on the steep slopes east of Oak Spring and south of Oak Spring Butte (Figure 5-6). In the sandy soils on top of the ridge north of these locations, several hundred individuals were found and mapped (Figure 5-4). Some plants were still in flower; however, most were in full seed set (Figure 5-5).

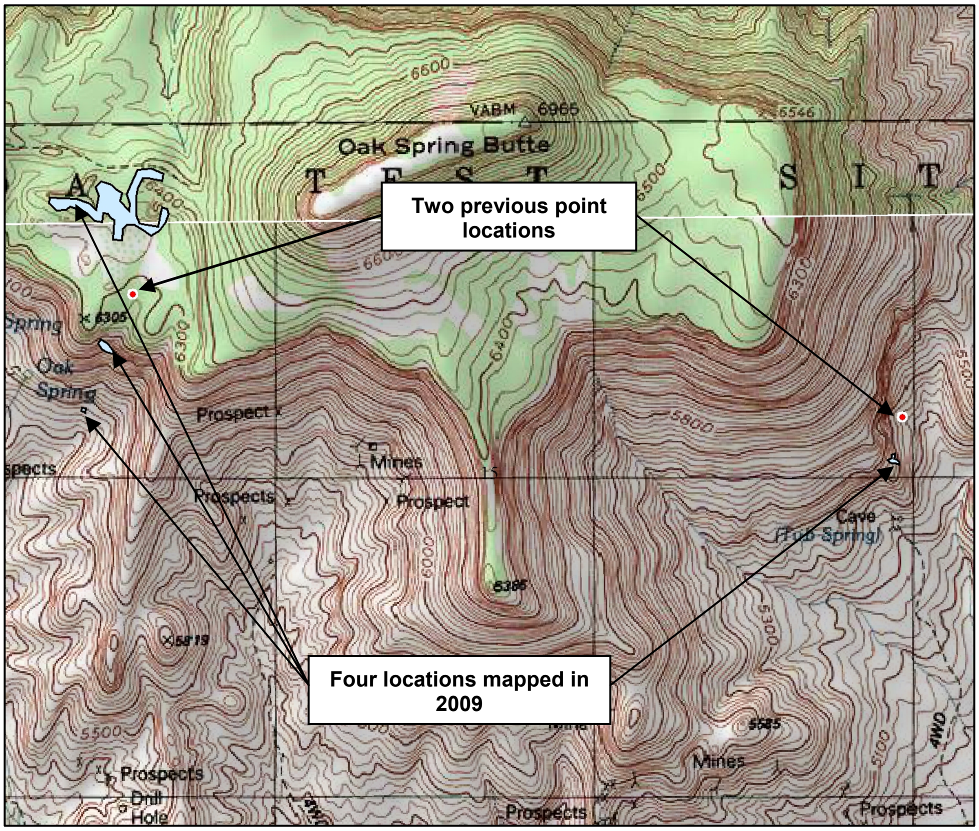

Figure 5-4. Previous locations reported for *G. hilendiae* ssp. *kingstonense* on the NTS and areas mapped in 2009

At Tub Spring, plants were found in the understory of *Pinus monophylla* and *Ephedra viridis* in light-colored tuff soils. On the slopes north and east of Oak Spring, plants were found at the base of large rocks (Figure 5-6) where small amounts of soil had accumulated. The population on top of the ridge west of Oak Spring Butte was in very sandy, tuffaceous soils. Plants were found primarily in the understory of *P. monophylla*.

The following day the area north of Tongue Wash on the east slope of Rainier Mesa was searched for *G. hilendiae* ssp. *kingstonense* with no success.

Figure 5-5. *G. hilendia* spp. *kingstonense* in full seed set at Oak Spring Butte site
(Photograph by D. C. Anderson, 2009)

Figure 5-6. Habitat of *G. hilendiae* ssp. *kingstonense* on slopes south of Oak Spring Butte and east and north of Oak Spring
(Photograph by D. C. Anderson, 2009)

5.3 Surveys and Observations of Other Sensitive Plant Species

New populations of three other sensitive species, *Astragalus oophorus* var. *clokeyi*, *Hulsea vestita* var. *inyoensis,* and *Penstemon fruticiformis* var. *amargosae*, were found in 2009. These species were not the focus of the long-term monitoring efforts for 2009 but were observed during other EMAC activities. Information was added to the sensitive plant species database.

5.3.1 **Astragalus oophorus *var.* clokeyi*, Clokey eggvetch***

The distribution of *A. oophorus* var. *clokeyi* on the NTS was thoroughly reviewed in 1997 (Anderson, 1998). Since then, known populations and new locations of the species on the NTS have been opportunistically encountered and recorded. Such was the case in 2009 when two previously unknown locations were identified. During the first week of June 2009, a small population of *A. oophorus* var. *clokeyi* was located in Tongue Wash. *A. oophorus* var. *clokeyi* is known to occur in this area, but further east near Captain Jack Spring. This location represents the first collection on the east face of Rainier Mesa.

The other location recorded for *A. oophorus* var. *clokeyi* was in Cat Canyon in Area 30. There are two known locations of the species in Cat Canyon. One is to the south of the Cat Canyon road and the other is to the north of Cat Canyon Road, west of the NTS boundary (Figure 5-7). No surveys for *A. oophorus* var. *clokeyi* have been conducted in this area since 1997. A one-day reconnaissance survey was conducted south of Cat Canyon Road on June 16, 2009. No plants were found where this species had been previously observed; however, over 40 individuals were found along the northwest facing slopes of a draw to the west of the known population. More than half of the individuals were in mature fruit, ten were in flower, and a few of the smaller plants scattered throughout the area had not flowered.

Cat Canyon and the east facing slopes of Rainier Mesa will be the focus of future surveys for this species (Figure 5-7).

5.3.2 **Hulsea vestita *var.* inyoensis*, Inyo hulsea***

No formal surveys were scheduled this year for *H. vestita* var. *inyoensis*. However, it was found during surveys for *G. hilendiae* ssp. *kingstonense* near Oak Spring Butte and Tongue Wash. A few dozen individuals were located at Oak Spring Butte and a couple of plants at Tongue Wash. The population at Oak Spring Butte had been reported before but never mapped. It was the first time it had been reported from Tongue Wash.

5.3.3 **Penstemon fruticiformis *var.* amargosae*, Death Valley Beardtongue***

There is a single known location of *P. fruticiflormis* var. *amargosae* on the western slopes of the Striped Hills along the southern boundary of the NTS. This population was surveyed in 2007 (Hansen et al., 2008) and over 70 individuals mapped. The next closest known population of *P. fruticiflormis* var. *amargosae* is in the Specter Range just south of the NTS boundary. This area was surveyed on May 4, 2009, where 12 individuals, most in full flower, were mapped. No other surveys were completed this year for this species.

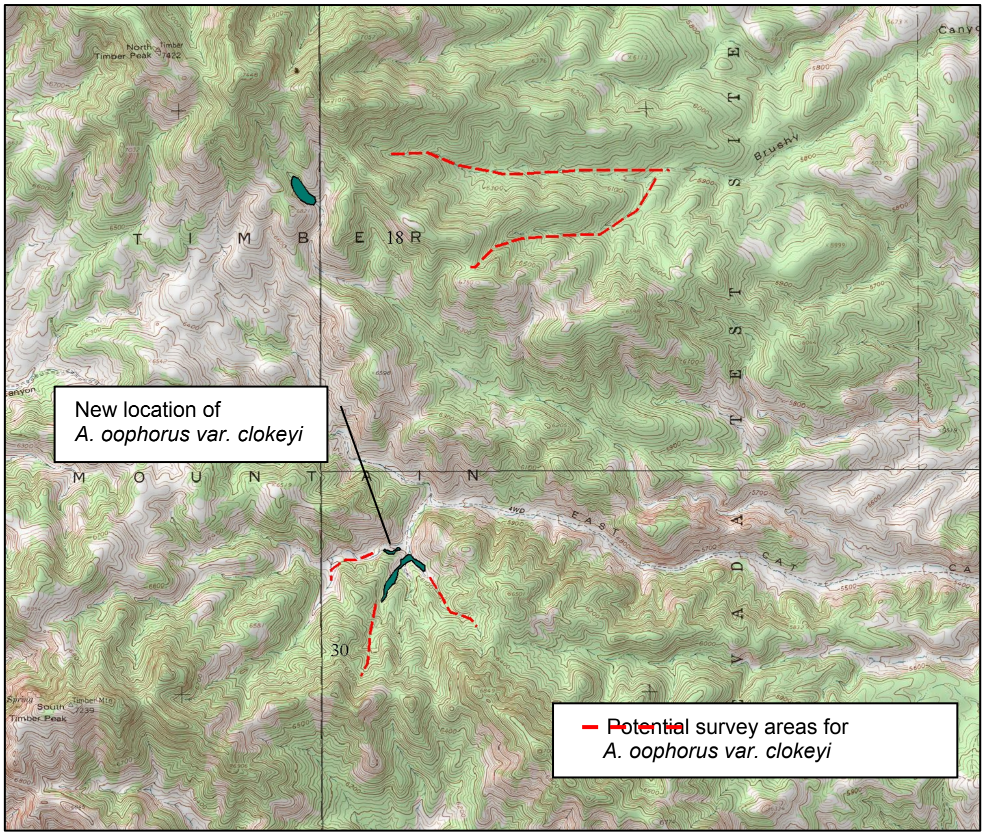

Figure 5-7. New location of *A. oophorus* var. *clokeyi* in the Cat Canyon area and locations of potential survey areas

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 NTS. No changes to the status of any NTS species were noted. However, Rocky Mountain Elk (*Cervus elaphus*) was added to the list after visual and photographic confirmation of this species' presence on the NTS was documented. 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 2009 focused on (1) western red-tailed skinks (*Eumeces gilberti rubricaudatus*), (2) small mammals including kangaroo mice (*Microdipodops* spp.), (3) bats, (4) wild horses (*Equus caballus*), (5) mule deer (*Odocoileus hemionus*), and (6) mountain lions (*Puma concolor*). Information about other noteworthy wildlife observations, bird mortalities, and a summary of nuisance animals and their control on the NTS 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 NTS. 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 NTS began in 2006 and were continued in 2009.

Figure 6-1. Western red-tailed skink (*Eumeces gilberti rubricaudatus*)
(Photo by D. B. Hall, June 5, 2008)

While the main focus of these surveys is to determine distribution and abundance of western red-tailed skinks, secondary objectives during 2009 included determining which trap type is best, evaluating season-long western red-tailed skink captures, documenting captures of other species including the Great Basin skink (*Eumeces skiltonianus utahensis*), and genetic testing of western red-tailed and Great Basin skinks.

6.1.1 Western Red-Tailed Skink Distribution and Abundance

Western red-tailed skinks were sampled systematically using a 5-kilometer (km) × 5 km (3.1-mile [mi] × 3.1 mi) grid overlay on the NTS. The beginning point was approximately 8 km (5 mi) northwest of the northwest corner of the NTS to ensure that the grid encompassed the entire NTS (Figure 6-2). Each grid cell was assigned an alphanumeric label (A1 to M17). Cells to be sampled were selected based on data gaps and logistics such as travel time and access. Within each grid cell, one or two sampling sites were selected based on habitat features (i.e., 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). 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.

Ten captures of eight western red-tailed skinks were documented over 5,746 trap days (0.2% or 1 skink/575 trap days) at 6 of 31 sites (Table 6-1; Figure 6-2). At Sites #112 and #117, two skinks were captured. At Sites #110 (Tub Spring) and #112 (John's Spring) skinks were recaptured within 1 to 7 m (3 to 23 ft) of their original trapping location. These were the first western red-tailed skink recaptures documented during this study, and both sites were located at springs.

6.1.2 Comparative Trap Design Study

At 11 sites (Table 6-1), two types of traps were used to determine if trap design affected trap success. Both were rectangular traps. One was a rectangular box-like funnel trap with metal frame (Figure 6-3), and one was made from wire-mesh with no supporting frame (Figure 6-4). Similar wire-mesh traps were used in a comparative study last year, but in 2009 wire-mesh traps were modified to more closely resemble the box-like funnel traps. Fifteen traps of each type were set for the same number of trap days in order to establish a comparative study. Percent trap success (number of reptiles captured/number of trap days × 100) was calculated and analyzed using a paired t-test to see which trap type was more effective.

Trap success was significantly higher ($t=3.8$, $p=0.004$) in the box-like funnel traps with metal frame (11.0%, 109 captures/990 trap days) than in the wire-mesh traps (4.2%, 42 captures/990 trap days). The advantages of the wire-mesh traps are that they are cheaper to make and lighter than the box-like traps, so fewer trips are required to set them at sites long distances from roads. The disadvantage is that they are less effective than the box-like traps at capturing reptiles.

6.1.3 Seasonal Activity and Recapture Study

A study was conducted at Site #87 where four western red-tailed skinks were captured in 2008. The objective of this study was to estimate their distribution and movements over several weeks. In addition, a data logger was set up to record temperature and relative humidity to determine if these variables affected skink activity.

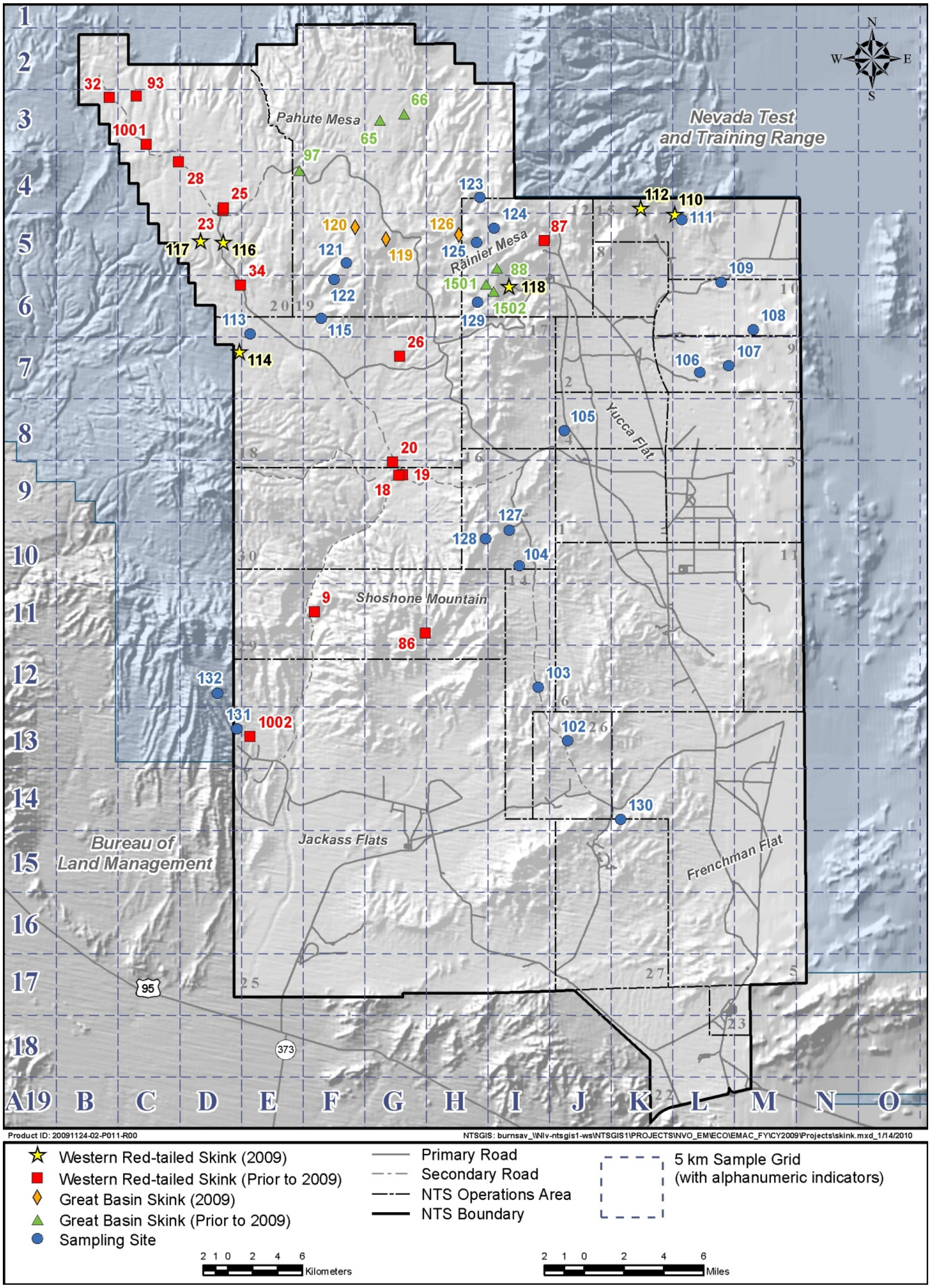

Figure 6-2. Western red-tailed and Great Basin skink capture sites on the NTS showing all known locations of skinks, a 5 km sample grid, and sites sampled in 2009

Table 6-1. Number of skink and other reptile captures by NTS area, site, and survey period
(P = species observed but not captured; [a] = Site where trap types were compared)

				Lizards											Snakes								
Site Number	NTS Area	Dates in 2009	Trap Days	*Cnemidophorus tigris*	*Coleonyx variegatus*	*Crotaphytus bicinctores*	*Eumeces gilberti*	*Eumeces skiltonianus*	*Gambelia wislizenii*	*Phrynosoma platyrhinos*	*Sceloporus graciosus*	*Sceloporus magister*	*Sceloporus occidentalis*	*Uta stansburiana*	*Crotalus mitchellii*	*Hypsiglena torquata*	*Lampropeltis getula*	*Masticophis flagellum*	*Masticophis taeniatus*	*Pituophis catenifer*	*Salvadora hexalepis*	Total	Percent Trap Success
102[a]	26	5/4-5/7; 5/11-5/14	188	1		P						18		11								30	16.0
103	14	5/4-5/7; 5/11-5/14	180	5		6			P			18		7	1		1	3				41	22.8
104	16	5/4-5/7; 5/11-5/14	180	5								16		7	1				2			31	17.2
105[a]	4	5/4-5/7; 5/11-5/14	180	9		3						9										21	11.7
106	9	5/18-5/21; 5/26-5/29	180	6	5	1			P	P		27		11								50	27.8
107[a]	9	5/18-5/21; 5/26-5/29	185	7		7								8								22	11.9
108	10	5/18-5/21; 5/26-5/29	180	1		1						1		2								5	2.8
109[a]	10	5/18-5/21; 5/26-5/29	180	7	1	P						14		3						2		27	15.0
110	15	6/1-6/4; 6/8-6/11	180	1			2					6	1	6					1	2		19	10.6
111[a]	15	6/1-6/4; 6/8-6/11	180	P	1								1	1					1			4	2.2
112[a]	15	6/1-6/4; 6/8-6/11	192				3						2	P					2			7	3.6
113	18	6/17-6/18; 6/22-6/25	64	1		P							6	6								13	20.3
114	18	6/15-6/18; 6/22-6/25	180	1		P	1						7	12				1	2			24	13.3
115[a]	18	6/15-6/18; 6/22-6/25	184	1		P						1	P	P					1			3	1.6
116	20	7/6-7/10; 7/13-7/17	240	1			1						21	4								27	11.3
117[a]	20	7/6-7/17	330	P		1	2		1				14	1								19	5.8
118	12	7/13-7/20	215	1		P	1						11	P								13	6.0
119[a]	19	8/10-8/13; 8/17-8/20	180					1					6									7	3.9
120	19	8/10-8/13; 8/17-8/20	180					1					8	1								10	5.6
121	19	8/10-8/13; 8/17-8/20	180										4	3								7	3.9
122	19	8/10-8/13; 8/17-8/20	180										5	4								9	5.0
123[a]	12	8/24-8/27; 8/31-9/3	188										4		P							4	2.1
124	12	8/24-8/27; 8/31-9/3	180								P		9	P						P		9	5.0
125[a]	12	8/24-8/27; 8/31-9/3	180										11	P					1			12	6.7
126	19	8/24-8/27; 8/31-9/3	180					2					11	1								14	7.8
127	16	9/8-9/11; 9/14-9/17	180										1	P								1	0.6
128	16	9/8-9/11; 9/14-9/17	180										P	1					1		1	3	1.7
129	12	9/8-9/11; 9/14-9/17	180										P	3	1				1			5	2.8
130	27	9/21-9/24; 9/28-10/1	180									4		2		1		1		1		9	5.0
131	25	9/21-9/24; 9/28-10/1	180	1										P								1	0.6
132	Off NTS	9/21-9/24; 9/28-10/1	180									2		1					1			4	2.2
		Total:	5,746	48	7	19	10	4	1	0	0	116	122	95	3	1	1	5	13	5	1	451	7.8
Number of sites species was found:				17	3	12	6	3	3	1	1	11	20	28	4	1	1	3	10	4	1		

Figure 6-3. Rectangular box-like funnel trap
(Photo by D. B. Hall, September 9, 2009)

Figure 6-4. Rectangular wire-mesh funnel trap
(Photo by D. B. Hall, June 2, 2009)

Only one western red-tailed skink was captured at Site #87 during the several weeks this site was trapped (June 1–4, June 22–25, June 29–July 2, August 3–6, September 14–17). It was a recapture from 2008, and was captured at the same trap location as last year. The capture dates were June 25 in 2009, and June 24 in 2008. It grew 8 millimeters (mm) (0.32 in.) in snout-vent length, from 75 mm (2.95 in.) last year to 83 mm (3.27 in.) this year. Overall trap success was similar between years (6.5% [13 captures/200 trap days in 2008]; 5.2% [28 captures/535 trap days in 2009]).

6.1.4 Other Species

A total of 11 of the 16 known lizards and 7 of the 17 known snake species on the NTS were captured or observed, including 422 captures of lizards and 29 captures of snakes (Table 6-1). Western fence lizards (*Sceloporus occidentalis*), desert spiny lizards (*Sceloporus magister*), and side-blotched lizards (*Uta stansburiana*) were the most abundant species captured, with side-blotched lizards being the most ubiquitous. Four Great Basin skinks (Figure 6-5) were captured at three locations (Figure 6-2; Sites #119, #120, and #126). The two Great Basin skinks captured at Site #126 were captured in an area between Pahute Mesa and Rainier Mesa, suggesting a continuous distribution of this species at the higher elevations of these mesas (Figure 6-2). Other noteworthy reptile observations included a sagebrush lizard (*Sceloporus graciosus*) at Site #124 and 13 captures of striped whipsnakes (*Masticophis taeniatus*) at 10 sites (Table 6-1 and Figure 6-2).

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

Other species such as mammals and birds were also documented. A total of 198 captures or observations of 18 mammal species or their sign (e.g., tracks, scat, antlers) were recorded. In addition, 17 species of birds were detected audibly or by sight including 10 captures of rock wrens (*Salpinctes obsoletus*), one black-throated sparrow (*Amphispiza bilineata*) capture, and one black-chinned sparrow (*Spizella atrogularis*) capture. These data expand the knowledge of the distribution of wildlife across the NTS, especially in areas not previously sampled.

6.1.5 Skink Genetics

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

Figure 6-5. Great Basin skink (*Eumeces skiltonianus utahensis*) captured at Site #120
(Photo by D. B. Hall, August 13, 2009)

6.2 Small Mammal Surveys

Small mammal surveys were conducted to provide information on species distribution on the NTS. The objectives were to (a) investigate potential new habitats for the dark kangaroo mouse (*Microdipodops megacephalus*) and the pale kangaroo mouse (*M. pallidus,*), (b) collect data on small mammals that can fill spatial data gaps needed for a better understanding of species distribution on the NTS, and (c) learn more about species occupancy at selected habitats on the NTS. Habitats sampled in 2009 were subjectively described as wash, upland, burn/unburned, spring, etc.

Small mammal sampling was conducted as in previous years (see Hansen et al., 2009, for details of trapping; Figure 6-6). Trapping design included two trap lines, one in each comparative habitat, such as a wash and an upland habitat. Chi-square tests were performed across similar habitat pairs to determine if species proportions varied significantly between sites. Cell totals (<6) were lumped into an "other species category" before conducting tests. Statistical significance was set at $p = 0.05$ for all tests. The intent of these comparisons was to learn more about species occupancy of different habitats throughout the NTS.

A total of 703 captures was recorded, representing 12 species at 12 sites on the NTS (Figure 6-6), and 434 individual nocturnal small mammals, representing 11 species, were caught (Table 6-2). No kangaroo mice were captured during 2009. Trap success averaged 19.5%, varying from 6% to 34% across sites, and was much higher than was recorded in 2008. Pair-wise comparisons representing different habitats were tested on rodent numbers at 10 locations in 2009.

Four of the five paired sites had significant differences in proportions of species present based on the paired tests: Mid Valley burn/unburned, Rounded Ridge (*Coleogyne ramosissima* [blackbrush]/*Artemisia nova* [black sagebrush]), Gold Meadows burn/unburned, and Cane Spring wash/upland (Table 6-2).

On the Mid Valley burn, proportions of Merriam's kangaroo rat (*Dipodomys merriami*) were higher than expected. On the unburned habitat, the long-tailed pocket mouse (*Chaetodipus formosus*) was more numerous than expected (χ^2=7.35, p=0.025, Table 6-2).

On the Rounded Ridge blackbrush site, proportions of grasshopper mouse (*Onychomys torridus*) and the Great Basin Pocket mouse (*Perognathus parvus*) were higher than expected. On the Rounded Ridge black sagebrush site, Desert packrat (*Neotoma lepida*) and the Canyon mouse (*Perognathus crinitus*) occurred more than expected (χ^2=17.25, p=0.005, Table 6-2).

At Gold Meadows, the Pinion mouse (*Peromyscus trueii*) was dominant and occurred in the unburned site, which had a closed canopy of pinion trees. On the burn site western harvest mouse, (*Reithrodontomys megalotis*) and Great Basin pocket mouse contributed significantly to a species composition difference (χ^2=19.67, p=0.005,Table 6-2).

At the Cane Spring Upland/Wash sites, the difference in species composition was highlighted primarily from a dominance of the canyon mouse on the upland site, and also higher than expected numbers of grasshopper mice on the wash site (χ^2=21.5, p>0.005, Table 6-2). The canyon mouse is known to be more abundant on rocky, shallow soils, which match the description of the upland habitat.

At the Oak Spring area, there were high numbers of long-tailed pocket mice. A secondarily dominant species was the Pinion mouse. The trapline covered two habitats, a rocky steep slope towards John's Spring and a heavily shaded area of Gambel's oak around Oak Spring. The long-tailed pocket mouse has been previously captured in rocky steep slopes. There are some scattered pinion trees on this slope, explaining the presence of the pinion mouse.

Comparisons were made between the Redrock Valley burn and the unburned area for the years 1992 and 2009. This is a very sandy site. Species proportions from numbers of individuals captured were not significant between habitats (burn verses unburned) in 2009 (χ^2=6.89, 4 d. f., p=0.17; Table 6-2). In contrast, the species proportions recorded in 1992 at these sites (Hunter, 1994) were significantly different between habitats (χ^2=17.3, 4 d. f., p>0.005). This difference is due in part to a higher than expected proportion of Merriam's kangaroo rat on the burn, and a higher than expected proportion of chisel-toothed kangaroo rat (*Dipodomys microps*) on the unburned area (Table 6-3). Overall species composition did not change greatly within each plot over time (Table 6-3). However, the Ord kangaroo rat (*Dipodomys ordii*), a species that typically invades newly disturbed areas, was present in low numbers in 1992 but was not detected in 2009.

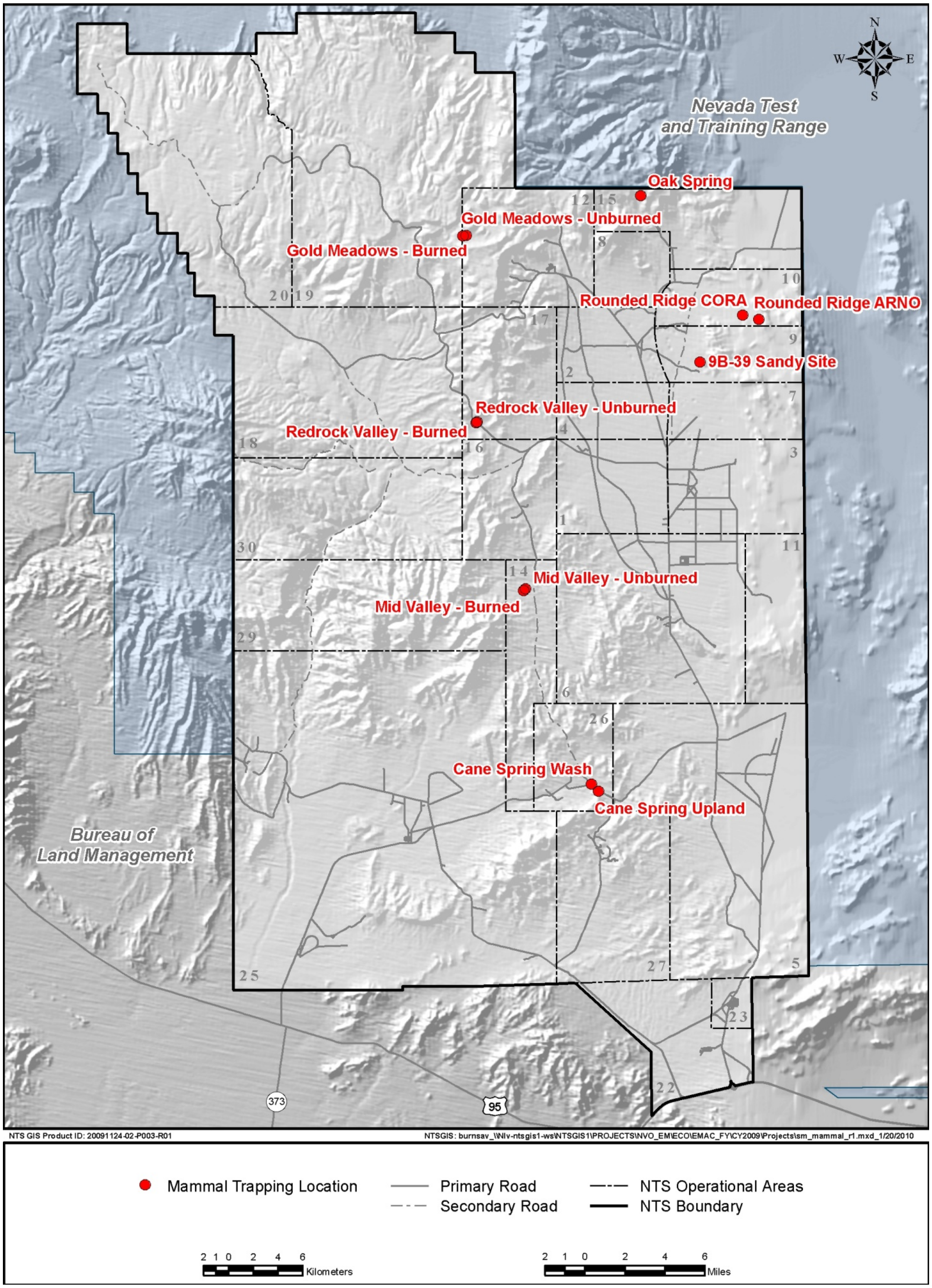

Figure 6-6. Trapping locations for small mammals on the NTS in 2009

Table 6-2. Number of small mammals captured on trap lines on the NTS in 2009[a] and tests of paired comparisons

Species			*Dipodomys merriami*	*Dipodomys microps*	*Chaetodipus formosus*	*Neotoma lepida*	*Onychomys torridus*	*Perognathus crinitus*	*Perognathus parvus*	*Peromyscus maniculatus*	*Peromyscus truei*	*Reithrodontomys megalotis*	*Thomomys bottae*	**Total Individuals**	**% Capture Success**	**Chi square, P, and (df) for test of parralel patterns among species including other species**	**Other species lumped into "other species" category**	**Total Mammal Captures**
Trapping Site	**Area**	**Dates**	**DIME**	**DIMI**	**CHFO**	**NELE**	**ONTO**	**PECR**	**PEPA**	**PEMA**	**PETR**	**REME**	**THBO**					
9B-39 site	9	5/19-5/21	12	6	6	3	4	3	0	0	0	0	0	**34**	18.30			**55**
Mid-Valley, Burn	14	5/12-5/14	10	0	0	0	1	0	0	4	0	0	0	**15**	6.30	7.35 0.025 (2)	DIMI ONTO CHFO	**19**
Mid-Valley, Unburned			6	1	**7**	0	1	0	0	8	0	0	0	**23**	9.70			**29**
Rounded Ridge, blackbrush	9	5/27-5/27	3	10	9	0	8	0	7	1	0	0	2	**40**	21.10	17.25 0.005 (4)	DIME NELE PECR PEMA	**62**
Rounded Ridge, black sagebrush			3	9	6	3	0	4	0	1	0	0	1	**27**	16.30			**49**
Oak Spring	15	6/9-6/11	0	0	32	5	1	0	0	0	13	0	0	**51**	22.00			**66**
Gold Meadows, Burn	12	9/1-9/3	1	0	0	0	0	0	5	18	0	3	0	**27**	12.30	19.67 0.005 (2)	DIME PEPA REME	**37**
Gold Meadows, Unburned			0	0	0	0	0	0	2	7	11	0	0	**20**	13.00			**39**
Red Rock Valley, Burn	17	9/9-9/11	60	10	0	0	5	0	2	3	0	0	0	**80**	30.00	6.89 0.17 (4)	PECR PEMA	**90**
Red Rock Valley, Unburned			23	8	0	0	2	2	5	0	0	0	0	**40**	25.60			**77**
Cane Spring, Wash	26	9/22-924	16	4	4	0	6	1	0	0	0	0	0	**31**	26.00	21.5, 0.005 (3)	PEMA NELE DIMI CHFO	**78**
Cane Spring, Upland			14	1	4	4	0	19	0	4	0	0	0	**46**	34.00			**102**
Totals			**148**	**49**	**68**	**15**	**28**	**29**	**21**	**46**	**24**	**3**	**3**	**434**	**19.55**			**703**

[a] % Capture success = total caught/total trap nights x 100

Excluded from statistical analysis (grey)
Minimal contribution to the Chi Square (green)
Substantial contribution to the Chi Square (yellow)

Table 6-3. Number of individual small mammals and species composition between 1992 and 2009 at Redrock Valley Plots, RED1 and RED2

Species	Burn				Unburned			
	1992		2009		1992		2009	
	No.	%	No.	%	No.	%	No.	%
Dipodomys merriami	69	70.4	60	75.0	49	49.5	23	57.5
Dipodomys microps	8	8.2	10	12.6	23	23.2	8	20.0
Dipodomys ordii	3	3.0			2	2.0		
Chaetodipus formosus					1	1.0		
Neotoma lepida					1	1.0		
Onychomys torridus	9	9.2	5	6.2	8	8.1	2	5.0
Peromyscus maniculatus	9	9.2	3	3.7	8	8.1		
Peromyscus crinitis							2	5.0
Perognathus parvus			2	2.5	7	7.0	5	12.5
Total Individuals	**98**		**80**		**99**		**40**	
Trap nights	420		300		420		300	
Total captures	177		90		180		77	
Trap success %	42		30		43		26	
Species Number	5		5		8		5	

Twice as many individual rodents were captured (80 versus 40 animals) on the Redrock burn compared to the natural area in 2009. Food resources may be higher on the burn in 2009, resulting in the higher numbers of small mammals due to the presence of a dense population of forbs (*Ambrosia acanthicarpa*) growing on the burn but not on the unburned site. These forbs were reproductive (numerous seed), large, and abundant at the time of trapping. Hunter (1994) found this species on the burn and unburned areas in 1994, but plants were small (19 milligrams mean weight/plant), non-reproductive, and not abundant (2 plants per square meter [m^2]), but that Russian thistle (*Salsola* spp.) dominated the biomass of all annuals at that time.

6.3 Bat Surveys

In 2009, bat monitoring focused on (a) sampling new sites for species distribution and roost information, (b) post-closure monitoring at 16A Tunnel and N Tunnel Complex, (c) passive acoustic monitoring of bat activity at Camp 17 Pond, and (d) removing bats from buildings and documenting bat roosts.

6.3.1 Sampling New Sites

The historic Rainstorm Mining District is located near the northeast corner of the NTS and has not been sampled for bat use. On August 7, one adit and one shaft were monitored to determine if bats were using these abandoned mines and, if so, what bat species were present and what type of roosts they were. A mist net, active acoustic monitoring system (Anabat II), and Palm IR250 camera with NightSight™ capability were set up at the adit for about two hours (2000–2155).

Four fringed myotis (*Myotis thysanodes*) were captured including one adult female and three juveniles (two females, one male), indicating this adit is a fringed myotis maternity roost (Figure 6-7). This is the third known fringed myotis maternity roost on the NTS. Results from the camera showed 88 exits and 19 entries of bats, indicating at least 69 bats are at this roost. Acoustic monitoring resulted in 17 files containing fringed myotis calls, 10 files containing small-footed myotis (*M. ciliolabrum*) calls, and one file containing California myotis (*M. californicus*) calls. Monitoring at the shaft was done with a passive acoustic monitoring system (Anabat II) and an observer with night vision goggles. No bats were observed entering or exiting the shaft, although at least four species were detected flying over or around the shaft: California myotis (three files), small-footed myotis (three files), fringed myotis (two files) and western pipistrelle (*Pipistrellus hesperus*) (two files). This shaft is considered a foraging site. Another nearby shaft was not sampled. The adit and two shafts should be sampled again to better assess bat activity at these sites. All bat species at these sites are considered sensitive or protected/regulated.

Oak Spring is a remote spring in Area 15, near the northern boundary of the NTS. In conjunction with other field work at this site, a passive acoustic monitoring system (Anabat II) was set up for five nights (June 2, 3, 8, 9, and 10) to document bat activity at the spring. The following species were detected: California myotis (29 calls), small-footed myotis (17 calls), long-eared myotis (*M. evotis*) (6 calls), long-legged myotis (*M. volans*) (3 calls), and silver-haired bat (*Lasionycteris noctivagans*) (1 call). All species except long-legged myotis are sensitive or protected/regulated.

Figure 6-7. Fringed myotis (*Myotis thysanodes*) maternity roost, Rainstorm Mining District Adit #1
(Photo by D. B. Hall August 7, 2009)

6.3.2 Post-Closure Monitoring

The 16A Tunnel was closed in 2008 as part of a plan to safely close certain facilities that are no longer being used. Prior to closure, NSTec biologists assessed the impacts to biological resources. Results from a survey in July 2003 indicated that the tunnel was used as a night roost and foraging site by three sensitive bat species (small-footed myotis, California myotis, and western pipistrelle)

(Bechtel Nevada, 2003). Another survey was conducted on July 1, 2008, to determine if the tunnel was still being used by bats. Bat vocalizations were recorded using an Anabat II™ system (about 2.5 hours) and videotaping the tunnel opening with a NightSight™ camera (about 1.5 hours). In all, 66 files containing vocalizations of five species were documented. In addition to the three species detected in 2003, two more sensitive bat species, fringed myotis (*M. thysanodes*) and Yuma myotis (*M. yumanensis*), were also detected. Video footage showed 20 bat exits and 18 bat entries. Based on the timing of these exits and entries, 16A Tunnel was being used as a day roost as well as a night roost and foraging site. Thus, it was decided to install a bat-compatible closure or bat gate. Due to budget constraints and the existing framework at the tunnel opening, it was decided to use a non-conventional bat gate and just leave a 10–15 cm (4–6 in.) opening at the top of the tunnel to allow bats and air to enter and exit the tunnel (Figure 6-8).

On July 7, 2009, a post-closure survey using the same techniques as in 2008 was conducted at 16A Tunnel to determine if bats were using the bat gate. Three sensitive or protected/regulated species (fringed myotis, small-footed myotis, and western pipistrelle) were detected acoustically with the same total number of files (66) as was recorded in 2008. Video footage revealed numerous bat passes through the opening with consistent activity inside and around the entrance throughout the survey.

Figure 6-8. Bat-compatible closure at 16A Tunnel
(Photo by D. B. Hall, December 10, 2008)

The bat gate appears to be working, and the site is still being used as a night roost and foraging site and possibly a day roost as well.

Acoustic monitoring conducted at the N Tunnel Complex prior to closure (Fall 2006/Winter 2007) documented the presence of five sensitive or protected/regulated species (California myotis, small-footed myotis, long-eared myotis, fringed myotis, and western pipistrelle) and one non-sensitive species (long-legged myotis). Monitoring also indicated the tunnel was being used as a day roost, night roost, and foraging site (Bechtel Nevada, 1999; 2006; NSTec, 2007). Post-closure monitoring results in 2007 revealed limited bat activity (Hansen et al., 2008). Post-closure monitoring during September 2009 detected the same six species as before plus Yuma myotis, another sensitive species. Video footage and night-vision goggle surveys demonstrated the tunnel is still being used as a day roost, night roost, and foraging site with some bat passes observed through the bat gate in the north portal (main drift).

6.3.3 Passive Acoustic Monitoring System at Camp 17 Pond

To learn more about long-term bat activity through different seasons and years, a passive acoustic monitoring system (Anabat II) was installed at Camp 17 Pond on September 22, 2003. Hundreds of thousands of electronic files containing bat calls have been recorded and are in the process of being analyzed by O'Farrell Biological Consulting. No comparable dataset exists on long-term bat activity in the Great Basin Desert region. Bat vocalizations and climatic data (e.g., temperature, humidity, wind, barometric pressure) were recorded again in 2009. Progress was made to summarize and format climatic data so it can be correlated directly with bat vocalization data. This will help elucidate patterns of bat activity in relation to weather conditions. NSTec personnel are collaborating with Dr. Mike O'Farrell (O'Farrell Biological Consulting) and Jason Williams (Nevada Department of Wildlife) to analyze these data.

6.3.4 Bats at Buildings

During 2009, 12 bats were documented at six buildings in Mercury, two buildings in Area 25, and one building in Area 6. Six of the bats were California myotis, two were western pipistrelles, one was a pallid bat (*Antrozous pallidus*), and three were not identified. Roost site locations and species were entered in the Ecological Geographic Information System (EGIS) faunal database.

6.4 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 NTS. Monitoring of individual horses at NTS began in 1989. In 2009, NSTec biologists determined horse abundance and recorded horse sign (e.g., droppings and hoof prints) along roads. Some of the natural and human-made water sources were visited in the summer of 2009 to assess their influence on horse distribution and movements and document the impact horses are having on NTS wetlands and water sources. Information on horse abundance and recruitment from 1990 to 1998 is summarized in Greger and Romney (1999).

6.4.1 Abundance

In 2009, a count of horses was made during 25 non-consecutive days between May and November. A standard road course was driven to locate and identify horses. Motion/heat activated cameras at Camp 17 Pond 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 2009, including 36 adults and 1 yearling, not including foals. This is an approximation of the actual number of horses that may be present. About eight horse bands were detected, which were composed of stallions, subordinate males, females, and their offspring. Only six foals were observed this year, but it is not known exactly how many foals were produced in 2009.

The NTS horse population in 2009 is only slightly lower than it was in 2006–2008. Survival of yearlings and foals was low in 2009. One yearling was alive in 2009 (Figure 6-9). Observations and photos taken indicate numerous foals were born in 2009 as in other years, but most disappeared over a few weeks. Greger and Romney (1999) found that over 60 healthy foals were lost over a five-year period at the NTS. Mountain lion predation is the most likely cause. Foal losses are a significant factor in controlling the size of the herd of horses on NTS. One foal was observed in November 2009 (Figure 6-10).

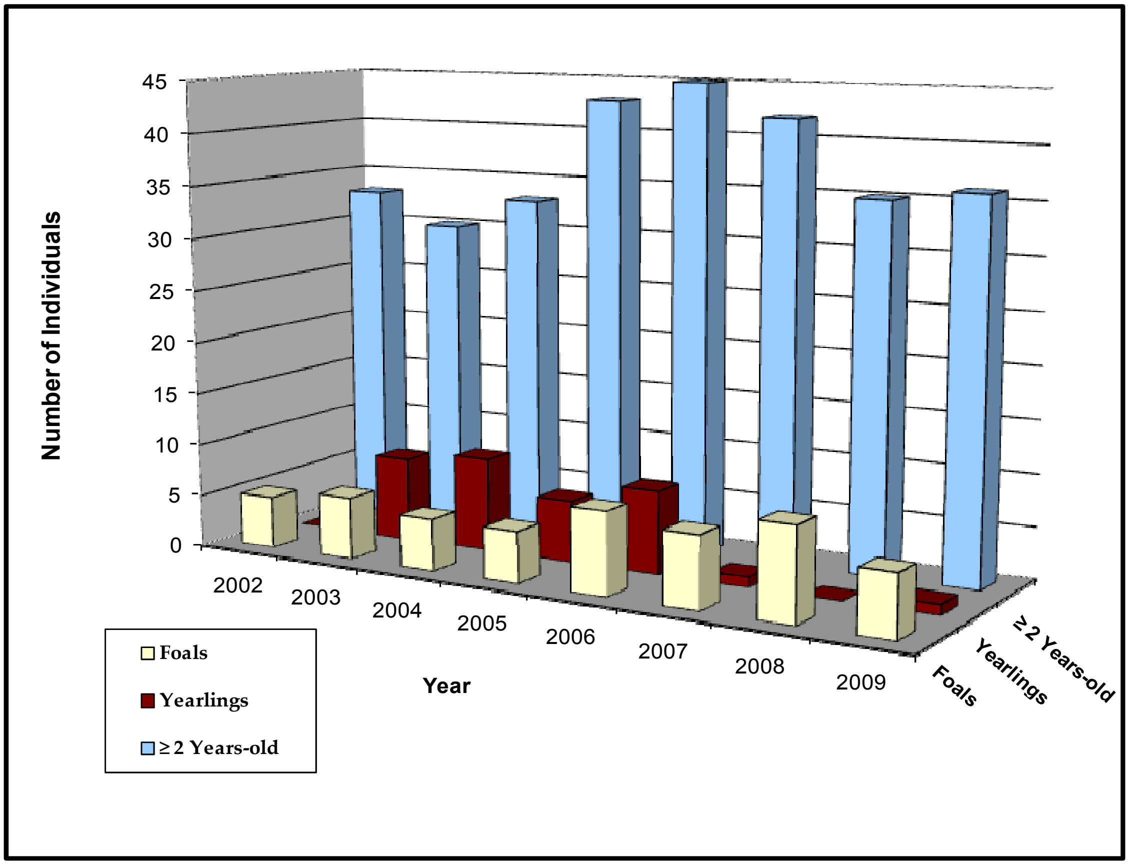

Figure 6-9. Trends in the age structure of the NTS horse population from 2002 to 2009

6.4.2 Annual Range Survey

During 2009, selected roads were driven within and along the boundaries range of horses, and all fresh sign (estimated to be <1 year old) encountered were recorded. Horse use in the Eleana Range was determined by walking surveys.

Horse sign data collected during the road and walking surveys indicate that the horse range on the NTS included Gold Meadows, Eleana Range, southwest foothills of the Eleana Range, the Echo Peak region of Pahute Mesa, and Wildhorse Seep in Area 30 (Figure 6-11). Overall, the estimated annual horse range in 2009 (<222 square kilometers [km^2], 85.7 square miles [mi^2]) is similar to 2008. The horse range on the NTS is characterized by rugged topography and was limited to a radius of approximately 8–11 km (5–7 mi) from any permanent water source. The preferred horse forage range seems to be above 1,524 m (5,000 ft) elevation, especially during the summer months. Yucca Flat has not been used in recent years by horses.

Figure 6-10. Foal in a band of horses on the NTS
(Photo by P. D. Greger, November 15, 2009)

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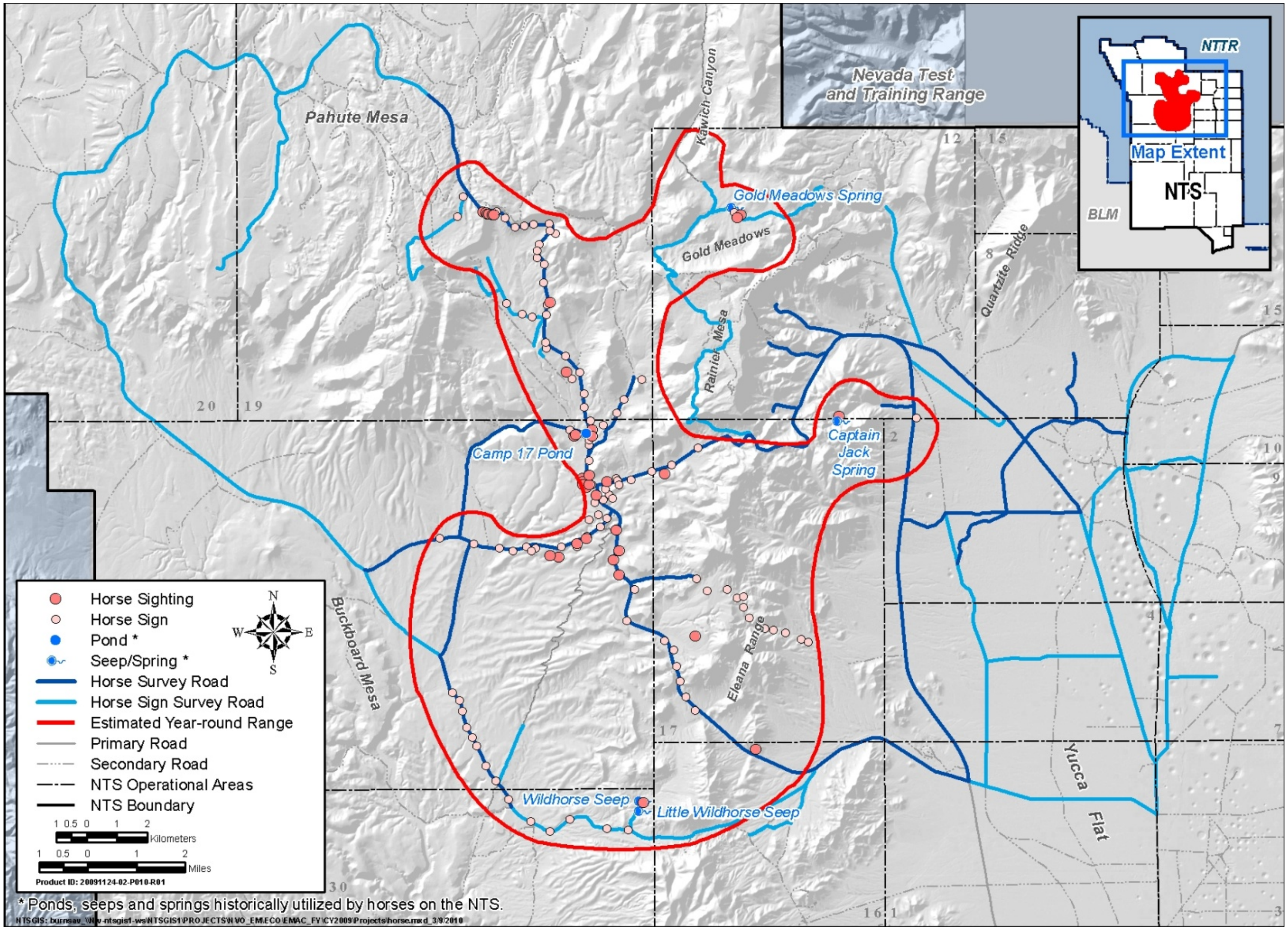

Figure 6-11. Feral horse sightings and horse sign observed on the NTS during 2009

6.4.3 Horse Use of Water Sources

The NTS horse population is dependent on several natural and human-made water sources in Areas 18, 12, and 30 (Figure 6-11). One natural, and perhaps human-enhanced, water source (Gold Meadows Spring in Area 12) and one human-made pond (Camp 17 Pond in Area 18) were used heavily as in past years (Figure 6-12). Horse use at this pond generally begins in March and extends through November. The Wildhorse and Little Wildhorse seeps in Area 30 were used heavily in December of 2009.

Some NTS springs used by horses are ephemeral in nature such as the Wildhorse Seeps, and Gold Meadows Spring. Gold Meadows Spring dried up in August but was reused by horses late in the year after fall rains replenished the spring. As in past years, none of the plastic-lined sumps within or near the horse range was used by horses this year. Captain Jack Spring had not been used by horses for nearly a year, and then horses were photographed at the spring starting on October 30, 2009.

Figure 6-12. Horse use at Camp 17 Pond
(Photo taken by P. D. Greger, March 13, 2008)

6.5 Mule Deer Surveys

6.5.1 Mule Deer Abundance

Mule deer abundance on the NTS was measured by driving two standardized (74 km [44 mi] total length) road courses (Figure 6-13) to count and identify mule deer. Previous studies of mule deer on the NTS were conducted by Giles and Cooper (1985). Temperature and wind speed were documented with a Kestrel 3000 Wind-Meter. Locations of all wildlife were recorded with a Garmin global positioning system (GPS) from the road centerline. Perpendicular distance from the road to each deer group was measured with a laser range finder. For mapping deer groups, corrections were made to GPS locations taken from the road with the range finder distances. Locations of deer groups were displayed using GIS methodology (see Hansen et al., 2009).

During 2009, total observations were made of 242 deer, two elk, 15 horses, four mountain lions, four grey foxes, eight coyotes, one badger, one ringtail, and numerous poor-wills during the nine surveys. The average annual counts from 2006 to 2009 changed significantly across years on NTS ($F = 10.37$, 3, 23 d. f., $p < 0.0001$, Figure 6-14). The average annual count dropped from 45 to 27 deer/night, a 40% decrease between 2008 and 2009 (Anova, $F = 9.04$, 1, 16 d. f., $p = 0.008$). There was a significant decline in deer abundance in 2009. The counts were variable in 2009, with the average coefficient of variation (CV) at 43.4%. There appears to be no distinctive trend in deer numbers on the NTS over time (Figure 6-14).

There was no significant difference in sighting rate of deer (Figure 6-15) between Rainier and Pahute Mesa regions from 2006 to 2009 (Anova, $F = 4.1$, 1, 22 d. f., $p = 0.07$). This indicates that deer are being sighted at approximately the same rate in both regions. However, more data are needed to be conclusive.

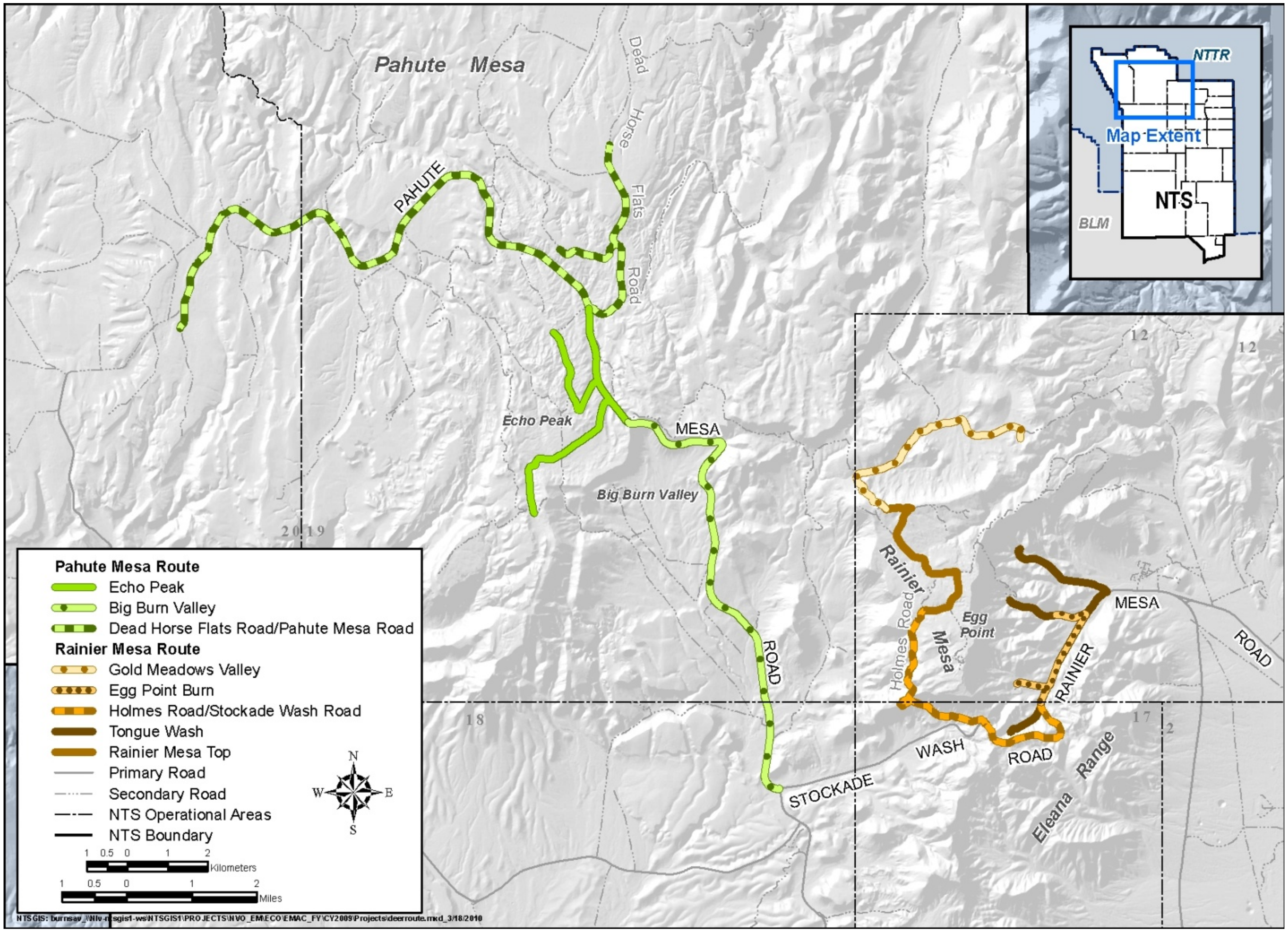

Figure 6-13. Road routes and sub-routes of two NTS regions driven to count deer

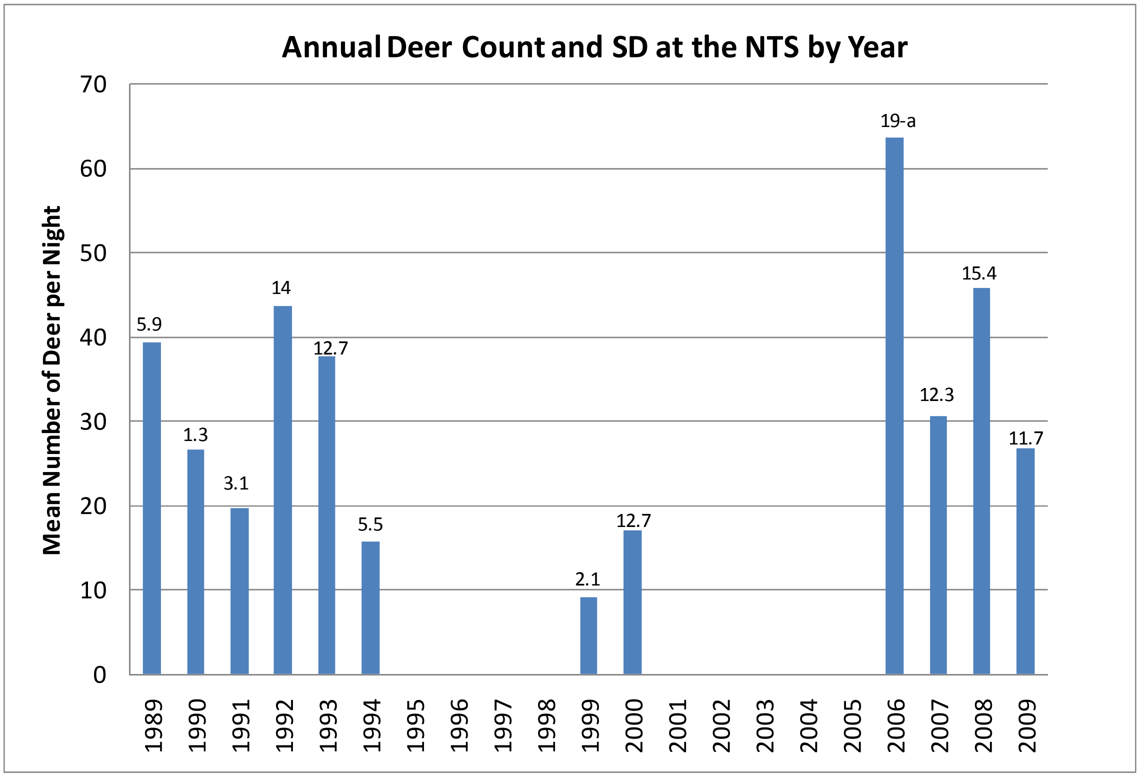

Figure 6-14. Trends in total deer count per night from 1989 to 2009 on the NTS

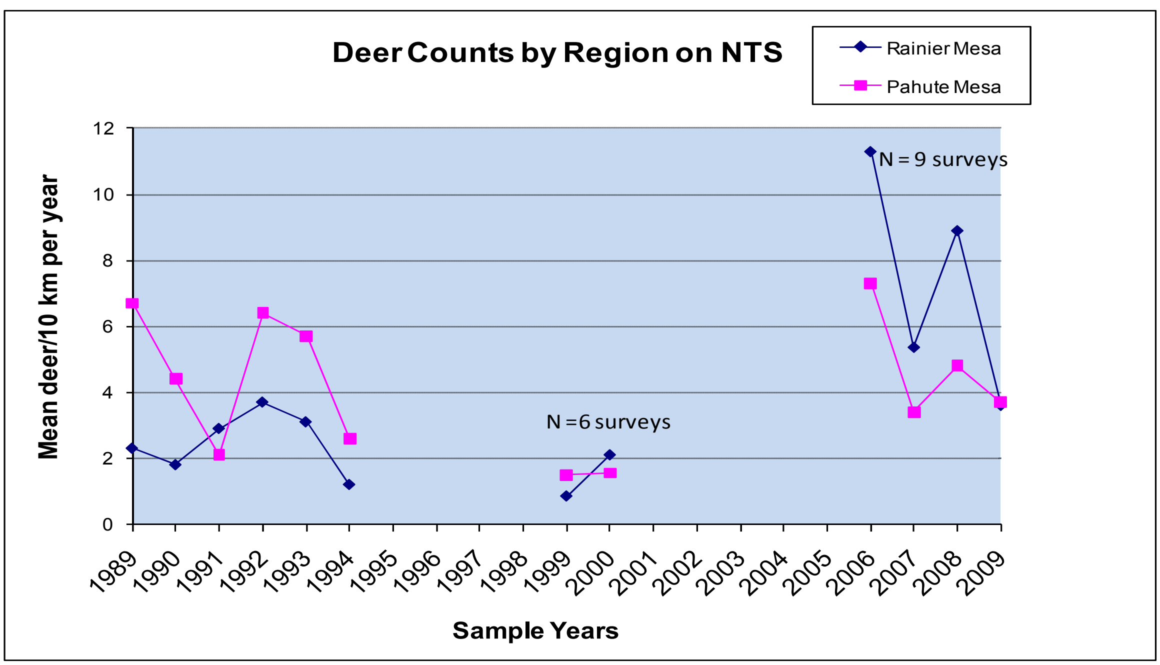

Figure 6-15. Deer counts from two regions of the NTS expressed as mean counts per three-night session per distance surveyed

6.5.2 Mule Deer Density

Deer surveys on the NTS were conducted in 2009. Densities of deer were calculated using the software program DISTANCE (Thomas et al., 2006) on two routes and several sub-routes (Figure 6-13). Stratification of the data was based mostly on differences in topography and elevation. The model was run with a half cosine function with no adjustments, and density was calculated on mean group size. More details of the DISTANCE methodology are described in Hansen et al. (2009).

A total of 242 deer observations were made on deer routes in 2009, representing 135 deer groups during nine survey dates in August, September, and October. Deer density estimates after nine days of sampling were 1.19 per km^2 for Rainier Mesa and 1.26 per km^2 for Pahute Mesa regions. The CV improved only slightly between three and nine days of sampling (Table 6-4). Given the mean and variance for the nine samples taken in 2009, a 30% change from the mean could be detected. Overall group size varied from 1 to 14 animals, and average group size was 1.73 and 1.79 deer, respectively, for Rainier Mesa and Pahute Mesa regions. Total number of deer spotted by region in 2009 varied from 92 on Rainier Mesa to 150 on Pahute Mesa. Most deer (97.5%) were seen within 200 m (656 ft) of the road centerline. The average distance that deer were sighted from the road centerline during 2009 was 75 m (range 0–240 m) (246 ft [range 0–780 ft]). This distance suggests that deer were probably not attracted to the road.

Table 6-4. Deer density estimates (D) number/km^2, number of deer sighted (groups), and coefficient of variation (CV), in two regions on the NTS by accumulated survey nights (n)

n	Rainier Mesa D	Number of deer	CV	Pahute Mesa D	Number of deer	CV
3	1.15	30 (21)	0.20	1.59	84 (41)	0.23
4	1.05	36 (26)	0.21	1.68	104 (56)	0.18
5	0.92	38 (28)	0.25	1.50	111 (62)	0.21
6	0.98	53 (35)	0.22	1.45	123 (69)	0.20
7	0.98	68 (40)	0.21	1.27	128 (71)	0.24
8	1.02	76 (46)	0.18	1.24	135 (75)	0.24
9	1.19	92 (53)	0.17	1.26	150 (82)	0.22

There were no significant differences in deer density between subregions on Rainier Mesa or Pahute Mesa in 2009 (Table 6-5). The Echo Peak area had a density of 2.45 deer/km^2 (all confidence intervals overlapped at $p = 0.05$). The CV for density was moderate to high in 2009 for the deer counts, both for the total and for sub-segments of the route (Table 6-5).

Table 6-5. Deer density estimates, confidence intervals, and other parameters for two transect regions and sub-transects of the NTS

Survey Transects	Transect Length (Km)	Total Number Deer Counted	Deer Density D^b, n/Km^2	95% Lower Confidence Interval of D	95% Upper Confidence Interval of D	Coefficent of Variation of D
Pahute Mesa Total	**47.0**	**150**	**1.26**	**0.80**	**1.99**	**0.215**
Big Burn Valley	13.0	37	1.37	0.56	3.36	0.444
Echo Peak	10.0	84	2.45	1.44	4.19	0.264
Dead Horse Flat Road/Pahute Mesa Road	24.0	29	0.81	0.44	1.49	0.285
Rainier Mesa Total	**27.4**	**92**	**1.19**	**0.85**	**1.66**	**0.168**
Tongue Wash Area	5.5	14	0.86	0.29	2.50	0.554
Eggpoint Burn	3.2	13	0.89	0.30	2.60	0.543
Holmes Road/Stockade Wash Road	6.4	22	1.33	0.35	4.99	0.705
Rainier Mesa Top	5.8	20	1.79	0.84	3.83	0.365
Gold Meadows	6.3	23	1.43	0.56	3.60	0.463

[a]Model used is Conventional Distance Sampling, Half Cosine Model, with 1 observer, and 1 parameter (cluster size)

[b]Number of transects is 9 for all estimates

On the Echo Peak sub-region, deer density was 6.4 deer/km^2 in 2008 compared to 2.5 deer/km^2 in 2009. The average deer density in 2009 for both regions was 1.23 deer/km^2.

The lower deer counts occurred on moderate to high windy nights. Furthermore, on two sampling dates after high winds lessened, the next day's counts increased. High winds (>24 km per hour [>15 mi per hour]), may have an effect on the deer count. Counts did not appear related to temperature or moon illumination. Rain coincided with higher winds on October 13 (Table 6-6).

Table 6-6. Weather conditions during deer surveys in 2009

Date	Total Deer Count	Wind Speed (kph)	Temp °C Range	Percent Cloud Range	Rain	Percent Moon Illumination
14-Sep	28	1-8	12-20	0-10	No	20
15-Sep	47	1-16	12-24	0-10	No	12
16-Sep	39	1-8	16-24	0	No	5
28-Oct	26	0-24	19-24	20-60	No	73
29-Oct	9	8-40	13-21	0-10	No	81
30-Oct	26	1-13	4-12	0	No	88
12-Oct	20	1-16	7-13	20-80	No	34
13-Oct	15	8-25	6-9	100	Yes	23
14-Oct	32	1-8	9-18	0-5	No	14
Wind: Low 1-8, Moderate 10-24, High > 24						

The sex of some deer could not be determined during deer surveys. The percentage of deer whose sex could not be determined ranged from 14% in 2009 to 21% in 2007; therefore, calculated sex ratios are not completely accurate. Sex ratios (number of males/female) have fluctuated from 0.96 in 2009 to 2.18 in 2007 (Table 6-7).

The number of fawns detected also varied from 2006 to 2009, ranging from 0 in 2007 to 47 in 2008. Low counts of fawns on the NTS probably were related to the time of year that surveys were conducted. Fawn surveys would be more effective if done earlier in the year (June–August) instead of September–October, avoiding early season fawn losses. Giles and Cooper (1985) conducted fawn/doe surveys from July to October (1977–1981) and determined fawn/doe ratios ranged from 0.34 to 0.73. These values are much higher than determined in recent deer counts from 2006 to 2009 on the NTS. A separate fawn/doe census done earlier than the normal fall deer surveys would provide a more accurate count of numbers of fawns produced.

Table 6-7. Mule deer sex ratios, fawns, and fawn to doe ratios across years on NTS

Year	M	F	M:F ratio	Sex not determined	Fawns	Fawns/Doe
2006	224	222	1.01	96	31	0.14
2007	148	68	2.18	59	0	0.00
2008	164	147	1.11	50	47	0.32
2009	98	102	0.96	35	7	0.07

6.5.3 Mule Deer Use of Habitat Types

Shrublands and woodlands were stratified in 2009 using vegetation associations and alliances described by Ostler et al. (2000) to better determine deer habitat use. Deer observation transects (Hansen et al., 2009) were superimposed on areas created by polygons delineating natural vegetation (as well as recovering vegetation in the area burned by the Egg Point Fire in 2002) using GIS software (ARCView). The lengths of deer transects in each habitat type were measured by route intersection analysis. Percentages of available habitat were calculated (Table 6-8). The locations of all deer groups detected were superimposed on the map and counted, and percentages of use by deer groups in each habitat were summed (Figure 6-16). Deer habitat selection indices (Table 6-8) 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.

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 (Figure 6-16). The *Artemisia* spp. Shrubland Alliance (*Artemisia* spp.) was also a substantial component (29%) of the habitat. Miscellaneous/disturbed habitats (20%), *Coleogyne ramosissima–Ephedra nevadensis* Shrubland (CORA-EPNE; 5%) and the Eggpoint Burn (4%), comprised the remainder of the habitats on the deer transects. The miscellaneous/disturbed category is composed of several elements, both minor vegetation types (smaller in area) and land previously disturbed by NNSA/NSO activities. Minor vegetation types included *Cercocarpus* spp. and the *Chrysothamnus-Ericameria* Shrubland Alliance.

Table 6-8. Habitat use of spotlighted mule deer on the NTS during 2009

Habitat	Km's of Deer Transect in Habitat type	Percent of Available Habitat (A)	Observed Number Deer Groups	Percent Deer Use by Habitat (B)	Habitat Use Index w_i = B/A	95 % CI of w_i
PIMO/ARTR Woodland	18.2	24.5	47	34.8	1.42	1.09, 1.75*
PIMO/ARNO Woodland	12.7	17.1	14	10.4	0.61	0.31, 0.91*
Artemisia spp. Alliance[1]	21.6	29	47	34.8	1.2	0.92, 1.48
Miscellaneous-disturbed	14.9	20	22	16.3	0.82	0.51, 1.13
CORA-EPNE Shrubland	3.8	5.1	2	1.5	0.3	-0.1, 0.7*
Eggpoint Burn, 2002	3.2	4.3	3	2.2	0.51	-0.06 , 1.08
Total	74.4	100	135	100		

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

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

The two highest habitat use areas for deer were the *Artemisia* spp. Shrubland Alliance and PIMO/ARTR Woodland habitats (Table 6-8). Habitat selection coefficients calculated suggest that selection (>1.0) or avoidance (<1.0) by deer may have occurred (Table 6-8). Three habitats (PIMO/ARTR Woodland, PIMO/ARNO Woodland, and CORA-EPNE Shrubland) had selection values that were significantly different from random (w_i=1.0), with 95% confidence intervals that did not overlap 1.0 (Table 6-8). PIMO/ARTR Woodland was selected over all other habitats. CORA-EPNE Shrubland habitat and PIMO/ARNO Woodland habitat were avoided relative to availability. Evaluating the deer-habitat relationships may be difficult for deer that were observed near the edge of differing vegetation types (e.g., shrublands and woodlands). It is noteworthy that PIMO/ARTR Woodland habitats have higher relative abundance of trees that can provide thermal cover and contain more forage for deer (i.e., Bitterbrush) than other less used habitats (Ostler et al., 2000).

6.5.4 Water Availability

Water availability was limited in the fall of 2009 during deer surveys. Three water sources (E Tunnel Pond, Captain Jack Spring, and Whiterock Spring) were available to deer around Rainier Mesa (Figure 6-16). Gold Meadows Spring was dry during deer surveys. As in previous years, Camp 17 Pond was the only permanent water source available to deer in 2009 west of Rainier Mesa. Sump U19Ad and Pahute Mesa

Pond were dry in September 2009 before deer surveys started (Figure 6-16). In contrast, ER 20-5 had the only available pond with water in Area 20 throughout the period when deer surveys were conducted. This sump is located approximately 6.4 km (4 mi) southwest of the end of the NTS deer route (Figure 6-16) in *Artemisia* spp. habitat. No deer were recorded during deer surveys in Area 20.

6.6 Mountain Lion Monitoring

Little data exist for mountain lion numbers and distribution in southern Nevada, including the NTS. Dr. Erin Boydston, a research scientist with USGS, is investigating mountain lion distribution and abundance using remote, motion-activated cameras. NSTec biologists have collaborated with Dr. Boydston since 2006 to determine the number of mountain lions found on the NTS and where they occur. This information will enable a better assessment of the potential risk of mountain lions to NTS workers. In 2009, additional cameras were obtained with the ability to take video or digital photographs using infrared at night and regular color during the day. This eliminates the bright flash. It also uses AA batteries and is energy-efficient, small, lightweight, and easy to mount to a variety of substrates.

In 2009, six locations of opportunistic sightings of mountain lions or their sign were recorded (Figure 6-17). Three mountain lion locations were documented during deer spotlight surveys including Pahute Mesa Road (September 14, one lion), E Tunnel Pond (September 28, one lion), and E Tunnel Road (September 30, two lions). Two locations where tracks were seen in the dirt occurred in the Horse Wash area (Area 18, November 4) and near a reptile-trapping site in Gold Meadows (Area 12, September 3). The tracks in Gold Meadows were on top of tracks made by a biologist during reptile trapping activities. On February 25, NSTec biologists were called to sample a roadkill mule deer on Tippipah Highway east of Captain Jack Spring (Area 12). Although little remained of the deer, based on the drag marks and the context of the remains, it suggested a mountain lion kill. A mountain lion was detected photographically at Captain Jack Spring on February 14 and again on March 13.

During 2009, remote, motion-activated cameras were set up at 22 sites (6 new sites, 16 sites from 2008) (Figure 6-17 and Table 6-9). Sites were selected at previous mountain lion sightings, on infrequently traveled dirt roads, or areas known to be frequented by mule deer (e.g., deer trails, water sources), a primary prey species of the mountain lion.

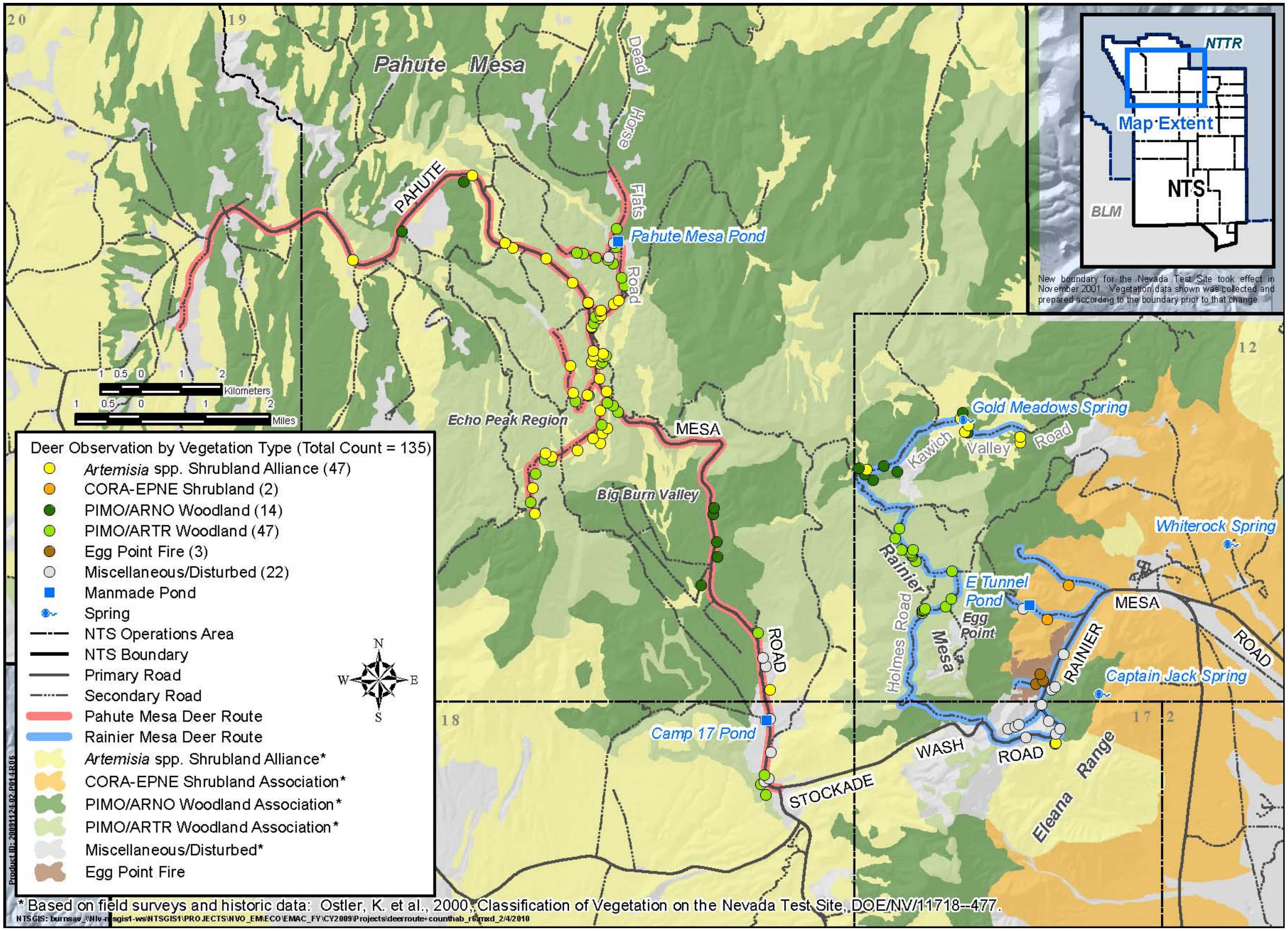

Figure 6-16. Mule deer observations by vegetation type on the NTS

A total of 117 mountain lion photographs/video clips were taken during 120,411 camera hours across all sites. This equates to about 1.0 mountain lion photo/video clip per 1,000 camera hours (Table 6-9). Mountain lions were detected at seven of the 22 sites. Four of the seven sites were on roads (three dirt roads and one paved road) with little to no vehicle traffic. The other three sites were Topopah Spring, Captain Jack Spring, and Gold Meadows Spring (Figure 6-17). A total of 104 photographs or video clips of mountain lions was taken at Topopah Spring (Table 6-9) (February—2 video clips, March—1 video clip, May—4 video clips, July—11 photos, August—22 photos, September—20 photos, November—42 photos, and December—2 photos). The increased number of photos in November is probably due to the increased use of Topopah Spring by mule deer during late October/early November (see Section 7.2.1). Four individual mountain lions frequented Topopah Spring, including a mother and two cubs and one or more males throughout the year. It is unknown if conspecifics documented in the northern part of the NTS (e.g., Pahute Mesa, Rainier Mesa) are different individuals than the ones documented at Topopah Spring. Noteworthy photos/videos at Topopah Spring include one photograph of a mountain lion with prey (small canid or mule deer fawn) in its jaws, one sniffing a gut pile, a female with two cubs nose-to-nose with the camera, and a lion interacting with bats flying in and out of the cave pool.

In order to investigate temporal activity of mountain lions, camera detection data from all four years (2006–2009) were combined. Mountain lions were detected in every month except April with peak occurrences in November (Figure 6-18). During most other months, there were fewer than 10 detections except for July (16 detections), August (32 detections), and September (29 detections). This pattern may partially be explained by the availability of water or the presence or absence of mule deer and, to a lesser extent, other prey due to seasonal migration. Mountain lions were detected regularly between late afternoon and early morning with a peak around 2000 hours (Figures 6-19 and 6-20). Only a few detections were documented during the morning and early afternoon (Figure 6-19). Over 80% of photos/videos were taken when it was dark. Only 34 photos/videos were taken during daylight hours with 62% taken in September–November, 23% in June–August, and 15% in December–February. No daylight photos/videos were taken from March to May.

A secondary objective of the camera surveys is to detect other species using these areas to better define species distributions on the NTS. A total of 4,843 photographs/videos of at least 25 species other than mountain lions were taken during 120,411 camera hours across all sites (Table 6-9). This is about 40 photos/videos per 1,000 camera hours. The most prevalent species photographed was mule deer (2,901 photos/videos at every site except one (Table 6-9). Some of the rarer, elusive species documented during camera surveys were Rocky Mountain elk, desert bighorn sheep (*Orvis Canadensis nelson*), wild burro (*Equus asinus*), bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), badger (*Taxidea taxus*), and great blue heron (*Ardea herodias*) (Table 6-9). Over 75% of the photos/videos were taken at three sites: Topopah Spring, Camp 17 Pond, and Captain Jack Spring. A majority of these were taken during the summer and fall, which emphasizes the importance of these water sources for several wildlife species, especially during the drier months.

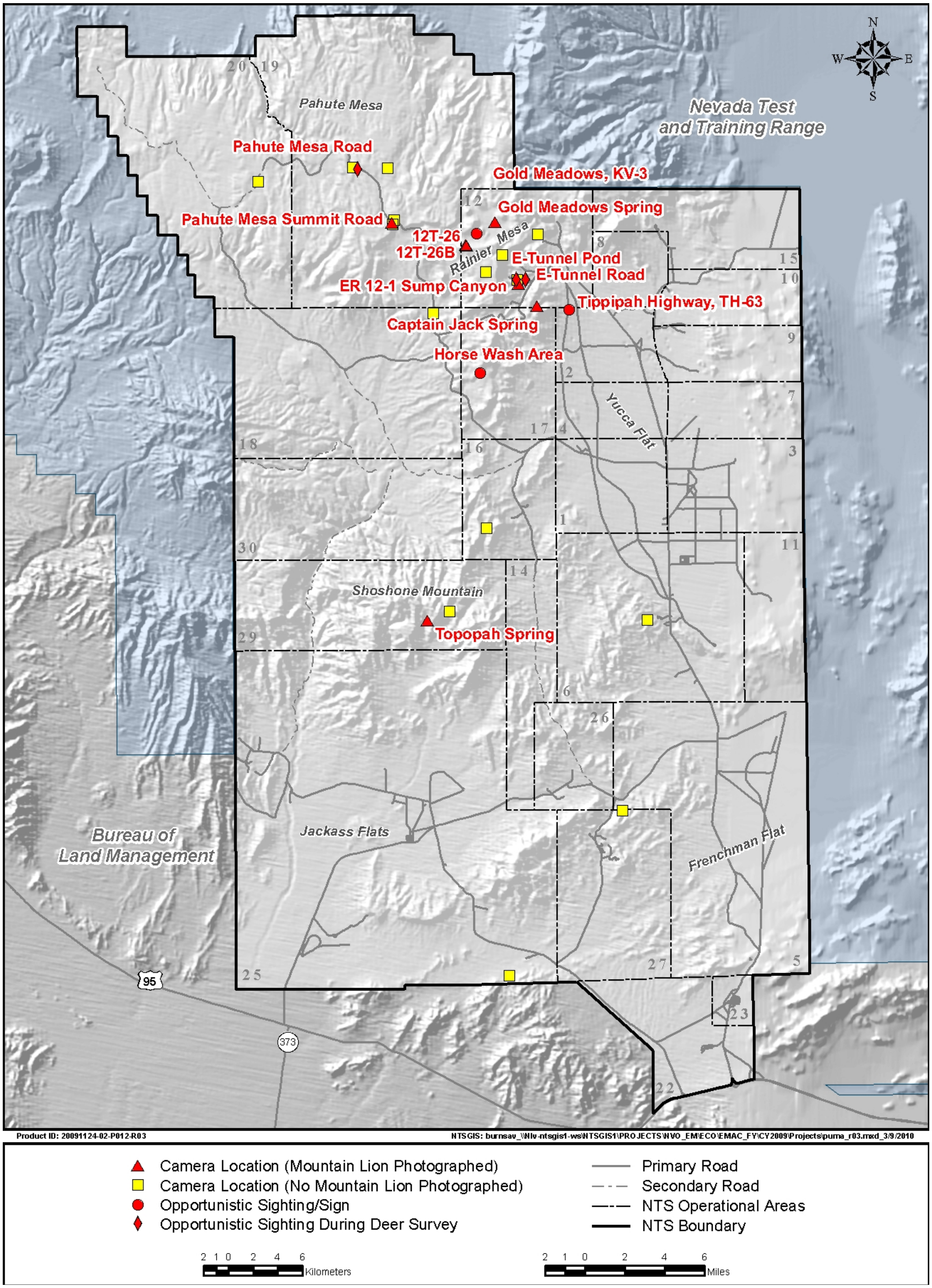

Figure 6-17. Locations of opportunistic mountain lion sightings, mountain lion photographic detections, and motion-activated cameras on the NTS during 2009

Table 6-9. Results of mountain lion camera surveys during 2009

Location	Dates Sampled	Camera Hours	Mountain Lion Photos/Video clips (No. photos/video clips per 1000 camera hours)	Other Animals (Number of photos/video clips)
Topopah Spring	[b]1/8/09–1/5/10	7,648.50	104 (13.6)	Bobcat (3), gray fox (14), coyote (24), desert bighorn sheep (85), mule deer (1,065), bat (1), raptor (1), mourning dove (73), chukar (403), black-headed grosbeak (2), pinyon jay (101)
Gold Meadows Spring	8/12–10/14/09	1,520.25	1 (0.7)	Coyote (2), pronghorn antelope (3), horse (78), mule deer (93), black-tailed jackrabbit (1)
Pahute Mesa Summit, Road	[b]1/7/09–1/5/10	7,770.50	5 (0.6)	Coyote (15), Rocky Mountain elk (6), pronghorn antelope (2), horse (23), mule deer (123), rock squirrel (1), cottontail rabbit (1)
Captain Jack Spring[a]	[b]12/10/08–1/6/10	4,988.75	3 (0.6)	Bobcat (1), coyote (4), horse (164), mule deer (541), mourning dove (16), chukar (6), raven (1), pinyon jay (2), passerine (1)
ER 12-1 Sump Canyon	10/14–1/6/10	2,013.50	1 (0.5)	Coyote (1), mule deer (47)
12T-26, Rainier Mesa	[b]1/15/09–1/6/10	7,771.25	2 (0.3)	Bobcat (4), gray fox (12), coyote (23), badger (1), mule deer (13), black-tailed jackrabbit (97), cottontail rabbit (3)
12T-26B, Rainier Mesa	[b]1/15/09–1/6/10	8,502.25	1 (0.1)	Bobcat (2), gray fox (3), coyote (11), mule deer (26), black-tailed jackrabbit (3)
Dick Adams Cutoff Road, Rainier Mesa	[b]1/15/09–1/6/10	7,179.50	0	Bobcat (4), gray fox (26), coyote (14), mule deer (65), black-tailed jackrabbit (35), cottontail rabbit (1)
Road above T Tunnel	[b]1/20/09–1/7/10	7,139.25	0	Coyote (1), mule deer (58)
Rainier Mesa top, Above B Tunnel	10/26/09–1/7/10	1,749.75	0	Gray fox (2), coyote (3), mule deer (7), black-tailed jackrabbit (2)
E Tunnel Road[a]	[b]10/14–1/6/10	1,147.00	0	Gray fox (1), coyote (1), mule deer (28), chukar (15), raven (6)

Table 6-9. Results of mountain lion camera surveys during 2009 (Continued)

Location	Dates Sampled	Camera Hours	Mountain Lion Photos/Video clips (No. photos/video clips per 1,000 camera hours)	Other Animals (Number of photos/video clips)
Camp 17 Pond[a]	[b]1/7/09–1/5/10	5,108.00	0	Coyote (7), horse (428), mule deer (657), bat (3), golden eagle (1), turkey vulture (16), red-tailed hawk (5), great blue heron (5), raven (26), pinyon jay (9), hawk (1)
Pahute Mesa Pond Area	[b]1/20/09–1/6/10	7,085.75	0	Bobcat (1), coyote (4), pronghorn antelope (1), mule deer (31), black-tailed jackrabbit (18), passerine (2)
19-01 Road, Pahute Mesa[a]	[b]1/20/09–1/5/10	5,619.25	0	Bobcat (1), coyote (2), mule deer (60)
Plateau Road Wash, Pahute Mesa	[b]1/7/09–10/14/09	4,659.50	0	Mule deer (6), passerine (1)
Pahute Mesa Summit, Trail	[b]1/7/09–10/14/09	4,576.75	0	Gray fox (2), mule deer (11)
ER 20-6 Sump	[b]3/17–6/16/09	1,319.75	0	Mule deer (2)
Shoshone Mountain, Tippipah Point Road	[b]1/7/09–1/5/10	8,501.50	0	Gray fox (1), mule deer (32)
Shoshone Mountain, Topopah Pass	[b]1/8/09–1/5/10	6,549.25	0	Mule deer (2), black-tailed jackrabbit (1)
Behind CP6, near 6-4C Barricade[a]	[b]1/7/09–1/5/10	5,902.75	0	Coyote (1), mule deer (10)
Cane Spring	[b]1/8/09–10/5/09	6,146.5	0	Bobcat (11), coyote (20), mule deer (24), raven (3), chukar (1), mourning dove (54), passerine (4)
Rock Valley	2/26/09–1/5/10	7,511.00	0	Coyote (2), wild burro (1), black-tailed jackrabbit (5)

[a]Camera hours not known for some time periods.
[b]Non-continuous operation due to camera problems, dead batteries, full memory cards, etc.

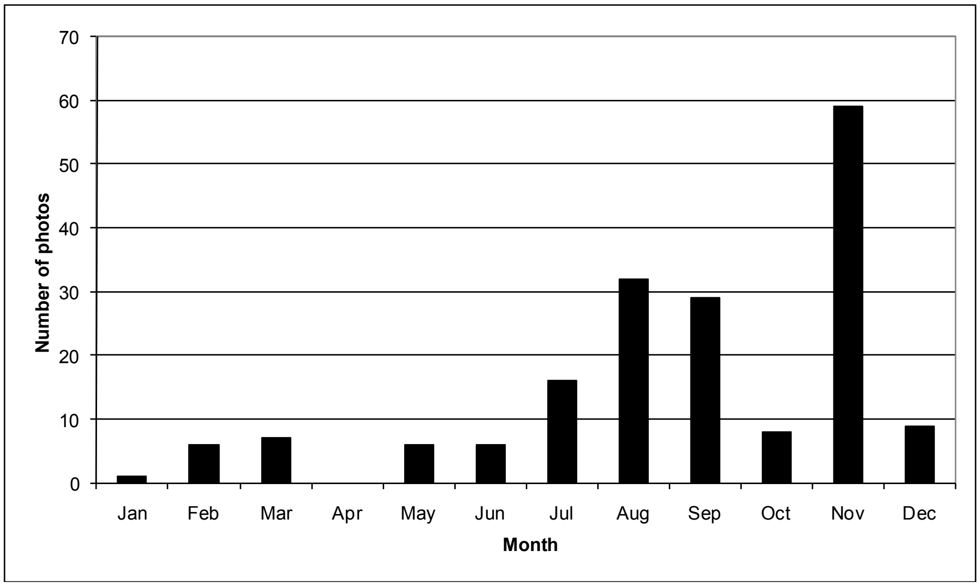

Figure 6-18. Numbers of mountain lion photographs/video clips by month for camera sites where mountain lions were detected during 2006 through 2009 (N=179)

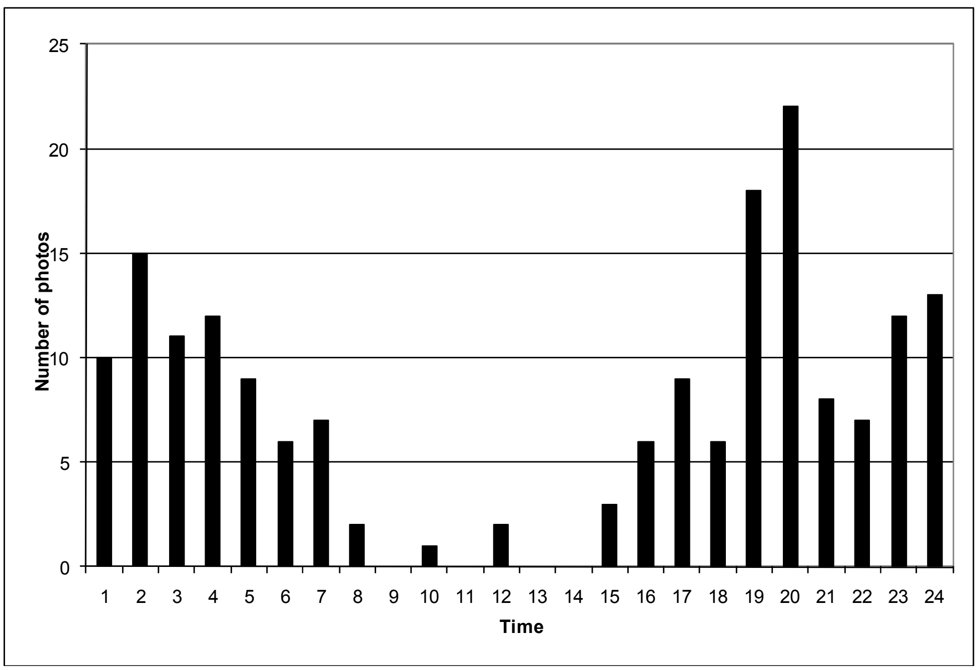

Figure 6-19. Numbers of mountain lion photographs/video clips by time of day for camera sites where mountain lions were detected during 2006 through 2009 (N=179)

Figure 6-20. Nighttime (11:34 p.m.) photograph of mountain lion at Topopah Spring
(Photo taken with ScoutGuard 550 motion-activated camera, November 9, 2009)

6.7 Raptors and Bird Mortality

6.7.1 Raptors

Historically, 16 species of raptors have been recorded for the NTS. 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 NTS, including the western burrowing owl (Hunter, 1994).

No western burrowing owl (*Athene cunicularia hypugaea*) trapping occurred during 2009. An opportunistic re-sighting of a burrowing owl banded last year was made at Burrow #78 in Area 18. A motion-activated camera was used to identify the Acraft band as Re-HA, which corresponds to an adult female captured July 8, 2008, at Burrow #64, approximately 28 km (18 mi) away. No successful reproduction was documented by this female in 2008, whereas in 2009, five juveniles were documented with this female. Three new burrowing owl locations were added this year, including one opportunistic sighting in Mercury (Area 23), a dead (roadkill) owl in Area 27, and a historical (2002) dead (roadkill) owl in Area 25.

6.7.2 Bird Mortality

Bird mortality is a measure of impacts that NNSA/NSO activities may have on protected bird species. NNSA/NSO activities that have affected birds typically have been of three types: collisions with buildings, electrocution from power lines, and vehicle mortalities. Presently there are no large-scale activities on the NTS that might harm birds. Workers are relied on to observe and report mortalities.

On January 5, 2009, an unusually large kill of over 130 ravens was reported in the Area 6 Wet and Wild Compound. NSTec biologists promptly investigated the situation, and the cause of the kill was from a planned poisoning of birds by Wildlife Services USDA at the Amargosa Dairy on December 30–31, 2008. The dairy is located approximately 64 km (40 mi) southwest of the NTS southern boundary. NTS birds apparently flew to this region, foraged on poisoned bait, and survivors returned to the NTS before succumbing. Small numbers of dead ravens were also recovered from several localities on the NTS in addition to the Area 6 compound. The poison used was a compound that quickly degrades and does not cause secondary deaths from animals that might eat the dead birds. Birds were sampled for West Nile virus and were disposed of that day in the Mercury landfill. All tests for West Nile fever were negative.

Only three additional bird mortalities were recorded in 2009: A red-tailed hawk in Mercury, a great horned owl at Test Cell C, and a road-killed burrowing owl in Area 27. The most common cause of bird mortality from onsite activities in 2009 was due to collisions with vehicles. Overall, few impacts to birds were observed and few were reported from onsite project activities. Impacts to bird populations from NNSA/NSO activities at the NTS appear to be low.

6.8 Sheep and Elk Sightings

Over the last couple of decades, there have been anecdotal reports of Rocky Mountain elk or their tracks seen on the NTS. However, until this year no conclusive evidence had been documented. On June 24, two NSTec biologists observed a bull elk on top of Rainier Mesa. The velvet antlers were not yet fully developed. Between August 26 and November 7, 2009, six photographs were taken of a single elk at the top of Pahute Mesa on Pahute Mesa Road (Figure 6-21) with a motion-activated camera as part of the mountain lion distribution and abundance study. In four of the photographs, the head was visible, indicating a five-point bull. A single elk was also observed on two separate occasions during deer spotlight surveys on Pahute Mesa in September, and elk tracks were seen at Gold Meadows Spring, Pahute Mesa Pond, along Holmes Road, and in Big Burn Valley. These records indicate that at least one bull elk spent a considerable part of the year on the NTS. Monitoring during 2010 will help determine if this is a transient animal or if elk are becoming resident on the NTS.

Desert bighorn sheep sightings are rare on the NTS with only eight recorded observations of their presence on or near the NTS since 1963. These have been in the southern part of the NTS (Areas 5, 23, and 25). Motion-activated cameras set at Topopah Spring (Area 29) to monitor mountain lions, photographed at least three rams 85 times between June 28 and November 3 (Figure 6-22). A ram was also photographed on Skull Mountain (Area 25) on May 26 and has similar horn shape to one photographed at Topopah Spring. Another sighting of a ram was documented in Area 18 in August. There is an established population of desert bighorns on the Specter Range, south of the NTS, and other populations west and north of the NTS. It is unknown if the rams at Topopah Spring are from the Specter Range or other populations or if there is animal movement between these distant populations. The NTS may provide a suitable corridor for movement between these populations. It is also unknown if these sheep are, or will become, residents on the NTS. Monitoring during 2010 will help determine if desert bighorn sheep are becoming resident on the NTS, especially if ewes or lambs are detected. Big game biologists with the Nevada Department of Wildlife were notified of the bighorn sheep and elk sightings.

Figure 6-21. The first photographed Rocky Mountain elk on Pahute Mesa Road in Area 19
(Photo by motion-activated camera, August 26, 2009)

Figure 6-22. Three desert bighorn sheep rams at Topopah Spring
(Photo by motion-activated camera, July 1, 2009)

6.9 Nuisance and Potentially Dangerous Wildlife

During 2009, NSTec biologists responded to 25 calls regarding nuisance or potentially dangerous wildlife in or around buildings and work areas. Problem or injured animals included coyotes (*Canis latrans*) (3 calls), bats (11 calls), feral cats (2 calls), and birds (9 calls). Mitigation measures taken usually entailed moving the animal away from people or disposing of dead animals. Notices were also communicated via radio, e-mail, safety meeting presentations, and various company publications to alert people to potentially dangerous situations involving wildlife and to remind employees not to feed wild animals on the NTS.

6.10 Coordination with Biologists and Wildlife Agencies

NSTec biologists, Derek Hall and Paul Greger, authored two articles about western burrowing owls that were published in the *Western North American Naturalist* in 2009, one on food habits (Hall et al., 2009) and one on burrow use (Greger and Hall, 2009). They also provided input into the new Nevada Bird Conservation Plan that the Great Basin Bird Observatory is writing, and presented a poster on the western red-tailed skink at the Southwest Partners in Amphibian and Reptile Conservation 3rd Annual Meeting in St. George, Utah. By invitation, NSTec biologists attended a two-day symposium in Pahrump, Nevada, that summarized research on many aspects of the biota at the Ash Meadows National Wildlife Refuge.

Mr. Hall attended a Bats and Wind Energy Symposium in conjunction with the 2009 Biennial Meeting of the Western Bat Working Group in Austin, Texas. He also attended the annual Nevada Bat Working Group meeting in Reno and gave an informal presentation on bat monitoring efforts on the NTS. He is also serving on the White Nose Syndrome committee of the Western Bat Working Group. The objective of this committee is to try to prevent White Nose Syndrome from spreading to the western United States and Canada. Affiliation with these groups is important to keep informed of the latest issues regarding bats and share data and lessons learned from bat monitoring on the NTS.

Dr. Ted Cohn, University of Michigan, is working on a group of invertebrates called camel crickets. Numerous specimens were collected from the NTS in the 1960s by Brigham Young University researchers. Dr. Cohn is reviewing that collection and requested assistance from NSTec biologists to collect additional camel crickets. This year, three specimens were collected from Tippipah Spring and sent to Dr. Cohn for identification.

USGS scientists received funding to conduct a mountain lion radiotelemetry study on the NTS in collaboration with NSTec. NSTec biologists assisted USGS personnel in preparing the documentation and obtaining the necessary approval to proceed with the project. The three main goals of this study are to (1) provide information relevant to managing the reduction of human exposure to mountain lions and related risks of mountain lion attacks on the NTS, (2) provide information relevant to the effects of mountain lion predation on prey populations of the NTS, and (3) provide preliminary information on demographics and behaviors of the unhunted population of mountain lions on the NTS and adjacent lands.

Aquatic invertebrate samples were collected from numerous springs in 2009 to learn more about the aquatic invertebrates and, in particular, Ostracoda (seed shrimp) on the NTS. Samples were sorted, preserved, and sent to Dr. Emanuel Palacios-Fest, a regional U.S. expert in Ostracode taxonomy at the Terra Nostra Aquatic Institute in Tucson, Arizona. Three species of Ostracods not previously known on the NTS were *Potamocypris smaragdinia*, *Eucypris meadensis*, and *Heterocypris brevacaudata* (Table 6-10). One of these is a common spring species (*E. meadensis*) present at six locations on the NTS, and the other two are common lake and stream species. The identification of a small fingernail clam (*Pisidium casertium*), a common western species but previously known only from Cane Spring on the NTS was also confirmed. *Pyrgulopsis turbatrix,* the Southeast Nevada pyrg, a sensitive species, was found to be abundant at Cane Spring in 2009 (Table 6-10) as in previous years.

Table 6-10. Presence of invertebrates sampled from selected springs on the NTS

Sample Locations	Gold Meadows Spring	Yucca Playa Pond	Cane Spring		Pahute Mesa Pond	White Rock Spring	Captain Jack Spring
Invertebrates	12/5/2007	7/14/1998	7/14/1998	9/27/2009	4/1/2009	7/2/2009	6/24/2009
Ostracoda (Seed Shrimp)							
Eucypris meadensis Gutentag & Benson	X	X	X		X	X	X
Potamocypris smaragdina Vavra		X	X				
Herpetocypris brevicaudata Kaufmann			X	X		X	
Bivalvia: Pisididae (Fingernail Clam)							
Pisidium casertium			X	X			
Gastropoda (Snails)							
Pyrgulopsis turbatrix			X	X			
x = species present							

Photos of tarantulas from the NTS were sent to Dr. Tom Prentice at University of California, Riverside, for species verification. Dr. Prentice has identified the common large tarantula at the NTS as *Aphonopelma iodius.* This corrects the previous name of *Aphonopelma steindachneri* documented from Rock Valley (Turner, 1973). A second species much smaller in size than the above-listed species and darker in color is *Aphonopelma mohave*. It is likely to occur on the NTS (Greger, 2009), but its presence has not been verified.

Terrestrial crane flies were collected opportunistically from reptile traps in rocky boulder areas in 2009. Crane flies, Family Tipulidae, have been noted but never examined in detail from the NTS. Records simply note Tipulidae from Rock Valley (Turner, 1973). In 2009, 43 specimens were collected from three sites in Mid Valley (Site numbers 102–104) and three sites in other regions (Area 2 Site 105, Area 9 Site 106, and Area 18 Site 114) of the NTS in 2009 (see reptile locations in Figure 6-2). The samples were sent to Dr. Jon Gelhous, an expert in desert crane flies, of the Philadelphia Academy of Sciences for identification. Dr. Gelhous identified two species from the samples, one species, near, *Tipula desertorum*, (which may require more work to complete its description) and a second species, *Tipula* near *zelotypa,* a new species, in the Palmarum Group. Both species are terrestrial, with larvae and pupae living in the soil and hatching in the spring. Crane fly larvae and pupae could possibly be important food resources for reptiles before they hatch as adults during the spring–summer. These crane flies appear to be widely distributed on the NTS in rocky areas. *T. desertorum* was found at all six sample sites. The probable new species was located in Mid Valley and the Area 2 reptile site.

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7.0 HABITAT MONITORING

7.1 West Nile Virus Surveillance

West Nile virus (WNV) is a potentially serious illness that is spread to humans and other animals through mosquito bites. It was first discovered in Uganda in 1937 and was not detected in North America until 1999. In southern Nevada, it was not detected until the spring of 2004. WNV surveillance continued in 2009 for the sixth consecutive year. WNV surveillance entails setting mosquito traps baited with dry ice overnight at sites where standing water provides a potential breeding site for mosquitoes (Figure 7-1). As the dry ice sublimates, it produces carbon dioxide, which attracts mosquitoes. Eight sites were sampled during 15 surveys (Table 7-1). Mosquitoes collected during the surveys were taken to the Southern Nevada Health District for species identification and WNV testing. A total of 18 individuals representing two species was captured and analyzed in 2009 (Table 7-1). All specimens were negative for WNV. Mosquito species identified were entered into the EGIS faunal database to define mosquito distribution on the NTS. In 2009, no new species were detected. Additionally, oral swabs from 15 dead ravens were submitted for WNV testing. All were negative for WNV.

Figure 7-1. Mosquito trap set at Shaker Plant Sump, Area 1 in Yucca Flat
(Photo by D. B. Hall, June 3, 2009)

Table 7-1. Results of West Nile virus surveillance on the NTS in 2009

Location	Date	Number Captured	Species	WNV
Well 3 Pond, Area 6	5/20/09	0	NA	NA
Well 5B Pond, Area 5	5/20/09	0	NA	NA
Mercury SOC Park, Area 23	5/20/09	0	NA	NA
Oak Spring, Area 15	6/02/09	1	*Culiseta inornata*	Negative
Oak Spring, Area 15	6/02/09	1	*Culex tarsalis*	Negative
Shaker Plant Sump, Area 1	6/02/09	0	NA	NA
Mercury SOC Park, Area 23	6/02/09	0	NA	NA
Camp 17 Pond, Area 18	7/07/09	0	NA	NA
Well 3 Pond, Area 6	7/07/09	1	*Culex tarsalis*	Negative
Mercury Sewage Lagoons, Area 23	7/07/09	0	NA	NA
Camp 17 Pond, Area 18	8/12/09	0	NA	NA
Well 3 Pond, Area 6	8/12/09	7	*Culex tarsalis*	Negative
Mercury SOC Park, Area 23	8/12/09	0	NA	NA
Well 3 Pond, Area 6	9/02/09	4	*Culex tarsalis*	Negative
Well 5B Pond, Area 5	9/02/09	4	*Culex tarsalis*	Negative
Cane Spring, Area 27	9/02/09	0	NA	NA

SOC: Special Operations Center

WNV: West Nile virus

7.2 Natural Wetlands Monitoring

Monitoring of numerous wetlands continued this year to characterize seasonal baselines and trends in physical and biological parameters. Twelve wetlands (Figure 7-2) were visited at least once during 2009 to record wildlife use, the presence/absence of land disturbance, water flow rates when applicable, and surface area of standing water (Table 7-2). Sizes of wetlands monitored varied greatly from very small areas (<1 m^2 [<10.8 ft^2]) to moderately sized springs (180–600 m^2 [1,938–6,458 ft^2]). Surface flow rates were low (<5 liters per minute [1.3 gallons per minute]) at most wetlands where flow was measurable (Table 7-2). Water flow was present at Cane Spring, Oak Spring, John's Spring, Carrie Spring, and Wildhorse Seep but was so low it was not realistic to measure.

Flow was generally estimated by collecting a known volume of water from permanently installed pipe(s) over a known time period. Sometimes a pipe was temporarily installed to accomplish this (i.e., Captain Jack Spring). Flow or discharge measured this way is an approximate measurement and is generally an underestimate of true flow. At some sites, water collects, but there is no way to estimate flow, which was the situation at Gold Meadows and Pahute Mesa Pond. Flow occurs as seepage through the local sediments into the pond collection area. Similarly, water collected at the Wildhorse and Little Wildhorse Seeps is mostly from runoff of slick-rock areas and flow is not measurable. Carrie Spring was a newly located seep on a steep hillside about 300 m (984 ft) east of Oak Spring (see Figure 7-2) that had visible flow over rocks, but was not measurable. Emilie Seep was only visited in July 1998, when it was found to be dry. It is located in a remote region northwest of Topopah Spring (Figure 7-2) and as such has not been regularly monitored. It was included in this year's map for completeness and will be visited in the spring–summer to assess its value to wildlife.

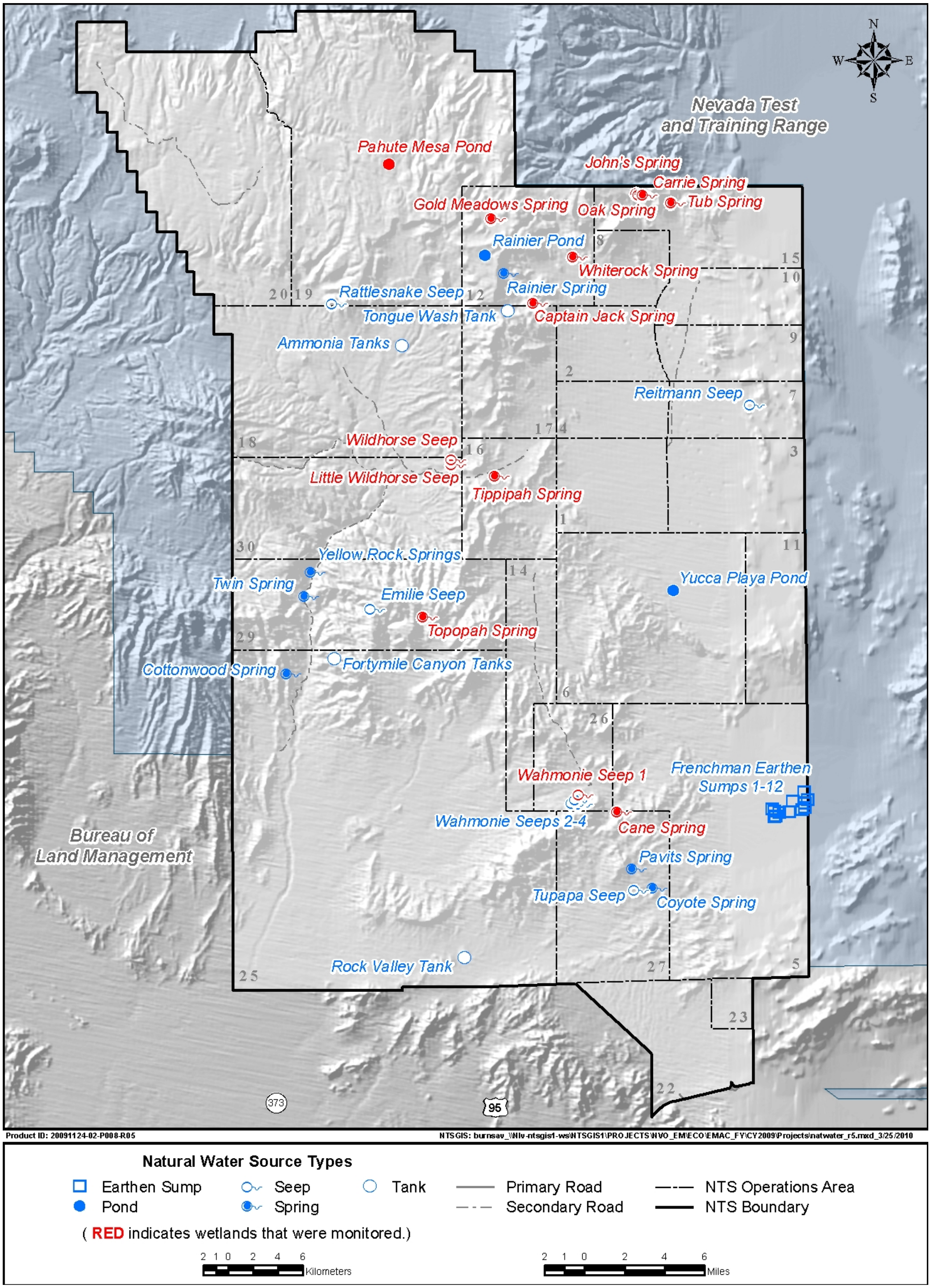

Figure 7-2. Natural water sources on the NTS, including those monitored in 2009

Table 7-2. Hydrology and disturbance data recorded at natural water sources on the NTS during 2009

Water Source	Date	Surface Area of Water (m^2)[a]	Surface Flow Rate (L/min)[b]	Disturbance at Spring
Cane Spring	9/22/09	15	NC	Heavy cattail growth in cave pool
Captain Jack Spring	6/24/09	15	1.2	None
Captain Jack Spring	9/16/09	15	1.4	None
Captain Jack Spring	10/15/09	NM	NC	Photos of horse use
Carrie Spring	6/4/09	2	NM[c]	None
Gold Meadows Spring	6/23/09	160	NM[c]	Horse trampling
Gold Meadows Spring	8/24/09	0	0	Horse trampling
John's Spring	6/4/09	4	NM[c]	None
Little Wildhorse Seep	1/06/10	0	0	Horse trampling
Pahute Mesa Pond	4/21/09	300	NM[c]	None
Pahute Mesa Pond	9/16/09	0	0	None
Oak Spring	6/4/09	3	NM[c]	None
Tippipah Spring	11/19/09	240	NM[c]	None
Topopah Spring	10/20/09	4	NM[c]	None
Wildhorse Seep	1/06/10	>5	NM[c]	Horse trampling

[a] m^2 = square meters
[b] L/min = liters per minute
[c] NM = not measurable due to diffused flow
NC = data not collected

Wildlife use data recorded at natural water sources during daytime sampling are summarized in Table 7-3. Two probable mountain lion deer kills were found at Topopah Spring. Elk tracks were also detected at or near Gold Meadows Spring and Pahute Mesa Pond in 2009. Horse and mountain lion activity was also detected at Captain Jack Spring. Overall, few birds were observed, especially chukars (*Alectoris chukar*) and mourning doves (*Zenaida macroura*) throughout the NTS in 2009 (Table 7-3). A black-chinned sparrow was captured at Oak Spring in a reptile trap. This species is a steep slope obligate in the Great Basin and is the first record for this species on the NTS since 1961 (Hayward et al., 1963).

Table 7-3. Number of wildlife species observed or inferred at NTS natural water sources in 2009

Wildlife Species Observed at NTS Natural Water Sources	**Cane Spring**	**Captain Jack Spring**	**Captain Jack Spring**	**Gold Meadows Spring**	**Gold Meadows Spring**	**John's Spring**	**Little Wildhorse Seep**	**Oak Spring**	**Pahute Mesa Pond**	**Tippipah Spring**	**Topopah Spring**	**Whiterock Spring**	**Wildhorse Seep**
Date Observed (month/day)	**9/27**	**6/24**	**1/6**	**6/23**	**8/24**	**6/4**	**1/6**	**6/4**	**4/20**	**11/19**	**10/20**	**7/2**	**1/6**
Mammals													
Coyote (*Canus latrans*)	P	P	P	P	P	P	P	P	P	P	P	P	P
Elk (*Cervus elaphus*)					P				P				
Feral horse (*Equus caballus*)			P	P	P		P						P
Bighorn Sheep (*Ovis canadensis*)											P[1]		
Mountain lion (*Puma concolor*)			P								P		
Mule deer (*Odocoileus hemionus*)	P	P	P	P	P	P	P	P	P	P	2	P	P
Birds													
Black-chinned Sparrow (*Spizella atrogularis*)								1					
Chukar (*Alectoris chukar*)	P		P										
House Finch (*Carpodacus mexicana*)			1							5			
Mourning dove *(Zenaida macroura)*	3											25	
Sage sparrow (*Amphispiza bellii*)										2			
Numbers of bird species detected:	**2**	**0**	**2**	**0**	**0**	**0**	**0**	**1**	**0**	**2**	**0**	**1**	0
P= Species presence inferred from sign	[1] detected from motion camera												

7.2.1 Deer Use of Topopah Spring

A newly positioned motion-activated camera at Topopah Spring recorded daily mule deer use in 2009. Topopah Spring is the only permanent water source in the Shoshone Mountain Area. Deer were recorded at the spring from late June 2009 until January 2010. The number of deer photos increased nearly fivefold from the initial monitoring period of August 19 to October 19 (132 photos in 62 days) to the mid-period of October 20 to December 1 (696 photos in 43 days). The number of deer photos decreased again for the later period of December 2 to January 5 (133 photos in 34 days). These data strongly infer a higher use rate of the spring by deer for the mid-period monitored (late October to early December). This could be related in part to dry conditions (relieved by early December precipitation) and to an increased number of deer in the area from winter migration. The onset of the mid-period coincides strongly with the time that many deer migrate from the summer/fall range on the mesas to the southwestern NTS as determined by radio telemetry (Giles and Cooper, 1985).

7.2.2 Fairy Shrimp Inventory on NTS

Fairy shrimp were abundant, and an additional reference collection of a small species (<15 mm [<0.59 in.]) of *Branchienecta* spp. was made from Pahute Mesa Pond on April 21, 2009. This is believed to be an undescribed species but needs further taxonomic verification. Ostracods were also abundant in the sample. Dry conditions limited suitable growing conditions for fairy shrimp at NTS wetlands for most of 2009.

7.3 Constructed Water Source Monitoring

NSTec biologists conducted quarterly monitoring of constructed water sources. These sources, located throughout the NTS (Figure 7-3), include 38 plastic-lined sumps at 19 sites. Several ponds or sumps are located next to each other at the same project site. Many animals rely on these human-made structures as sources of water. However, wildlife and migratory birds may drown in steep-sided or plastic-lined sumps as a result of entrapment, or ingest contaminants in sumps with drilling fluids or evaporative ponds. Ponds are monitored to assess their use by wildlife and to develop and implement mitigation measures to prevent them from causing significant harm to wildlife.

During March, July, October, and December 2009, 19 constructed water sources (Figure 7-3) 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, and the presence, absence, and condition of these structures were also noted. All dead animals (or any remains of an animal) in or adjacent to a human-made water source were recorded (Table 7-4). Monitoring frequency was decreased for many sumps in areas like Yucca Flat where older sumps no longer show evidence of entrapping animals. Older liners become less slippery over time, allowing animals to escape.

During 2009, three dead deer (a doe and two fawns) were detected in sumps on the NTS. They drowned at ER 20-5, in a sump (360 m^2 [3,875 ft^2]) that was filled with overflow water from a new nearby sump, ER 20-7, where extensive pumping had occurred during July. A sediment ladder was immediately constructed in one corner of this pond to prevent any further entrapment of animals. The pond was 3 m [9.8 ft]) deep and was the only sump known in Area 20 to contain water through the year.

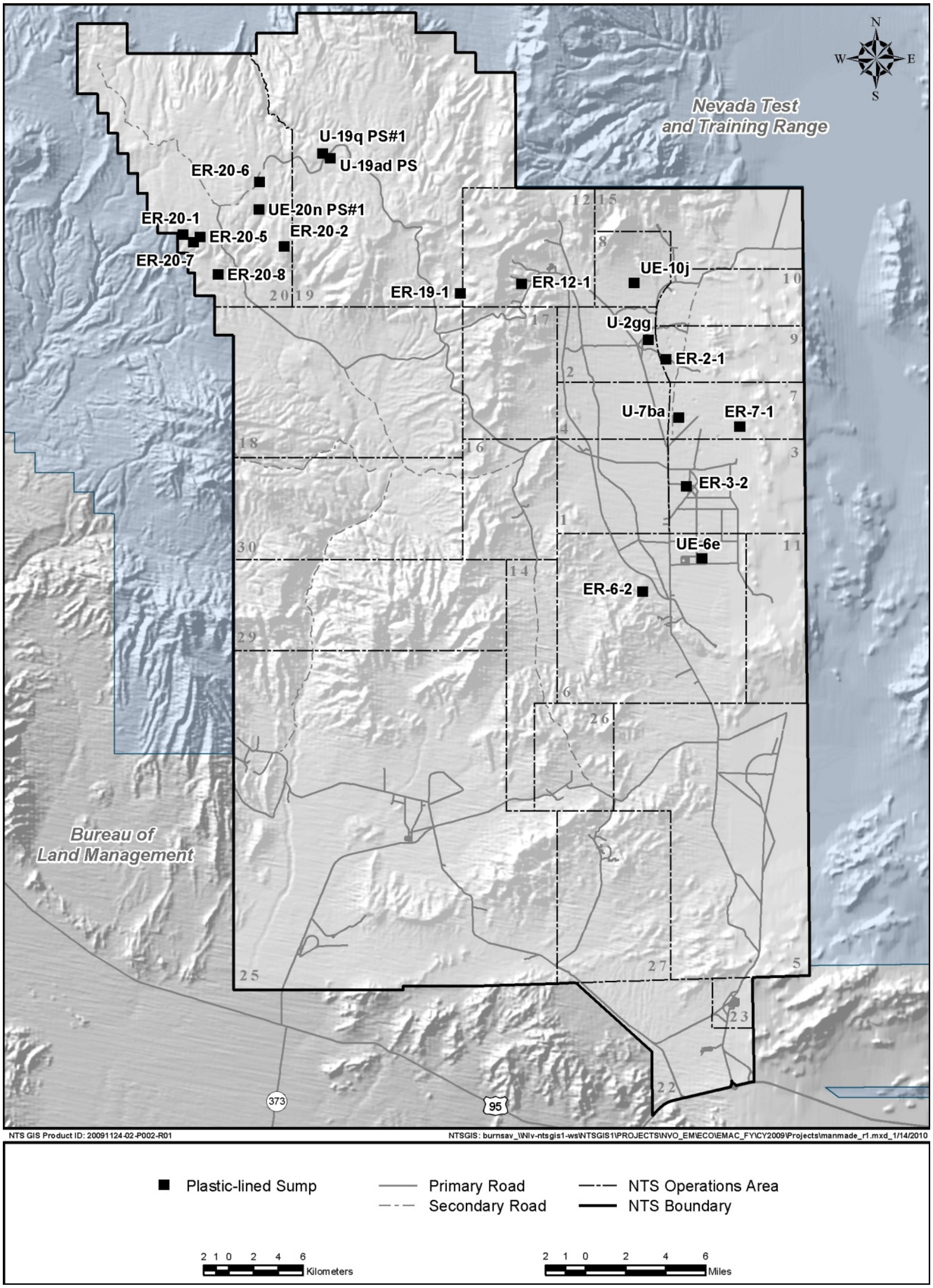

Figure 7-3. Constructed water sources monitored for wildlife use and mortality on the NTS during 2009

Table 7-4. Results of monitoring plastic-lined sumps for wildlife mortality at the NTS for 2009

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	20	18	6,000	10	None
April–June	0	0	0	0	None
July–September	8	2	800	0	3
October–December	24	2	950	11	None

Most sumps were dry by early October with the exception of two sumps where recent precipitation had occurred and water was 1.2–2.7 m (4–9 ft) deep. Most sumps fill with water from first snows in mid–late December. Use is limited to common species of passerine birds and shorebirds.

Sediment ramps were shown to be used by wildlife from the presence of fresh tracks on the ramps. It is recommended that sediment ramps be emplaced in new sumps when they are constructed because the liners are very slippery at that time. Sediment ramps, where installed, have been very effective in allowing animals to exit sumps without becoming entrapped.

8.0 HABITAT RESTORATION MONITORING

The habitat restoration program involves the revegetation of disturbances and the evaluation of previous revegetation efforts. Sites that have been revegetated are periodically sampled, and the information obtained is used to develop site-specific revegetation plans for future restoration efforts on the NTS.

Typically, reference areas are also sampled to provide a standard for determining revegetation success. The reference sites represent the type of vegetation that occurred prior to the disturbance and restoration activities. The amount of cover, the number of plants, and the kind of plants on the reference sites serve as standards for the restoration site and provide a means of determining reclamation success. Specific standards have not been set for any of the sites presented in this report. However, an arbitrary standard of 70% of the cover and density measured on the reference site is used as a measure of reclamation success.

8.1 Habitat Restoration: Nevada Test Site

In 2009, a portion of the land disturbed during the installation of an underground pipeline was revegetated, and a previously revegetated site on the NTS and the Tonopah Test Range (TTR) was monitored. The pipeline disturbance was revegetated in December, and previously revegetated site was monitored in May.

8.1.1 Monitoring CAU 110-Area U-3ax/bl

The closure cover for the U-3ax/bl disposal unit in Area 3 of the NTS was approved and constructed in the fall of 2000. Final construction included the establishment of a vegetative cover. To accomplish this, the site was revegetated in the fall of 2000 and has been monitored since 2001 to ensure that a viable plant community is established and persists on the closure cover. Field sampling this year was completed on May 13, 2009.

Growing season precipitation for monitoring consisted of precipitation received from September of the previous year through June of the current year. Precipitation received during July and August of the current year was considered insignificant in supporting plant growth due to high temperatures and rapid soil evaporation. Nearly 4 cm (1.5 in.) of precipitation was received in February, but only insignificant amounts of precipitation were received after February. Total growing season precipitation was 10.9 cm (4.3 in.), which compares to an 11-year (number of years since the site was revegetated) average of 12.0 cm (4.7 in.). Growing season precipitation has been below the 11-year average 7 of the last 11 years (NOAA ARL/SORD, 2010).

Total plant cover on the U-3ax/bl closure cover this year was 12%. *Atriplex confertifolia* made up 94% of the total cover; *Ephedra nevadensis* and two annual *Eriogonum* species contributed equally to the remaining 6%. Perennial grasses and invasive weeds did not contribute to overall plant cover in 2009. Litter made up 14% of the ground surface, and the remaining 74% was either rock or bare ground.

Plant cover on the peripheral area, which was not seeded, was only 4% in 2009. All of the cover was from an annual invasive weed, *Bromus tectorum*. Approximately 26% of the peripheral area was covered with litter, and the remaining 70% was bare ground or rock.

Plant cover over the last five years on the U-3ax/bl closure cover averaged 17.9% with a low of 10.6% in 2007 (a droughty year with only 4.4 cm [1.7 in.] of rainfall during the growing season) and a high of 26.8% in 2008. Precipitation during the growing season in 2008 was 15.9 cm (6.4 in.). Shrubs have made up the majority of the cover every year. Over the last five years, shrubs have averaged 14.3% cover, or about 80% of the total cover. Shrub cover was relatively high in 2005 and 2006, declined to a low of 10.6

in 2007, but has maintained at about 12% the last two years even during continued below normal precipitation (Figure 8-1). Perennial grasses have never established on the closure cover and have not contributed significantly to overall plant cover.

Annual forb (i.e., broadleaf herb) cover was insignificant in 2009, in contrast to last year when perennial plant cover and annual forb cover were both 12.8% (Figure 8-1). Annual forb cover has varied over the last five years, ranging from 2.0% in 2005, zero the next two years, a five-year high of 12.8% in 2008, and less than 0.5% this year (Figure 8-1). A similar trend is noted with invasive weeds, although the amount of cover from invasive weeds in 2008 was one-tenth the amount of cover for native annual forbs.

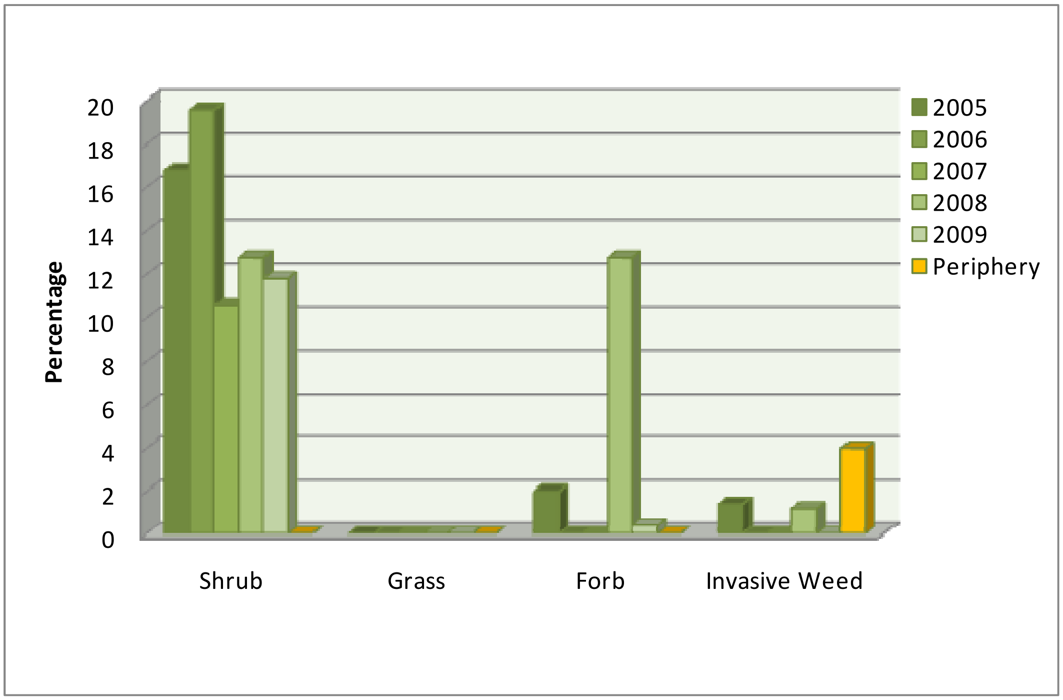

Figure 8-1. Plant cover by life form/invasive weeds on the cover cap at CAU 110 U-3ax/bl over the last five years

The establishment of several native shrubs has added stability to the plant community on the U-3ax/bl closure cover. The variation in shrub cover from year to year and over the last five years is much less than the variation with annual forbs. There does not appear to be any correlation between shrub cover and annual forb cover. Shrub cover was relatively high in 2005 and 2006 when there was very little forb cover. There has been very little variation in shrub cover the last three years, but annual forb cover has experienced two extremes (Figure 8-1).

There were 16.9 plants/m^2 (14.1 plants/square yard [yd^2]) this year on the closure cover, which included perennial shrubs, annual forbs, and invasive weeds. There were 1.3 shrubs/m^2 (1.1 shrubs/yd^2), or about 8% of the total plant density. The most abundant shrub was *A. confertifolia*, followed by *E. nevadensis* and a single *Krascheninnikovia lanata* plant. The majority of the plant density was from two annual forbs, almost exclusively *Eriogonum deflexum* with a few individuals of *Mentzelia albomarginatus*. Annual forbs made up 74% of the total plant density. Invasive weedy species made up the remaining 18%. The two invasive weeds present were *Salsola iberica* and *B. tectorum*.

Plant density on the peripheral, non-seeded area was quite different. There are no perennial plants on the peripheral area, but there was an average of 21.0 annual plants/m^2 (17.6 annual plants/yd^2). There were

8.5 annual forbs/m^2 (7.0 annual forbs/yd^2), primarily *E. deflexum*, which is approximately 40% of total plant density. The remaining 12.5 plants/m^2 (10.5 plants/yd^2) were invasive weeds, mainly *B. tectorum* along with lesser densities of *S. iberica* and *Halogeton glomeratus*.

Perennial plant density has declined over the last five years (Figure 8-2). In 2005, there were five perennial shrubs and two perennial grasses found on the closure cover. By 2009, there were only three shrubs and no grasses. Shrub density has declined from 4.7 plants/m^2 (3.9 yd^2) in 2005 to just 1.2 plants/m^2 (1.0 plants/yd^2) this year. *A. confertifolia*, *E. nevadensis*, and *K. lanata* were common in 2005 but have declined over the last five years, as have other less common shrub species such as *Picrothamnus desertorum* and *Grayia spinosa*. By 2006 *P. desertorum* was no longer found on the site, and by 2007 *Grayia spinosa* was absent. *K. lanata* is still found on the site but typically only one or two plants each year.

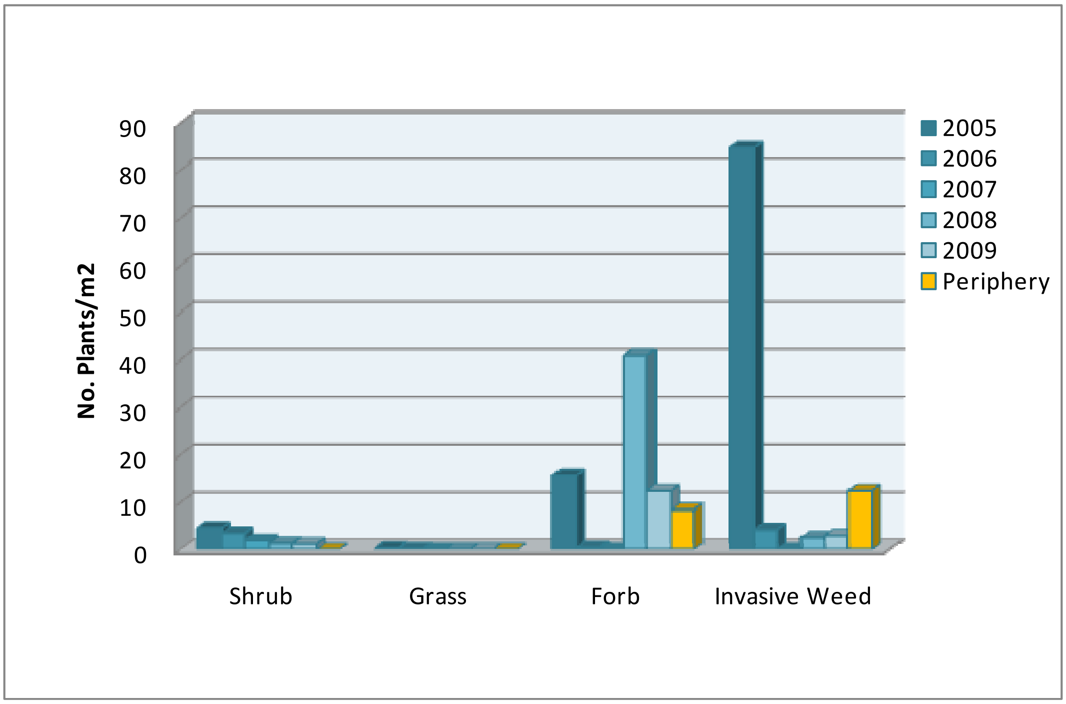

Figure 8-2. Plant density by life form/invasive weeds on the cover cap at CAU 110-U-3ax/bl over the last five years

The decline in plant density was dramatic for perennial grasses. *Achnatherum hymenoides* and *Elymus elymoides* were present in 2005 and 2006, but, because of the extreme drought of 2007, these species died and were rarely found on the closure cover, as has been the situation the last two years. A few individual plants have persisted over the years, but they have not been encountered during sampling.

There does not appear to be a definable trend for native annual forbs and invasive weeds. There were high densities of annual forbs in 2005, 2008, and 2009. The high densities in 2005 and 2009 were almost 100% attributable to *E. deflexum*. In 2008, it was a combination of *E. deflexum*, *Chaenactis stevioides*, and *Sisymbrium altisimum*. The abundance of annual forbs correlates with the amount of precipitation received during the growing season and the timing of the precipitation. Precipitation this year was below the 48-year average, but significant precipitation in February (almost 3.6 cm [1.4 in.]) may explain the abundance of *E. deflexum* this year.

Annual invasive weeds follow a trend similar to that of the annual forbs. *S. iberica* was very successful in 2005 when growing season precipitation was almost double the 48-year average. Since 2005 this species is rarely encountered on the closure cover, nor is *H. glomeratus*, which was also abundant in 2005. Growing season precipitation has not approached the 25.4 cm (10.0 in.) received in 2005, which may explain why these species have not done as well since then. Another reason that these species have not invaded and dominated the closure cover is because neither of these species competes well with established native species, such as *A. confertifolia*, *E. nevadensis*, *K. lanata*, or even the few plants of *A. hymenoides* or *E. elymoides*. The establishment of these native plants on the closure cover may have deterred the establishment of many invasive weedy species, especially *S. iberica* and *H. glomeratus*.

The plant community on the U-3ax/bl closure cover is characterized by a combination of native perennial shrubs and annual forbs. Weedy species are present occasionally but when present make up on average less than 6% of the total cover. Even though plant cover and density have declined over the last five years, a viable perennial plant community persists.

8.1.2 Revegetation of Control Point (CP) Waterline

An underground waterline was installed this past year, which resulted in a linear disturbance covering approximately 2.8 ha (7 ac). The western section of the waterline was in steep terrain and was susceptible to severe water erosion. This section of the waterline was revegetated, which was approximately 0.4 ha (1 ac). Preparation of the site consisted of a shallow (less than 15 cm [6 in.]) disking of the compacted surface soils because of the risk of damaging underground cables. Disking was completed on December 7, 2009, and on the following day, the area was broadcast seeded using a rangeland seeder with drill tubes disengaged. A drag bar with chains was used to cover the seed. A mix of native plant seed (Table 8-1) was used at a rate of approximately 34.8 kilograms/hectare (kg/ha) (31 pounds/acre [lb/ac]) of Pure Live Seed (PLS). A straw mulch was spread over the site using a straw blower at a rate of 4,500 kg/ha (4,000 lb/ac). The straw mulch was then crimped into the soil using a Finn Crimper (Figure 8-3).

Table 8-1. Seed mix used to revegetate the CP Waterline in Area 6 of the NTS

Genus	Species	Common Name	PLS kg/ha (lb/ac)
Coleogyne	*ramosissima*	blackbrush	11.7 (10.4)
Atriplex	*canescens*	*fourwing saltbush*	1.5 (1.3)
Atriplex	*confertifolia*	*shadscale saltbush*	4.4 (3.9)
Ephedra	*nevadensis*	*Nevada jointfir*	7.3 (6.5)
Ericameria	*nauseosa*	*rubber rabbitbrush*	0.8 (0.7)
Hymenoclea	*salsola*	*cheesebush*	1.5 (1.3)
Krascheninnikovia	*lanata*	*winterfat*	1.5 (1.3)
Achnatherum	*hymenoides*	*Indian ricegrass*	4.4 (3.9)
Elymus	*elymoides*	*squirreltail*	1.5 (1.3)
Baileya	*multiradiata*	*desert marigold*	0.1 (0.1)
Eschscholzia	*californica*	*California poppy*	0.2 (0.2)
Linum	*lewisii*	*Lewis' flax*	0.2 (0.2)
Penstemon	*palmeri*	*Palmer's penstemon*	0.1 (0.1)
Sphaeralcea	*ambigua*	*desert globemallow*	0.2 (0.2)
TOTALS			**35.2 (31.4)**

Figure 8-3. Crimping straw mulch at the CP waterline revegetation site
(Photograph by D.C. Anderson, December 7, 2009)

8.2 Habitat Restoration Monitoring: Tonopah Test Range

Five sites located on the TTR were monitored in June of 2009. Four of the sites were revegetated in 1997 and the other in 2004. These sites are monitored periodically to assess revegetation success.

Growing season precipitation this year for the sites located on TTR was below the long-term average of 9.9 cm (3.9 in.) (Community Environmental Monitoring Program, 2009). The 9.1 cm (3.6 in.) received this year was less than was received last year. Most of the precipitation came in November 2008, February 2009, and June 2009. Insignificant amounts of precipitation were received during the other months.

8.2.1 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.

Plant cover on the staging area this year was just over 11%. More than 80% of the plant cover was from *Atriplex canescens*. The two grasses present, *A. hymenoides* and *Pleuraphis jamesii,* contributed less than 1% of the total plant cover. The rest of the cover was from *Machaeranthera canescens* and *Nama pusillum*, both forbs common in the native plant community (Figure 8-4).

Plant cover on the reference area was 11% also. *A. canescens* and *Chrysothamnus greenei* made up the shrub cover, and *A. hymenoides* was the only perennial grass present. *A. hymenoides* made up more than half of the total plant cover. Two different forbs, *C. stevioides* and *S. iberica*, were found on the reference area; they contributed about the same to total plant cover, as did the two forbs on the staging area.

The amount of plant cover on the flooded area is improving. There is 2.5% shrub cover, all A. *canescens*, which is higher shrub cover than on the reference area. The only other plant that contributed to plant cover was an annual forb, *S. iberica*, which contributed less than 1% absolute cover.

Total plant density on the staging area is about two-thirds of the plant density on the reference area. Shrub density is about 50% greater than the standard for shrub density. Two shrubs, *A. canescens* and *P. desertorum*, made up the shrub density on the staging area. There were two species of grasses present, *A. hymenoides* and *P. jamesii*, but the two together only amounted to about 60% of the standard for grass density (Figure 8-5). *A. hymenoides* was the only grass on the reference area. On the reseeded area, plant density was less than 1 plant/m^2 (1.31 plants/yd^2). All three life forms (shrubs, grasses, and forbs) were present, but densities of each group were low.

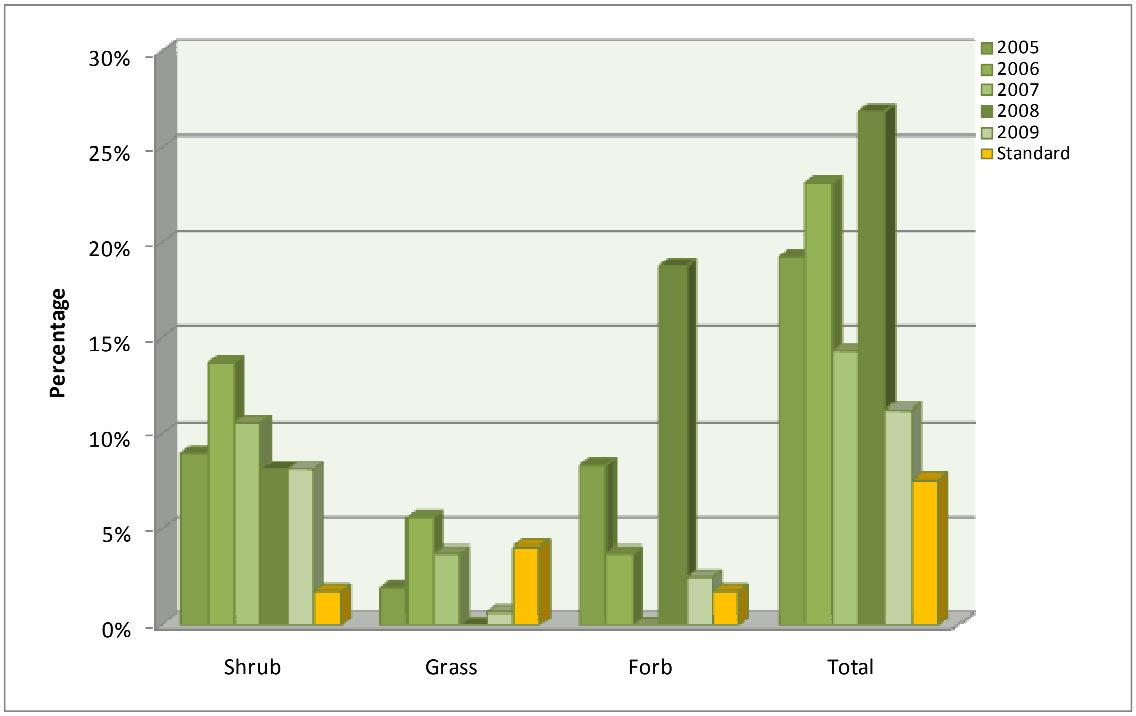

Figure 8-4. Plant cover by life form over the last five years at CAU 400-Five Points Landfill

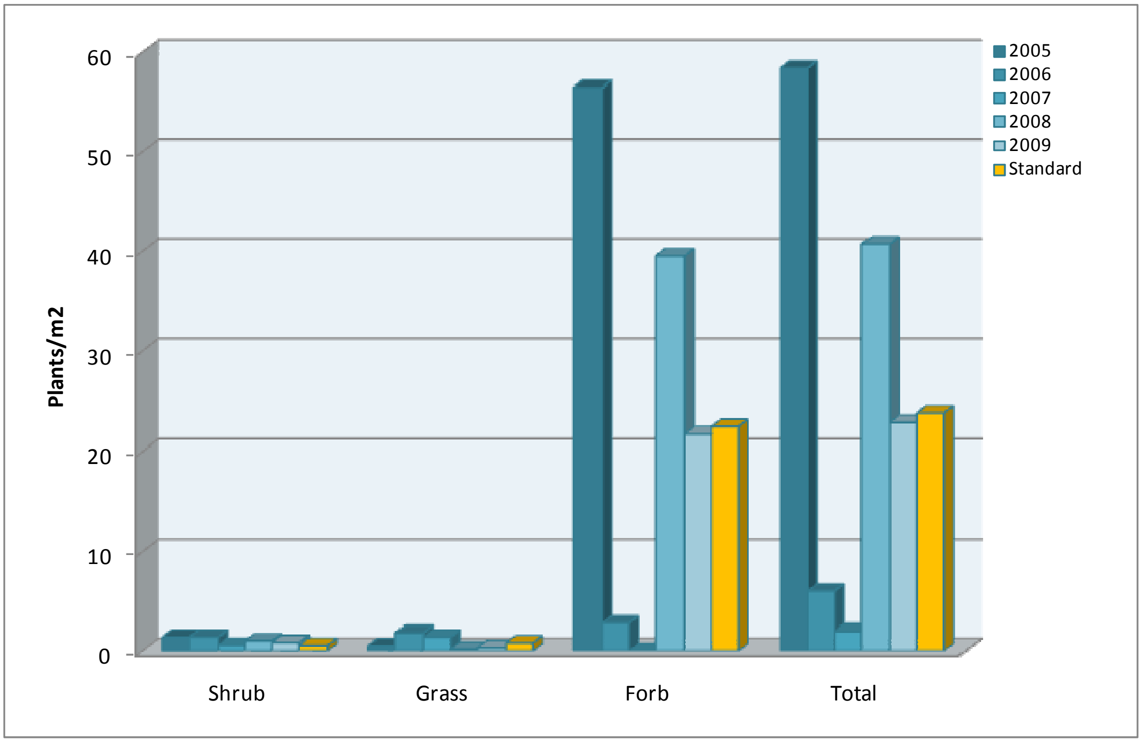

Figure 8-5. Plant density by life form over the last five years at CAU 400-Five Points Landfill

There was a good variety of forbs on both the staging area and the reference area. The difference in density between the two areas is attributable to the abundance of *C. stevioides* on the reference area. *C. stevioides* was the most abundant forb on both areas; however, there were almost four times as many individuals of this species on the reference area as on the staging area.

The plant community that has established on the Five Points Landfill site appears to be viable and persistent. Total plant cover exceeded the amount of plant cover in the adjacent native plant community (reference area), and plant density, although less than in the native plant community, was within a few percentage points of meeting arbitrarily established success standards. Over the last few years, the amount of precipitation received at these sites and throughout the region has been below normal. Grasses appear to suffer the greatest from these drier conditions, as is reflected in the gradual decline of grass cover and density over the last few years (Figures 8-4 and 8-5).

8.2.2 CAU 400-Bomblet Pit

The Bomblet Pit, located near the bottoms of Cactus Flat, was seeded in the fall of 1997. The site prior to revegetation efforts was heavily disturbed and dominated by *H. glomeratus*, an invasive weed. The main concern at this site was that *H. glomeratus* would return to the site after revegetation and impede the establishment of native plants, especially native shrubs and grasses. This is the twelfth year since this site was revegetated and is the last year it will be monitored.

The 7.5% total plant cover this year was made up entirely of shrubs. On the staging area, *A. confertifolia* accounted for all of the plant cover. On the reference area, there were three shrubs, *A. confertifolia*, *P. desertorum,* and *K. lanata*; but like the staging area, no grasses or forbs contributed to cover

(Figure 8-6). Shrub density on the staging area is excellent. The two most common species on the staging area were the same species found on the reference area, *A. confertifolia* and *P. desertorum*. There were no grasses on the staging area, and only *A. hymenoides* was found on the reference area. The absence of grasses was not unexpected. Grasses are not a major component of the native plant community, and, although the density of grasses was higher shortly after the site was revegetated in 1997, grasses have not persisted (Figure 8-7).

Forb density has never been high at the Bomblet Pit site. The only forb present on the staging area was *Lepidium densiflorum* and the most common forb on the reference area was *M. canescens*. *L. densiflorum* occurred on the reference area also but at lower densities than was found on the staging area.

The plant community that has established on the Bomblet Pit site has low plant cover, low plant density, and only a few species. This is typical of the native plant community in this area. Plant cover this year is about 85% of the revegetation success standard of 8.8% and has declined over the last three years (Figure 8-6). It is obvious that grasses have never made a significant contribution to plant cover at this site; forb cover is very sporadic and dependent on annual rainfall.

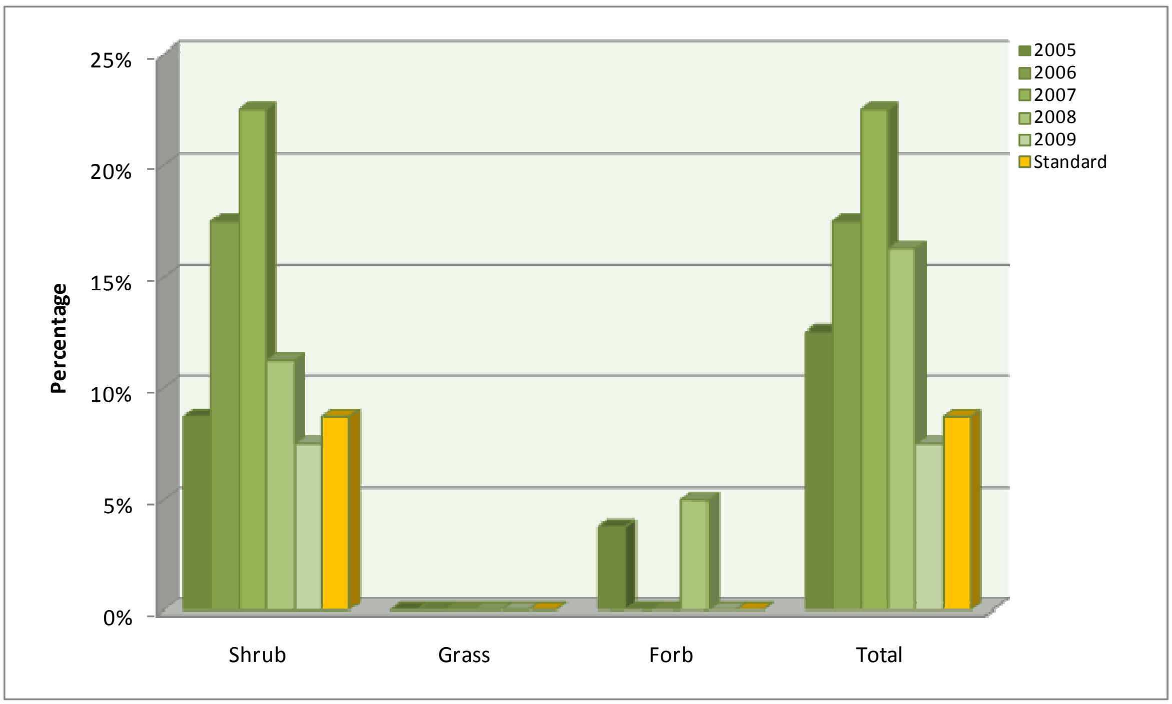

Figure 8-6. Plant cover by life form over the last five years on the CAU 400-Bomblet Pit

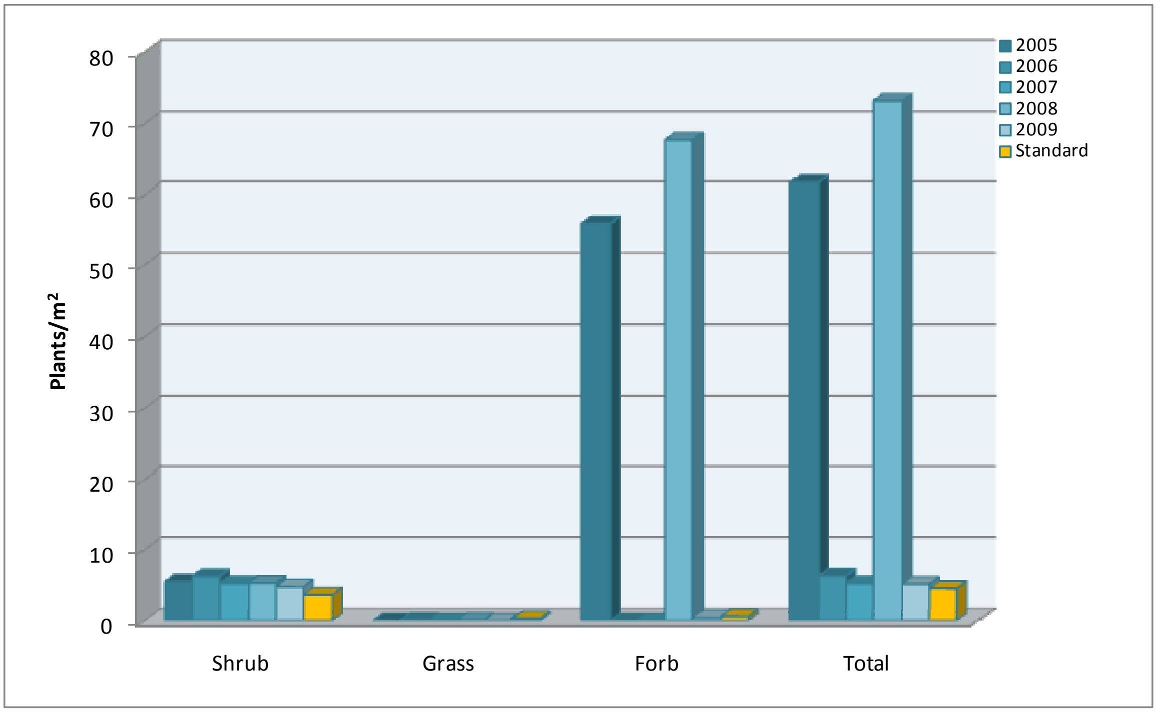

Figure 8-7. Plant density by life form over the last five years on the CAU 400-Bomblet Pit

Plant density on the staging area exceeded the revegetation success standard for plant density for the Bomblet Pit site by more than 2.0 plants/m^2 (2.4 plants/yd^2) (Figure 8-7). Shrubs are well established and have persisted through less than optimal growing conditions the last few years.

The goals of revegetation have been accomplished at CAU 400-Bomblet Pit. Native plant species are established and contribute significantly to overall plant cover and density. Although plant cover was short of revegetation success standards this year (Figure 8-6), plant density exceeded revegetation success standards (Figure 8-7). Less than optimal growing conditions have been the norm at this site for several years. Plant cover and plant density have been higher in previous years when growing conditions were better. Many species have persisted through poor growing conditions the last few years; when conditions do improve, species that have contributed to plant cover and density in the past may return.

8.2.3 CAU 426-Cactus Spring Waste Trenches

CAU 426-Cactus Spring Waste Trenches is located on the eastern slope of the Cactus Range just south and east of Cactus Peak and within a couple hundred yards of Cactus Spring. The site consists of a staging area and a cover cap, both revegetated in the fall of 1997. This is the twelfth year since this site was revegetated and is the last year it will be monitored.

Plant cover on the staging area at CAU 426-Cactus Spring Waste Trenches represents a good mix of native shrubs and grasses (Figure 8-8). Two shrubs, *A. canescens* and *E. nevadensis*, and one grass, *E. elymoides*, made up 88% of the total plant cover. A single forb, *M. canescens*, made up the rest of the plant cover.

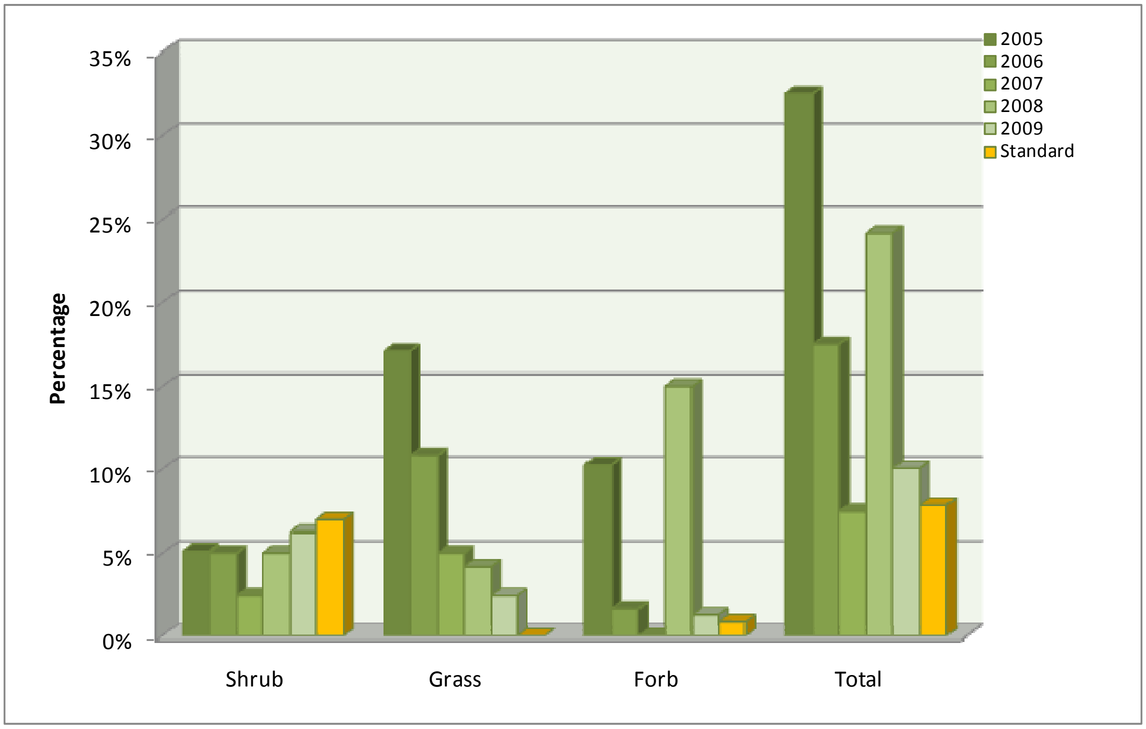

Figure 8-8. Plant cover by life form over the last five years on the CAU 426-Cactus Spring Waste Trenches staging area

In contrast, shrubs made up all the cover on the cover cap. Like on the staging area, *A. canescens* and *E. nevadensis*, made up all of the plant cover. There was a similar situation on the reference area. Three shrubs, no grasses, and one forb made up the plant cover on the reference area (Figure 8-9). The three shrubs were *Artemisia nova*, *A. canescens*, and *E. nevadensis*. The forb was *C. stevioides*.

The most commonly encountered shrub on the staging area was *E. nevadensis*. *P. desertorum* and *A. confertifolia* were less common. *P. jamesii* was the most common grass, followed by *A. hymenoides* and *E. elymoides*. There were nine forbs on the staging area, the most of the three areas sampled at the Cactus Spring site. The most common and with the highest densities were *Erodium cicutarium*, *Eriogonum nidularium*, and *Chaenactis xantiana*. Of note is the presence of *H. glomeratus*, an invasive weed.

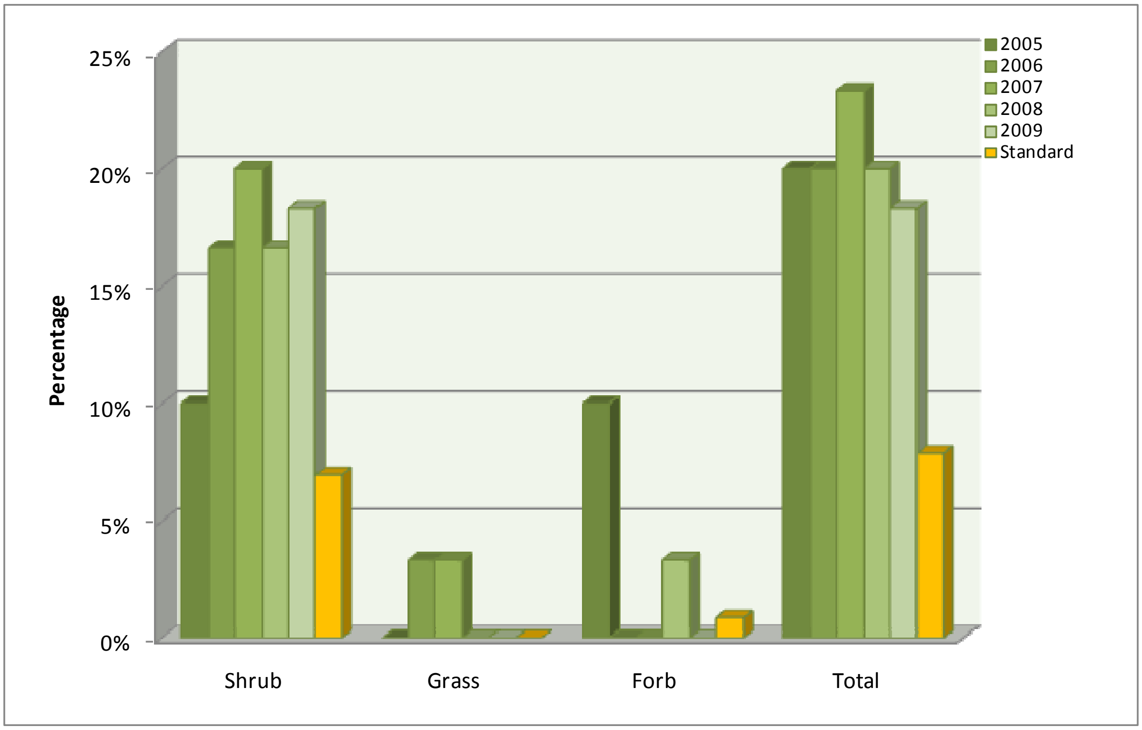

Figure 8-9. Plant cover by life form over the last five years on the CAU 426-Cactus Spring Waste Trenches cover cap

Plant density on the cover cap was similar except there were fewer forbs (Figure 8-10). There were four shrubs, with *E. nevadensis* as the most common. There were three grasses, two perennial species, and one annual invasive weed, *B. tectorum*. Density of the five forbs found on the cover cap was lower than on the staging area. The most common species was *E. nidularium*, followed by *C. stevioides* and *M. canescens*.

Plant density on the reference area was lower than on the staging area but higher than on the cover cap (Figures 8-10 and 8-11). Of the five shrubs occurring on the reference area, *A. nova* and *P. desertorum* were the most common. A few individuals of *E. nevadensis*, *A. confertifolia*, and *Chrysothamnus viscidiflorus* also occur on the site but in relatively low densities. Grass density was much higher on the reference area than on the staging area or cover cap. There were two grass species present; however, 99% of the grass density was *P. jamesii*. There were five different annual forb species, but the most common were *E. cicutarium*, *C. stevioides*, and *E. nidularium*. The 10% cover on the staging area and the 18% cover on the cover cap at the Cactus Spring Waste Trenches site exceeded the revegetation success standards (Figures 8-8 and 8-9). Shrub cover on the staging area was only 6%, which is less than the 7% standard. There were no grasses on the reference area this year, so the 3% cover on the staging area compensates for the lower shrub cover. There was one forb on the staging area, *M. canescens*, which contributed as much to plant cover, as did the one forb, *C. stevioides*, on the reference area. There was no grass or forb cover on the cover cap, but the 15% cover from *A. canescens* more than met the revegetation success standards. Overall, the amount of cover on both the staging area and the cover cap exceeded the revegetation success standards (Figures 8-8 and 8-9).

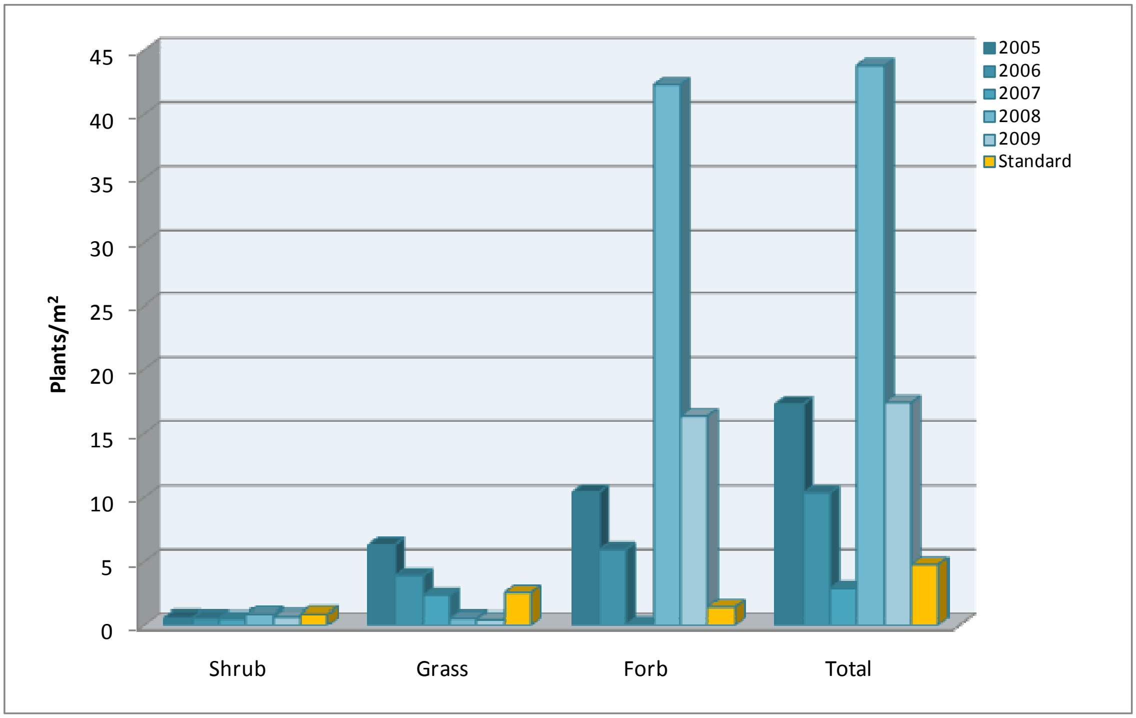

Figure 8-10. Plant density by life form over the last five years on the CAU 426-Cactus Spring Waste Trenches staging area

Plant density on the staging area at Cactus Spring Waste Trenches site is almost four times the revegetation success standards for plant density (Figure 8-10). The 16.35 forbs/m^2 (19.6 forbs/yd^2) account for almost 90% of the total density. Shrub density is 75% of success standard, and grass density is less than 20% of the standard. Shrub density has been relatively constant over the last five years, though there was a decrease from last year to this year (Figure 8-10). Grass density has experienced a rather dramatic decline over the last five years on the staging area. *E. elymoides* and *A. hymenoides* were common in previous years, but have declined, especially from 2007 to 2008 (Figure 8-10). There are still remnants of these grasses on site, which may return with improved growing conditions.

Total plant density on the cover cap is 83% of the revegetation success standard. Shrub density is almost double the success standard (Figure 8-11). There is a good mix of shrubs, including *A. canescens*, *E. nevadensis*, *Ericameria nauseosa*, and *C. viscidiflorus*. Three grass species are on the cover cap but occur infrequently, accounting for only 6% of the total plant density.

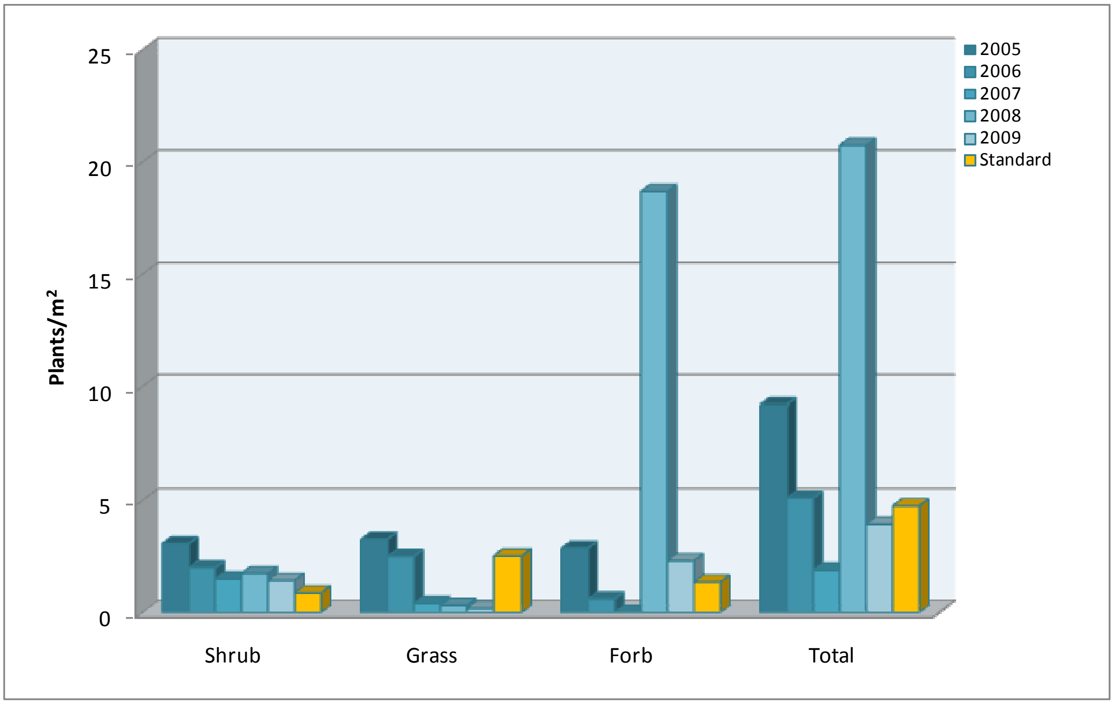

Figure 8-11. Plant density by life form over the last five years on the CAU 426-Cactus Spring Waste Trenches cover cap

Based on total plant cover, revegetation success standards were exceeded for both the staging area and the cover cap at CAU 426-Cactus Spring Waste Trenches. The plant community on the staging area is composed of native shrubs, grasses, and forbs. On the cover cap four shrub species made up over 18% cover and a density of 4.0 plants/m^2 (4.8 plants/yd^2) this year; both values exceed the revegetation success standards.

8.2.4 CAU 404-Rollercoaster Sewage Lagoons

CAU 404-Rollercoaster Sewage Lagoons is located midslope between the playa bottoms and the foothills of the Cactus Range, just east of Main Road and Rollercoaster Spring. The site covers approximately 2.2 ha (5.5 ac) and is the largest of the five CAUs monitored. About three-fourths of the site were disturbed during the construction of the cover cap; this land is designated as the staging area. The cover cap over the remediated sewage lagoons is about a meter above the level of the staging area. This is the twelfth year since this site was revegetated and is the last year it will be monitored.

Overall plant cover on the staging area was excellent this year. Three shrubs account for 96% of the total cover. *A. confertifolia* had the highest absolute cover, followed by *P. desertorum* and *A. canescens*. Only one grass, *A. hymenoides*, contributed to plant cover this year. There were no forbs present (Figure 8-12).

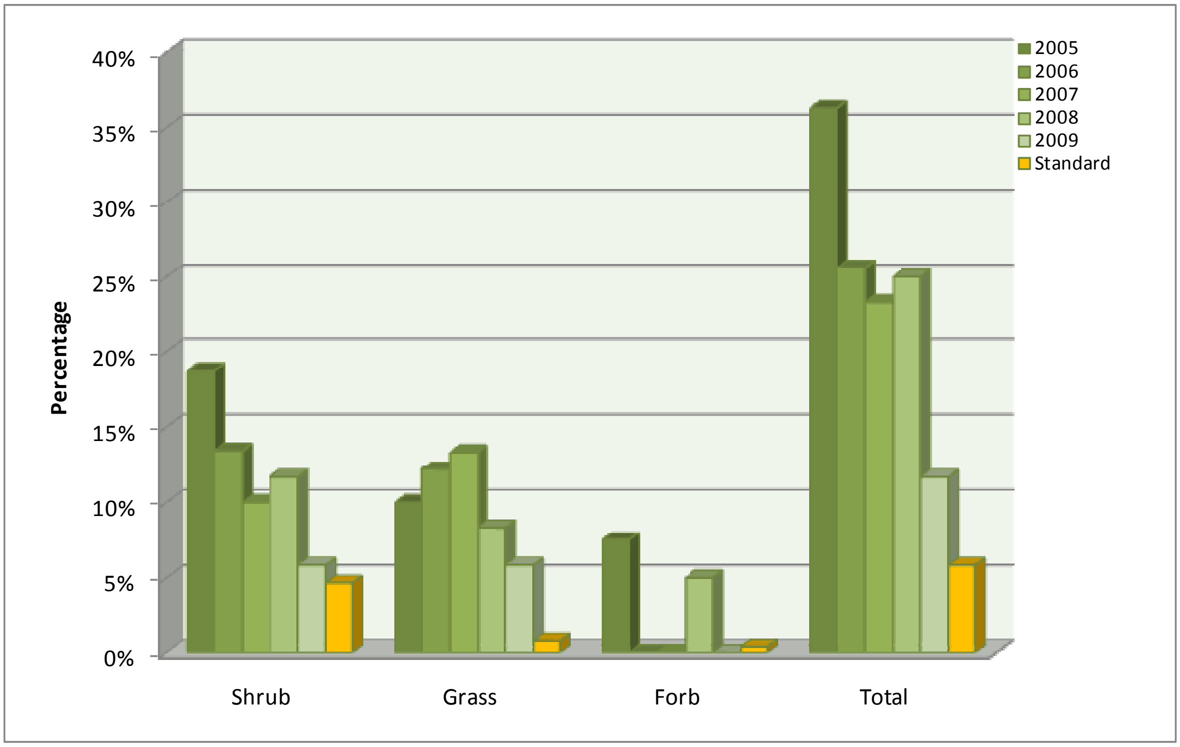

Figure 8-12. Plant cover by life form over the last five years on the CAU 404-Rollercoaster Sewage Lagoons staging area

Plant cover on the cover cap was also very good this year. It was not as high as the staging area but higher than the reference area (Figure 8-13). Cover on the cover cap is an equal mix of shrub cover and grass cover. *A. confertifolia* was the only shrub contributing to total plant cover, and *P. jamesii* was the only grass.

P. desertorum and *A. confertifolia* made up about 80% of the total plant cover on the reference area; two grasses, *P. jamesii* and *Dasyochloa pulchella*, made up about 7% of the cover as did the lone forb, *Sphaeralcea ambigua*.

Plant density on the staging area was 5.2 plants/m^2 (6.2 plants/yd^2). There were two shrubs, *P. desertorum* and *A. confertifolia*; one grass, *P. jamesii*; and one forb, *S. ambigua*, found on the staging area this year. Shrubs accounted for about 97% of the total plant density, grasses for 2%, and forbs less than 1% (Figure 8-14).

Plant density on the cover cap had a better balance of shrubs and grasses (Figure 8-15). Total density was a little higher at 6.6 plants/m^2 (7.9 plants/yd^2). Shrub density was 3.6 plants/m^2 (4.3 plants/yd^2), and grass density was 3.0 plants/m^2 (3.6 plants/yd^2). Shrubs made up about 55% of total density, grasses 45%, with forbs less than 1%. Three shrubs including *P. desertorum*, *A. canescens,* and *A. confertifolia* made up the shrub density. The main grass was *P. jamesii* with a few plants of *E. elymoides*. The only forb encountered was *M. canescens*.

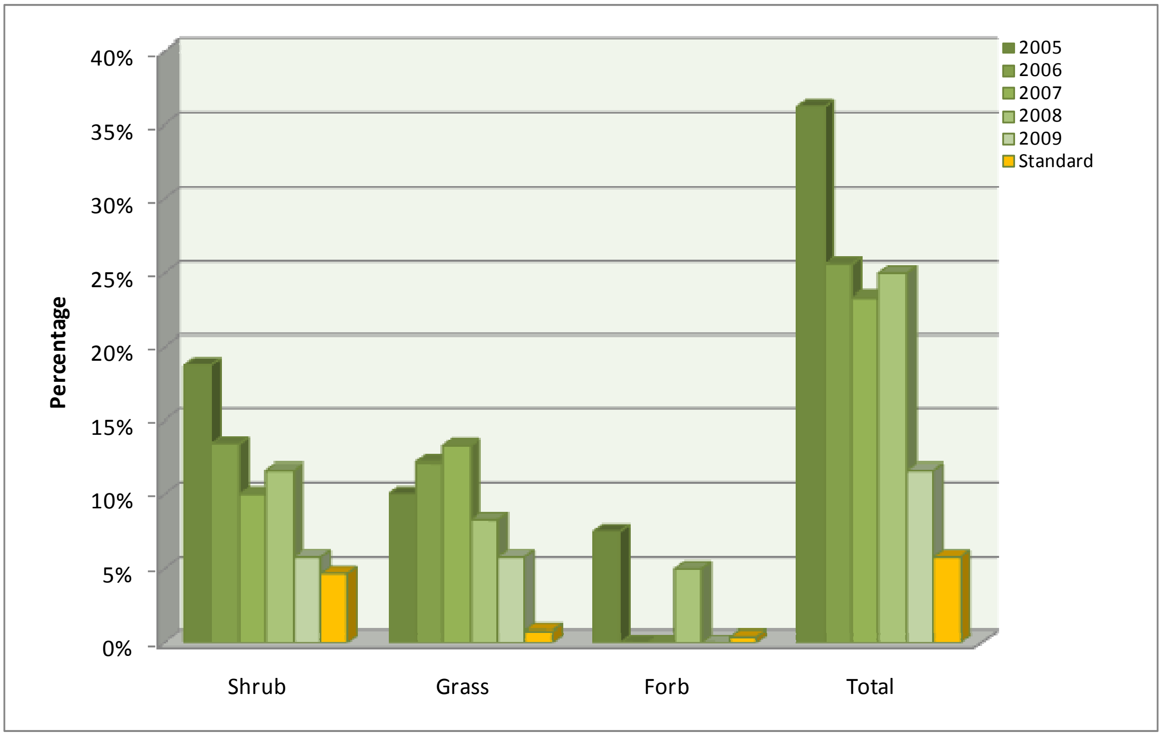

Figure 8-13. Plant cover by life form over the last five years on the CAU 404-Rollercoaster Sewage Lagoons cover cap

Plant density on the reference area was 10.6 plants/m^2 (12.7 plants/yd^2), which is almost double the density on the staging area and cover cap. The majority of the plant density, however, was from forbs, about 56%. Shrubs made up 33% and grasses 11%. Excluding the forbs, shrubs made up 74% of the density and grasses 26%. The common shrubs on the reference area were *P. desertorum*, *A. confertifolia*, *K. lanata*, and *C. viscidiflorus*. Three grasses, *A. hymenoides*, *P. jamesii*, and *Erioneuron pulchellum*, were present. The three forbs encountered this year on the reference area were an annual *Eriogonum*, *S. ambigua*, and *C. stevioides*. *C. stevioides* accounted for 97% of the forb density.

Total plant cover values exceeded the revegetation success standards for both the staging area and the cover cap. Plant cover on the staging area was almost three times the standard (Figure 8-12), and plant cover on the cover cap was about double the standard (Figure 8-13). For the staging area, almost all of the cover is from shrubs, so when considering success standards by life form (shrubs, grasses, or forbs), shrub cover far exceeded the standard, but grass cover was only about 70% of the standard. This is not the case for the cover cap. Shrubs and grasses contributed equally to cover, and the success standards were exceeded for each (Figure 8-12 and 8-13).

The same pattern is true when considering revegetation success based on plant density. Shrub density on both the staging area and cover cap exceeded the revegetation success standard (Figures 8-14 and 8-15). Grass density on the staging area was only about 12% of the success standard of 0.9 grasses/m^2 (1.0 grasses/yd^2). However, on the cover cap, grass density is more than three times the standard.

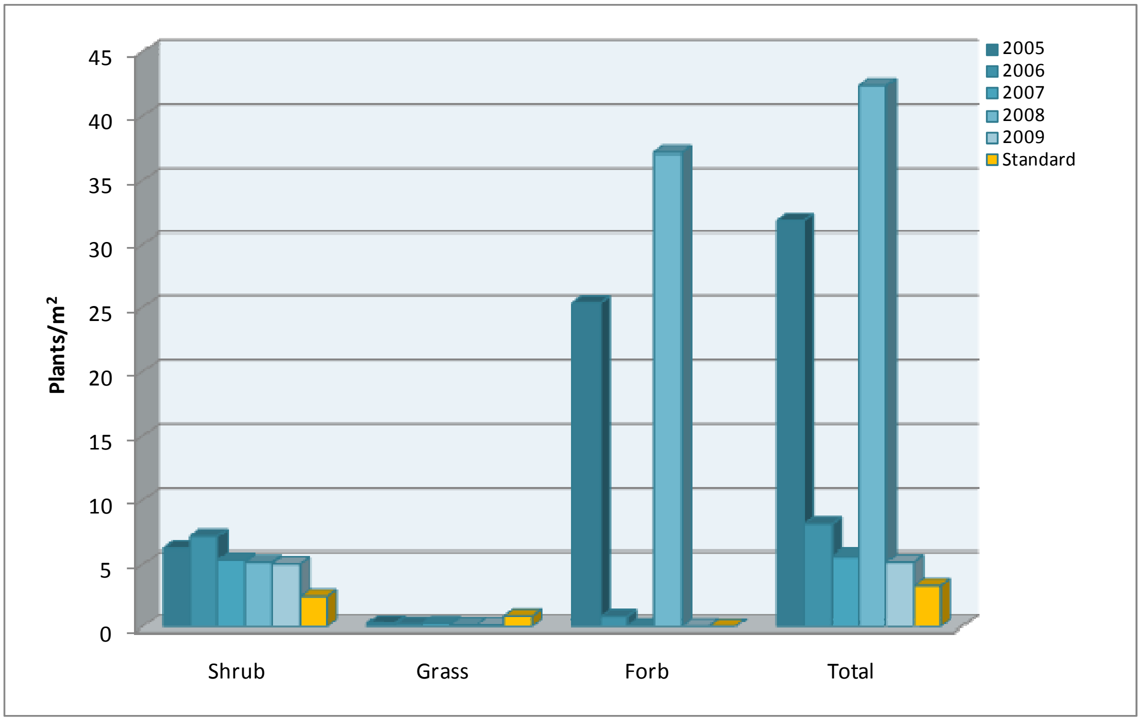

Figure 8-14. Plant density by life form over the last five years on the CAU 404-Rollercoaster Sewage Lagoons staging area

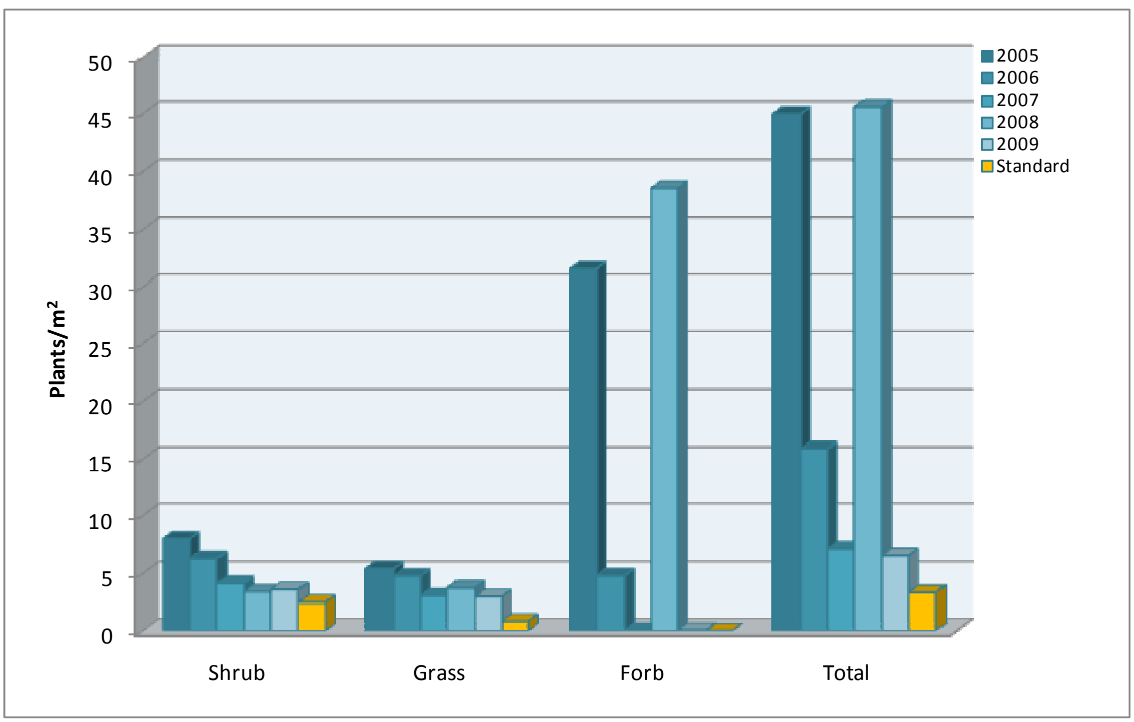

Figure 8-15. Plant density by life form over the last five years on the CAU 404-Rollercoaster Sewage Lagoons cover cap

Overall plant cover on the staging area and cover cap at the CAU 404-Rollercoaster Sewage Lagoons site exceeded the revegetation success standards. Density of perennial species (shrubs and grasses combined) also exceeded the revegetation success standards. A concern for all disturbed sites is the invasion of weedy species, which is not the situation at this site. It is apparent that a native plant community has established on both the staging area and the cover cap.

8.2.5 CAU 407-Rollercoaster RADSAFE Area

The CAU 407-Rollercoaster RADSAFE site was originally revegetated in 2000; subsequent work on the cover resulted in the loss of most of the vegetation on the cover cap, and it was reseeded in 2004.

Plant cover on the Rollercoaster RADSAFE cover cap was good this year. This is the second year cover has been recorded. Shrub cover was over 9% and composed primarily of *A. confertifolia* with some *A. canescens*. Grass cover was made up of *A. hymenoides*. Like most of the sites sampled this year on the TTR, there were no forbs encountered (Figure 8-16). Plant cover was good, considering this site is only in its fifth year of recovery.

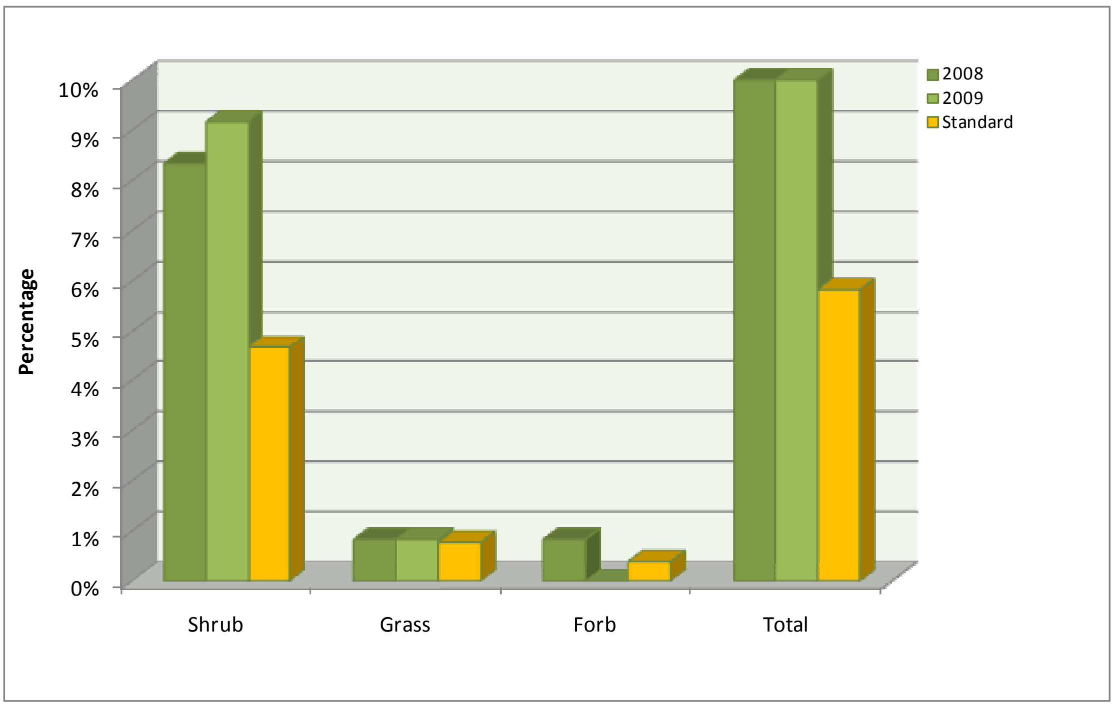

Figure 8-16. Plant cover by life form over the last two years on the CAU 407-Rollercoaster RADSAFE cover

Shrub density was still very high at this site. It has declined over the past five years (Figure 8-17) but was still more than 18 plants/m^2 (22 plants/yd^2). Plant density on the reference area was only 11 plants/m^2 (13 plants/yd^2). Plant density will probably continue to decline until a balance is reached with available resources on the site. This year *A. confertifolia* was the most common species, followed by *A. canescens* and *P. desertorum*. The only grass found this year was *E. elymoides*. Three annual forbs occur on the site (two common native forbs, *M. canescens* and *Lepidium montanum*, and an invasive weed, *H. glomeratus*. Plant density continued to be high and overall was almost double the success standard. Shrubs exceeded the success standards, but grasses were only about 38% of the standard and forbs were 80% of the standard.

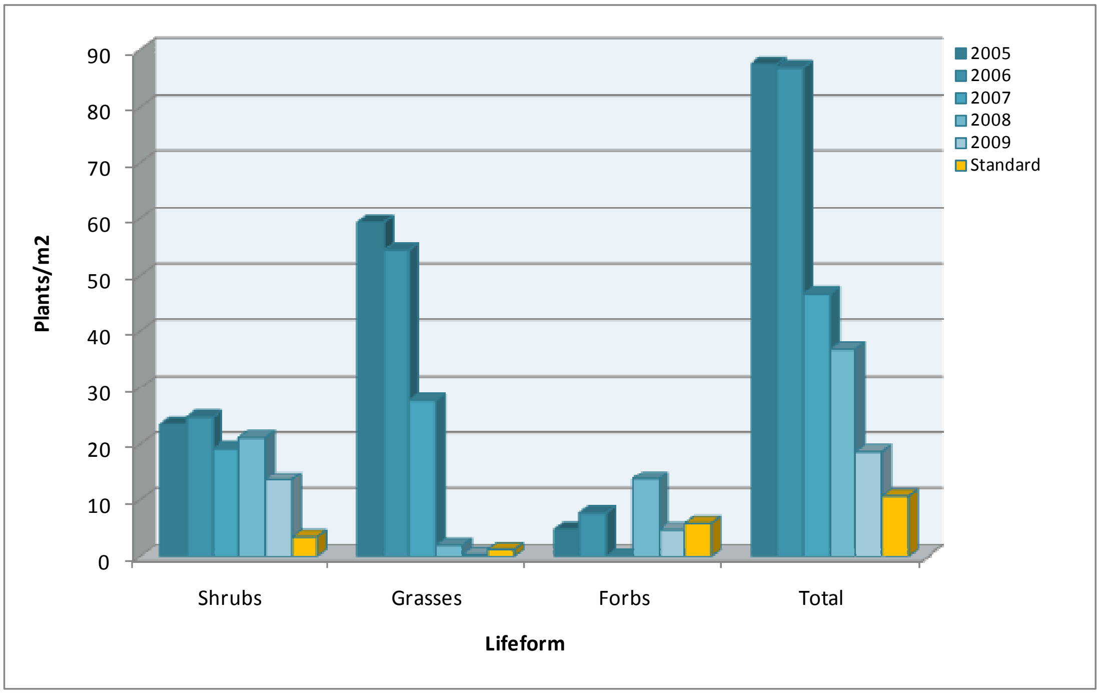

Figure 8-17. Plant density by life form over the last five years on the CAU 407-Rollercoaster RADSAFE cover

Plant cover data comparisons with revegetation success standards typically begin in the fifth year after revegetation. Plant cover at this site was almost double the revegetation success standard after five years. Plant cover was made up of almost 92% shrub cover and 8% grass cover, which exceeded the success standards for each life form (Figure 8-16). When shrub and grass densities were combined, plant density on the CAU 407-Rollercoaster RADSAFE site was higher than the success standard, even after substantial declines in plant density over the last four years (Figure 8-17).

9.0 MONITORING THE NPTEC

9.1 Task Description

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

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

9.2 Task Progress Summary

NSTec biologists did not review any chemical spill test plans during 2009. Baseline monitoring was not conducted at established control-treatment transects near the NPTEC in 2009 because no test-specific monitoring was required and due to budget constraints.

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