NEVADA TEST AND TRAINING RANGE (NTTR)

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SUMMARY OF GOLDEN EAGLES AND RAPTOR OBSERVATIONS ON THE NEVADA TEST AND TRAINING RANGE AND PROPOSED EXPANSION ALTERNATIVES

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SUMMARY OF GOLDEN EAGLES AND RAPTOR OBSERVATIONS ON THE NEVADA TEST AND TRAINING RANGE AND PROPOSED EXPANSION ALTERNATIVES
Final Report

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Abbreviations

99 CES/CEIEA	99th Civil Engineering Squadron/Installation Management Environmental Assessments Section
ACC	Air Combat Command
AFI	Air Force Instruction
BLM	Bureau of Land Management
CAFB	Creech Air Force Base
CWA	Clean Water Act
DNWR	Desert National Wildlife Range
DOD	U.S. Department of Defense
DOI	U.S. Department of the Interior
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
GBBO	Great Basin Bird Observatory
GIS	Geographic Information Systems
GPS	Global Positioning System
INRMP	Integrated Natural Resources Management Plan
MBTA	Migratory Bird Treaty Act
MSL	Mean Sea Level
NAFB	Nellis Air Force Base
NDF	Nevada Division of Forestry
NDOW	Nevada Department of Wildlife
NDWR	Nevada Division of Water Resources
NEPA	National Environmental Policy Act
NNRP	Nellis Natural Resources Program
NNSS	Nevada National Security Site
NRCS	Natural Resources Conservation Service
NTTR	Nevada Test and Training Range. Also the new name for 98th Range Wing
NWAP	Nevada's Wildlife Action Plan
SAR	Small Arms Range
USACE	U.S. Army Corps of Engineers
USAF	United States Air Force
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

Introduction

The United States Air Force (USAF) is in the process of renewing the withdrawal of land for military operations and training on the Nevada Test and Training Range (NTTR). Included in the withdrawal package are several potential expansion alternatives, which are discussed below in the "Study Area Description". The current withdrawal will expire November 6, 2021, unless Congress enacts legislation to extend it. In accordance with Section 3016 of the Military Land Withdrawal Act (MLWA), the Department of the Air Force, in coordination with DOD, has notified Congress of a continuing military need for the NTTR withdrawal. Furthermore, the Air Force plans to submit a Legislative Environmental Impact Statement (LEIS) that supports a legislative proposal through the Department of the Interior (DOI) to extend the withdrawal. The National Environmental Policy Act (NEPA) of 1969, United States Code [USC] Sections 18 4321-4370h, requires agencies to include an Environmental Impact Statement (EIS) with any proposal for legislation that may significantly affect the quality of the human environment. The land withdrawal renewal includes actions that present potential impacts to golden eagles and other raptors and their habitat. This report is a summary of historic and recent surveys or observations of golden eagles (*Aquila chryaetos)* and raptors on the NTTR and expansion alternatives. Also included is a limited golden eagle nest survey conducted on Expansion Alternative 3C in 2016.

Raptors are essential to the general health of the ecosystems due to their functional role as predators of small mammals, reptiles, and other birds in the Mojave and Great Basin Deserts. Field observations indicate that as many as 18 different species of raptors may be found on the study area. Several of these species are considered special status species by various state and federal agencies, but the only species in southern Nevada on a federal or state threatened and endangered species lists is the peregrine falcon (*Falco pererinus*), which is classified as a State of Nevada Protected/Endangered Bird (NAC 503.0050.2.b). The U.S. Fish and Wildlife Service (USFWS) expressed concern over diminishing populations of golden eagles in the western U.S. in the early 2000's and conservation efforts for the species were increased at the time. More recently, the populations have been considered stable in the west. In 2011, the USAF responded to the USFWS concerns by funding and implementing golden eagle occupancy and productivity surveys on the NTTR, which have continued through the present year (2017). Other raptors that are on the special status species list include the northern goshawk (*Accipiter gentilis*), western burrowing owl (*Athene cunicularia hypugea*), ferruginous hawk (*Buteo regalis*), flammulated owl (P*siloscops flammeolus*), and prairie falcon (*Falco mexicanus*). The golden eagle and other raptors are also protected by the Migratory Bird Treaty Act of 1918 (MBTA), under which all native, migratory birds are protected. Most importantly, the golden eagle is protected under the Bald and Golden Eagle Protection Act of 1962.

Description of the Project Study Area

The study area for this report includes the NTTR and potential alternatives for the expansion of the withdrawn land designated as Alternatives 3A, 3B, and 3C. The NTTR consists of 2,949,603 acres, in rural portions of Nye, Lincoln, and Clark Counties, Nevada (Figure 1). The potential expansion areas are shown in Figure 1 and consist of about 302,000 acres. Alternative 3A is 18,000 acres lying along the southwest boundary of the North Range of the NTTR. Alternative 3B is 57,000 acres located immediately south of the South Range of the NTTR. Alternative 3C is 227,000 acres immediately east of the South Range of the NTTR in the Desert National Wildlife Refuge (DNWR). Geology varies from limestone/dolomite in the south to volcanic fields in the north. The South Range Study Area lies in the eastern Mojave Desert and the North Range Study Area lies in the southern Great Basin (Figure 2).

Natural sources of water are scarce across most of the study area. Annual precipitation ranges from 3 to 5 inches in the basins to 16 inches in upper elevations of mountains. Vegetation composition is strongly influenced by the levels of precipitation. Most of the active springs are found in the North Range Study Area, especially in the Kawich, Belted, and Cactus mountain ranges and Stonewall Mountain. Only five springs are found in the South Range Study Area. Most water sources for wildlife in the South Range Study Area are provided by wildlife water developments, which collect water from storm events and store it in water tanks.

The South Range Study Area is typical of the Mojave Desert. Except for the higher elevations, most of the mountains are covered by scattered populations of various desert brush and cactus species. Typical physiography of the area consists of mountain ranges which drain into bajadas (collections of alluvial fans) which eventually drain into playas. Most of these areas are considered basins which are self-contained and do not drain into any of the major rivers in the area. Playas tend to have little or no vegetation while

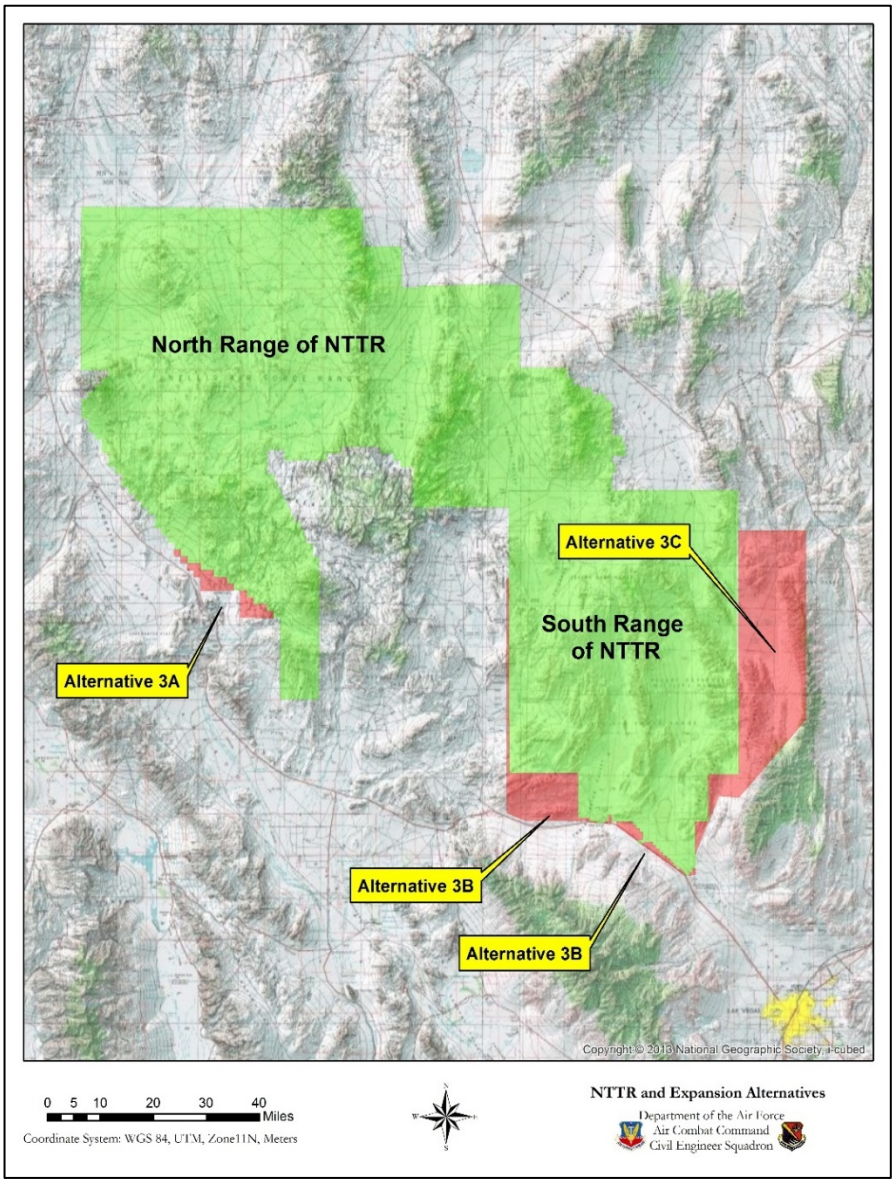


Figure 1. Location of the North and South Ranges of the NTTR as well as Alternatives 3A, 3B, and 3C.

bajadas are often dominated by creosote bush (*Larrea tridentata*) and bursage (*Ambrosia dumosa*) in the lower bajadas and blackbrush (*Coleogyne ramosissima*) and Joshua tree (*Yucca brevifolia*) in the upper bajadas. Mountain ranges support scattered populations of bitterbrush (*Purshia spp.*), matchweed (*Gutierrezia spp.)*, and shadscale (*Atriplex confertifolia*). At higher elevations, plant communities may be dominated by Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus monophylla*).

The North Range Study Area is typical of the southern portions of the Great Basin Desert. Again, the physiography of the area is comprised of mountains and closed basins similar to the South Range Study Area. However, rainfall is slightly higher in the North Range Study Area resulting in denser plant communities. Like the South Range Study Area, playas in the North Range Study Area contain little or no vegetation. From the boundaries of the playas to the base of mountains, plant communities are typically dominated by greasewood (*Sarcobatus spp.*) and shadscale (*Atriplex spp.*) in lower elevations and sagebrush (*Artemisia spp.*) in higher elevations. The upper elevations in the mountains are dominated by Utah juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus monophylla*).

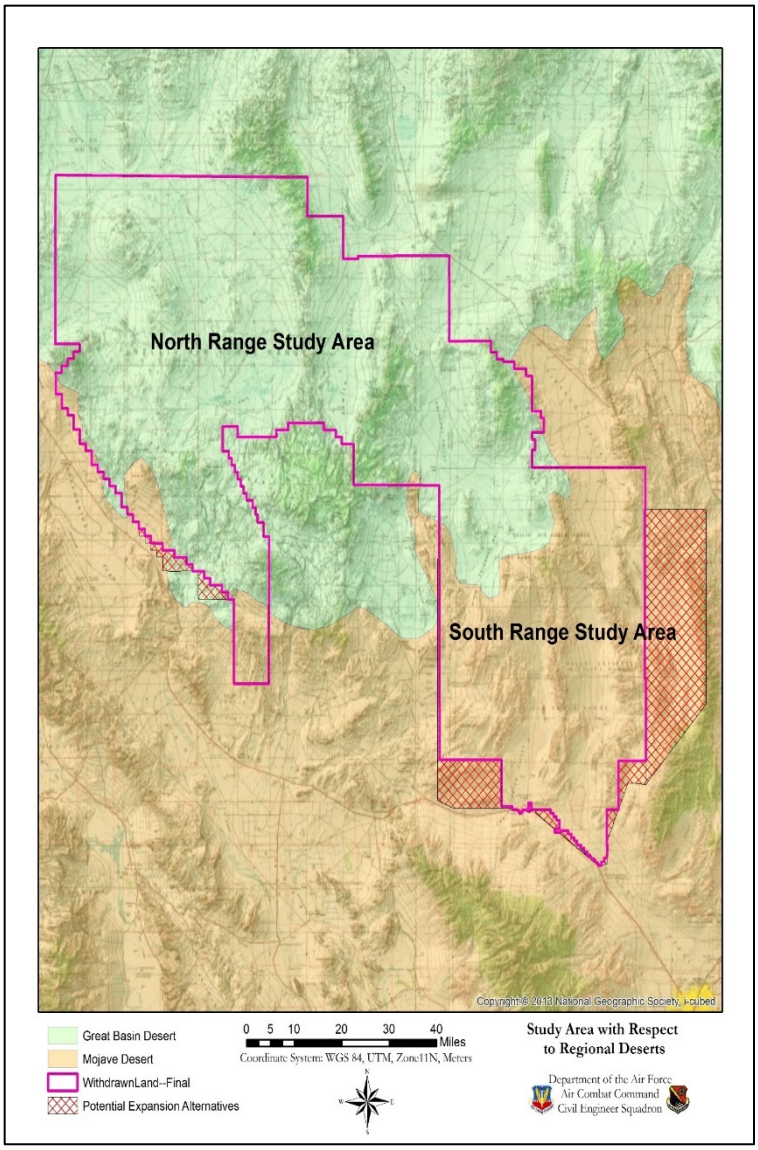


Figure 2. Location of the study area with respect to the Great Basin Desert and the Mojave Desert.

Background Information

Golden Eagle (*Aquila chrysaetos*)

Although the golden eagle is one of the most widespread raptors in the world, population trends and status within the United States, particularly in the southwest are continuing to be researched (Kochert & Steenhof, 2002). Literature and research conducted in the early 2000's indicated that the western golden eagle was potentially in decline in portions of its range (Hoffman & Smith, 2003). However, more recent research indicates that the golden eagle population in the western U.S. is not widely declining and the population appears to be stable (Millsap, et al., 2013; Milsap, Bjerre, Otto, Zimmerman, & Zimpfer, 2016). Although some uncertainty exists over the current population size and status of golden eagles in the western U.S., negative factors potentially causing population declines are becoming more common and widespread (Good, Nielson, Sawyer, & McDonald, 2004). Some of the factors that have been shown to negatively impact golden eagle populations include:

- Direct harassment from ranchers to protect livestock from predation by golden eagles (McGahan, 1968).
- Collisions with wind towers and other structures. This impact is likely to increase as the quantity of desert acreage that is devoted to renewable energy increases (Katzner, et al., 2012). Wind turbines have been shown to cause mortality of golden eagles in California. That impact was partially mitigated by modification of the design of turbine tower (Hunt, 2002).
- Electrocution on powerlines and transformers. Young eagles are more commonly electrocuted by smaller powerlines and transformers than adults (Bortolotti, 1984). However, since the 1970s many utility companies have modified transmission lines and equipment to prevent raptors from touching wings and/or feet to multiple lines at a time (Cornell Lab of Ornithology, 2015).
- Scavenging carrion poisoned to control mammalian predators. Typically, this is strychnine poison that has been placed in carcasses that were meant for feline or canine predator control (Bortolotti, 1984).
- Wildland fires resulting in temporary loss of shrub habitat and a subsequent decline in rodent, rabbit, and other golden eagle prey populations (Hawk Mountain, 2007).
- Invasion of exotic plant species resulting in a long lasting decrease or alteration in prey population density and composition (Hawk Mountain, 2007).
- Increase in human activity and development (Hawk Mountain, 2007).
- Potential injury and death caused by solar towers. Solar towers have been shown to have significant mortality rates on birds, but most of the data is preliminary and the impact on eagles has not been assessed (Kagan, Viner, Trail, & Espinosa, 2014).

As a result, the western populations remain a concern to regulatory agencies and are being monitored by natural resource managers. Golden eagles are currently protected by the Bald and Golden Eagle Protection Act of 1962 (16 U.S.C. §§ 668), and the Migratory Bird Treaty Act (MTBA) of 1918 (16 U.S.C. §§ 703–712). In addition to mitigating the immediate impacts to individual birds, these acts also regulate actions that disturb or destroy the nests and nesting sites for eagles and other migratory birds. If the nest or nesting site has been impacted in a manner that renders the eagles unable to normally breed or to have safe shelter, violators may be fined or imprisoned. However, some permits are available in western states to take or remove golden eagles that are a danger to livestock, particularly domestic lambs and kids (U.S. Fish and Wildlife Service, 2007; Bortolotti, 1984; McGahan, 1968).

Golden eagles currently have the following status in Nevada by state and federal agencies:

- **United States Fish and Wildlife Service (USFWS):** Protected under the Bald and Golden Eagle Protection Act of 1962 and the Migratory Bird Treaty Act of 1918
- **Bureau of Land Management (BLM):** Nevada Special Status, designated sensitive by BLM state office in Las Vegas, Nevada
- **Nevada Department of Wildlife (NDOW):** Nevada Protected Species
- **NNHP Global Rank:** G5--demonstrably secure, widespread and abundant
- NN**HP State Rank:** S4--long-term concern, though now apparently secure; usually rare in parts of its range, especially at its periphery

The golden eagle is one of the largest and most well-known birds of prey. Like most other birds of prey, the female is considerably larger than the male (Alsop, 2002). Both sexes are dark brown, with golden brown plumage on their heads and necks. Juveniles often show white patches at the base of their primary feathers, and at the base of their tail. The wingspan of a golden eagle reaches 96 in., and the height of the bird may be 36 in. Flight speeds for the golden eagle have been estimated at 120 miles per hour (mph) for steep glides and 150 mph for swoops to attack prey (Alsop, 2002).

Golden eagle soaring over the study area

The preferred prey for the golden eagle is predominantly leporids (hares and rabbits) and sciurids (ground squirrels, prairie dogs, & marmots). Small mammals, young large mammals, birds and reptiles comprise a minor part of the golden eagle diet. The number of golden eagle pairs occupying an area does not appear to be related to jackrabbit abundance, but does appear to be related to the proportion of eagle pairs that laid eggs. However, jackrabbit abundance does appear to be positively related to the proportion of successful breeding pairs, the mean brood size at fledging, and the number of young fledged per pair (Steenhof K. K., 1997). Habitats apparently preferred by golden eagle populations throughout the Great Basin include mountain cliffs, canyons and rim rock terrain adjacent to shrub steppe, native grassland and open desert.

Golden eagles can soar for long distances and hunt over open areas in search of prey, particularly around mountains and cliffs. During the nesting season, golden eagles will predate almost any animal species to feed their young, including game birds, young ungulates, smaller carnivores, and even reptiles. Limiting factors for the golden eagle are often related to food and not water sources. However, in a study from northeastern Nevada, it was found that 86% of golden eagle nest sites were located within two miles of a water source (Page, 1973). However, this study was restricted to Elko County and may not be applicable to the Great Basin or Mojave deserts.

The breeding range for golden eagles encompasses northern Alaska and extends south through the Rocky Mountains and western Texas into central Mexico (Boeker & Ray, 1971). Approximately 93% of nests are constructed on cliffs, with the remainder being placed in trees or earthen mounds. Strong trees such as Douglas firs are used, as those tree branches will support a heavy golden eagle nest (McGahan, 1968). According to McGahan (1968), in Montana, nests are typically built with a south or east aspect; though western aspects may be used. However, more recent research indicates that nest aspect is variable (Kochert & Steenhof, 2002) and nests surveyed on NTTR have been found to be facing in all directions (Nellis Natural Resources Program, 2016). Golden eagles avoid nesting near urban or densely forested

regions and favor nesting in areas of open terrain (Kochert & Steenhof, 2002). In the western deserts, golden eagles nest on high cliff faces that offer safety from predation, as well as an unobstructed view of the surrounding habitat. Golden eagle nest sites have been found on cliff ledges, cliffs, and rocky outcrops at elevations as high as 8,600 ft. Mean Sea Level (MSL) during surveys of all mountain ranges of NTTR (Nellis Natural Resources Program, 2012). As of 2016, golden eagles have only been found nesting in mountain habitat on NTTR (Draft Report submitted by the Nellis Natural Resources Program on Golden Eagle Nesting on NTTR 2016 (preliminary results)).

In southern Nevada, eagle courtship usually initiates in December, with eggs being laid in January or February. Golden eagles normally lay two eggs, but clutches as large as four eggs have been documented. Eggs will normally hatch by April or May, followed by an incubation period of 35-45 days. Fledglings will normally take flight 75-80 days after hatching. On average, 76% of the chicks will successfully fledge. Young of the year usually remain in the nesting area for the duration of the year (Collopy, 1983; McGahan, 1968). Nest abandonment and destruction can be caused by recreational climbers and researchers, yet short, close approaches by fixed-wing aircraft and helicopters during surveys do not appear to have significant negative impacts on nesting golden eagles (Kochert & Steenhof, 2002).

Golden eagle nests are not necessarily located in the center of their home range, with the outside edges of the home range being 1 to 25 miles from the nest (Katzner, et al., 2012). This variability may be due to the placement of nests on cliffs with eagles typically preferring to forage for prey in the adjacent, flat and open valleys in one direction from the nest and not in the rugged mountainous areas in the opposite direction from the nest.

Golden eagle at the DeJesus guzzler on the NTTR

Golden eagles are quite susceptible to human disturbances, and in one study, at least 85% of known nest losses were due to human disturbances (Boeker & Ray, 1971). Recently, the USFWS projected that anthropogenic impacts would cause 56% of the annual losses of golden eagles (Milsap, Bjerre, Otto, Zimmerman, & Zimpfer, 2016). In another study, the golden eagle was found to suffer mortality from direct harassment, electrocution, collisions with human-made structures, and consumption of carcasses poisoned for control of coyotes, felines, and other mammalian predators (Hawk Mountain, 2007). Franson found that human activities account for approximately 70% of all direct mortality of golden eagles, with accidental trauma (27%), electrocution (25%), gunshot (15%), and poisoning (6%) causing most of these deaths (Franson, 1995) . More recently, the USFWS summarized GPS tagged golden eagles from 1997-2013 and found that humans cause 63% mortality of adult golden eagles (>3 yr. old), 57% mortality of subadult golden eagles (1-3 yr. old), and 34% mortality of yearling golden eagles (<1 yr. old). The projected leading anthropogenic causes of death (in order of importance) were found to be poisoning, shot, vehicular collision, electrocution, trapping, and lead toxicosis (Milsap, Bjerre, Otto, Zimmerman, & Zimpfer, 2016).

No formal golden eagle surveys have been conducted on the Desert National Wildlife Refuge outside of the boundaries of NTTR. The nest inventory conducted on Alternative 3C on May 28-29, 2016, was the

first documented golden eagle nest survey conducted in that area. Historical data from the U.S. Geological Survey (USGS) North American Breeding Birds Survey recorded a total of three observations of golden eagles along Alamo Road on the NDWR in 1996, 2008, and 2014 (Pardieck, Ziolkowski, Hudson, & Campbell, 2016). Locations of these and other observations are provided in the Methodology and Results sections of this report.

Other Raptors Potentially Found on the Study Area

In the paragraphs that follow is a short description of the other raptors found, or potentially found, on the study area. Note that this is not intended to be a thorough literature review of each species, but is background information to familiarize the reader with the species. A summary of the observations of each species on the study area is provided in the results section of this report. This is a documentation of the occurrence of each species on the study area and is not to be construed as a population density estimate.

Red-tailed Hawk

Red-tailed hawks (*Buteo jamaicensis*) are one of the most common hawks in North America and, subsequently, have a wide distribution. The species is one of the larger hawks with large, broad wings and a short, wide tail. Adults characteristically have a bright red tail, while juveniles have a brown tail with thin horizontal bands. Overall plumage can vary, as there are multiple 'morphs'--light, dark, southwestern, and Harlan's (Cornell Lab of Ornithology, 2015).

Red-tailed Hawk at Cedar Pass on the NTTR

Red-tailed hawks are prevalent due to their wide variety of habitat preferences and are found on almost every habitat type on the continental U.S. They are also generalist predators; consuming prey that includes lizards, snakes, small mammals, rabbits and upland game birds (Herron, Mortimore, & Rawlings, 1985). Due to their wide-ranging distribution, very few population level threats are currently impacting red-tailed hawks. However, an abundance of direct threats, similar to those of the golden eagle, are present for the red-tailed hawk. Unlike the golden eagle, because of the size of their population and nearly ubiquitous distribution across the U.S., these threats are reduced to local or individual impacts instead of population-limiting impacts.

Swainson's Hawk

Swainson's hawk
(Copyright U.S. Fish and Wildlife Service-Mountain Prairie)

The Swainson's hawk (*Buteo swainsoni*) is a relatively gregarious raptor, except during the nesting season. They nest throughout open areas of the western United States and migrate to South America for the winter, making their journey one of the longest in the raptor world (Cornell Lab of Ornithology, 2015). As a *Buteo,* they resemble red-tailed hawks and ferrugi-

nous hawks, but their bodies are more slender and their wing span is larger. The species has several different morphs, but the more common light morph has a white face, white legs, and mottled brown wings. A reddish-brown 'bib' is located around the bird's head and neck and sharply contrasts with the bird's cinnamon to white chest. Their preferred habitat is semi-arid grasslands, including agricultural lands, with small stands of trees for nesting or roosting (Gilmer & Stewart, 1984). Swainson's hawks soar while hunting and, depending on their locale, prey on a variety of small mammals including pocket gophers (*Thomomys spp*), (Gilmer & Stewart, 1984), large insects (in winter) (Cornell Lab of Ornithology, 2015), cottontail rabbits (*Sylvilagus auduboni*), and woodrats (*Neotoma spp*.) (Bednarz, 1988). Potential threats to the Swainson's hawk are habitat destruction and alterations through fire or invasive plants.

Rough-legged Hawk

The rough-legged hawk (*Buteo lagopus*) prefers cooler temperatures, only migrating into Nevada in the winter. The name "rough-legged" refers to their feather-covered legs. The diet of the rough-legged hawks consists of lemmings in the spring and summer and small mammals hunted throughout the winter.

Rough-legged Hawk

Rough-legged hawk habitat is variable, depending on the time of year. The hawk breeds in steep cliffs in the arctic tundra during summer, and they spend the winter months in sagebrush and grassland habitats, such as those found on the study area (Watson, 1985; Cornell Lab of Ornithology, 2015). Potential threats to these hawks include energy development in both their summer and winter ranges.

Ferruginous Hawk

The ferruginous hawk (*Buteo regalis*) is the largest species in the genus *Buteo*. As with most raptors, ferruginous hawks feed opportunistically, preying on small to medium-sized mammals, reptiles, and birds. Commonly, they will perch high and patiently wait to ambush mammals venturing outside of their burrow or hiding spot. However, they also use a variety of hunting techniques including low-level flight, hovering, cooperative hunting, and ground perching. Primary habitat types include prairie and arid shrublands (Griggs, 1997).

Ferruginous Hawk
(Photo by Gary Melagoo)

Threats to this species include the eradication of prey sources such as prairie dogs and jackrabbits, habitat loss due to agricultural development, removal of native vegetation, and improper application or management of pesticides (Nevada Department of Wildlife, 2006). Currently, ferruginous hawks are listed by the BLM as "Sensitive", and the NNHP lists them at the state level as "Imperiled". The global population is "Apparently Secure" according to the NNHP.

Cooper's Hawk

Cooper's Hawk
(Photo by NNRP)

Cooper's hawks (*Accipiter cooperii*) are medium-sized raptors with a slenderer appearance compared to their *Buteo* cousins. They can be challenging to distinguish from sharp-shinned hawks, yet the adult Cooper's hawk has a pale nape, giving it a "capped" look (Cornell Lab of Ornithology, 2015). Cooper's hawks prey on songbirds and small mammals almost equally throughout the year (Bielefeldt, Rosenfeld, & Papp, 1992). Their natural habitat is in forested areas, but Cooper's hawks may be found in a variety of brushy habitats, including urban areas (Cornell Lab of Ornithology, 2015).

Sharp-shinned Hawk

Sharp-Shinned hawk
(Copyright Alan Schmierer)

Sharp-shinned hawks (*Accipiter striatus*) look almost identical to Cooper's hawk, but are smaller. Adults are blue-gray on their wings, back, and head, with rufous-colored bands on the chest. The back of the neck is gray, distinguishing it from Cooper's hawk (Cornell Lab of Ornithology, 2015). Juveniles have brown wings and back, with crisp brown streaks across a white breast.

Swift and agile fliers, sharp-shinned hawks predate primarily on songbirds, yet will capture small mammals and lizards when available. Sharp-shinned hawks nest in dense foliage in forested areas, and young hawks develop rapidly (Herron, Mortimore, & Rawlings, 1985). While not in breeding season, sharp-shinned hawks may be found in a variety of habitats, including agricultural, urban, riverine and desert shrublands.

Northern Goshawk

The northern goshawk (*Accipiter gentilis*) is the avian equivalent of a fighter jet. They are secretive raptors, larger than a Cooper's hawk with a longer tail, broad, round wings, and yellow eyes. A bold, white stripe runs from the base of the beak, over the eye, and to the back of the head; a characteristic unique to northern goshawks. Adults have slate-gray wings, back, and head with a barred, barrel-shaped chest. Juveniles are brown with a streaky breast and an indistinct, white "eyebrow."

Northern Goshawk
(Copyright Francesco Veronesi)

The northern goshawk is reputed to be among the most territorial and aggressive raptor species. Nests are often found by surveyors opportunistically because of the agitated territorial behavior of adults (Smith & Keinath, 2004). These nests are usually found in conifer trees, with as many as eight nests located in one territory (Cornell Lab of Ornithology, 2015). Northern goshawks are sensitive to disturbance at their nest sites. During the breeding season, goshawks will consume a variety of birds and small mammals, depending on location and availability (Lewis, Titus, & Fuller, 2006). Threats to this species include timber harvesting of old growth forests, human disturbance causing nest abandonment, wildfires, and human disturbances associated with habitat development (Reynolds, et al., 1992).

Prairie Falcon

The prairie falcon (*Falco mexicanus*) has a pale brown back and wings, with a thin brown "mustache." Their chests and legs are white with interspersed brown spots. It is distinguished in flight by its distinctive dark axillaries and trailing edge of under wing-coverts, which contrast with light-colored under wing surface (Steenhof K. , 1998). These characteristics are most visible from beneath the bird.

Prairie Falcon
(Copyright *Martin Meyers)*

The prairie falcon is a year-round resident of Nevada, found in open areas below 10,000 ft. MSL (Tesky, 1994). A significant proportion of the global populations of prairie falcons inhabit Nevada, where their preferred habitats of cliffs adjacent to arid, semi-barren valleys, are abundant. In Nevada, they are most often observed hunting over a variety of sagebrush, salt desert and Mojave Desert scrub (Great Basin Bird Observatory, 2010). The prairie falcon mostly feeds on small mammals and songbirds (Steenhof K. , 1998). They may forage up to 15 miles from the nest. The eyries or nests are often located within 0.25 mi. of a water source (Polite & Pratt, 2005).

Illegal shooting is the most commonly reported cause of death for adults (Enderson, 1964). Additionally, collisions with vehicles (Robbins & Easteria, 1992), organochlorine pesticide poisoning (Fyfe, Risenbrough, Monk, Jarman, & Anderson, 1988), lead poisoning from lead shot in the tissue of prey (Redig, Stowe, Barnes, & Arent, 1980), and degradation of habitat have negatively impacted prairie falcons throughout their range. Extensive wildfires have altered shrub-steppe habitat potentially impacting important prairie falcon nesting areas since 1980 (U.S. Department of the Interior, 1996).

Merlin

The merlin (*Falco columbarius*) is a small but powerful falcon. The coloring of the merlin will vary by geographic location, with males appearing dark to bluish gray and females and juveniles displaying a more brown appearance.

These powerful raptors nest along the edges of forests and rivers and hunt primarily songbirds and, occasionally, dragonflies (Cornell Lab of Ornithology, 2015). They have been known to hunt in pairs, with one flying into a flock of songbirds and the other swooping to attack the confused prey (Cornell Lab of Ornithology, 2015).

Merlin, female
(Copyright Sara Schuster)

American Kestrel

The American kestrel (*Falco sparverius*) is North America's smallest falcon (Cornell Lab of Ornithology, 2015). Males and females are sexually dimorphic, with females possessing tan wings and tails. Males have rufous tales and wings that are a combination of blue/gray and rufous. Both have a typical falcon "mustache."

The diet of American kestrels consists of small mammals, reptiles, songbirds, and large insects. They will hunt and reside in various habitats, if open areas are present. They have been found in agricultural areas, woodland habitats, arid shrublands, and urban areas.

American Kestrel, male (Photo by NNRP)

Peregrine Falcon

The peregrine falcon (*Falco peregrinus*) was historically widespread and abundant throughout the United States, until populations across the United States faced a sharp decline in the 1940s, 1950s, and 1960s, forcing the USFWS to list them as Endangered in 1970 under the Endangered Species Conservation Act and in 1975 under the ESA (U.S. Fish & Wildlife Service, 2013). This dramatic population decline was largely due to the bioaccumulation of pesticides, such as dichloro-diphenyl-trichloroethane (DDT) in predatory birds. These pesticides hampered reproduction of the peregrine falcon because the pesticide caused eggshells to be thin and extremely fragile. After DDT was banned, the peregrine has recovered to some degree and has regained a large distribution across the globe. As part of a recovery strategy, continued monitoring to determine the stability of regional populations has been recommended through 2015 in some regions (U.S. Fish and Wildlife Service, 2003). Throughout their range, the peregrine will nest on cliffs and canyons, including tall buildings in urban areas. They show a strong preference for site fidelity (GBBO, 2011). Within Nevada, they utilize various environments including steppe, open water, desert shrub and suitable nesting cliffs (American Ornithologists' Union, 1983). When they are not breeding, they occur in areas here prey concentrates. These areas include marshes, lake shores, rivers and river valleys, cities, and airports (Nevada Department of Wildlife, 2006).

Peregrine Falcon (Photo by NNRP)

Northern Harrier

Northern Harrier

The northern harrier (*Circus cyaneus*) is a slender, medium sized hawk averaging 18-20 in. in length with a wingspan of 40-46 in. (MacWhirter, 1996). The distinctive low-flying pattern with its wings held in a 'V' position during flight makes the northern harrier easy to distinguish from other raptors

(MacWhirter, 1996). Another unique characteristic of the northern harrier is the white patch found on the bird's rump, which is obvious in flight. Male northern harriers are gray on the back with a pale underside while the females are larger in size with dark brown on the back and a brown and tan striped underside (Brown, 1968). The face of a northern harrier is described as owl-like in appearance (Brown, 1968). Like an owl, the northern harrier relies on its hearing to help locate prey as it flies low over grasslands and meadows.

The northern harrier has an extremely wide distribution throughout the United States, Canada, and Central America (MacWhirter, 1996). They have also been found across Eurasia, across northern Europe and Asia, south to Portugal, and in northern China (American Ornithologists Union, 1998). Due to the northern harrier preference for flying low over open areas to forage; grasslands, meadows and marshes are the habitats it prefers (Balfour, 1975). Because of its low flight pattern for hunting, the northern harrier avoids forests and woodlands. However, it has been observed on the edges of meadows, nesting under dense forest vegetation (Craighead, 1956).

Western Burrowing Owl

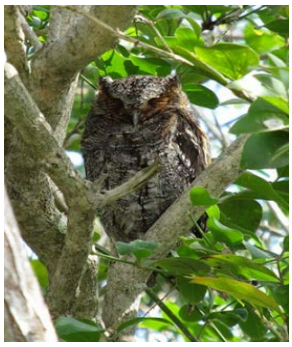
The western burrowing owl (*Athene cunicularia hypugea*) is a relatively small owl weighing approximately 5 oz. and standing 7–10 in. in height. The diet for western burrowing owls is comprised of small mammals, birds, amphibians, reptiles, and arthropods (Haug, Millsap, & Martell, 1993). They are opportunistic hunters and nesters. They forage in a variety of habitats, including cropland, pasture, prairie dog colonies, fallow fields, and sparsely vegetated areas (Butts, 1973). Western burrowing owls are relatively tolerant of urban development, and increasing human presence has caused the western burrowing owl to adapt to the environment by using highly maintained areas such as golf courses, airports, and road cuts for nesting habitat (G.B. Herron, 1985).

Western Burrowing Owl
(Photo by NNRP)

Primary threats to the western burrowing owl are habitat loss and fragmentation primarily due to intensive agricultural and urban development and, in the midwestern states, declines in populations of colonial burrowing mammals, such as prairie dogs (United States Fish and Wildlife Service, 2003). Other negative impacts include livestock grazing, fire suppression, mowing and shredding, and pesticide use.

Flammulated Owl

The flammulated owl (*Psiloscops flammeolus*) is a small nocturnal and insectivorous bird sometimes referred to as the "dwarf owl" due to its size. It is a migratory, secondary cavity nester of coniferous forest vegetation in western North America (Marshall, 1967). This owl is about 2 oz. with a length of 6 in. and a 14-inch wingspan. Males and females are indistinguishable by plumage or size (HawkWatch International, 2009). Flammulated owls have dark eyes, indistinct ear tufts, a grayish back, a lighter belly, and reddish and dark gray markings (Bureau of Land Management, 2010). The Latin word "*flammeolus*" refers to the unique flame colored appearance of the feathers.



Flammulated Owl
(Copyright Hans De Grys)

Northern Saw-whet Owl

Northern saw-whet owls (*Aegolius acadicus*) are small owls characterized by secretive behavior. They have a square-shaped head that almost appears too large for their body, with brown streaks on a white chest.

Northern Saw-whet Owl
(Copyright Kameron Perensovich)

Northern saw-whet owls breed in vast forests throughout Canada, the Rocky Mountains, and the Sierra Mountains. They may migrate large distances, and winter territory is found in forests with dense cover throughout the remainder of the United States (Cornell Lab of Ornithology, 2015). Their diet consists almost entirely of small mice. The major threat to northern saw-whet owls is deforestation, as they use tree cavities to breed.

Western Screech Owl

The western screech owl (*Megascops kennicottii*) is a short, stocky owl found in the western half of North America. They are nocturnal, with excellent camouflage to remain incognito during the daytime.

Western Screech Owl
(Photo by NNRP)

The preferred habitat for the western screech owl is forested woodlands, where they roost in tree cavities. However, they can be adaptable, and are found in riparian habitats, deserts, coastal areas, and suburban neighborhoods (Cornell Lab of Ornithology, 2015). Their diet is variable, including an assortment of rodents, bats, insects, fish, amphibians, and even earthworms and crayfish.

Short-eared Owl

Short-eared owls (*Asio flammeus*) are found in a variety of habitats throughout the continent. They are mottled brown, with an obvious facial disk, complete with golden-yellow eyes. They have broad wings and a short tail. Dark patches resembling a comma are visible from the underside of the wings (G.B. Herron, 1985).

Short-eared Owl
(Copyright USFWS-Mountain Prairie)

Short-eared owls may be seen during the day, and, if flushed from their perch, will land on the ground or low on a tree. They hunt by flying low over the ground, eating, almost exclusively, small mammals (G.B. Herron, 1985). Typical habitat is open areas with short vegetation. Nests are constructed on the ground with dry grasses and twigs. In southern Nevada, short-eared owls are typically found during the winter months.

Long-eared Owl

Long-eared owls (*Asio otus*) are medium sized owls that inhabit most of North America. Their obvious "ear" tufts stick straight up, and their facial disk contains feathers that range from light buff to darker orange. They are nocturnal, roosting in trees or dense brush during the day, relying on their spotted plumage to provide camouflage. Long-eared owls hunt small mammals at night and their calls can be heard up to one kilometer away (Cornell Lab of Ornithology, 2015). Their preferred hunting habitat is a variety of open areas including desert, sagebrush, grasslands, and agricultural habitats (Cornell Lab of Ornithology, 2015).

Long-eared Owl
(Copyright Darrel Birkett)

Barn Owl

Barn owls (*Tyto alba*) are strictly nocturnal birds that can be found throughout the United States and South America. These slender owls hunt small mammals by sound and are able to locate their prey in complete darkness (Cornell Lab of Ornithology, 2015). During the day they roost in quiet areas such as mines, large trees, or barns. They are found in a variety of habitats including deserts, grasslands, mining areas, or agricultural lands.

Barn Owl
(Copyright Chris Parker)

Great Horned Owl

Great horned owls *(Bubo virginianus*) are the largest owls in North America. They are nocturnal and found in semi-open areas ranging from forests, swamps, desert, suburbs, and tropical rainforests (Cornell Lab of Ornithology, 2015). Their diet is as variable as their habitat preferences, and includes small mammals, large insects, reptiles, and other owls (Cornell Lab of Ornithology, 2015).

Great Horned Owl
(Copyright Joe Lewis)

Methodology

Introduction

Golden eagle, raptor, and migratory bird surveys have been conducted on the NTTR since 2005 to comply with the Sikes Act and the Integrated Natural Resources Management Plan (INRMP) prepared for NAFB and the NTTR. The NNRP coordinated with NDOW to schedule and conduct golden eagle surveys in a manner to minimize impacts to bighorn sheep lambs in the spring and early summer. To accommodate productivity surveys, helicopter surveys were often scheduled during lambing season, but if any lambs were observed, the area was immediately avoided until the lambs were no longer present or the nest was not inspected.

Golden eagle on a power pole on the NTTR (Photo by NNRP)

Beginning in 2007, cliff raptor nesting helicopter surveys, seasonal raptor ground surveys, and Nevada point count/stationary surveys were conducted annually on the NTTR. Summer and winter raptor surveys were initially conducted in 2009 and continued annually. These surveys consisted of ten established 20-mile survey routes on the NTTR along major roads. Spring raptor cliff nesting surveys were initiated in 2007 and were scheduled to be conducted a minimum of every other year, as recommended by NDOW. In 2014 and 2015, helicopter surveys for raptors nesting in Joshua tree habitat, and were conducted in the basins of the North Range of the NTTR and the bajadas of the South Range of the NTTR. The USAF initiated golden eagle nest inventory and productivity surveys for the NTTR in 2011. The methodology used for the golden eagle and raptor surveys summarized in this report is discussed in the sections that follow.

Golden Eagle

An initial protocol for surveying nesting golden eagles was released by the USFWS on September 11, 2009; under Parts 13 and 22 of Title 50 of the CFR (Pagel, Whittington, & Allen, 2010). However, a final protocol is still being developed. In view of this situation, NNRP initiated an intensive golden eagle nesting survey protocol that would meet the requirements of the USFWS until a formal protocol was prepared and approved. The methodology used for the NNRP Golden Eagle Nest Survey is summarized below. The goal of these surveys was to identify the location and characteristics of active and inactive eagle nests and to estimate productivity of active nests within the scheduling and constraints of the military mission. Surveys were scheduled to comply with the survey protocol, but because of safety and scheduling issues, timing of surveys was not always ideal for determining productivity. The surveys were planned and conducted to assist the USAF with the management of the golden eagle population on

Helicopter approaching cliff habitat (Photo by NNRP)

the withdrawn lands and not for scientific analysis. The general areas that were included in the golden eagle nest surveys conducted from 2011 to 2016 are shown in Figure 3.

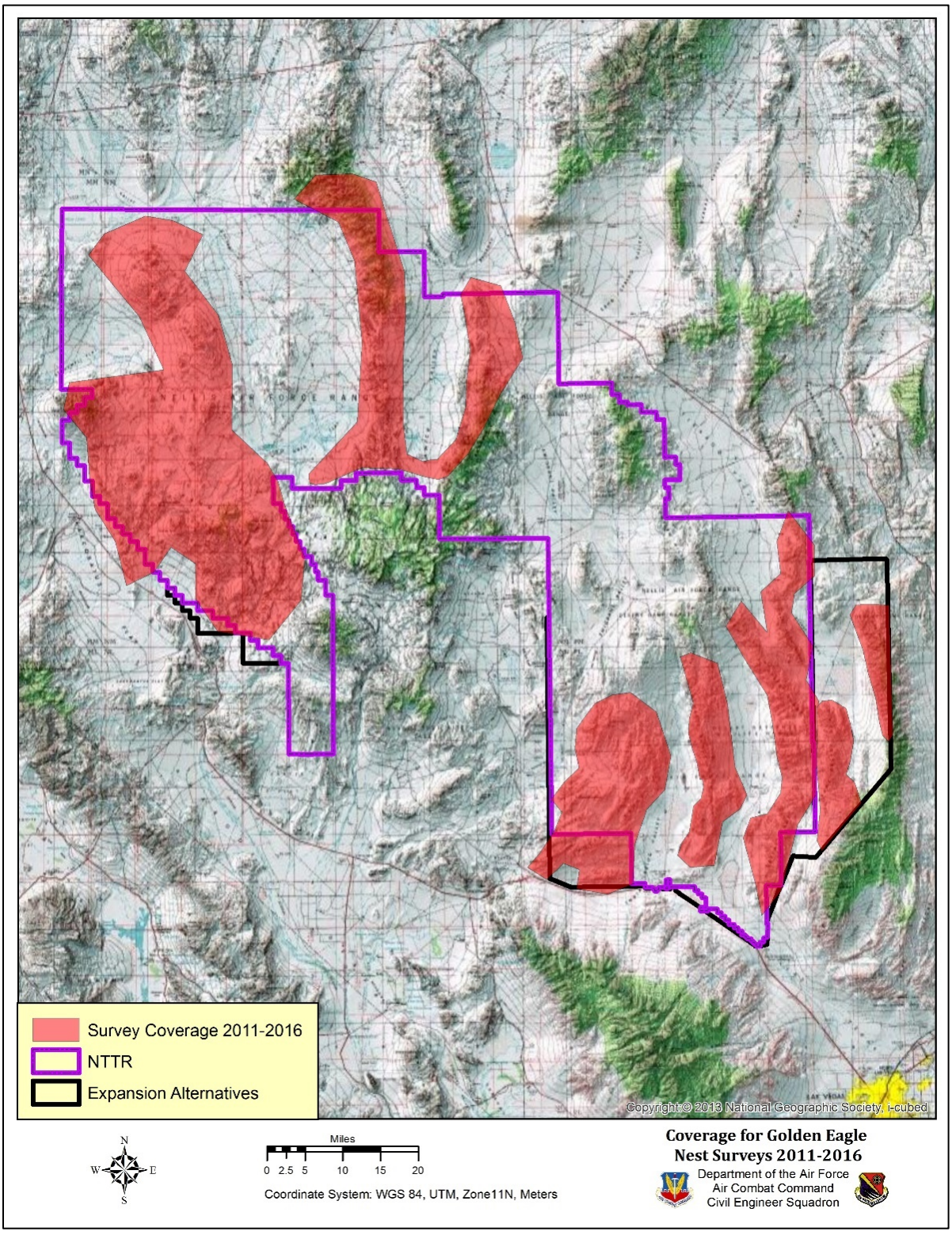


Figure 3. Areas that have been surveyed for golden eagle nests on the study area from 2011 to 2016.

Inventory Techniques--NTTR

Golden eagles are one of several cliff and tree dwelling species sensitive to human disturbance. Monitoring eagles in a manner that "disturbs" them, and causes them to be "agitated or bothered" can cause nesting failure and permanent site abandonment, either of which constitute "take" under the Bald and Golden Eagle Protection Act. Helicopters (A-Star AS350) were used for the golden eagle surveys because they have been shown to not harass nesting eagles, if done properly, and large areas can be surveyed thoroughly and efficiently. The helicopters were flown no closer than 32-65 feet and no farther than 650 feet from nesting sites. Hovering near active nests was maintained no more than 30 seconds. Close approach and extended hovering was used only if birds were not present on the nest. If a golden eagle appeared disturbed, the helicopter turned away and terminated the nest observation. During all years, no disturbance behaviors were observed, and the golden eagles appeared to be virtually unaffected by the presence of the helicopter, a belief which is shared by NDOW (G.B. Herron, 1985).

Surveying methodology complied with the interim U.S. Fish and Wildlife Service protocol (Pagel, Whittington, & Allen, 2010). The survey team included a minimum of two wildlife biologists, one seated to the left of the pilot and the other biologist in the back seat on the right side of the helicopter, behind the pilot. The helicopter pilot was experienced in golden eagle surveys and understood the proper and safe approach to nests. Cliff sides were surveyed by starting the helicopter flight at the top of the cliff. The helicopter was flown parallel to the rock-face, maintaining constant elevation, until the end of the cliff. The pilot then turned around and dropped approximately 200-250 feet in elevation and flew in the opposite direction parallel to the cliff face. This was repeated until the entire cliff side was observed.

Occupancy Surveys--NTTR

Occupancy surveys were conducted early in the nesting season to locate active nests. Dates of surveys are provided in Table 1. These surveys were initiated at 7:00 AM and concluded around 3:00 PM. A nest was deemed active (or occupied) if eggs or chicks were present. If present, the age of chicks was assessed. The nesting chronology (estimated hatch date, current age, estimated fledge date) was determined by the age of the chicks. The age classification of the chicks was critical to determine the required timeframe to conduct productivity surveys. Age classification was determined using the guidance provided by D.E. Driscoll (Driscoll, 2010). While surveying areas where active golden eagle nest territories had been previously identified, biologists searched for new nests and signs of perching activity. New nests and data on nest attributes was recorded and the nests and its occupants were photographed, if possible.

During occupancy surveys, nests were located and their condition described. Excellent, good, or decorated nests were considered potentially active nests that may be used for egg laying. Photographs were taken of all active and inactive nests. Information collected during the first inspection of a nest was as follows:

- Survey date
- Observers, including the pilot
- Mountain range
- Coordinates of the nest (UTM, WGS 1984, Zone 11N, Meters).
- Approximate elevation of the nest (ft. MSL)
- Cliff aspect, height and length (Estimated)
- Habitat (using NDOW Wildlife Action Plan Key Habitats) of adjacent areas used for hunting
- Materials used to make the nest
- Estimated height of the nest above the base of the cliff or outcrop
- Estimated nest size (length x width)
- Direction nest faced

- Nest condition (Excellent, Very Good, Good, Good/Decorated, Decorated, Fair, Poor)
- Miscellaneous notes

Productivity Surveys--NTTR

Productivity surveys were conducted later in the season, typically in April or May, using a helicopter to fly to all active nests identified from the occupancy survey conducted earlier in the year. The objective of productivity surveys was to document nesting success and number of fledged eagles. Only a small window of time was available when these surveys were conducted. The USFWS considers 51 day old eaglets to be fledged. The juvenile eagles will remain at the nest until they are approximately 75-80 days old. The timeframe for the productivity surveys was dependent on an accurate estimated age of the nestlings at the time of the nesting surveys to ensure that the productivity survey was conducted after the 51 day fledge date. Surveys for productivity were conducted during this narrow timeframe to accurately determine the fledging success of each nest. However, compliance to this protocol was not always possible because of scheduling constraints emanating from military mission and DOE activities.

Three-week old golden eagle chicks (Photo by NNRP)

A nest was designated as unoccupied by golden eagles if it was not occupied at the time of the second survey. If nests contained chicks or eggs during the occupancy surveys, they were considered active and surveyors checked on those nests during the productivity surveys. Data collected for active nests included the following:

- Hatch date (estimated from age of nestlings through photographs)
- Date clutch complete (estimated)
- Fledge date (known or estimated)
- Number of young at each visit
- Digital photographs of the nest, young, and surrounding habitat

Table 1. Dates of golden eagle surveys conducted on the NTTR

Year	Inventory Surveys	Occupancy Surveys	Productivity Surveys
2011	South Range: January 15-17; 22-23 North Range: February 5-6; 12-13	South Range: April 16-17 North Range: May 7, 8, 15	South Range: None, no chicks observed North Range: June 24; July 4
2012	South Range: None North Range: None	South Range: April 14-15, 21, 22 North Range: May 5-6	South Range: None, no chicks observed North Range: June 24
2013	South Range: February 2-3 North Range: February 16-17	South Range: April 14, 21 North Range: May 5, 18, 19	South Range: June 1 North Range: June 15
2014	South Range: None North Range: None	South Range: April 26, 27 North Range: May 4, 18	South Range: June 14 North Range: May 26; June 22

Year	Inventory Surveys	Occupancy Surveys	Productivity Surveys
2015	South Range: None North Range: None	South Range: April 26 North Range: May 10	South Range: May 24 North Range: June 6
2016	South Range: None North Range: None Potential Expansion Alternatives: May 28-29	South Range: April 23-24 North Range: May 1, 8	South Range: June 4 North Range: June 5

Nesting Success--NTTR

Five-week old golden eagle chicks (Photo by NNRP)

Fledging success was determined via the observation of young that were at least 51 days of age or older. The nesting attempt would be deemed successful if:

- White wash and a well-worn nest are present.
- Any young were observed in the nest to be > 4 weeks old during a previous visit.
- The young would have been > 51 days old at the time of the visit, and no dead young were found.

Nesting failure would be noted when eggs were laid or incubation behavior was observed during occupancy surveys and the nest failed to produce any young 51 days of age or older. Nesting failures would be determined if observations of the nest prior to the projected fledge date yielded no young or fledglings where eggs or young were previously observed.

Additional Surveys--NTTR

Two nine-week-old golden eagle chicks *(Photo by NNRP)*

In addition to the field surveys listed above, raptor drive surveys and remote sensing camera deployment provided ancillary data on golden eagles throughout the year. All surveys were conducted by experienced ornithologists. Location of the raptor driving survey routes is provided in Figure 4. These routes were usually driven in the winter months and sometimes in the summer. Incidental observations of golden eagles in flight or roosting were recorded during these surveys.

Wildlife cameras were placed at various locations across the NTTR, with an emphasis on water features, since these are a major attractant for wildlife in arid regions. Locations of cameras is provided in Figure 5. Cameras were activated and placed in locations at different times of the year depending on the intent for their use. Photos taken by the cameras were reviewed by a biologist, data (species observed, sex, age, etc.) was recorded in a database, and the photographs were catalogued on a hard drive. If golden eagles were photographed by these cameras, the location of the camera and the condition of the eagle was noted and recorded in the migratory bird database for the NTTR. This data was used to complement the more thorough helicopter surveys. Incidental observations of golden eagles made by biologists during other surveys on the NTTR were also recorded in the

migratory bird database. This ancillary data was collected throughout the year, whereas nesting and territory information was only collected during the breeding and nesting season for the golden eagle.

2016 Golden Eagle Nest Survey—Alternative 3C

In 2016, a limited nest survey was conducted for the golden eagle and other raptors. This survey was conducted on May 28 and 29, as recommended by NDOW and USFWS to avoid impacts to the bighorn sheep lambing season. During this survey, a helicopter was used to fly along the cliffs and canyons of the Desert and Sheep Ranges in Alternative 3C. The survey followed the USFWS Interim Golden Eagle Protocol described in the previous sections (Pagel, Whittington, & Allen, 2010). Two experienced biologists surveyed cliff faces for evidence of raptor nesting and roosting. An emphasis was made to determine location of active nests. Because of time limitations, the survey covered the entire East Desert Range but only approximately 50% of the Sheep Range.

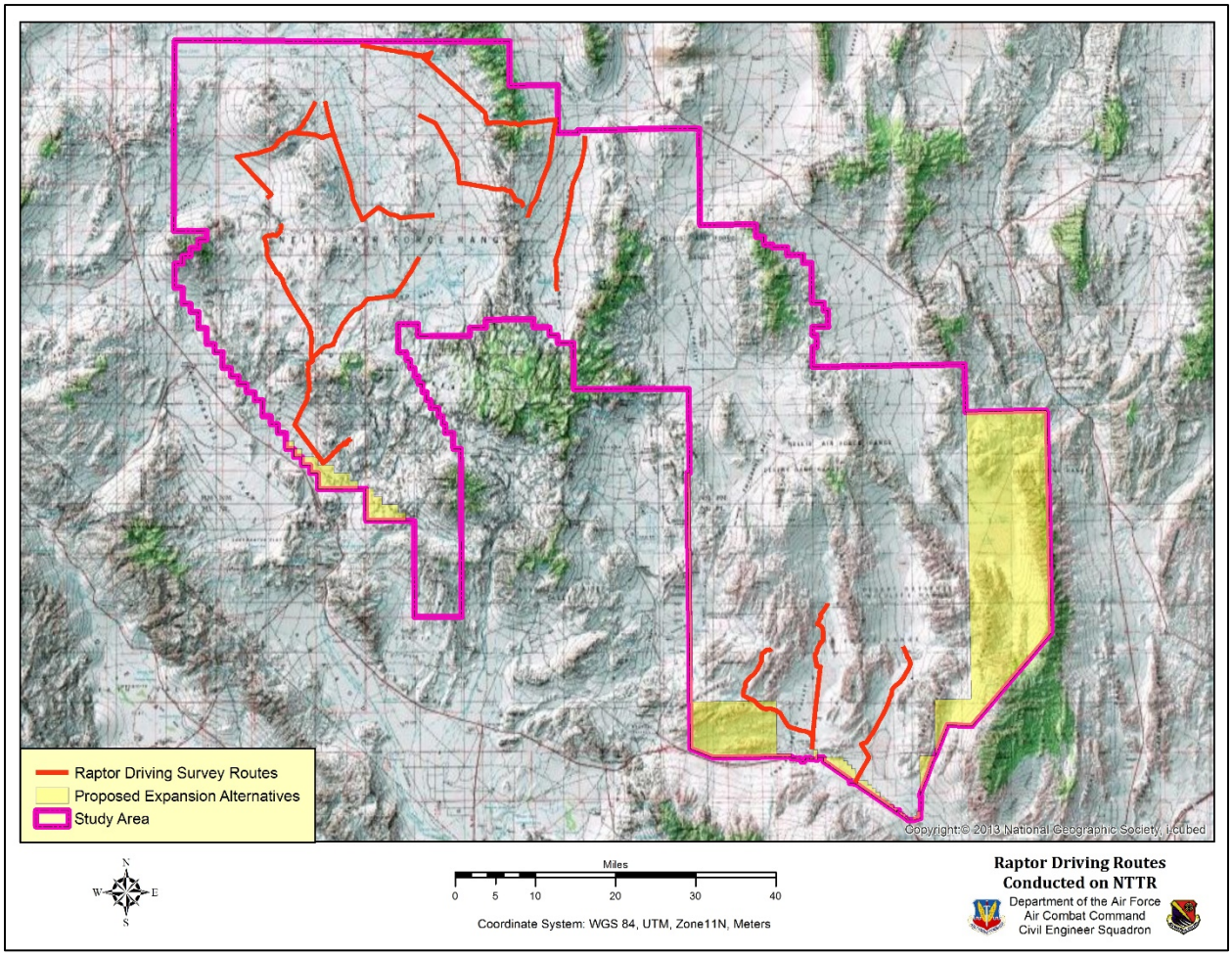


Figure 4. Routes used for seasonal raptor driving surveys on NTTR.

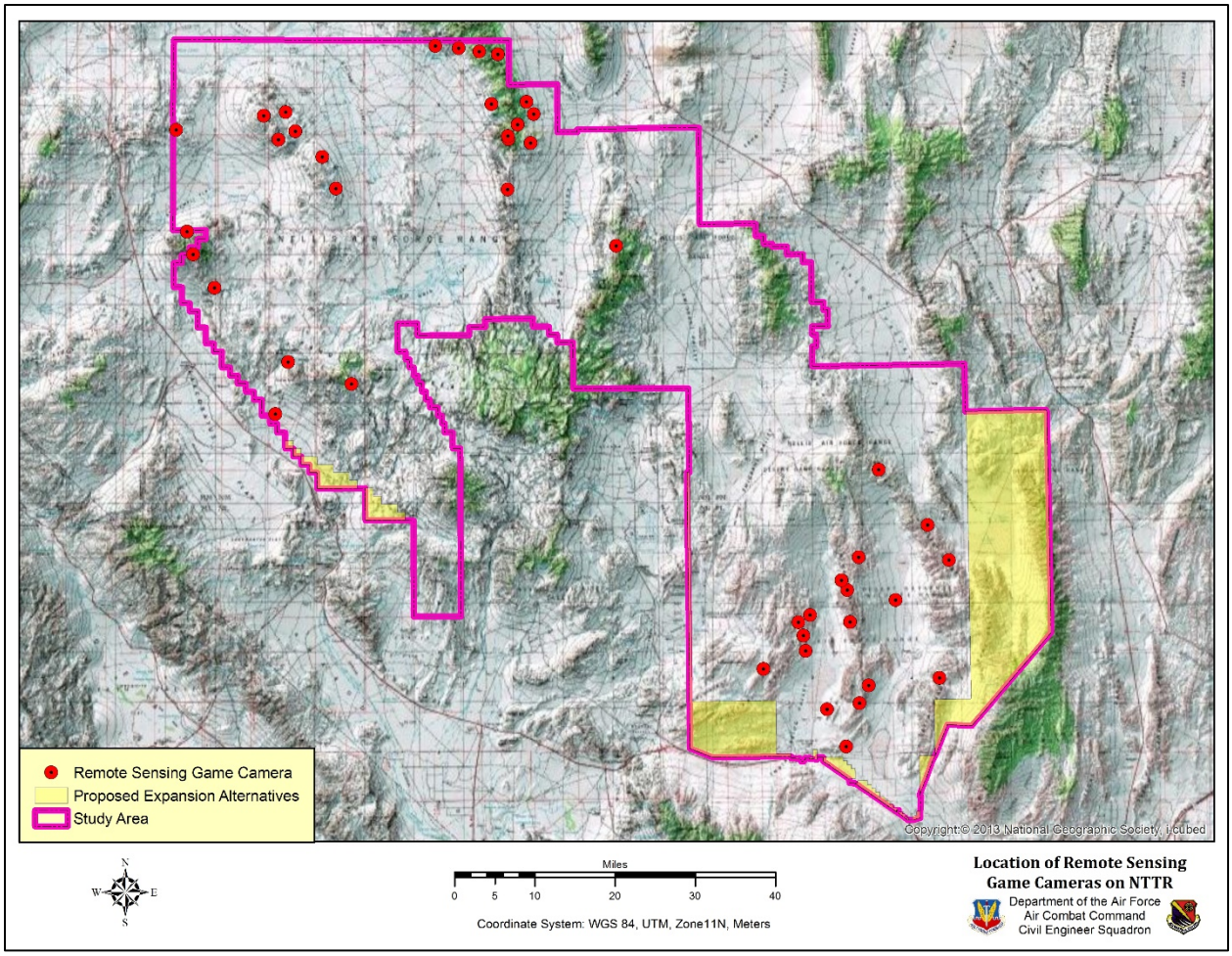


Figure 5. Locations where remote sensing game cameras were placed on NTTR.

Golden Eagle Habitat Models

Computer models were used to delineate potential nesting habitat for the golden eagle on the study area. Two different models were used—a Habitat Suitability Model and Maxent, a probabilistic model. The model methodology is described below. Further detail on the models may be found in the Special Status Species Habitat Range Model for the Nevada Test and Training Range and Proposed Expansion Alternatives Report prepared by the USAF under separate cover.

Habitat Suitability Model

For the Habitat Suitability Model, documented parameters for the golden eagle were researched and the limiting range was determined. After layer criteria were selected the model, each of the layers was weighted based on the importance of the layer in determining habitat range. Thus, if a layer was more important in determining habitat range, it was given a higher weighting factor. Weighting factors ranged from one to five with five being very important. Last, if golden eagles were rarely found outside of a range of limits within a layer, that criterion was considered inclusive and any other criteria used for the model outside of those limits were excluded from the model.

Habitat Suitability for the golden eagle was modeled using the Habitat Range Prediction Tool (HRPT), which was recently developed by Adams Ecology for natural resources modeling. The HRPT is a script and

associated script tool that was created to model and score locations of a species' preferred habitat. To build this tool, environmental layers were used to map suitable habitat for the golden eagle. Vector layers were converted to raster files, and all layers were clipped to the boundaries of the NTTR and proposed expansion alternatives. The parameters could only be used if GIS layers were available for the parameter on the study area. Thus, the following GIS layers were selected for the Habitat Suitability Model for golden eagle:

- Elevation: USGS Digital Elevation Map (DEM); 10 m resolution. The elevation range for the species was considered the highest score and the score for this layer decreased as one moved away from the lower or upper limit of elevation.
- Slope: Created from 10 m DEM using ArcMap.
- Key Habitat: NDOW Key Habitats: Nevada Wildlife Action Plan (Nevada Department of Wildlife, 2013)
- Mountains: Prepared by Adams Ecology based on digital elevation maps of the area.
- Valleys: Prepared by Adams Ecology based on topographic maps of the area.

The script for the model was created in Python. Using "arcpy.GetParameterAsText," user inputs could be entered for each variable directly through ArcMap or ArcCatalog. For each layer, specific inputs were required to allow the script to proceed. Invalid inputs caused an error in the script and it would no longer process. In layers with ranges, the user-specified range was scored a five (highest), while scores four through one were determined incrementally by ten percent of the range added or subtracted from the upper and lower ends of the range. Layers containing specific types were scored based on presence or absence of the user-input type. After the script created scoring outputs for each of the environmental layers, they were all multiplied by the weighting factor for each layer using the ArcGIS Raster Calculator tool. A simple addition method was used to prepare a total of the resulting scores of all layers.

The final resulting output consisted of a raster file with values from zero (no habitat) to the raster's maximum value (prime habitat). A higher score indicated that more preferred habitat parameters were met at that location. The final model for golden eagle was placed on a topographic map using ArcGIS, with the overlay being color coded to show the varying degree of potential for golden eagle nesting habitat to be present, based on habitat quality.

Parameters used for golden eagle nesting habitat included the following:

- Elevation: 3,800–8,800 ft. MSL based on data collected for the NTTR (Nellis Natural Resources Program, 2016) (No weighting factor)
- Slope: 80° to 90° (Weighting factor of 5)
- Key Habitat: Cliffs and Canyons (No weighting factor)
- Mountains: Included
- Valleys: Excluded

Maxent

Maxent is a probabilistic model program that uses the habitat attributes at observation points to delineate areas where a species is likely to be found (Phillips, Anderson, & Schapire, 2006). The model relies on a sufficient number of observation points (no less than 30 and preferably greater than 100) to provide a reliable delineation of habitat preferences for a species (Wisz, et al., 2008). The intersection of point observations with available environmental parameter GIS layers are used to create importance values and limits for parameters, which, in turn, are used to create the final habitat map. The model GIS layers used for the Maxent model for the golden eagle included the following:

- Elevation: USGS Digital Elevation Map (DEM); 10 m resolution. The elevation range for the species was considered the highest score and the score for this layer decreased as one moved away from the lower or upper limit of elevation.
- Slope: Created from 10m DEM using ArcMap.
- Aspect: Created from DEM using ArcMap.
- Geologic Outcrops: Geologic Map of Nevada (Crafford, 2007).
- NDOW Key Habitats: Nevada Wildlife Action Plan (Nevada Department of Wildlife, 2013).
- Mountains: Prepared by Adams Ecology based on digital elevation maps of the area.
- Permanent Water Sources: Created from seeps and springs database from NTTR and DNWR and includes only perennial seeps and springs and construction ponds. Scoring was based on distance from the source with 0.5 mi. radius being the highest score and the score decreasing as the radius increased (1.0, 2.0, 3.0, 5.0, and > 5.0 mi.).
- Soil Associations: U.S. Natural Resources Conservation Service STATSGO2 Database.
- Temporary Water Sources: Created from seeps and springs database from NTTR and DNWR and includes all intermittent and ephemeral water features except washes and dry lakes. Scoring was based on distance from the source with 0.5 mi. radius being the highest score and the score decreasing as the radius increased (1.0, 2.0, 3.0, 5.0, and > 5.0 mi.).
- Valleys: Prepared by Adams Ecology based on topographic maps of the area.
- Plant Alliances: Map developed by Adams Ecology for the documentation of plant alliances on the study area (U.S. Air Force, 2017).

The GIS layers were converted into raster files having the exact same resolution and clipped to the exact same size and shape. The raster files were converted into ASCII format as required for the model with each record being comprised of the attribute value, an x coordinate and a y coordinate. Once the layers were properly converted, Maxent was run in four different formats including Cloglog, Raw, Cumulative, and Logistic formats. The format showing the most realistic results based on the location of point observations was provided in the results section of this report.

Other Raptor Species Surveys

A bird monitoring program was initiated in 2010 on lands managed by the NNRP to evaluate and monitor the seasonal habitat use and bird demographics on NTTR. During all bird point count surveys, any raptors that were observed were recorded. These additional surveys include Christmas bird counts (conducted in December 2014 and December 2015 only), Nevada bird count surveys, and stationary point counts. Methodology for surveys specifically targeting raptors is provided below. The reader is referred to the 2014 Migrator/Neo-Tropical Bird Project Report for details on the methodology for these surveys (Nellis Natural Resources Program, 2015).

Seasonal Driving Raptor Survey

Seasonal raptor surveys are conducted by driving a 20-mile transect, at a speed of approximately 20 mph (Figure 4). A total of ten transects have been established, with seven on the North Range of the NTTR and three on the South Range of the NTTR. The location of routes was determined by uniformity of habitat within the route as well as accessibility and safety. Data collected during the surveys included species name, key habitat, estimated distance from road, and estimated height above the ground. A description of the routes and more detailed information may be found in the 2014 Migratory/Neo-Tropical Bird Annual Report for NTTR (Nellis Natural Resources Program, 2015).

Nesting Surveys

Nesting surveys consisted of using helicopters to fly transects over Joshua tree habitat to record the location and characteristics of raptor nests. The surveys were flown from 7:00 AM to 3:00 PM at approximately 60 mph. However, to allow sufficient time to observe all trees in the area, speed was periodically adjusted based on the density of the Joshua trees. Transects were approximately 0.10-0.25 mi. apart depending on Joshua tree density. The helicopter was maintained at 25-50 ft. above ground level. The location of all nests were recorded with a GPS. Additional information was provided for active nests (species of bird, numbers of eggs/young, type, and size of nest). Photographs of the nests were taken, when possible. These surveys were conducted on the NTTR on April 12-13, 2014; May 2-3, 2014; and June 6, 2015.

In addition to the transects in Joshua tree habitat, aerial surveys using a helicopter were conducted to target cliff-nesting raptors other than golden eagles. The surveys employed an experienced pilot and two biologists, one on each side of the helicopter, to search for active nests. These surveys were conducted independent of the golden eagle surveys and focused on raptors other than golden eagles. Cliff raptor surveys were conducted from 7:00 AM to 3:00 PM on the following dates:

- 2009: April 25-26 and May 2-3
- 2010: April 10
- 2013: April 28, May 4-5 and May 18-19

Owl Surveys

A call-broadcast method of surveying for owls was initiated in 2013 to provide presence/absence information on owl species on NTTR. This method involved driving surveys, but sometimes specific points were visited where burrowing owls were known to be nesting. The driving surveys were conducted by stopping every two miles on a planned route and playing recorded owl calls. Due to the predatory nature of larger owls, small owl species calls were played first. When no response was garnered, the larger owl calls were played. At each survey location, a time of five minutes of silence started each survey to allow biologists to listen for any owls already calling. Next, 30 seconds of a territorial owl call was played, followed by an additional 30 seconds of silence. This was repeated three times, and, if available, an additional 30 seconds of an alarm call was played at the finish. Following this, an additional 3-5 minutes was spent listening for any response. If a response was elicited, no further calls were played for that species. The biologists walked in the direction of the call, and replayed calls to elicit further response as necessary, until the nest was located (Nellis Natural Resources Program, 2015).

Results

Golden Eagle

Historical Data for Golden Eagle on the Expansion Alternatives

Historical data from the USGS North American Breeding Birds Survey shows that a total of three golden eagles have been observed on survey routes along Alamo Road in Alternative 3C (Pardieck, Ziolkowski, Hudson, & Campbell, 2016), one bird in 1996, one in 2008, and one in 2014. No other golden eagle observations prior to the surveys conducted in 2016 have been documented for the expansion alternatives.

NTTR

In 2011, golden eagle nest surveys were initiated and a full survey of mountain ranges on the NTTR was conducted as described in the methodology section of this report (Figure 6). These surveys were initiated to locate active golden eagle nests annually to estimate productivity and ensure protection of the nests while they are active. Surveys typically covered 90-100% of the habitat expected to support golden eagles. Both active and inactive nests were inventoried. If nests of other raptors were found, they were also identified and entered onto the database. During the survey, 65 nests were found on the South Range and 31 nests were found on the North Range. Although five of the nests appeared to be active and decorated on the first survey of the South Range, none of the nests were found to be active or occupied by the second survey in April. In contrast, of the 31 nests observed during the first survey on the North Range, eight were found to be occupied and active on the May survey. Three nests contained one egg each and five nests contained two eggs. All eggs hatched and produced chicks. All of the chicks survived and fledged in July.

In 2012, no occupied golden eagle nests were observed on the South Range. After locating and inspecting close to 100 nests on the North Range, only one nest found on the Kawich Range was occupied. The Kawich nest fledged a single chick.

In 2013, another inventory of golden eagle nest sites was conducted in February on the North and South Ranges. During the weekend of February 2-3 on the South Range and February 16-17 on the North Range, 125 nests were inspected for evidence of active nesting, including decoration, fresh muting (whitewash), and/or presence of golden eagle feathers. During these two weekends, 16 nests were noted to have fresh decoration even though no definitive nesting efforts were noted. Two of the nests were assumed to be active with prairie falcons, since adult prairie falcons were flushed from nearby areas. However, no other evidence was present to suggest that golden eagles were absent. Sixteen unoccupied nests were added to the database in 2013, five on the North Range and eleven on the South Range.

Follow-up productivity surveys were conducted on June 1 on the South Range, and June 15 on the North Range in 2013. Observations indicated that none of the nesting attempts failed in 2013. Every nest that was found to be active was successful. In all, eleven nests were active and occupied with golden eagles on NTTR in 2013, with only one occupied nest on the South Range (in the Pintwater Range) and the remaining ten on the North Range. When the nest on the South Range was inspected on June 1, it was determined that the single chick had fledged, making it the only successful nest observed on the South Range in 2013. All of the nests on the North Range were deemed successful, as all of the eaglets had reached 51 days of age. In 2013, a total of 16 chicks fledged from nests in the North Range and 17 total chicks fledged on the NTTR.

In 2014, occupancy surveys were conducted on April 26 and 27 on the South Range, and May 4 and May 18 on the North Range. Nine new nests were discovered in the Thirsty Canyon area of the North Range on May 18. During these occupancy surveys, four active golden eagle nests were recorded on the NTTR. Follow-up productivity surveys were conducted on May 26 and June 22 on the North Range, where four nests were labeled as successful. All of the chicks were able to fly, as they flushed when the helicopter approached. Three of the nests had one chick, while one nest in the Kawich Range successfully raised two chicks to fledge. On June 14, the productivity surveys indicated that two of the nests on the South Range, one on the Pintwater Range, and another on the East Desert Range, had failed. The cause of nest failure was not determined. The other two nests, one on the Spotted Range and the other on the Pintwater Range, each fledged one chick, bringing the total number of fledged chicks on the NTTR to seven in 2014.

In 2015, the entire inventory of 73 nests on the South Range was surveyed on April 26 to identify nests that were active with golden eagles. One nest on the Spotted Range was observed to have one hatchling golden eagle. The survey of the 49 known nests on North Range took place on May 10, where seven nests were found to be occupied with golden eagles. The follow-up survey on the South Range took place on May 23, where the single occupied nest produced one successful juvenile. On May 24, all seven golden eagle nests on the North Range were successfully fledged with a total of eight fledged golden eagles.

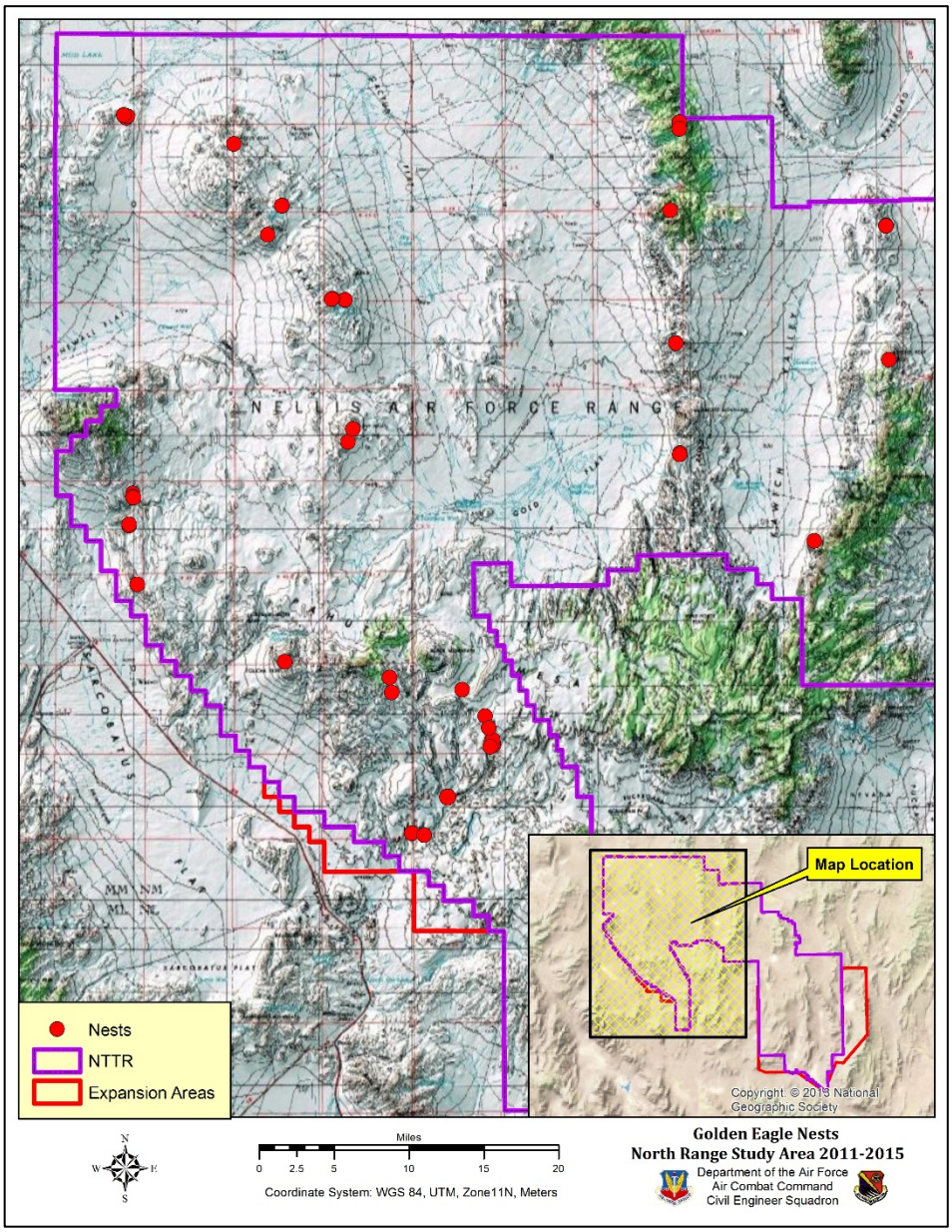


Figure 6. Active and inactive golden eagle nests on the North Range Study Area in 2011 – 2015.

During the years 2011 – 2015, there have been 36 observations of nests occupied by golden eagles on the NTTR with a total of 47 eaglets successfully fledged. The locations of all golden eagle nests identified on the NTTR is provided in Figures 6 and 7. Thirty occupied nests were observed on the North Range and six

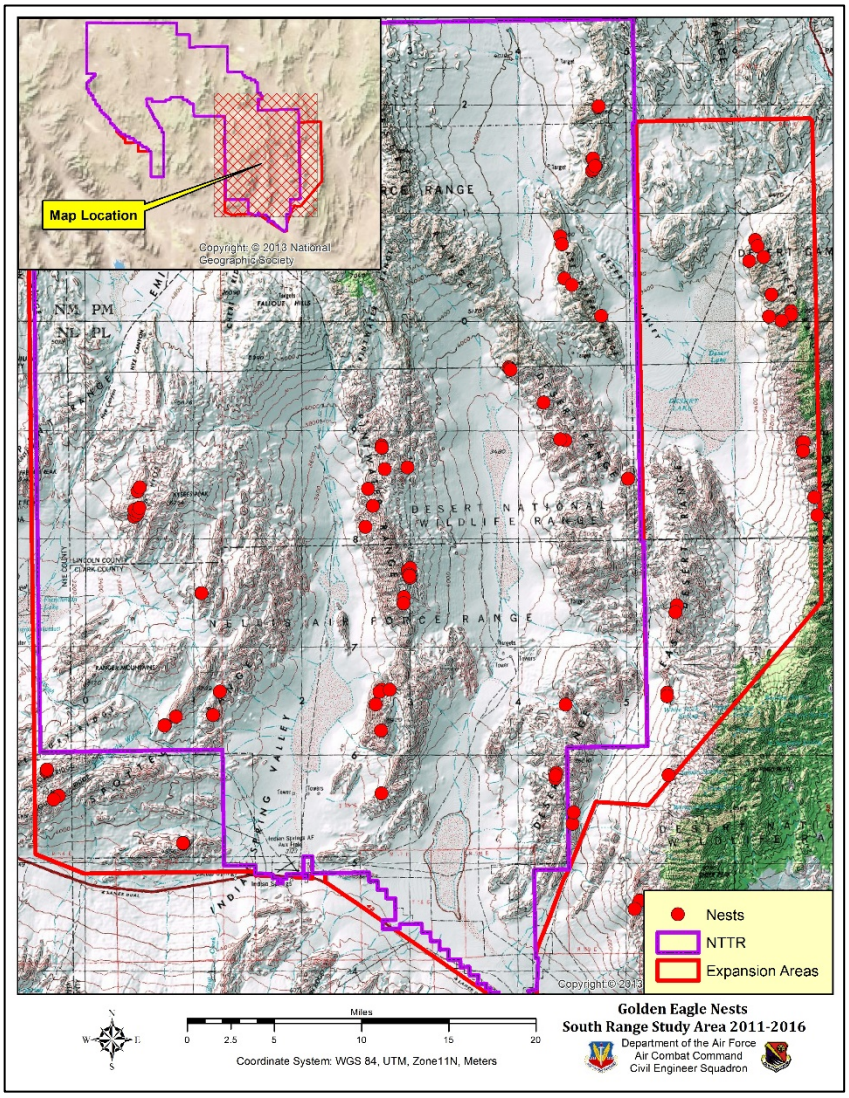


Figure 7. Active and inactive golden eagle nests on the South Range Study Area from 2011 – 2016.

occupied nests were observed on the South Range (Figures 8 and 9). A summary of the findings of the NTTR golden eagle nest surveys from 2011 to 2015 is provided in Table 2.

Limited information was available for surveys conducted on NTTR for golden eagle nests in 2016. On the South Range, a total of four occupied nests were identified producing a total of six hatchlings. Four of the six hatchlings successfully fledged. On the North Range, a total of ten occupied nests with seventeen hatchlings were identified. Eleven of the seventeen hatchlings successfully fledged with two of the hatchlings known not to fledge, and the status of the other four hatchlings was unknown. Overall, from 2011 to 2016, 69 golden eagles hatched and 59, or 86%, of the hatchlings fledged. Of the 14% remaining chicks, 5% definitely did not fledge and the fledging status was unknown for the other 5%. The results of the 2016 survey are provided in Table 2.

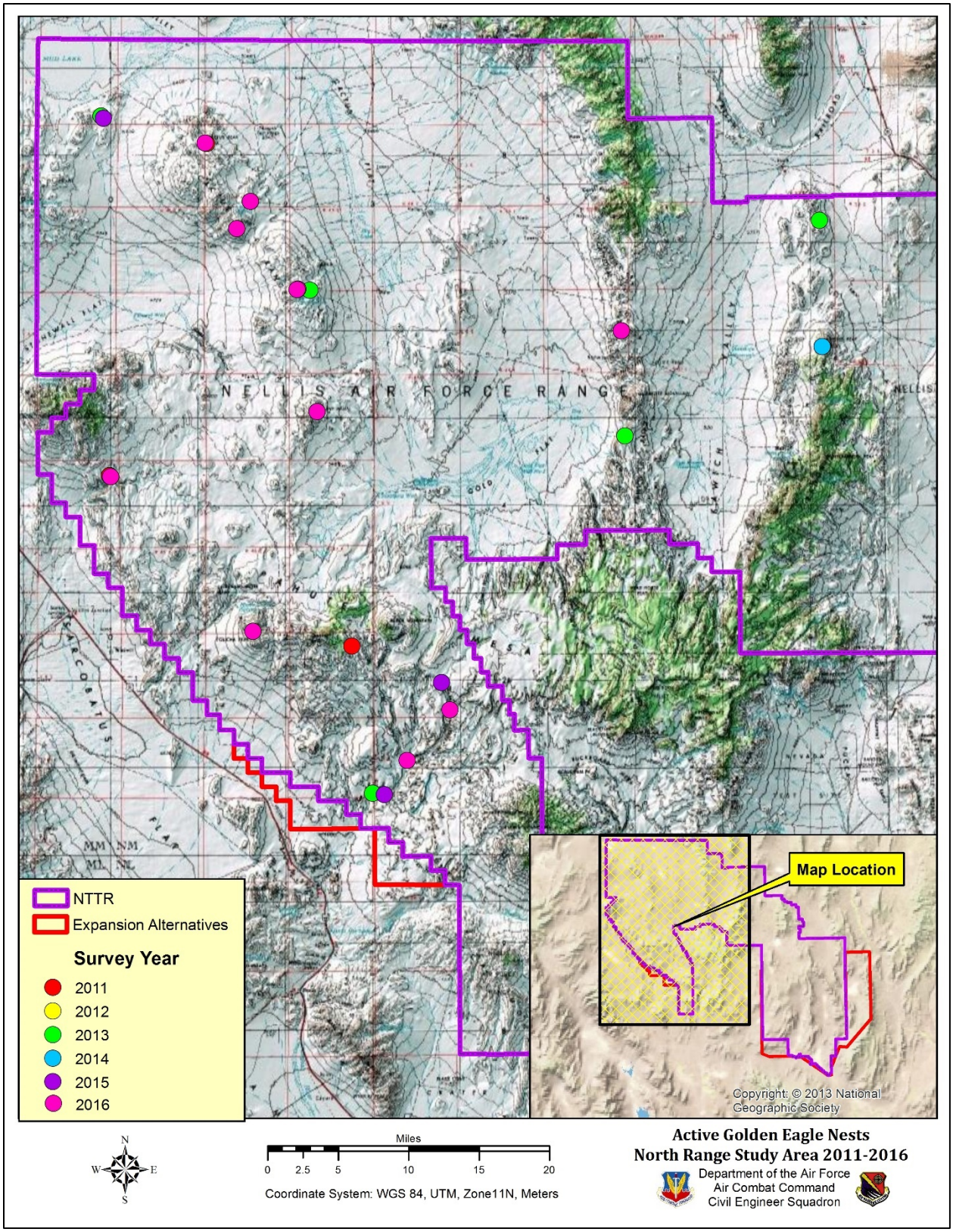


Figure 8. Active and occupied golden eagle nests identified on the North Range Study Area on 2011-2016.

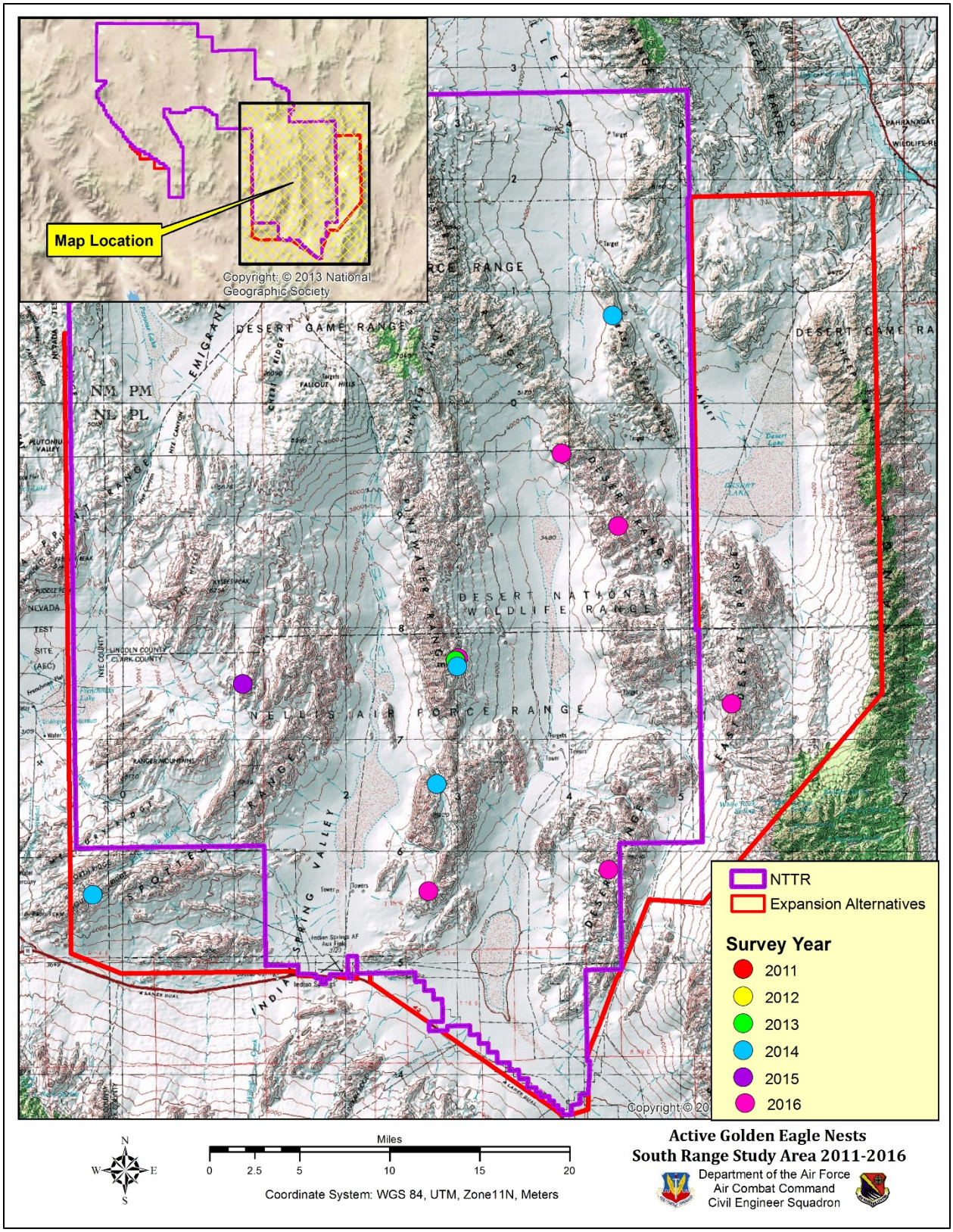


Figure 9. Active and occupied golden eagle nests identified on the South Range Study Area on 2011-2016.

Table 2. Nesting and productivity results 2011-2016 for the NTTR.

Year	Range	Occupied Nests	Chicks Initially Observed	Chicks Success-fully Fledged	Chicks Fledge Status Unknown	Chicks Failed to Fledge
2011	South	0	0	0	0	0
	North	8	13	13	0	0
2012	South	0	0	0	0	0
	North	1	1	1	0	0
2013	South	1	1	1	0	0
	North	9	14	14	0	0
2014	South	4	4	2	1	1
	North	4	5	5	0	0
2015	South	1	1	1	0	0
	North	5	7	7	0	0
2016	South	4	6	4	0	2
	North	10	17	11	4	2
TOTAL		**47**	**69**	**59 (86%)**	**5 (7%)**	**5 (7%)**

Golden Eagle and Raptor Nest Surveys in 2016 on Expansion Alternative 3C

To avoid the bighorn sheep lambing season, the golden eagle and raptor nest surveys were scheduled for the end of May for Expansion Alternative 3C. These helicopter surveys were conducted with two experienced biologists and an experienced pilot. The surveys were conducted on May 28 and 29, during the Memorial Day weekend and covered the entire Desert Range and approximately half of the Sheep Range.

Surveyors recorded 23 stick nests, of which 17 were in good condition (Table 3). Of those in good condition, the following five nests were occupied:

- One red-tailed hawk nest
- One golden eagle nest
- One peregrine falcon nest
- Two common raven nests (probably old golden eagle nests)

The remaining six nests included five nests in fair condition and one nest in poor condition. Figure 10 shows the locations of recorded nests.

Table 3. Description of nests observed during the golden eagle nest surveys conducted in 2016 in Alternative 3C.

Common Name	Height of Nest Above Cliff Base (ft.)	Nest Dimensions (Height x Length x Width) (Ft.)	Nest Condition	Nest Status	Direction of Cliff Face	Height of Cliff (ft.)	Eggs or Young Observed
Golden Eagle	60	1x4x8	Good	Inactive	SE	120	None
Golden Eagle	120	2x3x3	Good	Active	W	500	None
Golden Eagle	600	3x5x5	Good	Inactive	NW	1700	None
Golden Eagle	750	3x5x5	Good	Active	W	1900	2 Juveniles, 8-10 weeks
Golden Eagle	300	3x3x3	Good	Active	NW	800	None
Golden Eagle	300	2x8x4	Fair	Inactive	W	400	None
Golden Eagle	200	1x5x3	Fair	Inactive	NW	300	None

Common Name	Height of Nest Above Cliff Base (ft.)	Nest Dimensions (Height x Length x Width) (Ft.)	Nest Condition	Nest Status	Direction of Cliff Face	Height of Cliff (ft.)	Eggs or Young Observed
Golden Eagle	800	2x3x4	Fair	Inactive	SE	1500	None
Golden Eagle	600	2x5x5	Good	Inactive	S	1000	None
Golden Eagle	100	3x3x5	Good	Inactive	N	1000	None
Golden Eagle	100	1x2x5	Good	Inactive	N	1000	None
Golden Eagle	100	No Data	Good	Inactive	N	1000	None
Peregrine Falcon	700	2x5x4	Good	Active	S	1000	None
Red-Tail Hawk	100	1x5x3	Good	Active	W	600	2 Eggs
Unknown	75	0.5x5x3	Poor	Inactive	NE	400	None
Unknown	300	1x2x2	Good	Inactive	NW	1000	None
Unknown	300	1x3x3	Fair	Inactive	SW	500	None
Unknown	100	2x3x4	Fair	Inactive	W	400	None
Unknown	50	2x2x1	Good	Inactive	N	100	None
Unknown	300	2x4x4	Good	Inactive	S	1500	None
Unknown	600	0.5x3x3	Good	Inactive	N	650	None
Unknown	75	1x2x3	Good	Inactive	N	300	None
Unknown	75	1x1x1	Good	Inactive	S	400	None

The Sheep Range is very rugged with excellent golden eagle and raptor nesting habitat. Prior to 2016, this range had not been surveyed for nesting raptors. The north end of the range is extremely rugged with approximately 1000 ft. cliffs. The 2016 survey covered about 50% of the potential habitat in the Sheep Range and this should be considered when observing and analyzing the data. Additional surveys should be conducted to locate additional nests in the un-surveyed areas. If Alternative 3C is incorporated into the withdrawn land, additional annual golden eagle and raptor surveys will likely be conducted to meet the requirements of the Sikes Act and the current INRMP for the NTTR.

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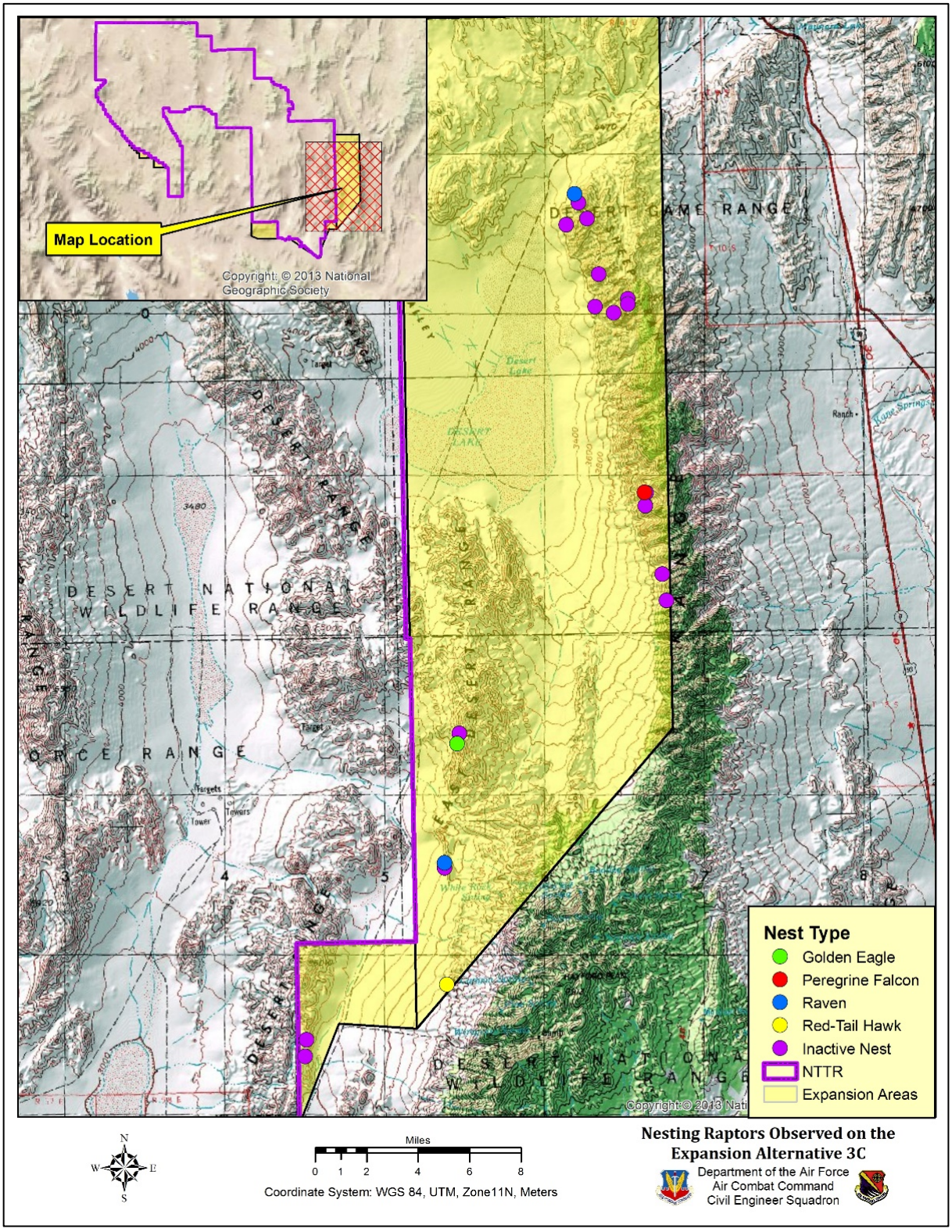

Figure 10. Raptor nesting activity on proposed Expansion Alternative 3C.

Golden Eagle Nest Habitat Models

A habitat suitability model was prepared to delineate the potential for habitat to be suitable for selection of nesting sites for the golden eagle. The parameters used for the model are listed in the Methodology section. The model was relatively simple and emphasized slope as a limiting factor and restricted result to the mountains, excluding valleys. Figure 11 shows the results of this model. The model appears to be a reasonable prediction of areas that would be attractive for nesting by golden eagles.

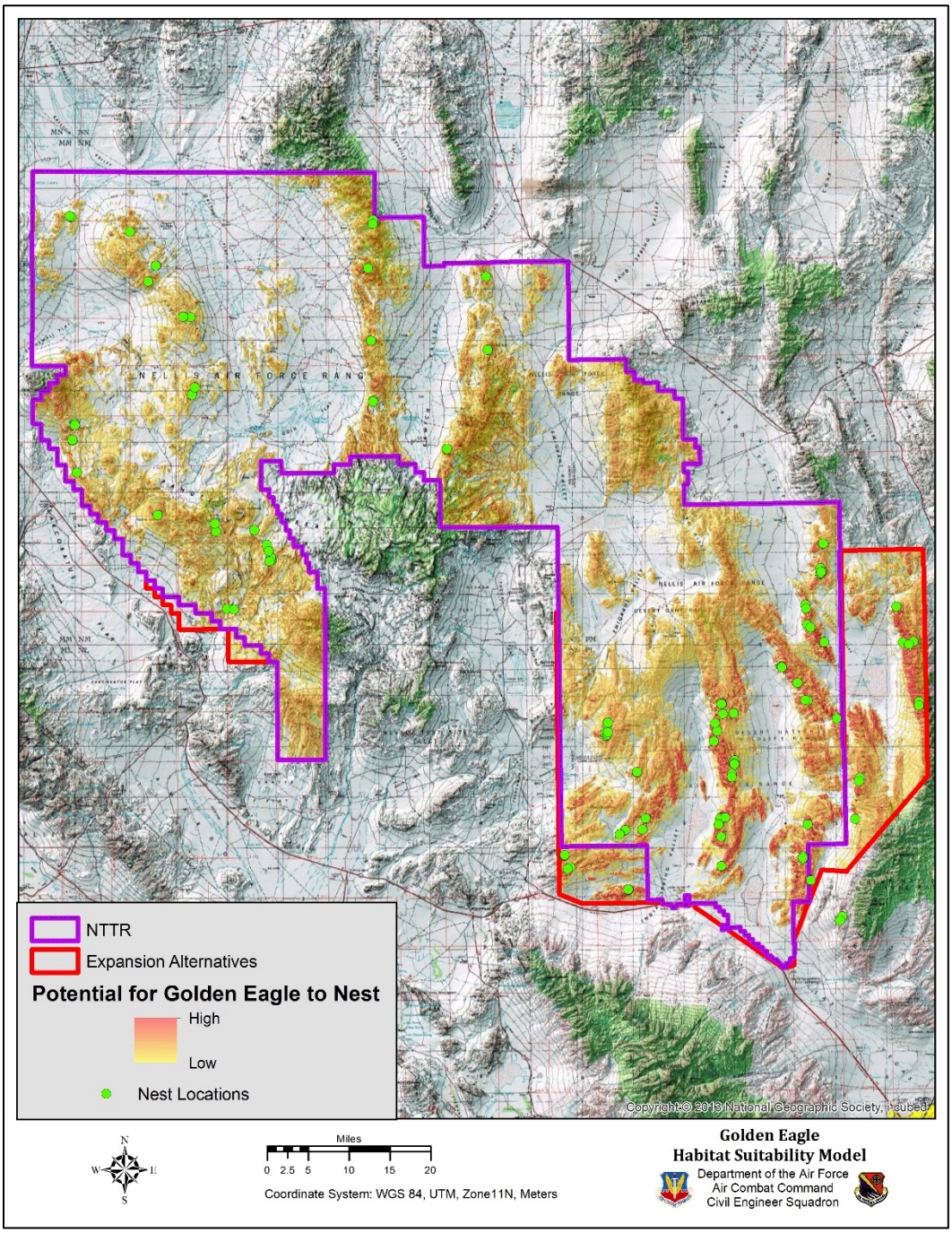

Figure 11. Results of the Habitat Suitability Model for golden eagle nesting habitat.

Maxent was also used to delineate potential nesting habitat for golden eagles based on the characteristics of GIS layers at the points where nests were observed. For the initial runs of the model, it was determined that the water sources layers should be removed from the analysis because they biased the results causing good habitat to be located in dry lakes. As previously mentioned, the model was run in four different formats including cloglog, logistic, cumulative, and raw. Results were similar for all four formats, but the cloglog format appeared to be the best choice. The final model is provided in Figure 12. Results appear to be fairly good for the South Range Study Area, but some habitat is still being depicted in the dry lakes and areas known to not be good habitat. Similarly, habitat is delineated in the basins of the North Range Study Area where habitat is not suitable for nesting. Overall, the results of Maxent were not considered satisfactory and the habitat suitability model should be used for golden eagle management.

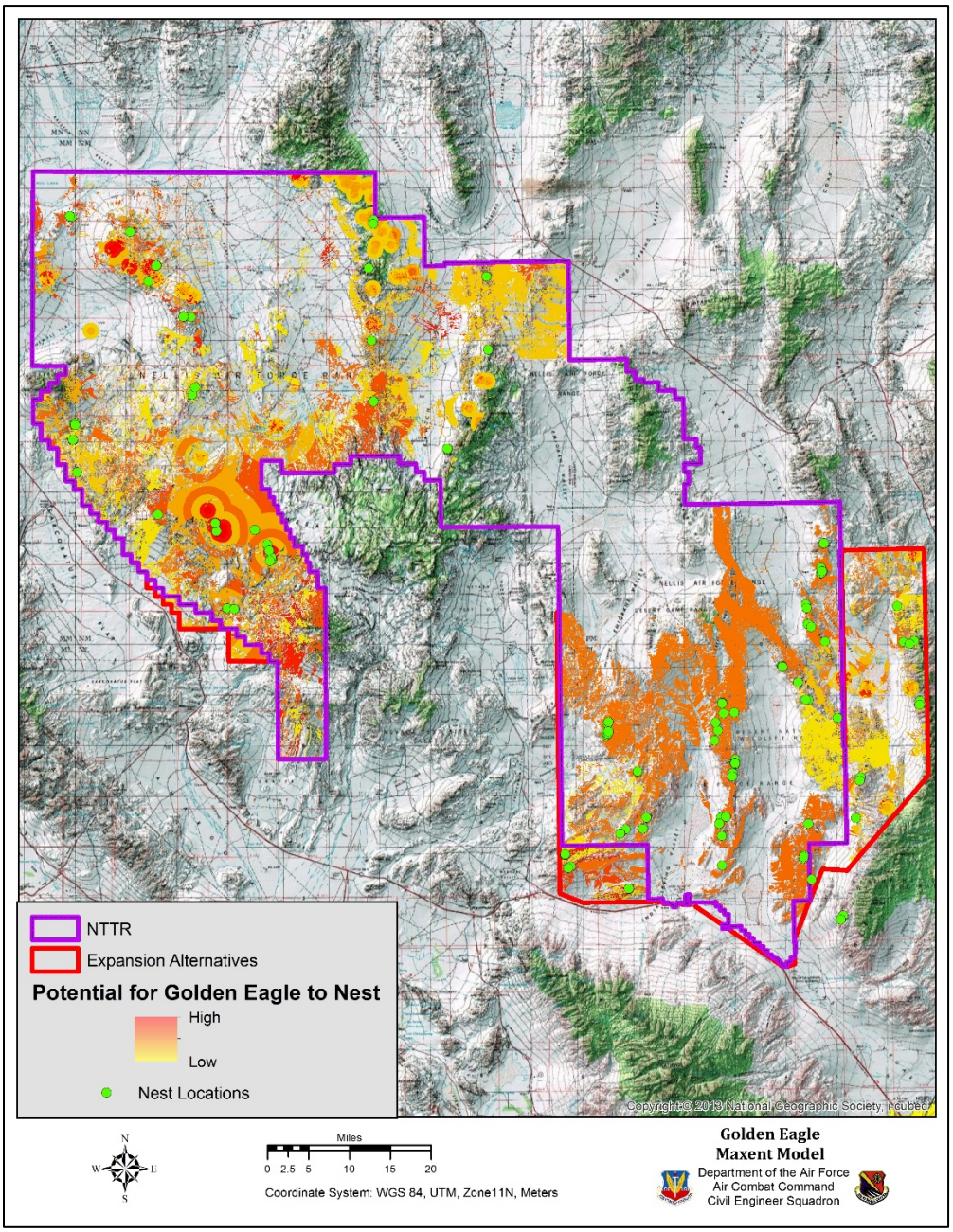

Figure 12. Results of the Maxent Model for golden eagle nesting habitat.

Nesting Raptor Surveys

Nesting raptor surveys were conducted on the NTTR beginning in 2007 and continuing through 2015. The methodology for these surveys is detailed in the Methodology Section (Nesting Raptor Surveys) of this report. Results for each year are listed below.

- 2007 -- One stick nest and four prairie falcons were observed during cliff raptor surveys.
- 2009 – Cliff raptor surveys were conducted in the Desert, Pintwater, and Spotted Ranges and the Kawich Range on the North Range. Biologists recorded 62 inactive stick nests, four inactive eyries, four eyries occupied by prairie falcons, and a variety of active stick nests. The active nests included a peregrine falcon nest, two common raven nests, one ferruginous hawk nest, and 12 prairie falcon nests. Other raptors observed during the survey included: 13 red-tailed hawks, eight prairie falcons, one common raven, and three short-eared owls.
- 2010 -- Biologists observed one red-tailed hawk and three peregrine falcons during cliff raptor surveys. No nests were observed.
- 2013 -- Nests observed during cliff raptor surveys included one inactive eyrie, seven active prairie falcon nests, and one Swainson's hawk nest in a Joshua tree. Other raptors that were observed included: three American kestrels, one common raven, one great horned owl, eight red-tailed hawks, four turkey vultures, and twelve prairie falcons.
- 2014 -- Helicopter surveys were conducted on the South Range and the North Range focusing on Joshua tree woodlands. One occupied nest was located and determined to be a stick nest in active use by a red-tailed hawk. Nine other inactive stick nests were recorded. During the survey, three Swainson's hawks, one American kestrel, one prairie falcon, one peregrine falcon, one turkey vulture, and eight red-tailed hawks were observed.
- 2015 -- Biologists continued to survey areas with dense Joshua trees. During these surveys a total of 13 nests were located, of which three were actively in use by red-tailed hawks and two were being used by great horned owls. In addition to these nests, one turkey vulture, one short-eared owl, seven great horned owls, and 21 red-tailed hawks were observed.

Figure 13 shows locations where raptors have been observed nesting on the NTTR. Descriptions of the raptors and owls that have been observed on the study area are provided in the paragraphs that follow. Additionally, information and maps showing locations of observations of those species are provided.

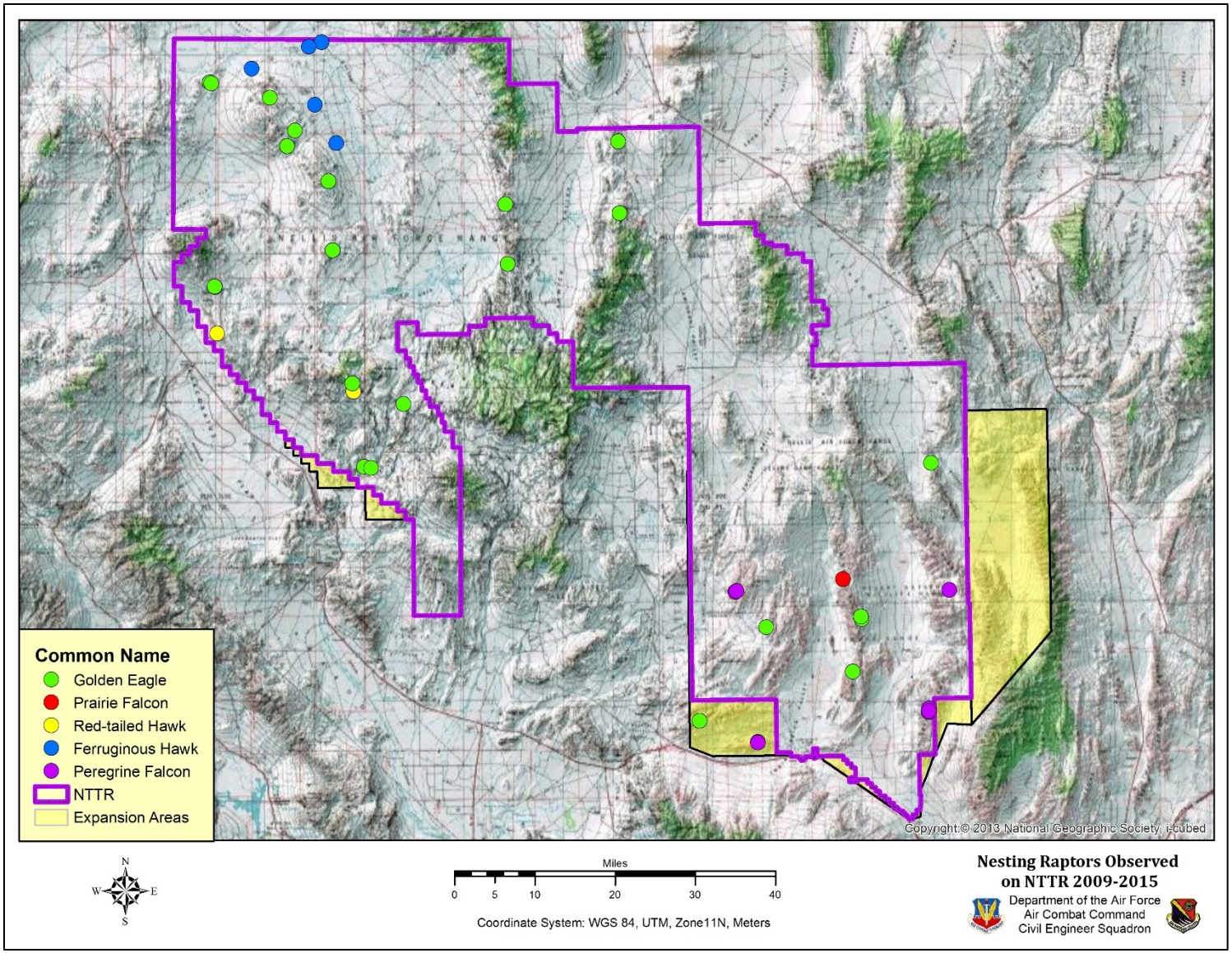

Figure 13. Nesting raptors on the NTTR 2009-2015.

Other Raptors Observed during Various Surveys on the Study Area

Red-tailed Hawk

Red-tailed hawks were frequently observed during surveys on the proposed expansion lands in 2016. A total of 42 red-tailed hawks were observed on the proposed expansion lands in 2016, nine of which were observed during the aerial nesting surveys, while the remaining 33 were either heard or seen during the migratory bird transects (Figure 14). One active nest was located in a Joshua tree near the Pahranagat Range in April, and during a survey in May, one chick appearing to be several weeks old was observed perched on the side of the nest. A total of 186 red-tailed hawks have been directly observed on the North and South ranges of the NTTR since 2007. These birds were observed year-round during a variety of surveys including seasonal driving surveys, migratory bird transects, Christmas bird count surveys, aerial wildlife surveys, and herpetological surveys. Multiple records of red-tailed hawks captured on motion-censored trail cameras were also recorded at almost every water source where the cameras were deployed. Historical data from the USGS North American Breeding Birds Survey shows that a total of sixteen red-tailed hawks have been observed on their survey route along Alamo Road (Pardieck, Ziolkowski, Hudson, & Campbell, 2016). Two were observed in 1994, while the following fourteen were observed during the 2007-2015 surveys. Additional historical data from the Great Basin Bird Observatory shows that thirteen red-tailed hawks have been observed since 2005 on surveys around the Sheep Range. In general, red-tailed hawks are quite common on the study area, especially in the foothills and mountains.

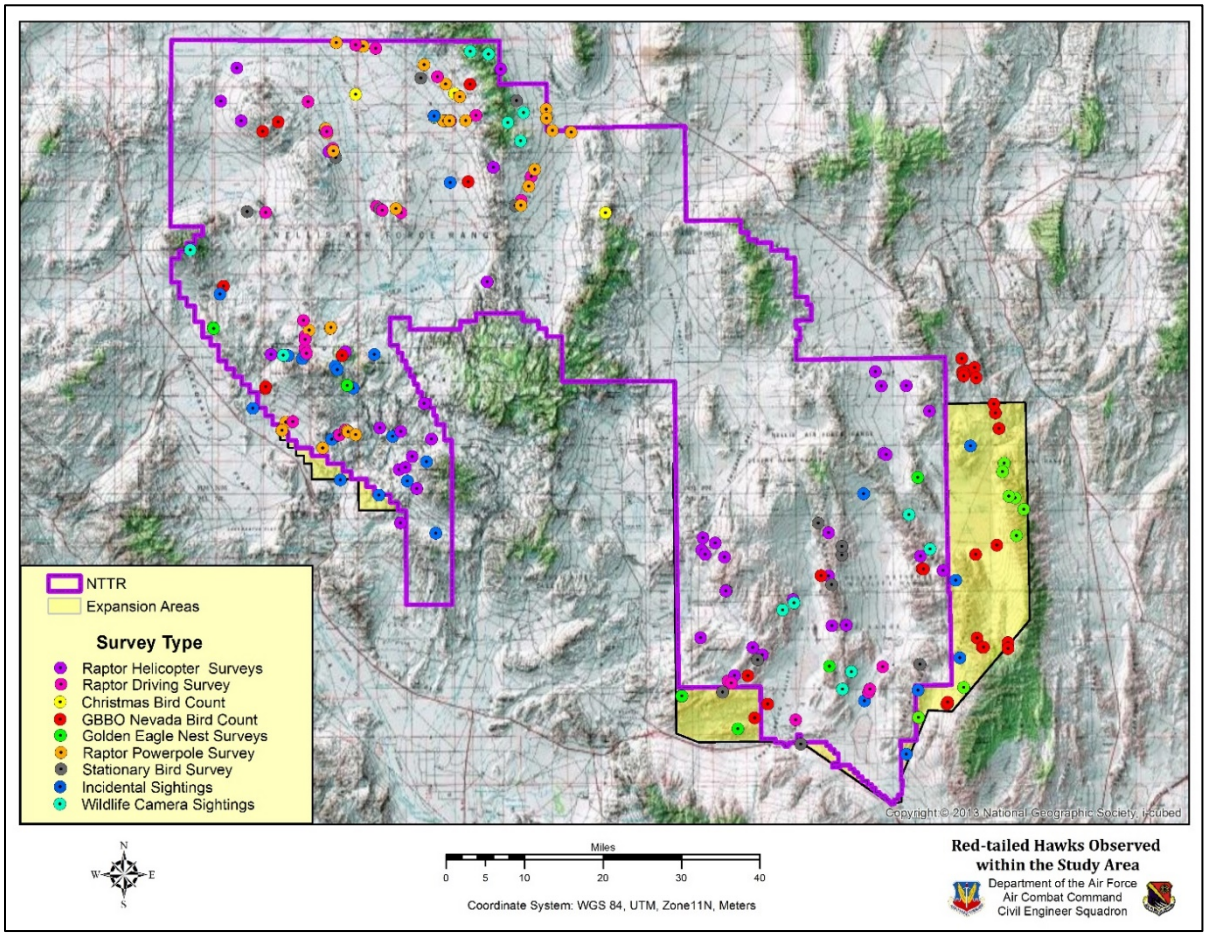

Figure 14. Locations where red-tailed hawks have been observed during various surveys on the study area.

Swainson's Hawk

No Swainson's hawks were observed during the surveys in 2016 on the proposed expansion lands. However, they have been frequently observed throughout the North and South Ranges of the NTTR since 2008 (Figure 15). A nest with two chicks was found in 2011 and a nest with three eggs was found in 2013. Overall, eleven birds have been observed during bird surveys conducted on the NTTR from 2008-2015.

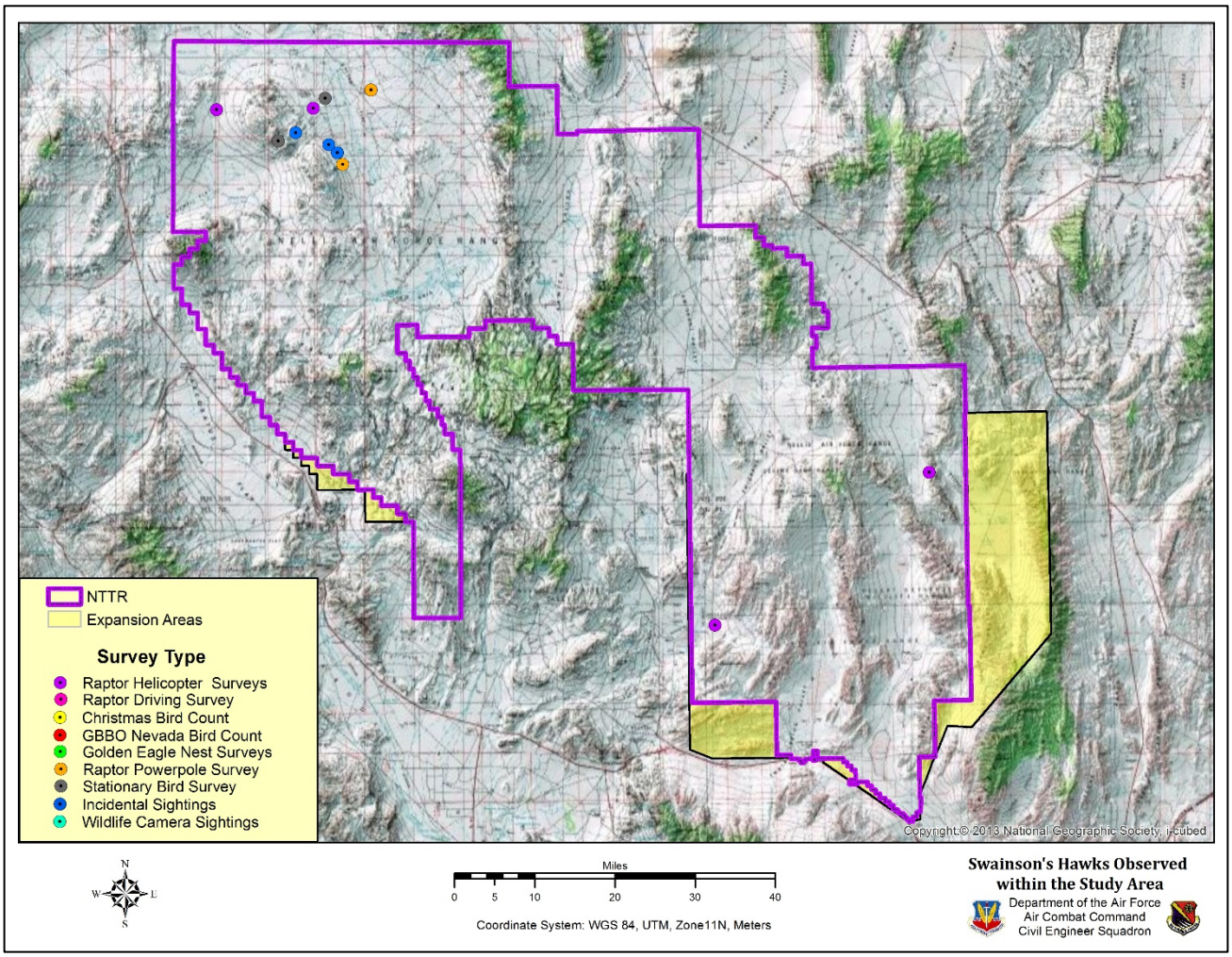

Figure 15. Locations where Swainson's hawks have been observed on the study area.

Rough-legged Hawk

Seventy-four adults have been observed on the North Range Study Area from 2007 to 2015 (Figure 16). These birds were all identified in the winter months of November to February, during either driving surveys or Christmas bird count surveys. Data suggest that the populations on the study area may be migratory during the winter months. No rough-legged hawks have been observed on the South Range Study Area.

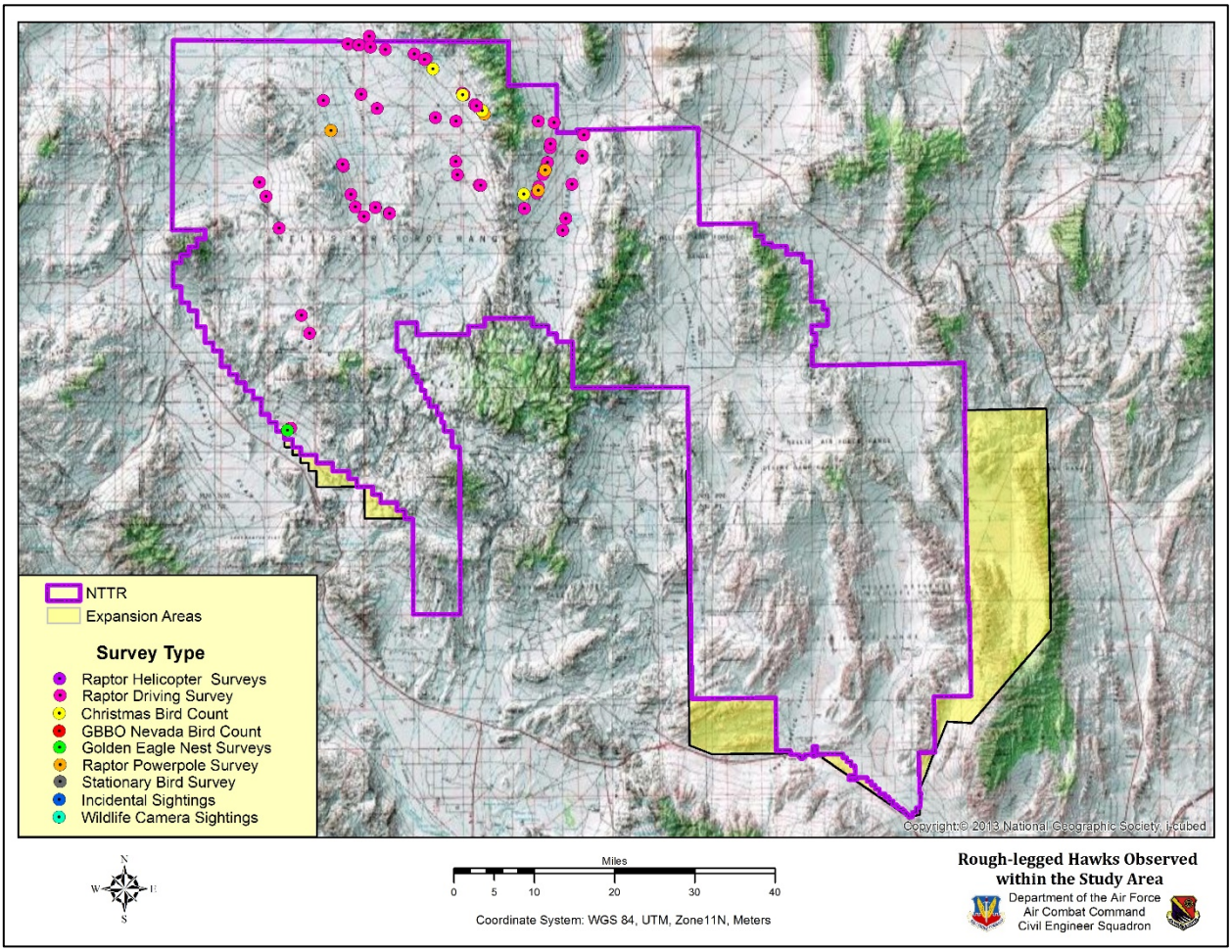

Figure 16. Locations where rough-legged hawks have been observed on the study area.

Ferruginous Hawk

During surveys in the proposed expansion areas in 2016, no ferruginous hawks were observed. However, a total of twelve ferruginous hawks have been observed in the North Range Study Area from 2007-2014 (Figure 17). No ferruginous hawks have been observed on the South Range Study Area.

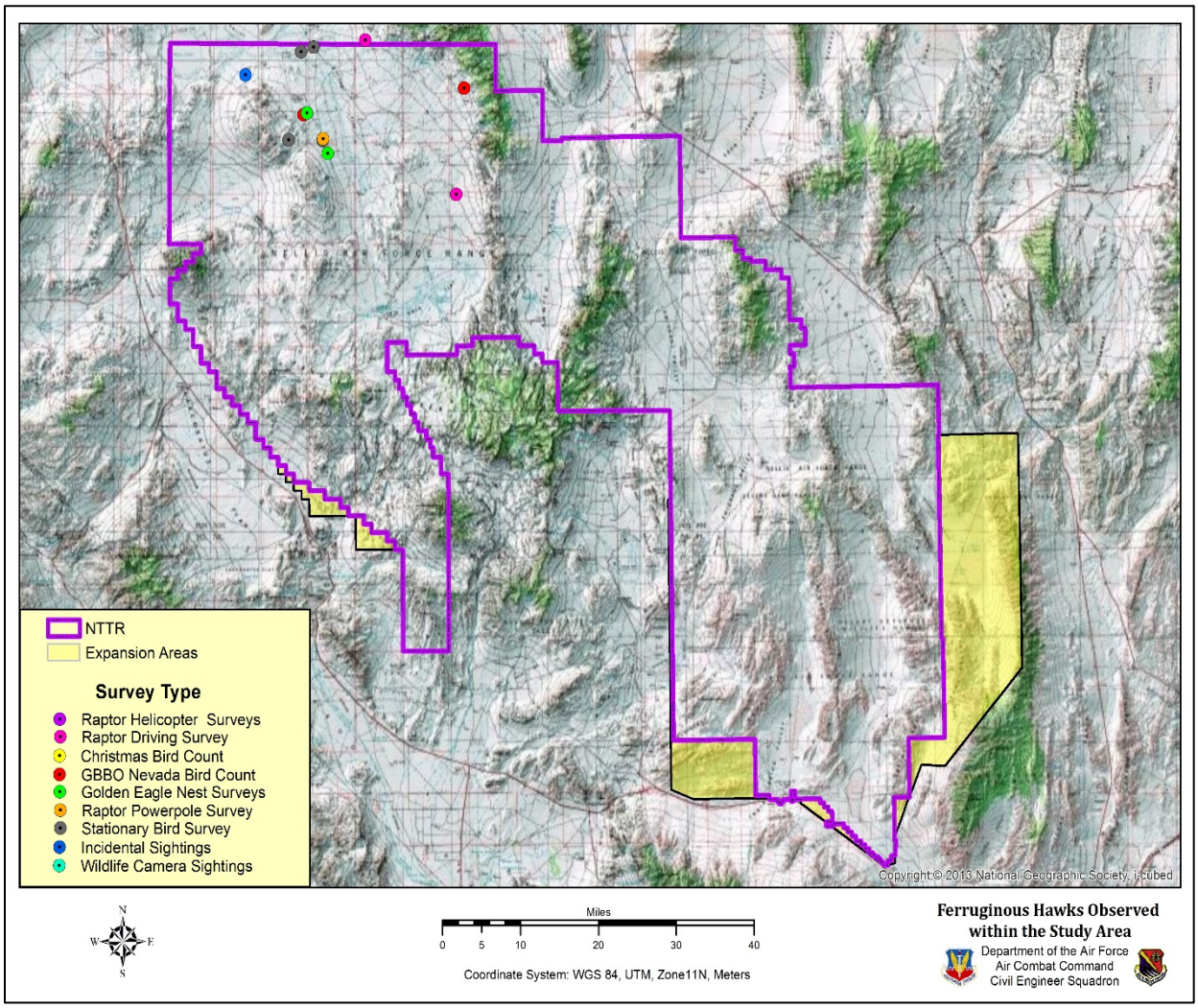

Figure 17. Locations where ferruginous hawks have been observed on the study area.

Cooper's Hawk

Twelve Cooper's hawks were observed from 2011-2015 on the NTTR (Figure 18). Ten observations were made in the North Range Study Area and two observations were made on the South Range Study Area at Creech Air Force Base (CAFB). During the surveys on the proposed expansion lands in 2016, one Cooper's hawk was observed in Alternative 3C, just north of the study area boundary. The hawks have frequently been captured on remote sensing trail cameras installed at certain water sources throughout the NTTR. In 2015, Cooper's hawks were photographed at water sources on the northwestern areas of the North Range Study Area. They have also been observed at water sources in the Kawich in 2010 and 2011. Cooper's hawks were observed several times in 2011 at guzzlers in the Spotted Range as well. Historical records from the Great Basin Bird Observatory show that four Cooper's hawks were observed in the area-- one in 2009 and two in 2014 near Corn Creek. Additionally, in 2008, one was observed east of Sawmill Canyon in pine forest habitat.

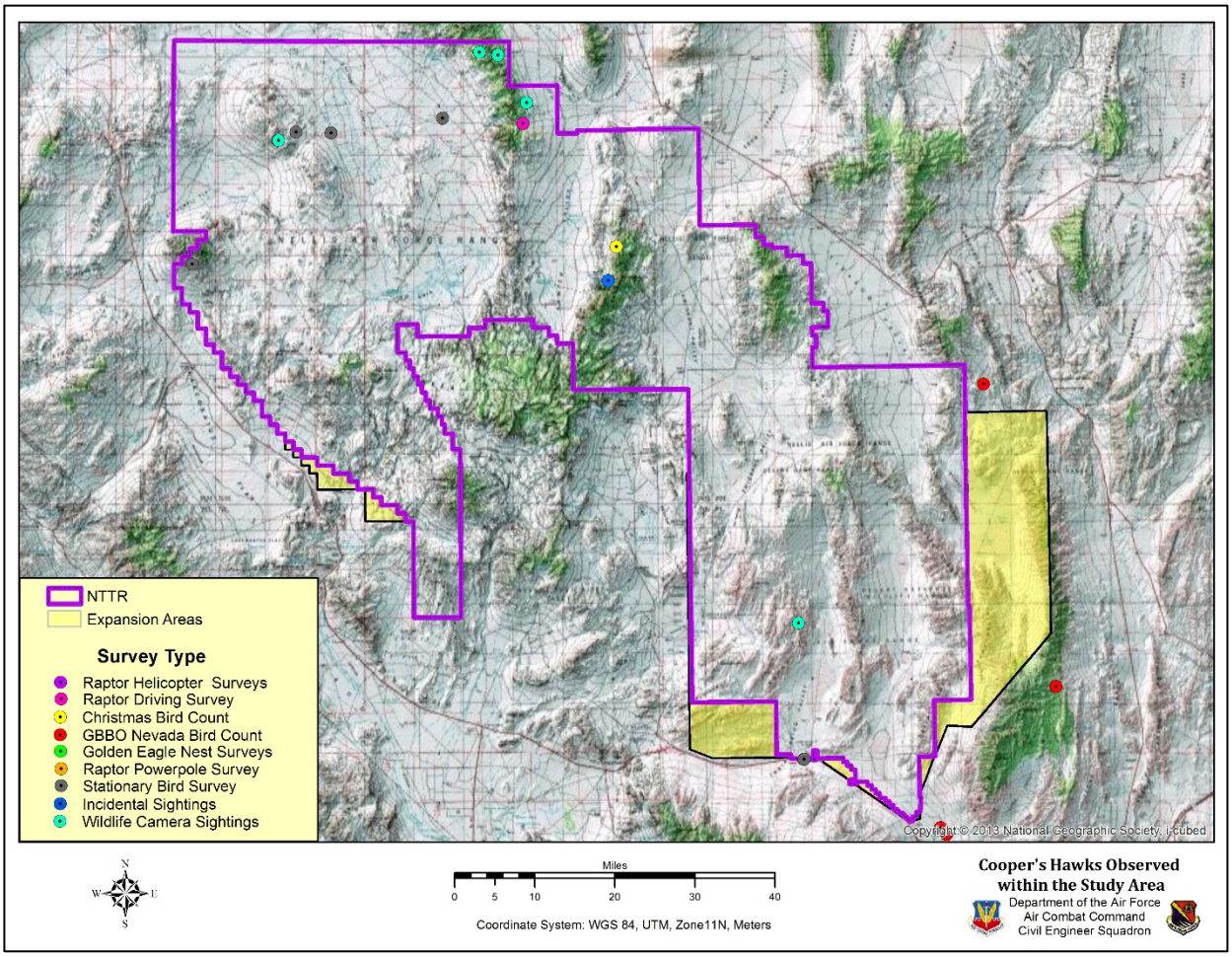

Figure 18. Locations where Cooper's hawks have been observed on the study area.

Sharp-shinned Hawk

During biological surveys on the proposed expansion lands in 2016, no sharp-shinned hawks were observed (Figure 19). Only three sharp-shinned hawks have been identified on the NTTR since 2008--two in the North Range Study Area, one on the east side of the Cactus Range, one on the west side of Stonewall Mountain, and one hawk in the bajadas between the Desert and Pintwater ranges in the South Range Study Area. Historical records from the Great Basin Bird Observatory show that in 2010, one sharp-shinned hawk was observed near Corn Creek Spring during a seasonal point count survey.

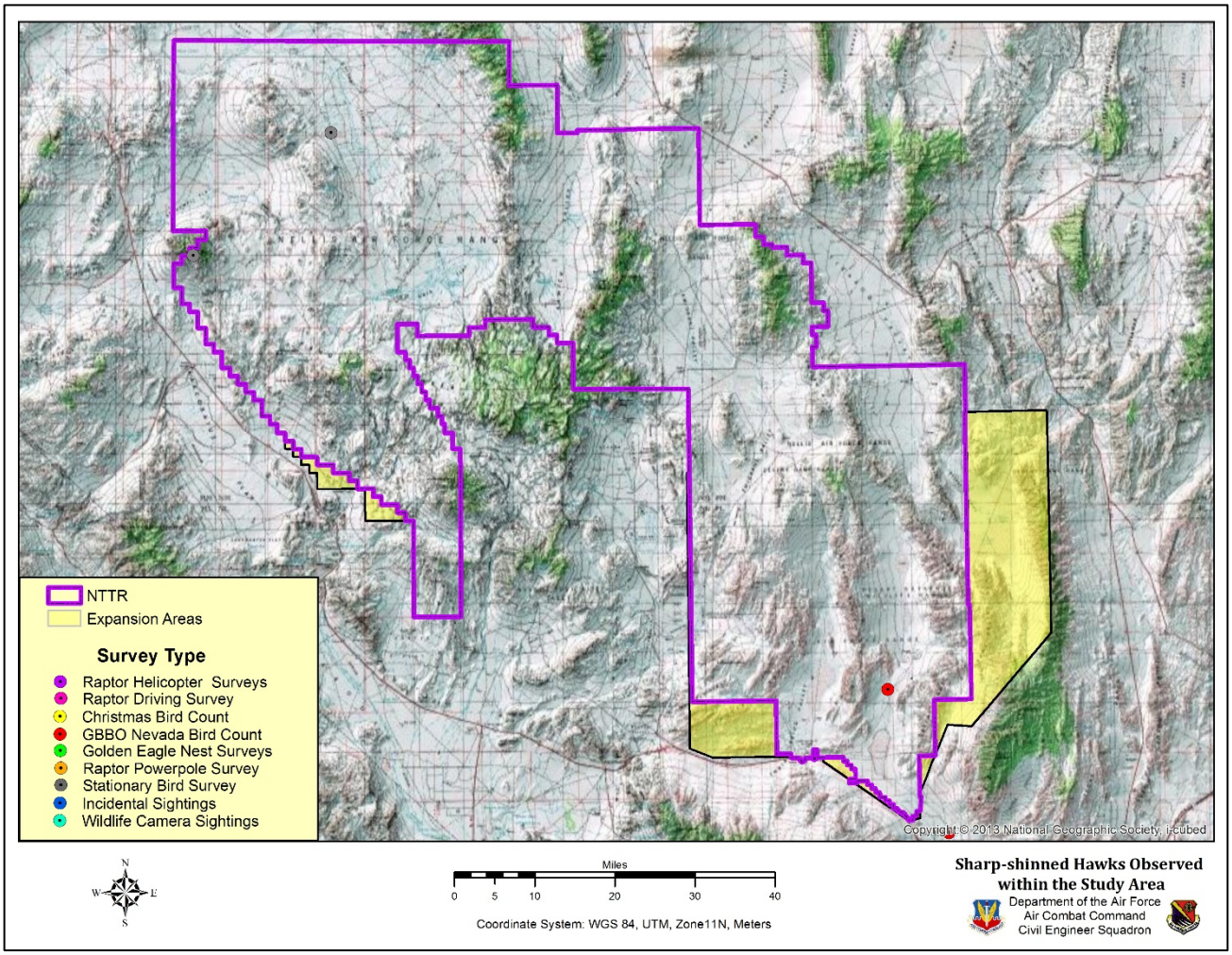

Figure 19. Locations where sharp-shinned hawks have been observed on the study area.

Northern Goshawk

Due to their secretive nature, northern goshawks are not often observed during biological surveys. In fact, no documented observations have been recorded by ornithologists on any surveys on the NTTR or DNWR partly because no surveys have been conducted with methodology specifically targeting this species. Northern goshawks have been photographed by trail cameras on the NTTR. In 2012, one northern goshawk made frequent visits to a natural seep called Cooper's Meadow Complex on the northwest side of the Kawich Range. It is likely that northern goshawks may frequent the dense vegetation found in the higher elevation pinyon pine plant communities in the Kawich and Belted ranges.

Prairie Falcon

During surveys of the proposed expansion lands in 2016, eight prairie falcons were seen observed during Great Basin Bird Observatory (GBBO) Nevada Breeding Bird Count Surveys in Alternatives 3B and 3C (Figure 20). Since 2007 and continuing until 2015, 183 prairie falcons were observed flying, perching, or actively nesting throughout the NTTR. Additional records of prairie falcons have been recorded on trail cameras that were placed at water sources on the South Range of the NTTR in 2011 and 2015. Historical data from the USGS Breeding Bird Survey lists two prairie falcons that were observed along Alamo Road in Alternative 3C; one in 2007 and one in 2014 (Pardieck, Ziolkowski, Hudson, & Campbell, 2016). Additionally, GBBO surveyors recorded two prairie falcons during their point count surveys; one in 2008 near Corn Creek Spring and one in 2009 east of the Sheep Range.

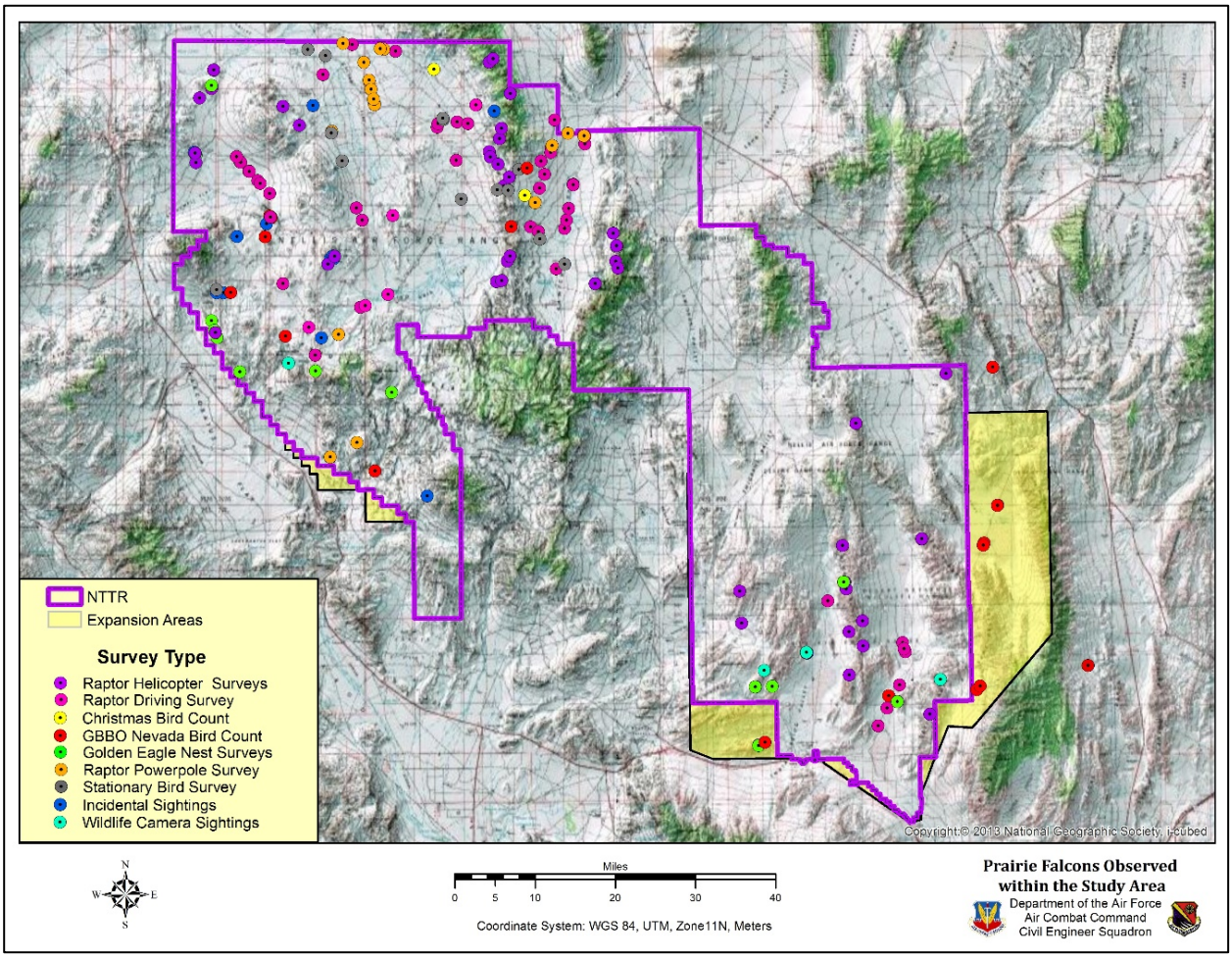

Figure 20. Locations where prairie falcons have been observed on the study area.

Merlin

Merlins breed in Canada during the summer and only inhabit Nevada during the winter months. Merlins have not been observed on the expansion lands, but four merlins were observed on the North Range Study Area (Figure 21). One observation was made on the east side of the Cactus Range. Two merlins were observed on Cactus Flats. The last observation was in the Kawich Range near Cedar Pass Road.

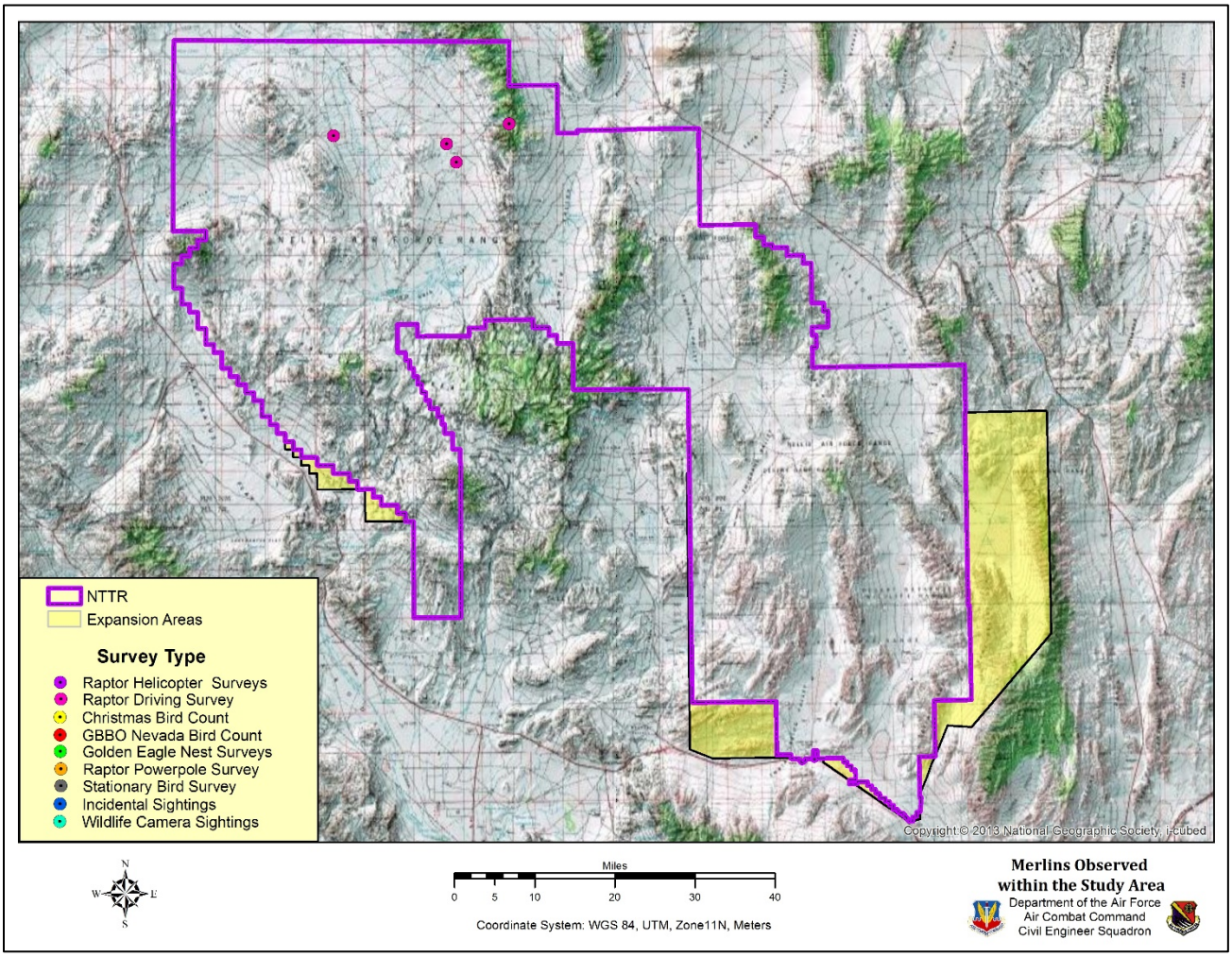

Figure 21. Locations where merlins have been observed on the study area.

American Kestrel

American kestrels appear to be common on the study area with a total of 132 kestrels being observed since 2007 (Figure 22). On the proposed expansion lands in 2016, five American kestrels were observed throughout the study area. Four were seen during point count surveys, while the fifth was observed during the helicopter surveys targeting golden eagles. Historical data from the Great Basin Bird Observatory shows that in 2006 one American kestrel was observed at Corn Creek, while seven others were observed in 2004, 2006, 2007 and 2009 on the southeast end of the Sheep Range, outside of the study area.

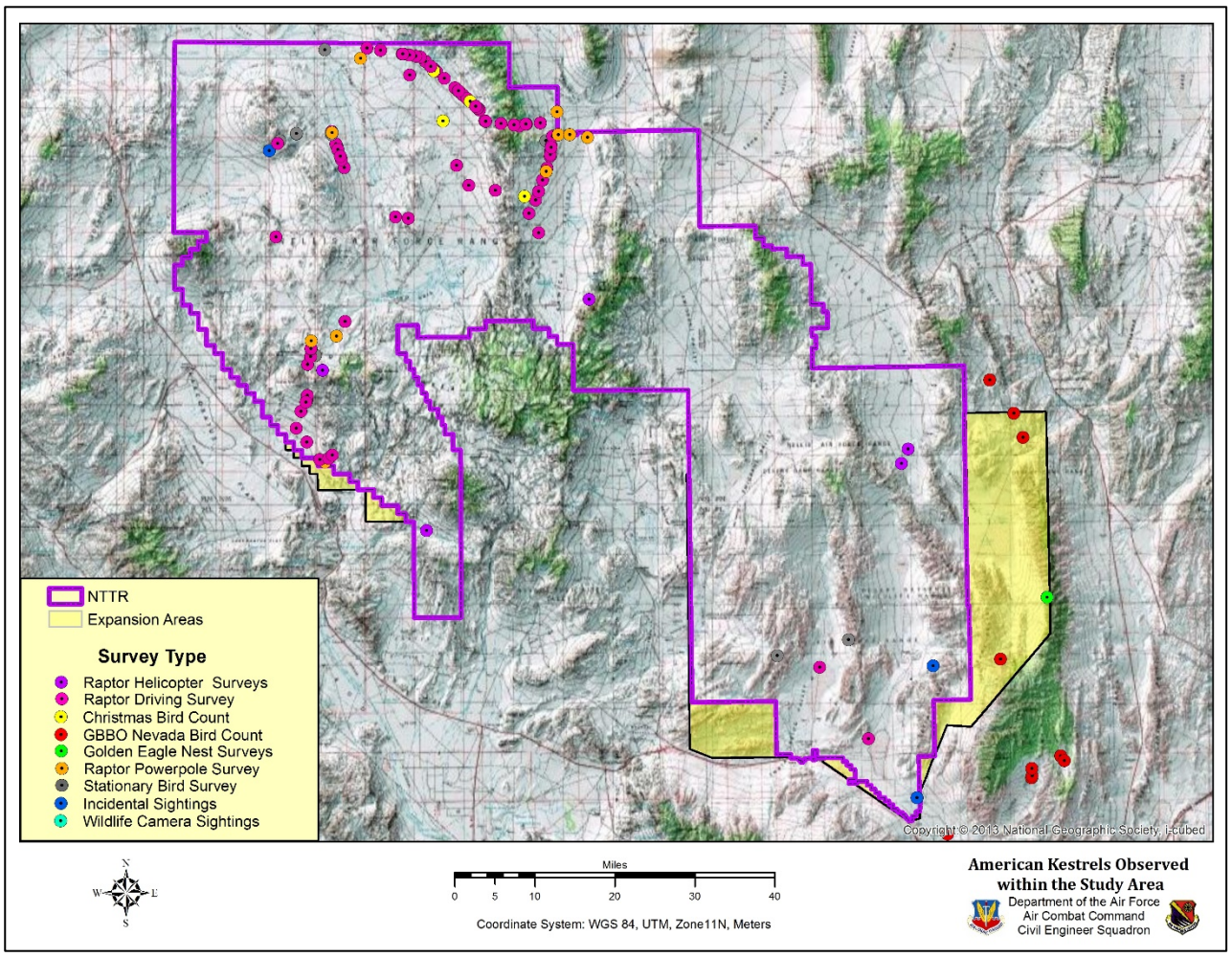

Figure 22. Locations where American kestrels have been observed on the study area.

Peregrine Falcon

A total of sixteen peregrine falcons have been observed on both the North and South ranges of the NTTR, of which ten were displaying nesting behavior by perching on or nearby a nest with eggs or hatchlings (Figure 23). Nests were not recorded until 2009, and were then consistently observed every year until 2015. In 2016 during the surveys on the proposed expansion lands, a female peregrine falcon was seen incubating an unknown number of eggs on an old golden eagle nest in Alternative 3C. Multiple photographs of peregrine falcons were documented on trail cameras placed at water sources on the South Range in 2011.

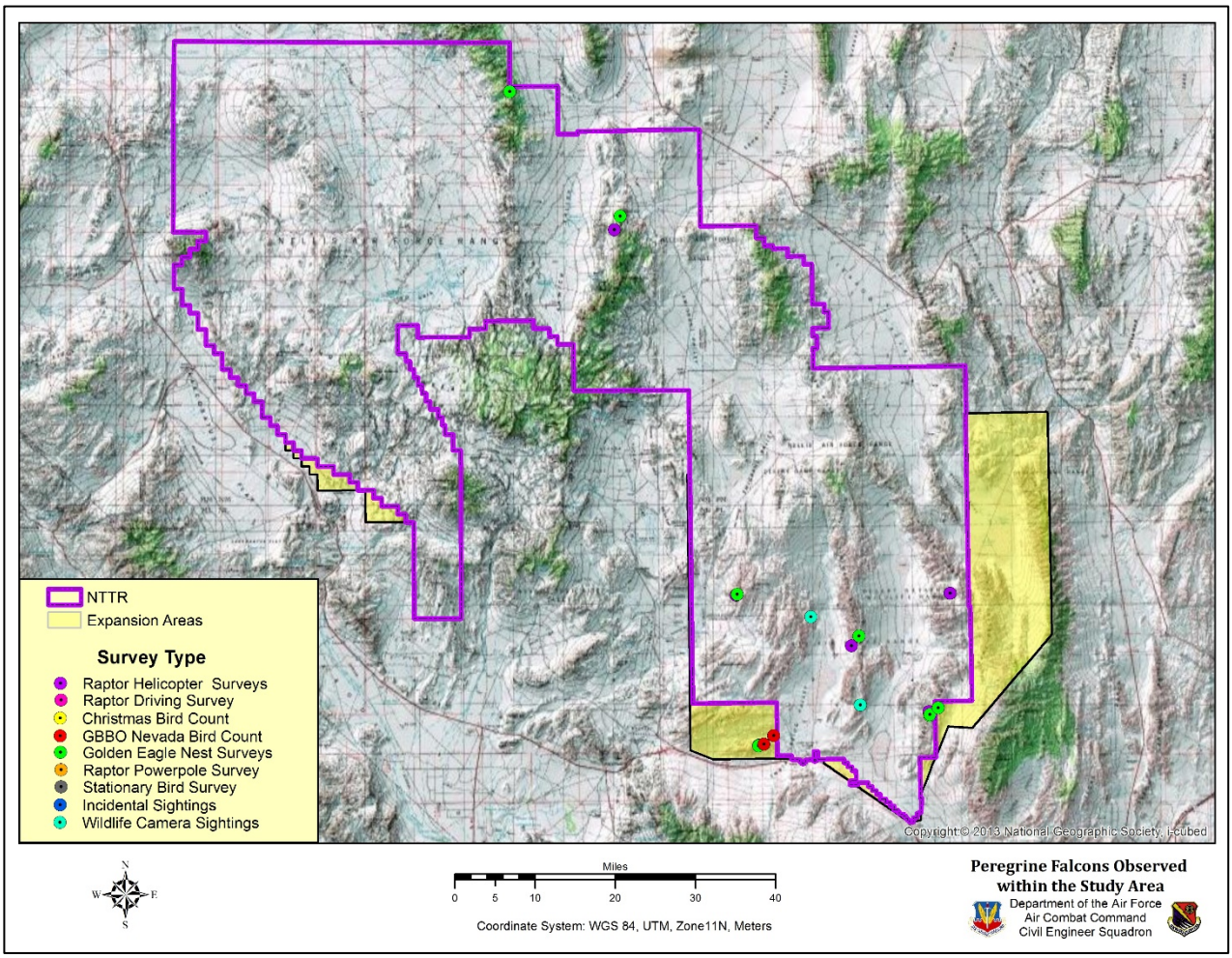

Figure 23. Locations where peregrine falcons have been observed on the study area.

Northern Harrier

Northern harriers have been observed commonly on most of the basins of the North Range Study Area (Figure 24). The species appears to be less common on the South Range Study Area where five sightings have been made as of 2016. Two observations of the harriers were made on Alternative 3C in 2016.

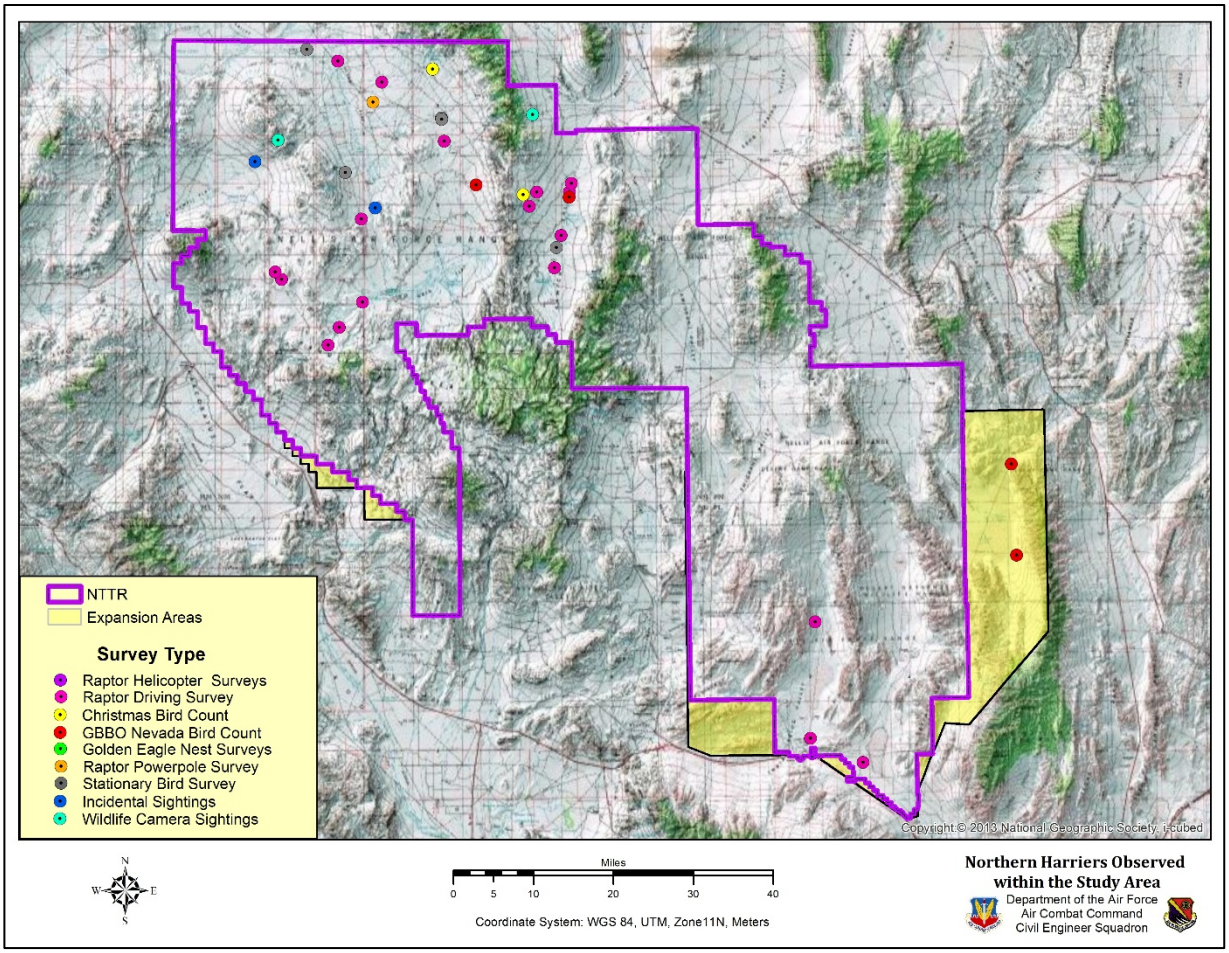

Figure 24. Locations where northern harriers have been observed on the study area.

Western Burrowing Owl

Since 2009, fifteen western burrowing owls were observed on the NTTR -- two on the South Range and the other thirteen scattered throughout the North Range of the NTTR (Figure 25). No western burrowing owls were observed during the surveys in 2016 on Expansion Alternative 3C.

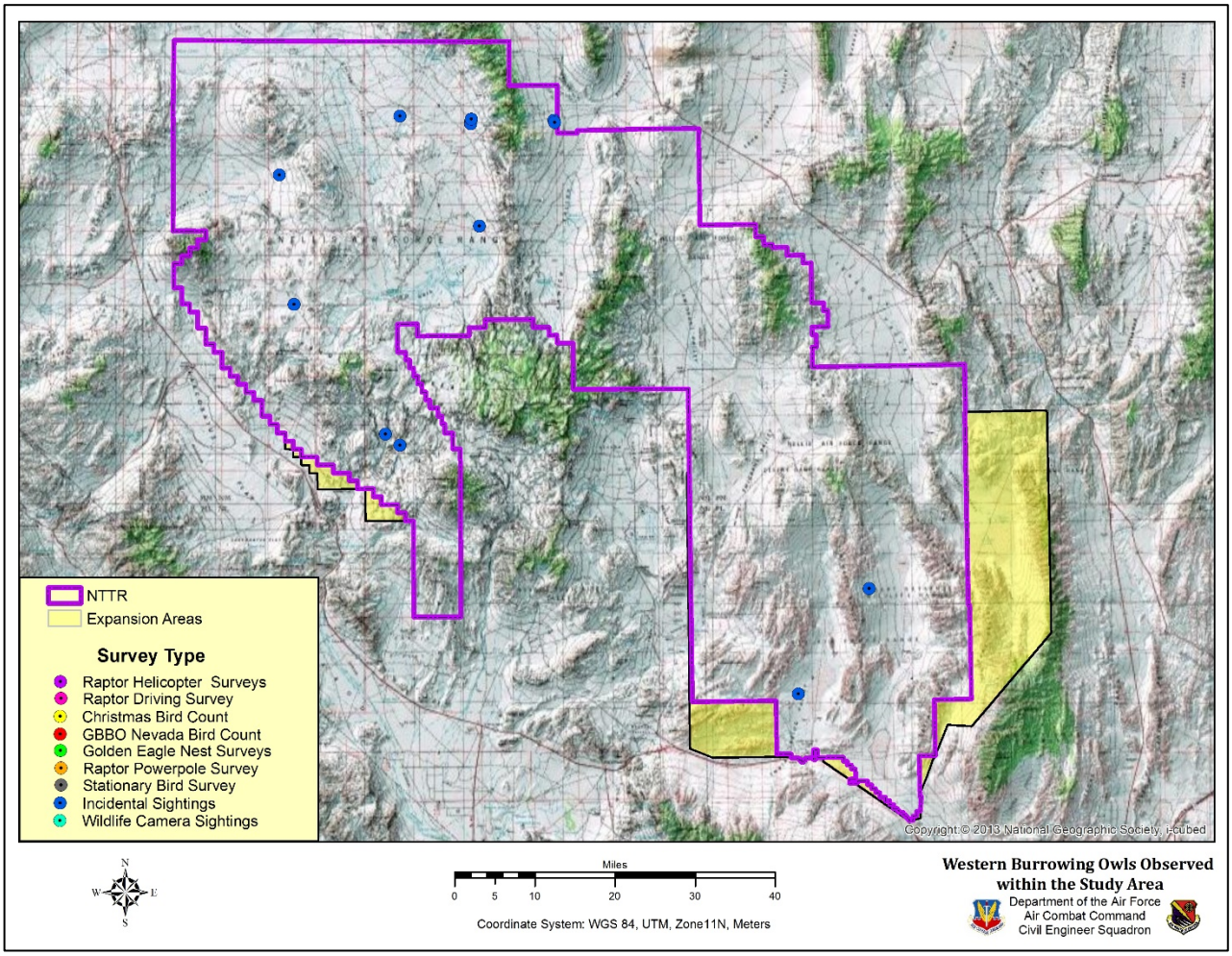

Figure 25. Locations where western burrowing owls have been observed on the study area.

Flammulated Owl

Currently, no occurrences of this owl have been documented on the NTTR or the proposed expansion alternatives. Given the extent of lower montane woodlands in the areas, only the highest elevations on the study area have the potential for this inhabitant. Also, the species can be easily misidentified due to difficulty in distinguishing it from the western screech owl and northern saw-whet in black and white night vision photos. Potential habitat may be found on Stonewall Mountain, Kawich Range, Belted Range, and Sheep Range.

Northern Saw-whet Owl

These owls can be difficult to detect depending on the distance to the owl to the survey point, probability of initiating a call response, difficulty in the surveyor hearing the call (Kissling, Lewis, & Pendleton, 2010). In 2012, a northern saw-whet owl was photographed by wildlife cameras eight times throughout the summer at Cooper's Meadow Complex and one time in 2013 at the Dain's Peak wildlife water development (Figure 26).

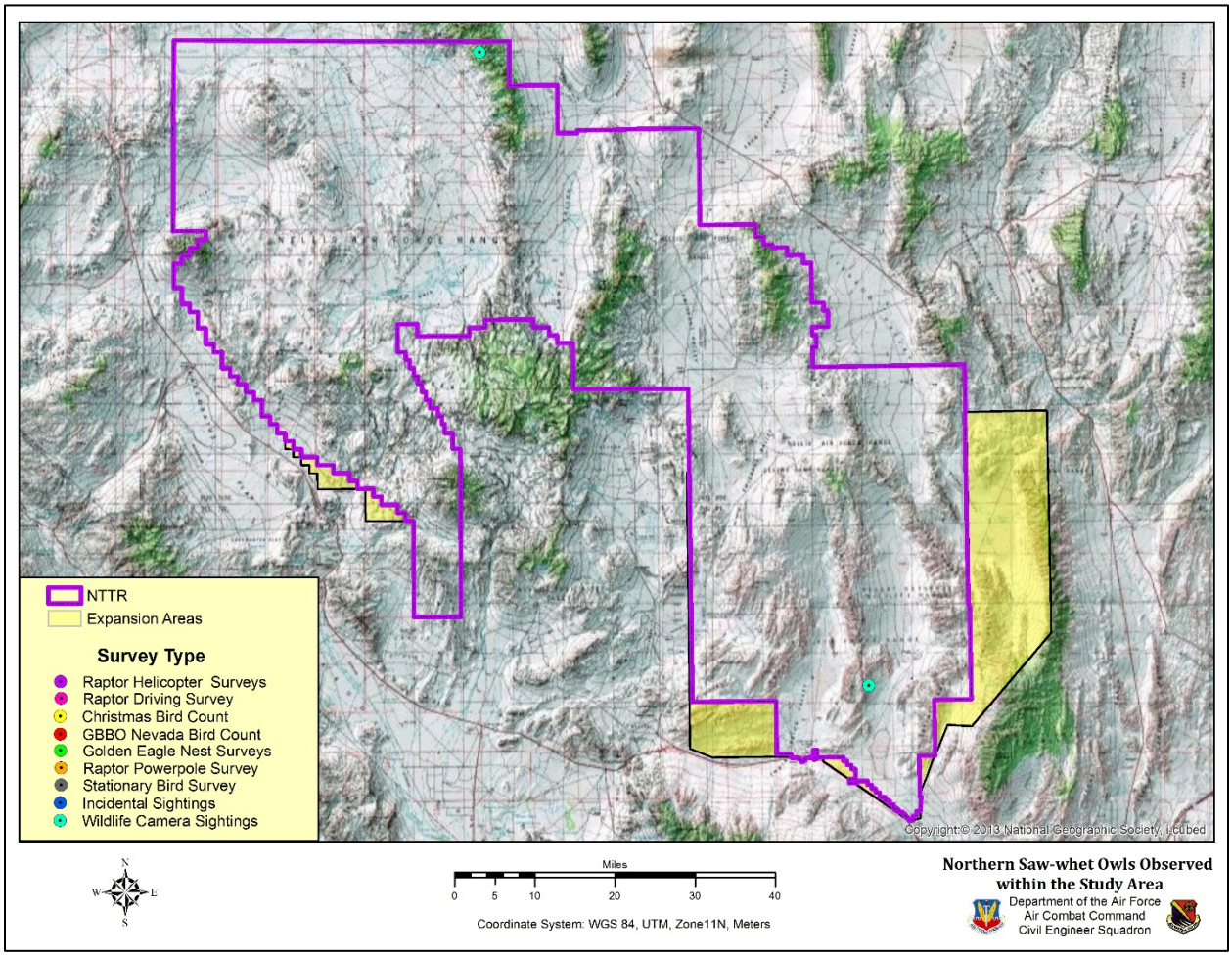

Figure 26. Locations where northern saw-whet owls have been observed on the study area.

Western Screech Owl

Western screech owls are difficult to survey due to their nocturnal behaviors (Kissling, Lewis, & Pendleton, 2010), yet they have been observed occasionally on the North Range of the NTTR (Figure 27). In the Kawich Range, western screech owls were heard responding to recorded owl calls in July 2013 and April 2015 along Cedar Pass Road.

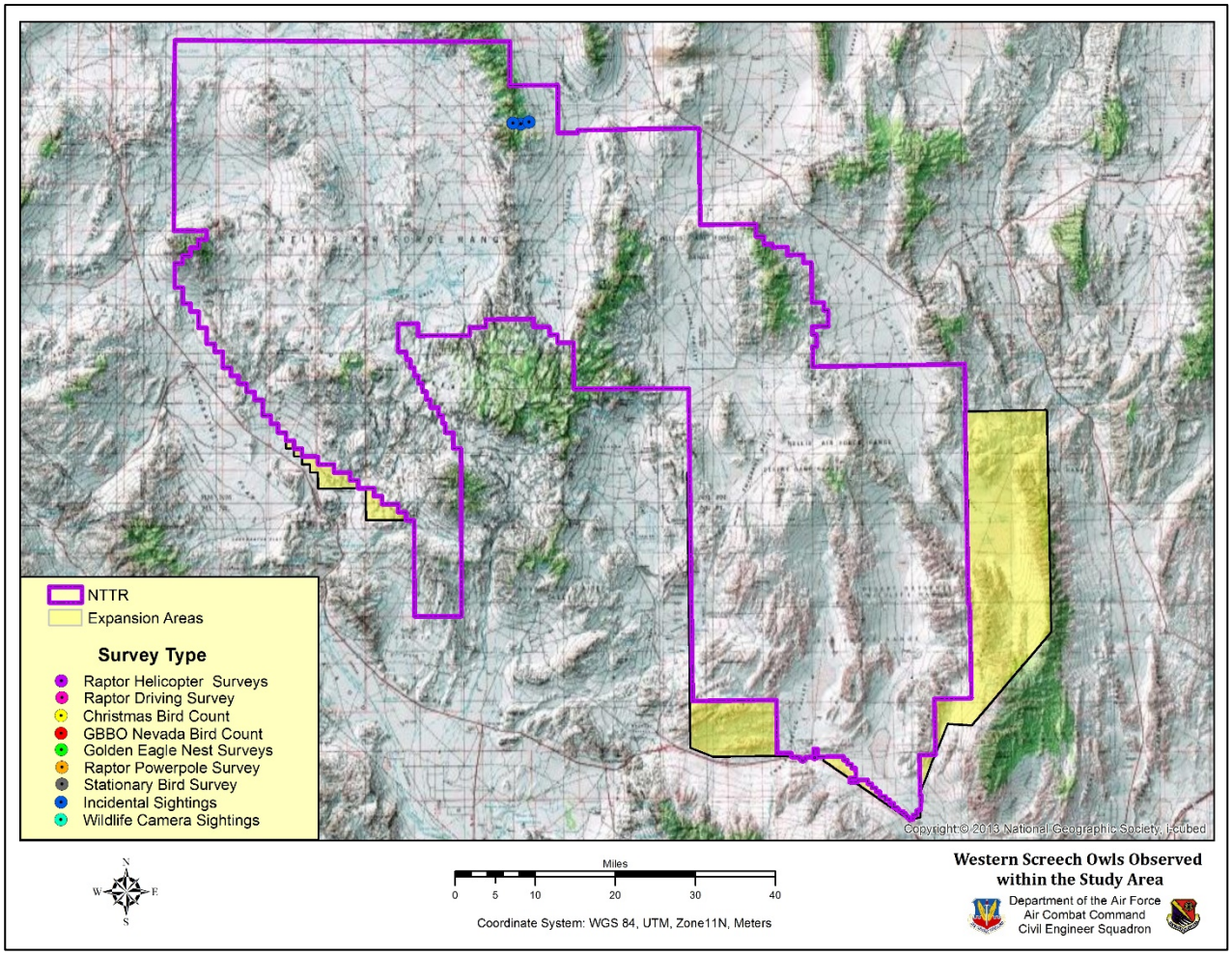

Figure 27. Locations where western screech owls have been observed on the study area.

Barn Owl

No confirmed sightings of barn owls have been documented on any lands managed by the NTTR or during surveys in 2016 on the proposed expansion lands. Nocturnal photos of unidentified owls have been made by several trail cameras, but barn owls have not been definitively identified in these photos.

Short-eared Owl

Though short-eared owls are not commonly viewed during surveys, ten adult owls were observed throughout the NTTR during various avian surveys (Figure 28). In 2013, six adults were found roosting in willows at Breen Creek on the North Range of the NTTR. The other observations on the NTTR were in either sagebrush or mixed desert scrubs in 2009, 2012, and 2015. No stranger to water sources, these owls have been captured on trail cameras on the North Range at Monte Cristo Spring in 2015, Sumner Spring in 2010 and a mountain seep in the Kawich Range in 2012. During surveys on the proposed expansion areas in 2016, one short-eared owl was spotted while the survey crew was enroute to a point count survey in Alternative 3C.

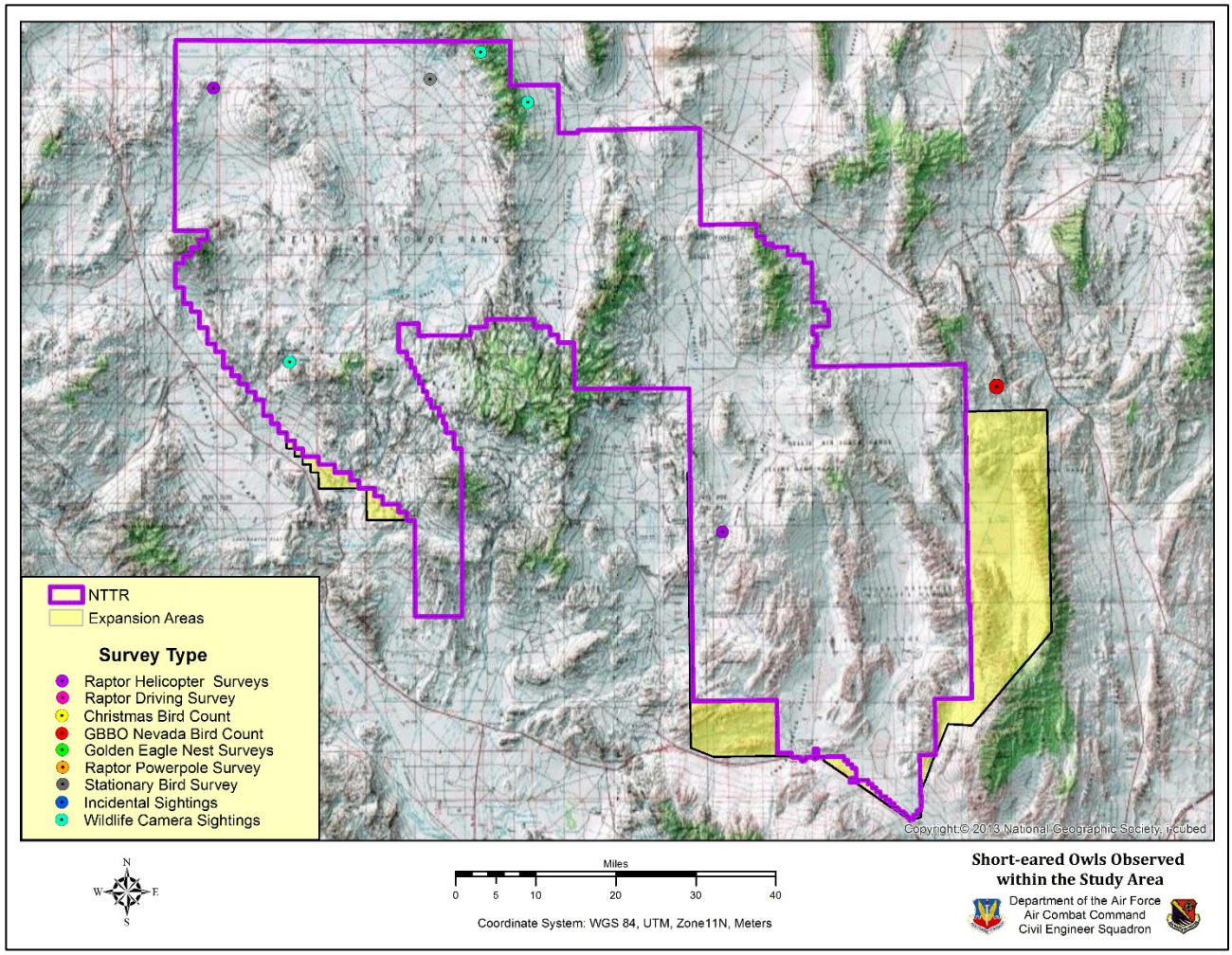

Figure 28. Locations where short-eared owls have been observed on the study area.

Long-eared Owl

Three long-eared owls observed on the NTTR during biological surveys, all in 2013 (Figure 29). Two of the owls were observed during nocturnal owl surveys using the call-broadcast technique at Sumner Spring. One was observed near Breen Creek, roosting with a flock of short-eared owls during migration season. During the surveys on the proposed expansion areas in 2016, one long-eared owl was heard vocalizing in the early hours near the Desert Lake Playa. Historical data from the Great Basin Bird Observatory shows that a long-eared owl was present near Corn Creek Spring in 2005 and 2006.

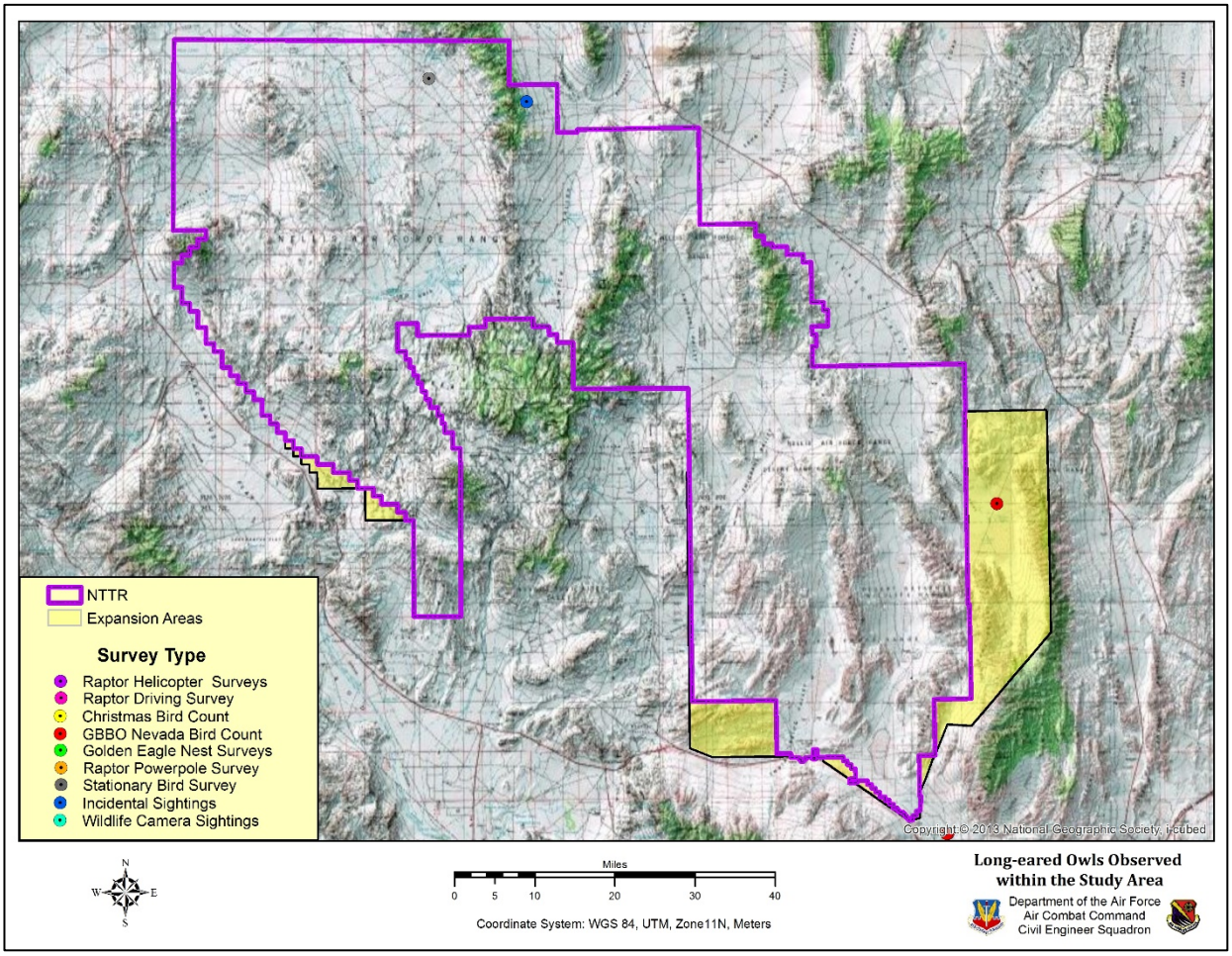

Figure 29. Locations where long-eared owls have been observed on the study area

Great Horned Owl

Great horned owls have been observed on the NTTR ten times since 2009 (Figure 30). In 2015, six great horned owls were observed from a helicopter during the raptor nesting survey. Four additional great horned owls were incidentally observed on the North Range in 2009, 2012, and 2013 during wildlife surveys. Wildlife cameras photographed thirty-five different great horned owls at the following locations:

- 2009: Sleeping Column Spring (North Range)
- 2010: Sumner Spring (North Range)
- 2011: Sumner Spring (North Range); Spotted #1 Wildlife Water Development, White Sage Gap Wildlife Water Development, Chuckwalla Wildlife Water Development, Patches Wildlife Water Development, and Indian Spring Wildlife Water Development (South Range)
- 2013: Brent Seep Wildlife Water Development (South Range)
- 2014: Dain Peak Wildlife Water Development (South Range)
- 2015: Monte Cristo Spring (North Range)

Historical data from the Great Basin Bird Observatory shows that in 2004 one great horned owl was observed near Sawmill Canyon in the DNWR.

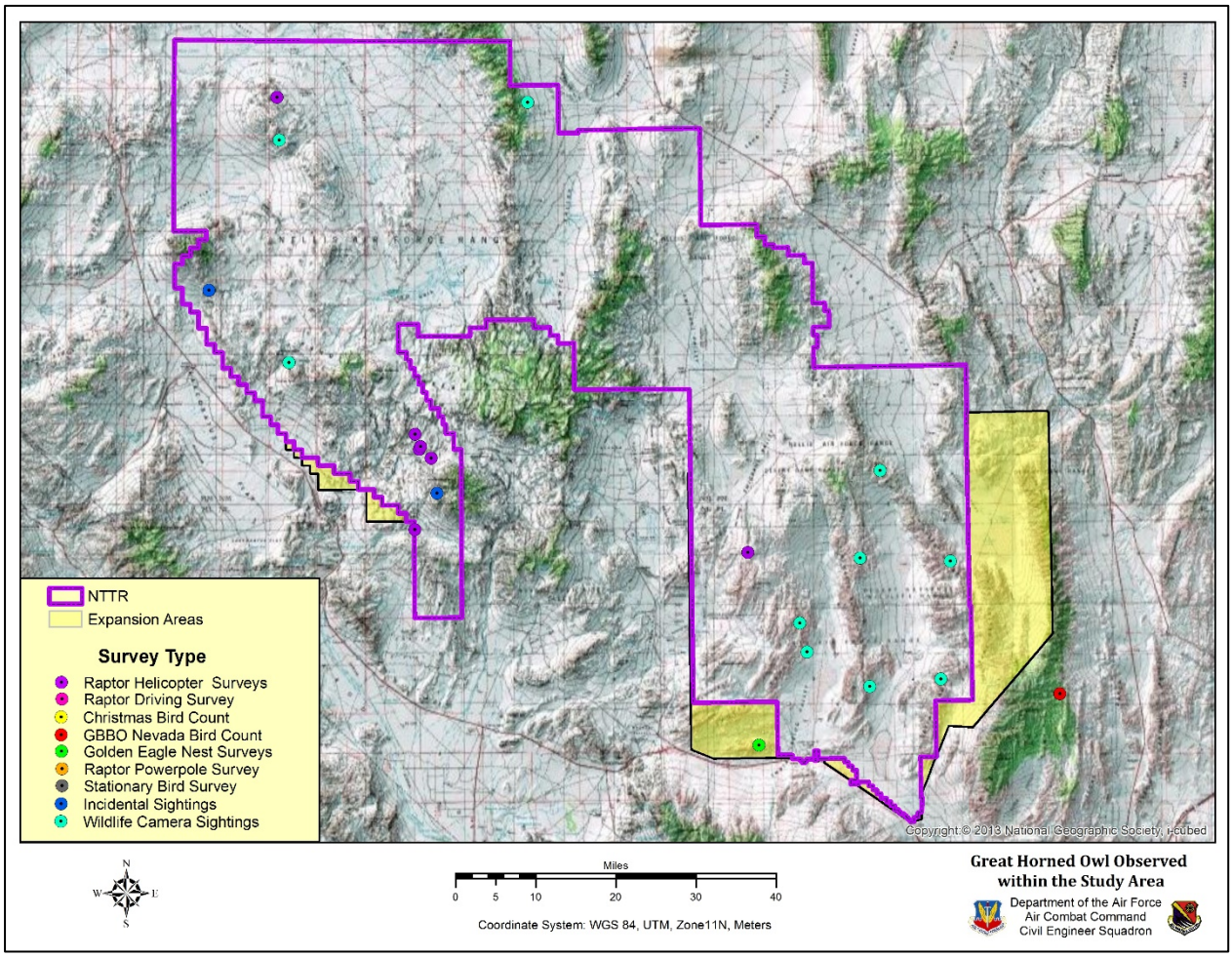

Figure 30. Locations where great horned owls have been observed on the study area.

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