

# **The Revised Nevada Bat Conservation Plan**



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**The Nevada Bat  
Working Group  
2006**



## Abstract

The Nevada Bat Working Group (NBWG), a subcommittee of the Western Bat Working Group (WBWG) is an assemblage of wildlife scientists dedicated to the preservation, protection, management and restoration of Nevada's bat fauna. In 1998, the NBWG dedicated itself to the production of a comprehensive conservation plan for Nevada's 23 bat species. A plan was initially completed in 2002. This current plan represents a complete revision and update of the 2002 plan. The plan assesses the current state of bat conservation in Nevada and suggests proactive strategies for improving and standardizing the conservation of Nevada's bats. The plan profiles each species and cross-references conservation strategies by roosting and foraging habitats specific to each bat. Conservation support materials in the form of research need summaries, survey protocols, permit requirements, standardized data collection sheets, approved gate and bridge designs, current and proposed legislation, as well as NBWG habitat position statements were appended for ease of retrieval for managers charged with the stewardship of Nevada's bat resource. This document is designed to guide and educate public and private land managers in the conservation of Nevada's bats into the next decade. Signatories have dedicated their agencies to the spirit of the plan and will do their best to conserve bats and bat resources within their jurisdictions. It is the intent of the NBWG that this plan is seen as a dynamic document with periodic review and complete revisions on a ten-year cycle to reflect improvements in the knowledge base of bat conservation in the State of Nevada.

KEY WORDS: Nevada, bats, conservation, habitat, *Chiroptera*.

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**SIGNATURE PAGE**

Whereas, the conservation of Nevada's biological diversity is one of the cornerstones of our quality of life,

Therefore, we the undersigned agree to work toward the conservation of Nevada's bat fauna through a good faith effort to implement the tenets of this plan. This plan shall be revised once every ten years to incorporate new information and better methods towards the conservation of bats and bat resources.

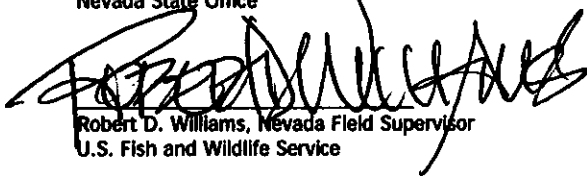
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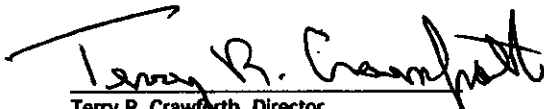
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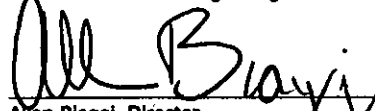
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## **EXECUTIVE SUMMARY**

This document is a product of several years of research, planning and discussions by dozens of wildlife scientists dedicated to the conservation of Nevada's bats. Individuals from several jurisdictions came together with a common purpose, a commitment to the long-term preservation, protection, management and restoration of bat populations in the State. This document is intended to be a dynamic model for the conservation of Nevada's bat fauna far into the next decade.

The Nevada Bat Conservation Plan was created by the Nevada Bat Working Group, which in turn is part of the Western Bat Working Group (WBWG) and The North American Bat Conservation Partnership (NABCP). NABCP is an alliance of four regional working groups from Mexico, Canada, and the United States. The NABCP was created to support continent-wide bat conservation efforts in an organized way. The NABCP's four regional working groups include: the Northeastern Bat Working Group, Southeastern Bat Diversity Network, Mexico Bat Working Group, and the Western Bat Working Group (WBWG). The WBWG is a coalition of state bat working groups from 13 Western states (including the Nevada Bat Working Group) and the Canadian provinces of British Columbia and Alberta. The WBWG steering committee includes a core group of individuals and representatives from each of the state working groups.

This document provides a summary of the known biological characteristics of each of Nevada's 23 species of bats. Following the biological profiles are habitat guilds including various roosting sites, foraging sites, and water resources. Each guild includes specific goals and actions for species that may occur in that guild. Education and research needs are also addressed in the plan and the appendices provide technical information on a variety of subjects relating to the tenets of the plan.

We envision that this plan will be completely reviewed and updated every 10 years. In the meantime, the Nevada Bat Working Group will continue to meet at least once a year to review annual updates to the plan, document annual progress, implement adaptive management practices, and coordinate research, inventory, monitoring, and educational efforts. Implementation of specific tasks and funding for such tasks will come, as it has in the past, from a variety of resources, agencies, and personnel. Data on all of Nevada's bat species will be housed at the Nevada Natural Heritage Program and the Nevada Department of Wildlife.

Signatories to the plan have agreed to work towards the conservation of Nevada's bat fauna in a collaborative effort. Although the conservation of Nevada's 23 bat species are complicated by complex biological, ecological, and practical management constraints, we believe that by working together, we can make positive strides in conserving this important guild of mammals.

## **ACKNOWLEDGMENTS**

A big thank you goes out to several individuals and agencies for their moral and financial support of the Nevada Bat Working Group and in the initiation, production and eventual distribution of this document. They include:

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## CONSERVATION ASSESSMENT

### Introduction

This Conservation Plan applies to 23 bat species within the State of Nevada. The purpose of this Plan is to reduce the threats to bat populations and their habitats within Nevada's borders and is intended to diminish the likelihood that any bat species in Nevada will require protection under the Endangered Species Act. Recognizing that Nevada's bats are part of a much larger ecosystem, the goal of the Plan is to promote healthy bat habitats and stable and/or increasing bat populations throughout western North America.

### Landscape Description

Nevada is the seventh largest State in the Union, covering 110,540 square miles. Our State also has the distinction of being the driest as well as the most mountainous. Habitats range from the Mojave Desert in the south to alpine tundra on several mountains throughout the State. Salt desert shrub (*Atriplex* sp.), sagebrush steppe (*Artemisia* sp.), wetland (*Scirpus* sp.), pinyon/juniper/mahogany woodland (*Pinus monophylla*, *Juniperus* sp., *Cercocarpus* sp.), mountain brush (*Amelanchier* sp.), willow/cottonwood/aspen riparian (*Salix* sp., *Populus* sp.), and subalpine coniferous forest of pine, fir and spruce (*Pinus* sp., *Abies* sp., *Pseudotsuga* sp., *Picea* sp.) habitats fill the gap between hot deserts and cold alpine mountain peaks (Munz, 1973). Extreme differences in elevation (200-4,000 meters) and latitude (35-42 degrees), rain shadow and storm track influences, as well as geological variability in parent rock materials have provided a grand mosaic of habitats throughout Nevada. The habitat diversity displayed by this mosaic contributes to Nevada's distinction of being ranked 11<sup>th</sup> in the Nation in terms of its biological diversity (Stein, 2002). Nevada's bat fauna mirrors this biological diversity – of the 40 species in the U.S. and Canada, 23 occur in Nevada. Bats inhabit or utilize many niches across the Nevada landscape. These include caves, abandoned mines, cliffs, springs, riparian, aspen, pinyon-juniper, subalpine coniferous forest, and desert shrub habitats (Ports and Bradley, 1996; Kuenzi et al., 1999; Sherwin et al., 2000a; Williams, 2001).

### Bat Conservation in Nevada - A Brief History

Aside from an inadvertent introduction of bats from Sacramento into the Virginia City area in 1858 (Covington, 1976), bat conservation is a relatively new phenomenon in the field of conservation biology in the State of Nevada. In 1985, along with several other "undesirable" mammalian species, the entire order of *Chiroptera*, with the exception of the spotted bat, was assigned the status of "unprotected mammal" in Nevada. Similar to the black-tailed jackrabbit, the valley pocket gopher, the coyote, the house mouse and the Norway rat, there was no protection afforded these species. Recently, in 2004, the Nevada State Legislature provided protection for an additional 8 species of bats, classifying them as protected, sensitive, or threatened. Currently, 15 of 23 Nevada bat species remain unprotected.

Bat conservation was first discussed in earnest in 1946 with the publication of *Mammals of Nevada* (Hall, 1976). Hall provided the first species accounts and distribution maps based on empirical data for 18 bat species in the State. He also provided the first sound arguments for a conservative treatment of this order of mammals in Nevada:

"The population of most species of bats is maintained by the birth of only one young per year, whereas most other kinds of mammals must necessarily produce far more young to maintain themselves...and...Bats usually return annually to the same caves to hibernate. Destruction of every individual in a wintering colony therefore might have more lasting effect on the number of bats than it would if

they were less provincial...and...The many popularly held superstitions about bats generally prove upon experiment to be groundless...and... Only the deeper caves and mine tunnels are suitable as winter quarters for the [bats] that hibernate, because they require a temperature above freezing."

Indiscriminate closure of abandoned mines is recognized as a threat to bats and their habitats. Today, an attempt is being made to provide input to closure plans for the roughly 300,000 mine openings based on recent empirical data. Three of Nevada's most significant bat roosts on record occupy historical mine workings, i.e. 1) the largest known Townsend's big-eared bat (*Corynorhinus townsendii*) hibernation roost in Nevada (White Pine County), 2) the largest known western small-footed Myotis bat (*Myotis ciliolabrum*) hibernation roost in Nevada (Eureka County), and 3) Nevada's largest known pallid bat (*Antrozous pallidus*) maternity roost (Pershing County).

Several additional threats to the long-term stability of bat populations continue to surface. The lack of accurate information/education dissemination is perhaps the most insidious and damaging to the bats' public relations image and ultimately to the conservation of this order of mammals. For example, the State Health Lab continues to provide the statistic that 10-15% of all bats carry the rabies virus, which comes with the added baggage of all bats being placed on a *State Vector List* of disease-carrying animals. This estimated statistic is based on a biased sample of injured and/or sick, and therefore easily captured, individual bats that make their way to the lab for rabies testing. The normal background incidence of rabies in North American bats is less than 0.5% (Constantine, 1979). By comparison, the greatest incidence of rabies infection continues to be found in raccoons and skunks. In 2001, 7437 cases of rabid animals were reported to the CDC. Raccoons were 37.2%, skunks 30.7%, bats 17.2%, cats 3.6% and dogs 1.2% (CDC, 2002). While the greatest incidence of rabies in wildlife may be in other mammals, bats were the source of 14 out of 18 human rabies cases in the U.S. between 1980 and 1994 (CDC, 1995). This is likely due to people attempting to pick up or handle a sick bat, as rabid bats are rarely aggressive when left alone. To put this into perspective, more people die annually from dog bites than have died from rabid bat bites in a decade. Statistically speaking, pets, playground equipment, and sports are far more dangerous than bats (BCI, 2003). Nevertheless, prudence and simple precautions can save lives. It is in the best interest of all Nevadans and the bat resource that rabies education be continued. However, this education process should be made fair and accurate and put into the proper context. The North American Symposium on Bat Research, with a broad membership, has created a resolution concerning bats and rabies that speaks to this issue (Appendix D).

Since Hall's work in the 1930s and 40s, five additional bat species have been documented in Nevada and range distribution maps for all species have been greatly enhanced. Bat survey and inventory techniques have become less intrusive and more accurate and sophisticated. Conservation of critical roosting habitats has commenced, foraging habitats are being identified with ever-increasing accuracy and conservation education is in full swing in many parts of the State. Still, as Hall pointed out in 1946, we are dealing with a group of 23 species that share characteristics, beyond leather wings, which make them some of the most sensitive animals we manage. First, they are, in many cases, extremely rare. Second, they are often thinly distributed across the landscape. Third, most spend a good part of their summers clumped in caves, adits, shafts, tree trunks, behind exfoliating bark and incessantly circling water sources. Therefore, they put many of their "eggs in only a few baskets". Fourth, they spend their relatively long lives giving birth to only one or two young per year. Fifth, most do not migrate long distances, but rather congregate during winter to hibernate. For these reasons, scientists and managers need to proceed with caution and in the best interest of Nevada's bat populations. The ecological, economic and human health benefits Nevada realizes from their role as primary predators on insect pests may reach into the millions of dollars.

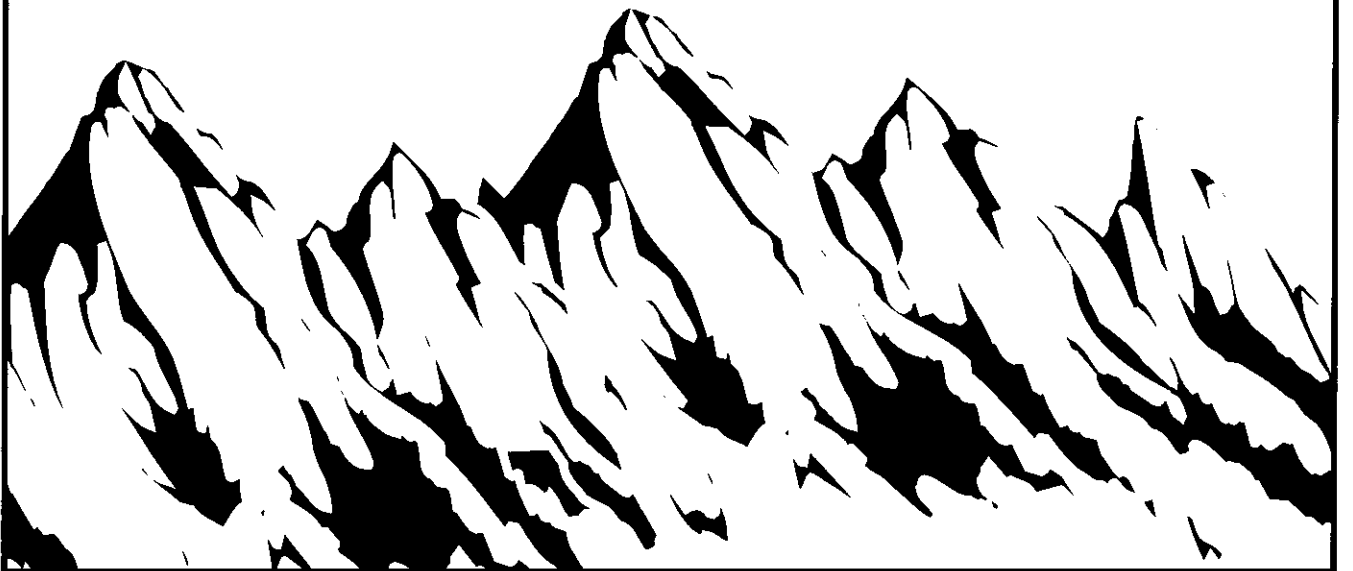
***"So much remains to be learned about them and so little is known that they well repay study."***

***E. R. Hall, 1946***



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## **Bat Species Profiles**



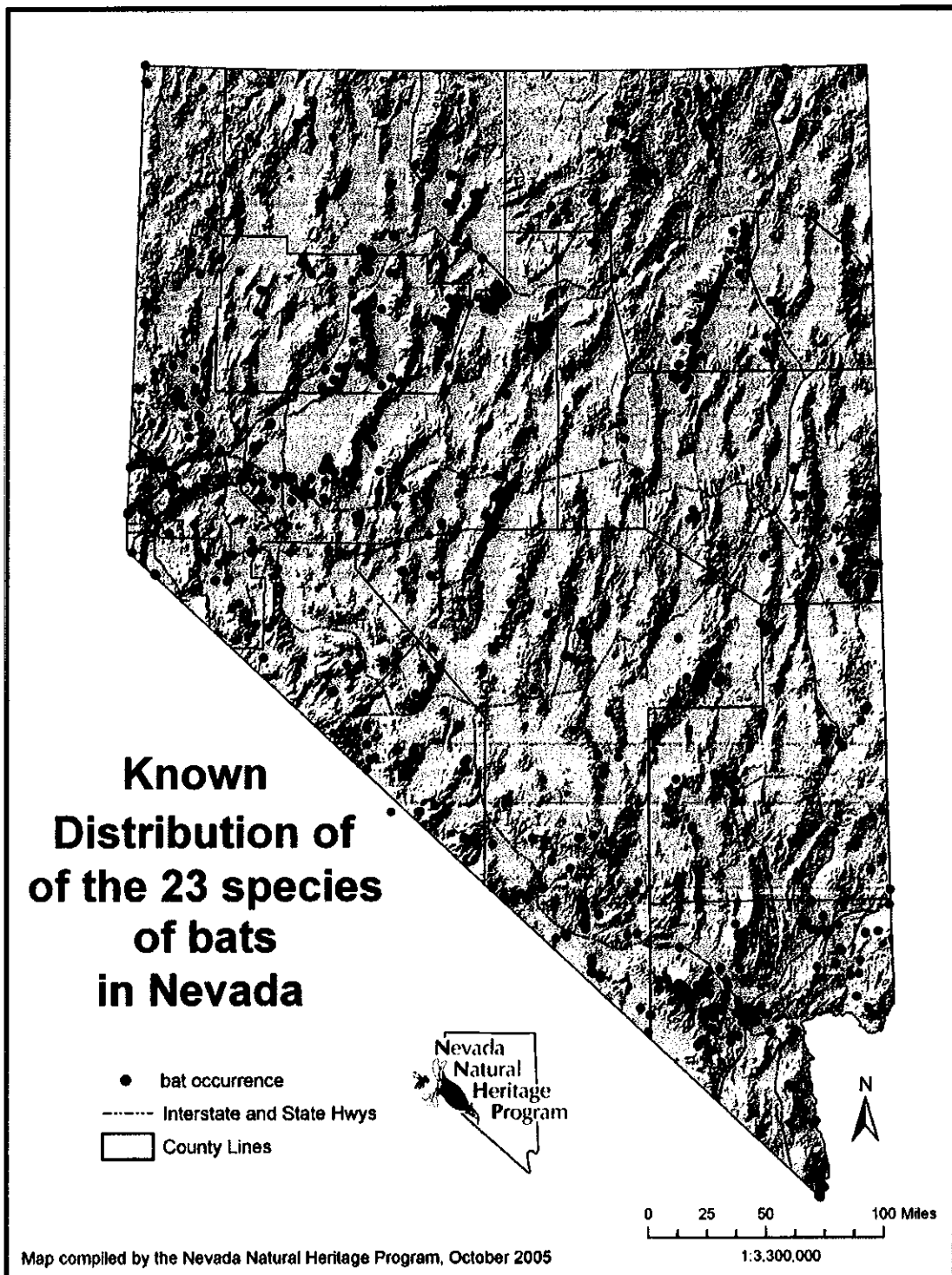


**Species Profiles**

**Taxonomic Checklist of Nevada Bats  
and  
Habitat Conservation Guild Cross-Reference**

<b>FAMILY / SPECIES</b>	<b>COMMON NAME</b>	<b>HABITAT CONSERVATION GUILDS</b>
<b>Phyllostomidae</b>		
<i>Choeronycteris mexicana</i>	Mexican long-tongued bat	CA, WS
<i>Macrotus californicus</i>	California leaf-nosed bat	CA, WS, DW, BB
<b>Vespertilionidae</b>		
<i>Antrozous pallidus</i>	pallid bat	CA, CL, TR, BB, WS, DW
<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	CA, CL, TR, BB, WS, FW
<i>Eptesicus fuscus</i>	big brown bat	CA, TR, BB, WS, FW, CL
<i>Euderma maculatum</i>	spotted bat	CL, BB, WS, FW, DW, CA
<i>Idionycteris phyllotis</i>	Allen's big-eared bat	TR, CA, WS, FW, DW
<i>Lasionycteris noctivagans</i>	silver-haired bat	TR, CA, WS, FW, CL, BB
<i>Lasiurus blossevillii</i>	western red bat	TR, WS, FW
<i>Lasiurus cinereus</i>	hoary bat	TR, FW, WS
<i>Lasiurus xanthinus</i>	western yellow bat	TR, WS, FW
<i>Myotis californicus</i>	California myotis	CA, CL, TR, BB, WS, DW, FW
<i>Myotis ciliolabrum</i>	western small-footed Myotis	CA, CL, TR, FW, WS
<i>Myotis evotis</i>	long-eared myotis	TR, CA, FW, WS, CL, BB
<i>Myotis lucifugus</i>	little brown bat	TR, BB, WS, CL, CA, FW
<i>Myotis thysanodes</i>	fringed myotis	CA, TR, BB, WS, DW, FW, CL
<i>Myotis velifer</i>	cave myotis	CA, WS, BB, FW
<i>Myotis volans</i>	long-legged myotis	TR, CA, CL, WS, FW, BB
<i>Myotis yumanensis</i>	Yuma myotis	TR, BB, WS, CA, CL, FW
<i>Pipistrellus hesperus</i>	western pipistrelle	CL, CA, WS, BB, DW,
<b>Molossidae</b>		
<i>Eumops perotis</i>	western mastiff bat	CL, WS, FW
<i>Nyctinomops macrotis</i>	big free-tailed bat	CL, CA, WS, FW, BB
<i>Tadarida brasiliensis</i>	Brazilian free-tailed bat	CA, CL, BB, TR, WS, DW

- BB Bridge and Building Roosting Habitat
- CA Natural Cave, Mine Shaft and Adit Roosting Habitat
- CL Cliff, Crevice and Talus Roosting Habitat
- DW Desert Wash Foraging Habitat
- FW Forest and Woodland Foraging Habitat
- TR Tree Roosting Habitat
- WS Water Source Foraging and Watering Habitat



## Bat Species Risk Assessment in Nevada

Scientific Name	Common Name	Populations/Habitats At Risk
<i>Choeronycteris mexicana</i>	Mexican long-tongued bat	HIGH/EDGE OF RANGE
<i>Macrotus californicus</i>	California leaf-nosed bat	HIGH/EDGE OF RANGE
<i>Antrozous pallidus</i>	pallid bat	MODERATE
<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	HIGH
<i>Eptesicus fuscus</i>	big brown bat	LOW
<i>Euderma maculatum</i>	spotted bat	MODERATE
<i>Idionycteris phyllotis</i>	Allen's big-eared bat	HIGH
<i>Lasionycteris noctivagans</i>	silver-haired bat	MODERATE
<i>Lasiurus blossevillii</i>	western red bat	HIGH
<i>Lasiurus cinereus</i>	hoary bat	MODERATE
<i>Lasiurus xanthinus</i>	western yellow bat	MODERATE/EDGE OF RANGE
<i>Myotis californicus</i>	California myotis	MODERATE
<i>Myotis ciliolabrum</i>	western small-footed Myotis	MODERATE
<i>Myotis evotis</i>	long-eared myotis	MODERATE
<i>Myotis lucifugus</i>	little brown bat	MODERATE
<i>Myotis thysanodes</i>	fringed myotis	HIGH
<i>Myotis velifer</i>	cave myotis	HIGH/EDGE OF RANGE
<i>Myotis volans</i>	long-legged myotis	LOW
<i>Myotis yumanensis</i>	Yuma myotis	MODERATE
<i>Pipistrellus hesperus</i>	western pipistrelle	MODERATE
<i>Eumops perotis</i>	western mastiff bat	MODERATE/EDGE OF RANGE
<i>Nyctinomops macrotis</i>	big free-tailed bat	MODERATE/EDGE OF RANGE
<i>Tadarida brasiliensis</i>	Brazilian free-tailed bat	LOW

Adapted from: "Western Bat Species - Regional Priority Matrix" (Western Bat Working Group, 1998) – See Appendix B for the entire Regional Priority Matrix.

**Vespertilionidae*****Antrozous pallidus* — pallid bat**

*Distribution:* Found throughout the state, primarily in the low and middle elevations (1,800 m), although has been found at over 3,100 m.

*Habitat Characteristics:* Found in a variety of habitats from low desert to brushy terrain to coniferous forest and non-coniferous woodlands. Current Nevada records indicate this species is distributed between 420-2,580 m (mean = 1,426 m  $\pm$  431 m) in pinyon-juniper, blackbrush, creosote, sagebrush, and salt desert scrub habitats.

*Resident Status:* Year round resident.

*Winter Status:* Hibernates but periodically arouses to actively forage and drink in the winter.

*Roost Sites:* Selects a variety of day roosts including rock outcrops, mines (maternity colonies have been found in geothermally-influenced adlts), caves, hollow trees, buildings, and bridges. Night roosts very commonly under bridges, but also caves and mines. Intolerant of roosts in excess of 40°C.

*Reproduction:* One to two young per year, with birth occurring in May to June. Nursery colonies may contain up to several hundred females, but generally less than 100 individuals.

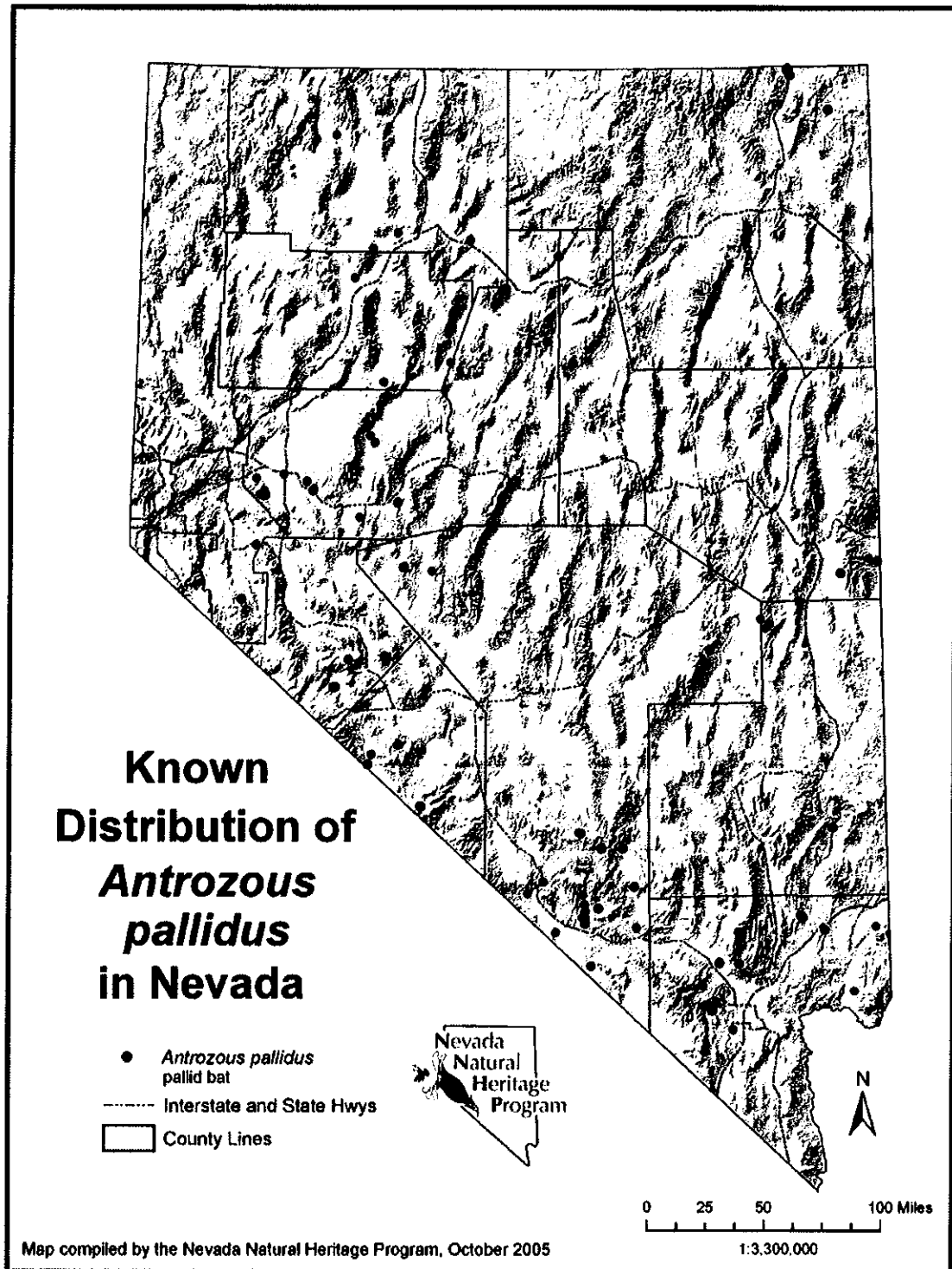
*Food Habits:* Food items are primarily large ground-dwelling arthropods (scorpions, centipedes, millipedes, grasshoppers, long-horned beetles, Jerusalem crickets), but also include large moths. Foraging occurs in and among vegetation as well on the ground surface. Pallid bats may actually land and take prey.

*Current Nevada Status:* State Protected. BLM: Sensitive. USFS: Inyo NF Sensitive. NNHP: G5S3.

*Conservation/Management Issues:* Recreational caving; closure of mines for reclamation; renewed mining; and water impoundments. Behaviorally sensitive to roost disturbance. Need more information on seasonal movements and winter activity patterns.

*Relevant References:* Brown (1976), Hall (1946), Hermanson and O'Shea (1983), Lewis (1993, 1994, 1996), Licht and Leitner (1967), O'Farrell and Bradley (1977), Orr (1954), Pierson et al. (1996), Rambaldini (2005), Ruffner et al. (1979), Williams (2001).





***Corynorhinus townsendii* — Townsend's big-eared bat**

***Distribution:*** Found throughout the state, from low desert to high mountain habitats. Observed foraging in krumholz bristlecone pine as high as 3,500 m in the Snake Range of eastern White Pine County. Distribution is strongly correlated with the availability of caves and abandoned mines..

***Habitat Characteristics:*** Highly associated with caves and mines. Found primarily in rural settings from deserts to lower, mid to high-elevation mixed coniferous-deciduous forest. Current Nevada records indicate this species is distributed between 210-3,500 m (mean = 1,720 m ± 421 m) primarily in pinyon-juniper-mahogany, white fir, blackbrush, sagebrush, salt desert scrub, agricultural, and occasionally in urban habitats.

***Resident Status:*** Year round resident.

***Winter Status:*** Hibernates in mixed sex aggregations of a few to many hundred. Periodically arouses to move to alternate roosts and to actively forage and drink in the winter. Hibernation prolonged in colder areas, and intermittent where climate is predominantly non-freezing.

***Roost Sites:*** A cavern-dwelling species that uses mines, caves, trees and buildings. One of the species most dependent on mines and caves. Trees and buildings must offer "cave-like" spaces in order to be suitable. Will roost in more open settings, including under bridges. Colony size is typically 35-150, with a few larger (> 200) colonies known. Recent studies indicate that use of roosts is variable within seasons and among years, and multiple surveys may be required before use can be documented.

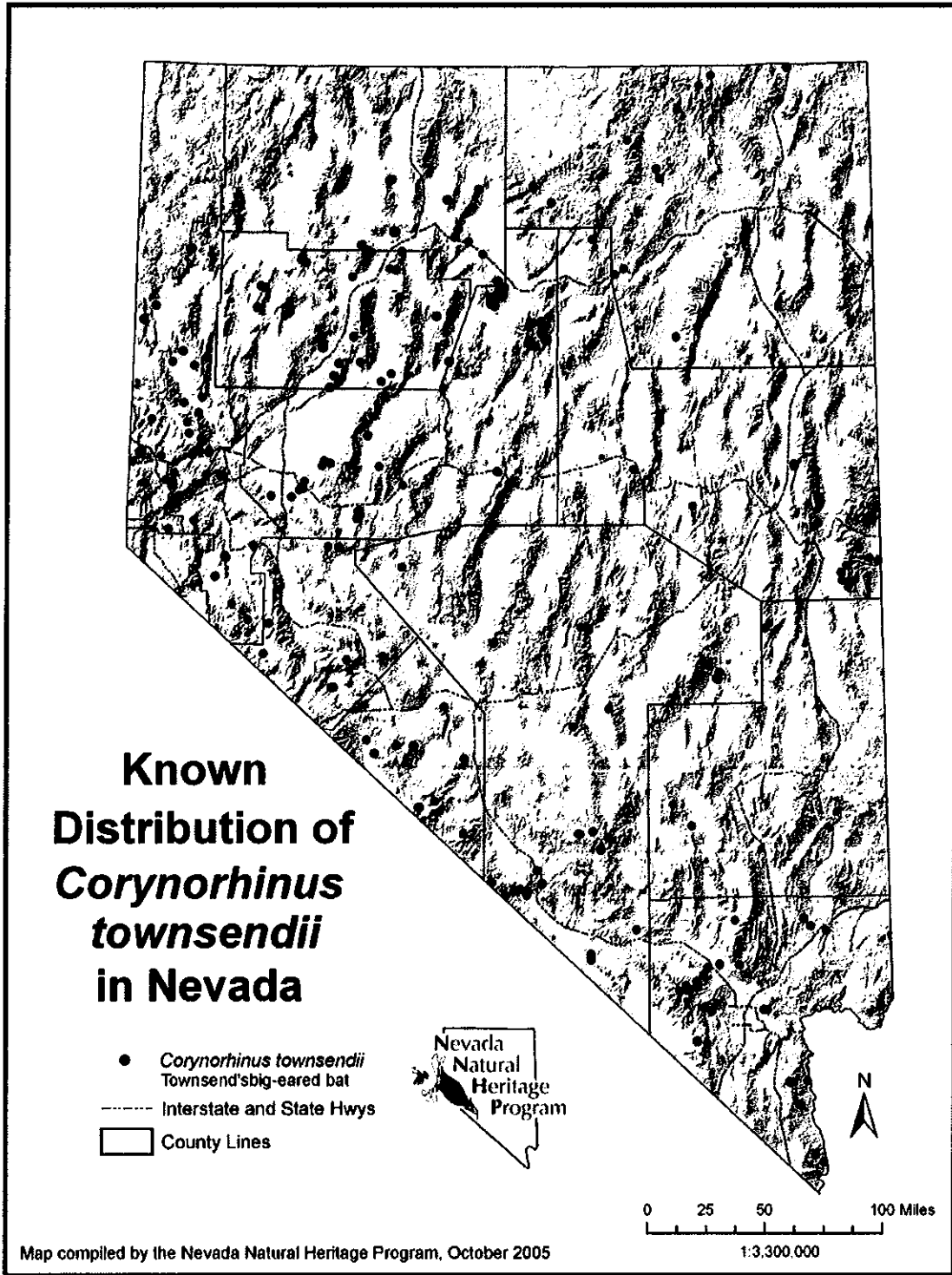
***Reproduction:*** One young per year with birth occurring in May to July, depending on latitude and local climate. Females form maternity colonies; males roost individually. Historically, maternity colonies typically contained several hundred females.

***Food Habits:*** This species is a moth specialist. Foraging occurs near vegetation and other surfaces and prey is probably gleaned from these surfaces. Telemetry studies in northern Nevada have revealed over 95% of foraging activity to be concentrated in open forest habitats of pinyon, juniper, mahogany, white fir, aspen and cottonwood (Bradley, 2000a). This species may travel large distances to suitable foraging areas.

***Current Nevada Status:*** State protected as Sensitive. Serious population declines in past forty years in parts of the western United States (Pierson and Rainey, 1996). Roost size reductions have been documented in Nevada (P. V. Bradley, personal communication). Formerly a Category 2 Candidate for federal listing as Threatened or Endangered. BLM: Sensitive. USFS: Sensitive. NNHP: G4S2.

***Conservation/Management Issues:*** Primary threats consist of disturbance and destruction of roost sites. Its habit of roosting on open surfaces makes it readily detectable and therefore highly susceptible to disturbance at roost sites. Recreational caving; closure of mines for reclamation; renewed mining; frequent, repeated surveys during hibernation and maternity seasons; water impoundments; loss of building roosts; and bridge replacement. Location, protection, and monitoring of significant roosts are needed as well as more information on foraging requirements and seasonal movement patterns.

***Relevant References:*** Bradley (2000a), Brown et al. (1994), Graham (1966), Hall (1946), Humphrey and Kunz (1976), Fellers and Pierson (2002), Kunz and Martin (1982), Mohr (1972), Pearson et al. (1952), Perkins (1990), Piaggio (2005), Piaggio and Perkins (in review), Pierson and Fellers (1994), Pierson and Rainey (1996), Pierson et al. (1991), Pierson et al. (1999), Sherwin and Strickland (2000), Sherwin et al. (2000b, 2003), Stebbings (1966), Stihler and Hall (1993), Wackenhut (1990), Western Association of Fish and Wildlife Agencies (2002).



***Eptesicus fuscus* — big brown bat**

***Distribution:*** Found throughout the state, from low to high elevations (220 to > 3,000 m).

***Habitat Characteristics:*** Occurs in a variety of habitats, including pinyon-juniper, blackbrush, creosote, sagebrush, agriculture, and urban habitats. Better adapted to human habitation than most species. Current Nevada records indicate this species is distributed between 300-3,000 m (mean = 1,723 m ± 573 m).

***Resident Status:*** Year round resident.

***Winter Status:*** Hibernates but periodically arouses to actively forage and drink in the winter. Year-round resident. Characteristics and locations of winter hibernacula in Nevada are completely unknown, and poorly understood throughout this species range.

***Roost Sites:*** Selects a variety of day roosts including caves, trees (e.g., Ponderosa pine, quaking aspen and oaks), mines, buildings and bridges. Often night roosts in more open settings in buildings, mines and bridges. Roosts in groups up to several hundred.

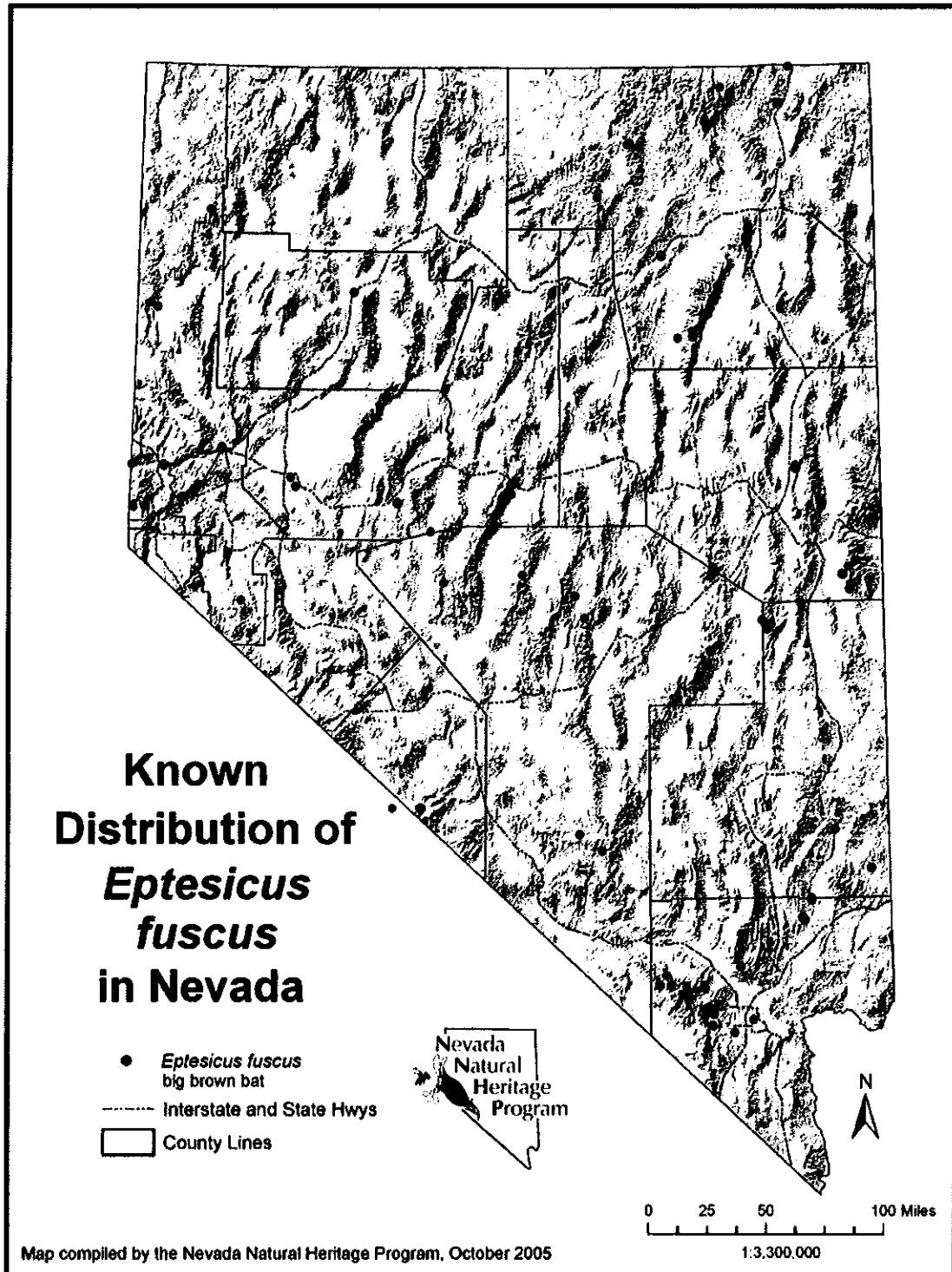
***Reproduction:*** One young per year (twins in portions of its eastern range) with birth occurring in May to June. Females form relatively small maternity colonies (20-200).

***Food Habits:*** Feed on a wide range of insect taxa, but beetles and caddis flies are dominant in the diet. Foraging occurs in the open over land and water, as well as in both forested and edge situations.

***Current Nevada Status:*** State unprotected. Widespread and regionally common. BLM: Sensitive. NNHP: G5S4.

***Conservation/Management Issues:*** Roost disturbance and destruction; Timber harvest; bridge replacement; building demolition; recreational caving; mine reclamation; renewed mining; water impoundments; pest control exclusion. Need more information about roosting requirements (particularly in forests), seasonal movement patterns, and hibernation sites (locations and microhabitat characteristics).

***Relevant References:*** Betts (1996), Black (1976), Borrell and Ellis (1934), Brigham (1991), Brigham and Fenton (1986), Hall (1946), Kurta and Baker (1990), Menzel et al. (2001), O'Farrell and Bradley (1977), Perkins (2005), Vonhof (1996), Whitaker et al. (1997), Williams (2001).



***Euderma maculatum* — spotted bat**

***Distribution:*** Known from only twelve localities, but scattered distribution throughout Nevada. Distribution is patchy and linked to availability of cliff roosting-habitat. Recent studies have documented significant activity throughout the summer months in the Muddy River drainage (Williams, 2001). There are recent high elevation records from the Sierra Nevada in California (P. E. Brown, personal communication) and lower elevation basalt canyon records just across the border in southern Idaho. The Idaho portion of the Bruneau-Jarvis River area appears to be an important population center (Doering and Keller, 1998). Detected acoustically in Lincoln County in 2003 (Tomlinson and Kenney, 2005)

***Habitat Characteristics:*** Found in a wide variety of habitats from low elevation desert scrub to high elevation coniferous forest habitats, including pinyon-juniper, sagebrush, riparian and on urban high-rise (cliff analog) habitats. Closely associated with rocky cliffs. Current Nevada records indicate this species is distributed between 540-2,130 m (mean = 1,447 m ± 569m).

***Resident Status:*** Year round resident.

***Winter Status:*** Hibernates but periodically arouses to actively forage and drink in the winter. Characteristics and locations of winter hibernacula in Nevada are completely unknown, and poorly understood throughout this species range.

***Roost Sites:*** Day roosts primarily in crevices in cliff faces but some indication that mines and caves may occasionally be used, primarily in winter. Has been found roosting on/in buildings but reliance on such roosts is unclear. Likely roosts singly.

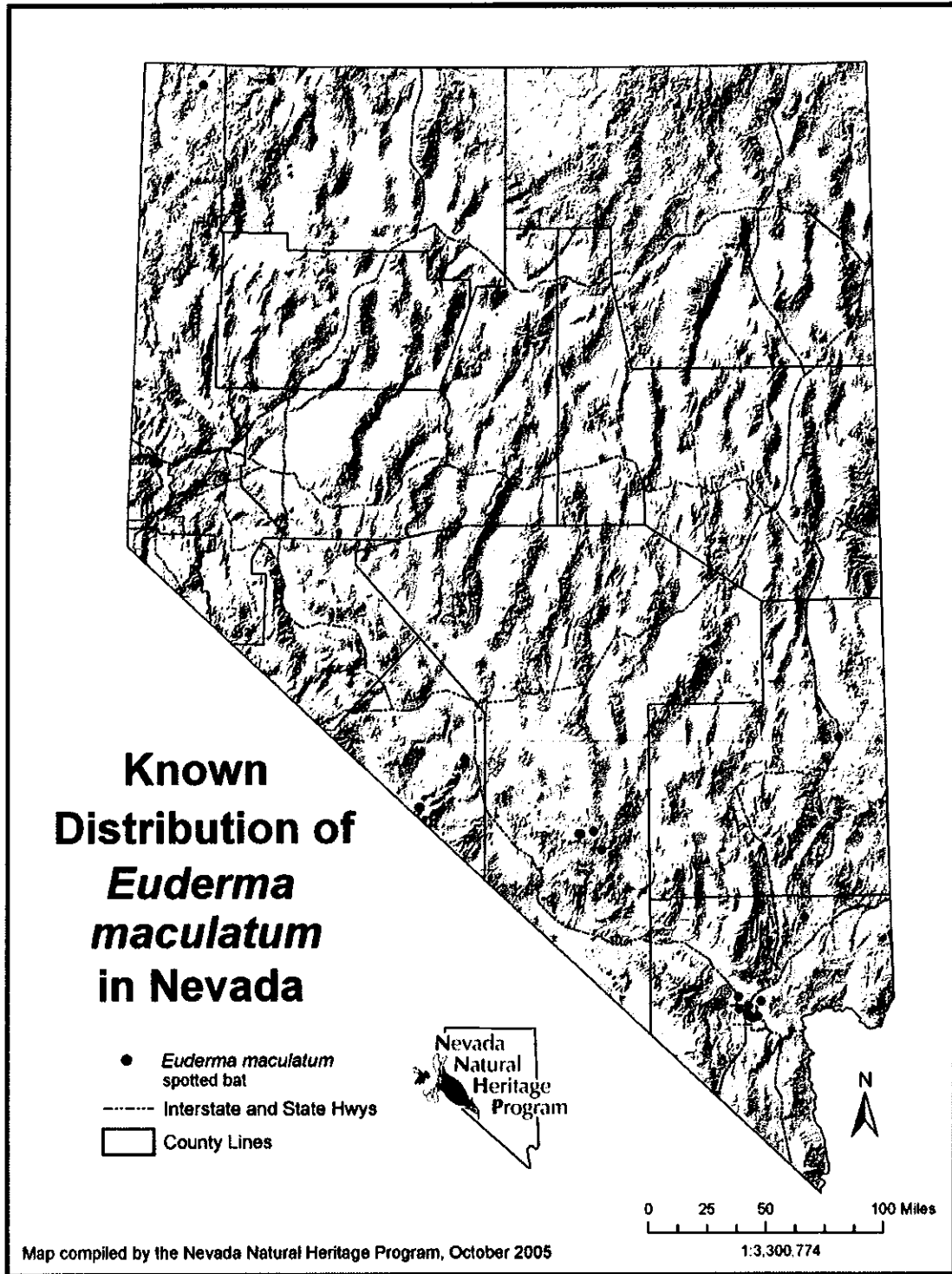
***Reproduction:*** One young per year with birth occurring in June to July.

***Food Habits:*** Diet includes a variety of insects but predominantly consists of moths. In desert settings, foraging occurs in canyons, in the open, or over riparian vegetation. In montane habitats, individuals forage over meadows, along forest edges, or in open coniferous woodland. Animals generally forage alone, apparently maintaining foraging territories, and at other times "trap lining". This species is capable of flying long distances to suitable foraging grounds.

***Current Nevada Status:*** State Protected: Threatened. Rare and patchy in occurrence although recent findings indicate it may be more common than previously thought. Formerly a Category 2 Candidate for federal listing as Threatened or Endangered. BLM: Special Status Species. USFS: Sensitive. NNHP: G4S2.

***Conservation/Management Issues:*** Recreational climbing; water impoundments; grazing/meadow management; mining and quarry operations. Need more information on distribution, status, breeding range, and life history. Winter habits are not well known and hibernacula microclimates not documented.

***Relevant References:*** Constantine (1987), Chambers and Herder (2005), Deacon and Bradley (1962), Doering and Keller (1998), Fenton et al. (1987), Geluso (2000), Hall (1946), Kuenzi et al. (1999), Leonard and Fenton (1983), Luce and Keinath (2005), Navo et al. (1992), Perry et al. (1997), Pierson and Rainey (1995), Poché (1981), Poché and Bailie (1974), Rabe et al. (1998a), Storz (1995), Szwczak et al. (1998), Wai-ping and Fenton (1989), Watkins (1977), Williams (2001), Woodsworth et al. (1981).



***Lasionycteris noctivagans* — silver-haired bat**

***Distribution:*** Widely distributed in the state, but confined primarily to forested habitats. Found in riparian habitats in the south and in woodland and riparian habitats in the central and northern portions of the state.

***Habitat Characteristics:*** A forest-associated species, more common in mature forests. Found primarily at higher latitudes and altitudes. Found in coniferous and mixed deciduous/coniferous forests of pinyon-juniper, subalpine fir, white fir, limber pine, aspen, cottonwood and willow. Usually found at lower elevations in southern Nevada associated with riparian corridors. Current Nevada records indicate this species is distributed between 480-2,520 m (mean = 1,679 m ± 525 m).

***Resident Status:*** Poorly understood. Recent August records of seven post-lactating females and four juveniles in mixed subalpine fir/limber pine/aspen habitat (Bradley, 2000b) and four lactating females in mixed coniferous/deciduous forest (Bradley, 2004) indicates maternity activity in northeast Nevada.

***Winter Status:*** Migrates but probably hibernates in some parts of its winter range. Migratory patterns not well understood. Recent October records of migrating individuals, one juvenile near Mesquite, in the foothills of the Virgin Mountains (M. J. O'Farrell, personal communication) and one in the Santa Rosa Mountains of Humboldt County (P. V. Bradley, personal communication). In Spring Valley of Eastern Nevada, one individual was observed flying and drinking during mid-day in January 2002 (J. A. Williams, personal communication).

***Roost Sites:*** Roosts almost exclusively in trees in summer. Maternity roosts are generally in woodpecker hollows and under the loose bark of large diameter snags. They are generally located at least 15m above ground. Uses multiple roost sites, switching them frequently. Small groups and single animals will roost under exfoliating bark. Winter roosts include hollow trees, rock crevices, mines, caves, and houses. Also has been found roosting under leaf litter.

***Reproduction:*** One to two young per year but generally two, with birth occurring in June to July. Forms small maternity colonies of several to about 75 individuals.

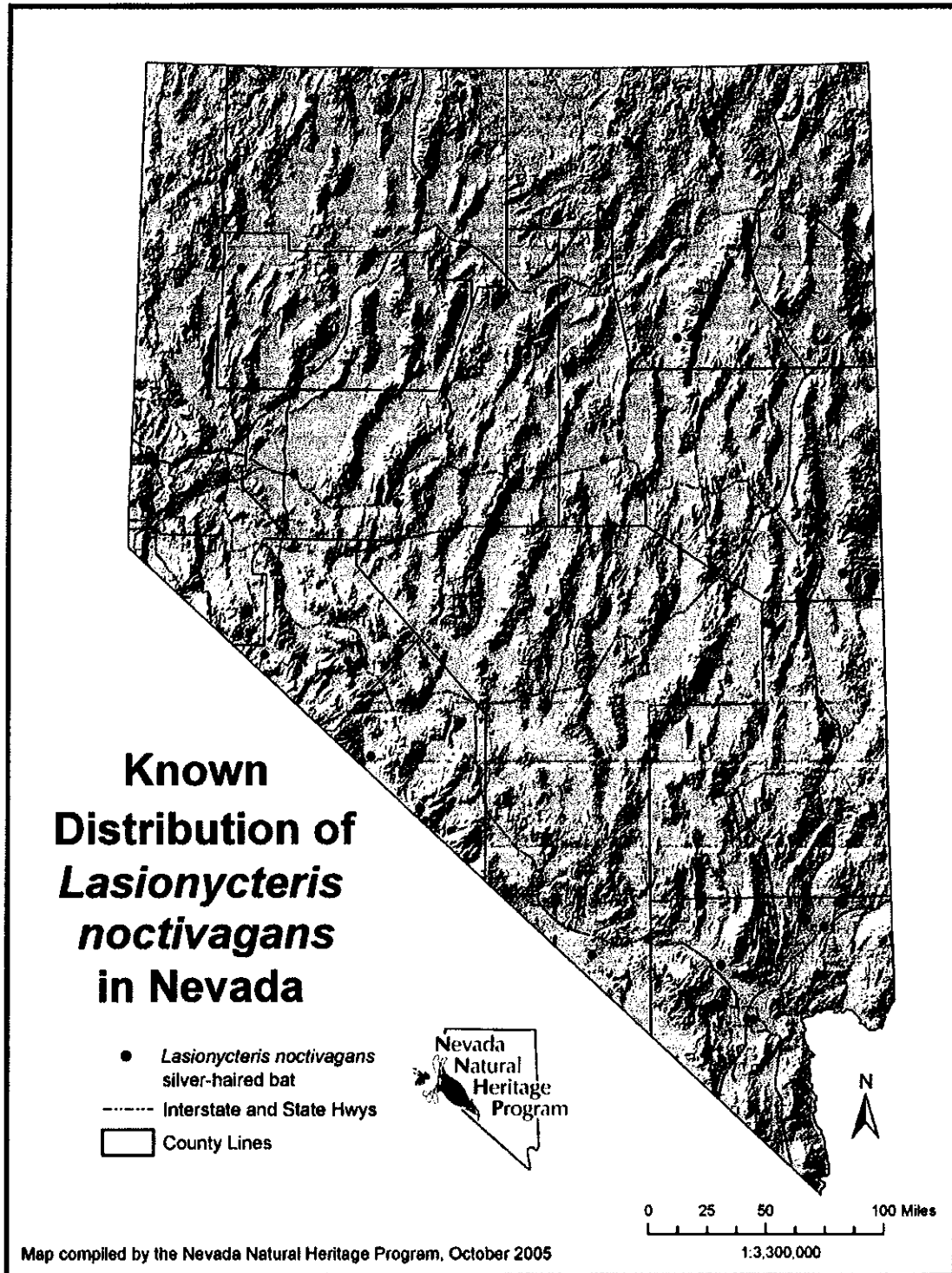
***Food Habits:*** Diet consists of a variety of insects but moths feature prominently. Foraging is generally above the canopy layer in or near wooded areas and along edges of roads, streams or water bodies. Travels considerable distances (up to 15 km) from roost sites to foraging areas.

***Current Nevada Status:*** State unprotected. Locally common, at least seasonally. BLM: Sensitive. NNHP: G5S3.

***Conservation/Management Issues:*** Timber harvest; grazing of riparian habitats; pesticide spraying. Need more information about breeding populations, roost requirements, and the timing and patterns of migration.

***Relevant References:*** Barclay (1985), Barclay et al. (1988), Betts (1996), Bradley (2000b, 2004), Bradley et al. (1965), Burt (1934), Campbell (1996), Campbell et al. (1996), Hall (1946), Izor (1979), Jung et al. (1999), Krutzsch (1966), Kunz (1982), Kurta and Stewart (1990), Mattson et al. (1996), Parsons et al. (1986), Perkins (2005), Perkins and Cross (1988), Sanborn (1953), Vonhof (1996), Williams (2001).





***Lasiurus cinereus*— hoary bat**

***Distribution:*** Distribution patchy throughout the State and known mostly from the capture of single animals while foraging or acoustic records. Roosting locations are not well known.

***Habitat Characteristics:*** Tree-associated species. Found primarily in forested upland habitats, as well as in gallery-forest riparian zones (e.g., in cottonwoods along the Colorado River drainage), and agriculture habitats. Also found in valley basins in pure stands of Rocky Mountain juniper (*Juniperus scopulorum*) (Bradley and Baldino, 1997). May occur in park and garden settings in urban areas. Current Nevada records indicate this species is distributed between 570-2,520 m (mean = 1,587 m ± 560 m).

***Resident Status:*** Summer resident. In California, summer residents are primarily males, which may also be the case in much of Nevada although a non-lactating female, along with three reproductively active males were caught over water in August, 1997 at 1,800 m in Spring Valley, east-central Nevada in Rocky Mtn juniper habitat (Bradley and Baldino, 1997). Three females were captured near Yucca Mountain in 1991 (Rakestraw *et al.*, 1998). One was captured on 6 May and one on 14 August over a well pond (990 meters) in Mojave Desert scrub vegetation. Another individual was captured on 13 August in a dry wash. Recent acoustic and capture surveys in the Muddy River and Meadow Valley Wash drainages documented arrival and continued presence from early April through late May (J. A. Williams and M. J. O'Farrell, personal communication). A single capture in late April 2000 was an emaciated adult female. Prolonged presence from March through June was recorded in the upper Moapa Valley (Williams, 2001). Until recently, all records from southern Nevada were from the spring. However, two localities at the Nevada Test Site (Rakestraw *et al.*, 1998; Hall, 2000) and the Spring Mountains (O'Farrell, 2002a) have yielded records in the fall months. Records from the northeast span 15 July to 21 August (Ports and Bradley, 1996). Documented in July at Key Pittman Reservoir and in September in Eagle Valley, Lincoln County (Tomlinson and Kenney, 2005).

***Winter Status:*** Migrates but probably hibernates in parts of its winter range. Records are primarily from the spring and fall but migratory patterns in Nevada are not known.

***Roost Sites:*** Solitary. Day roosts in trees, within foliage 3-12 m above the ground in both coniferous and deciduous trees. Some unusual roosting situations have been reported in caves, beneath a rock ledge, in a woodpecker hole, and in a squirrel's nest.

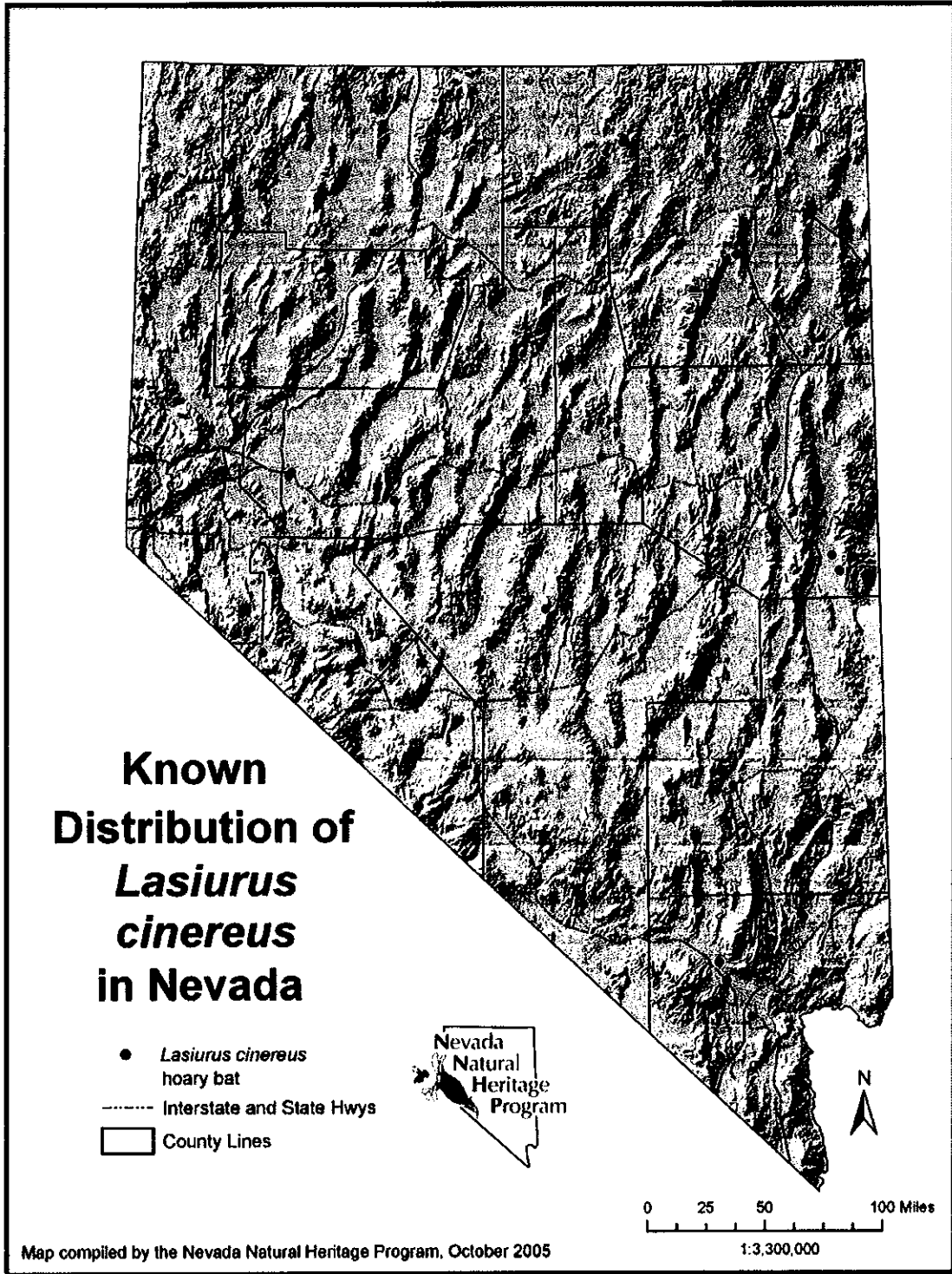
***Reproduction:*** One to four young per year but generally two, with birth occurring in May to June. Maternity colonies are not formed.

***Food Habits:*** Food items include a variety of insects but moths, dragonflies, and beetles feature prominently. Foraging is generally high altitude and occurs over tree canopy. In the open, rapid descending arcs are exhibited. Also, will follow watercourses for foraging and drinking. It forages over long distances, up to 40 km from its roost. Evening emergence is variable, from one hour after sunset to midnight.

***Current Nevada Status:*** State unprotected. Widespread but may be threatened by reduction in forest cover. BLM: Sensitive. NNHP: G5S3.

***Conservation/Management Issues:*** Loss of roosting habitat due to timber harvest; pesticide spraying; loss of riparian habitats. In urban/suburban areas may encounter people and pets (frequently turned in to public health facilities); predation by jays. In areas being developed for wind energy, windmills may pose a significant threat to this species, especially during migration. More information is needed about seasonal movement patterns, and distribution and status within Nevada.

***Relevant References:*** Barclay (1985), Bolster (2005), Bradley and Baldino (1997), Bradley *et al.* (1965), Constantine (1959), Findley and Jones (1964), Hall (1946), Hall (2000), Hickey (1990), Hickey (1992), Hickey *et al.* (1996), Jung *et al.* (1999), O'Farrell (2002a), O'Farrell and Bradley (1977), O'Farrell *et al.* (2000), Orr (1950b), Perkins and Cross (1988), Ports and Bradley (1996), Rakestraw *et al.* (1998), Shump and Shump (1982b), Williams (2001).



***Myotis californicus*— California myotis**

**Distribution:** Found throughout Nevada, primarily at the low and middle elevations (to 1,800 m), although occasionally found at higher elevations. More common in the southern half of the state.

**Habitat Characteristics:** Found in a variety of habitats from Lower Sonoran desert scrub to forests. Current Nevada records indicate this species is distributed between 210-2,730 m (mean = 1,426 m ± 517 m).

**Resident Status:** Year round resident.

**Winter Status:** Hibernates but periodically arouses to actively forage and drink in the winter.

**Roost Sites:** Crevice roosting. Selects a variety of day roosts including mines, caves, buildings, rock crevices, hollow trees, and under exfoliating bark. Night roosts in a wider variety of structures. Generally roost singly or in small groups, although some mines in the Mojave Desert shelter colonies of over 100 in both the summer and winter.

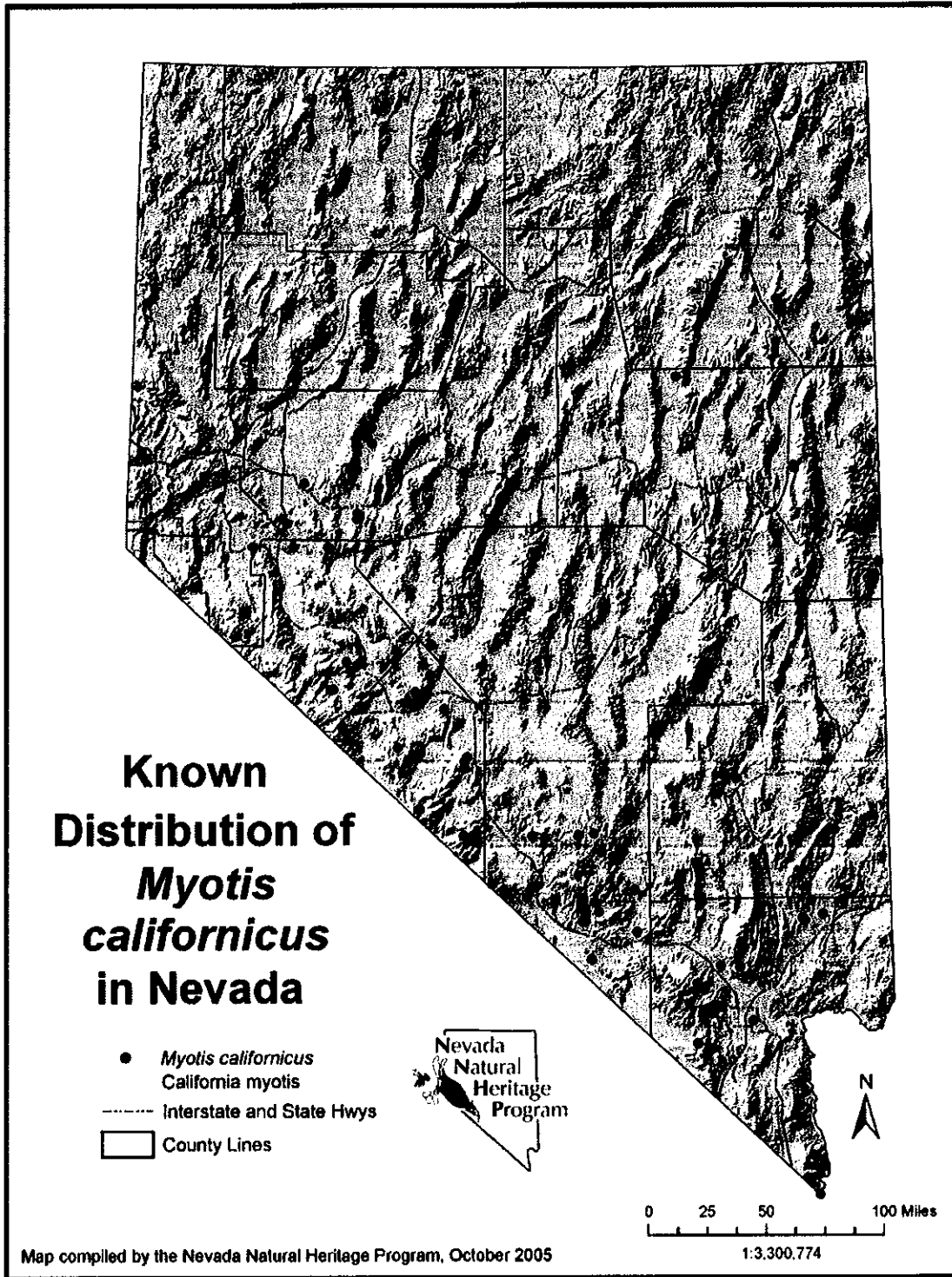
**Reproduction:** One young per year with birth occurring in May to June. Females may form small maternity colonies, usually less than 100 individuals.

**Food Habits:** Food items include small moths, flies and beetles. Foraging occurs in the open, but some individuals observed entering mines at dusk presumably to feed on resident insects.

**Current Nevada Status:** State unprotected. Widespread and regionally common. BLM: Sensitive. NNHP: G5S4.

**Conservation/Management Issues:** Closure of mines for reclamation; renewed mining; pesticide spraying. Need more information about roosting and foraging requirements, population trends, and acceptance of bat gates. This species looks very similar to *Myotis ciliolabrum* (western small-footed myotis).

**Relevant References:** Bogan (1974, 1975, in press), Bogan et al. (2005), Brigham et al. (1997), Constantine (1998b), Gannon et al. (2001), Hall (1946), Hoffmeister (1986), Krutzsch (1954), O'Farrell and Bradley (1977), Simpson (1993).



***Myotis ciliolabrum*** — western small-footed Myotis

**Distribution:** Found throughout the state. In the south, primarily found at the middle and higher elevations (> 1,800 m), although occasionally found at lower elevations. In central and northern part of the State it is more common at valley bottoms (1,050-1,800 m).

**Habitat Characteristics:** Inhabits a variety of habitats including desert scrub, grasslands, sagebrush steppe, and blackbrush, greasewood, pinyon-juniper woodlands, pine-fir forests, agriculture, and urban areas. Current Nevada records indicate this species is distributed between 510-2,760 m (mean = 1,949 m ± 381 m).

**Resident Status:** Year round resident.

**Winter Status:** Hibernates. At least in some areas may tolerate drier and colder hibernacula than some other species. Hibernates individually or in large colonies. A large colony (>100 individuals) was found at a depth of 137 m in an abandoned mine near Eureka (J. S. Altenbach, personal communication).

**Roost Sites:** Roosts have been found in caves, mines, and trees. Roosting preferences expected to be similar to those for *Myotis californicus*.

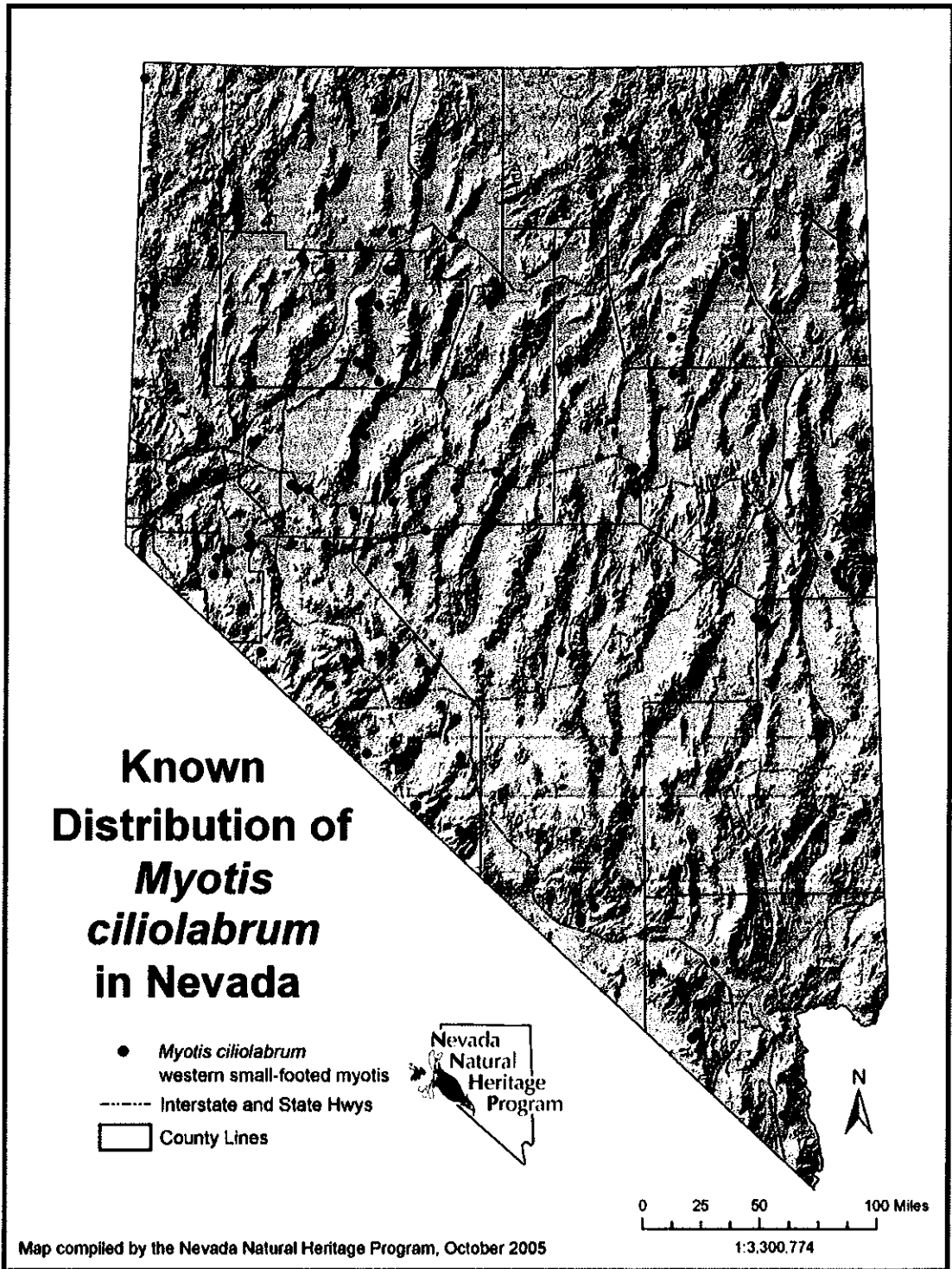
**Reproduction:** One young per year with birth occurring in May to July. Females may form small maternity colonies, generally fewer than 30 individuals, although one maternity roost in the Mojave Desert had more than 50.

**Food Habits:** Food items include small moths, flies, ants, and beetles. Foraging occurs in the open.

**Current Nevada Status:** State unprotected. Widespread and regionally common. Formerly a Category 2 Candidate for federal listing as Threatened or Endangered. BLM: Sensitive. NNHP: G5S3.

**Conservation/Management Issues:** Mine reclamation; renewed mining; recreational caving; water impoundments; timber harvest. Need more information about roosting and foraging requirements, population trends, and acceptance of bat gates. This species looks very similar to *Myotis californicus* (California myotis).

**Relevant References:** Barbour and Davis (1969), Bogan (1974), Bogan et al. (2005), Constantine (1998b), Gannon et al. (2001), Hall (1946), Ports and Bradley (1996), Hoffmeister (1986), O'Farrell (2001c), Ports and Bradley (1996), Tuttle and Heaney (1974).



***Myotis evotis*— long-eared myotis**

***Distribution:*** Found throughout the state, primarily at the higher elevations associated with coniferous forest. More widespread and common in the northern half of the state.

***Habitat Characteristics:*** Primarily a forest-associated species. In southern Nevada, only found in Ponderosa pine or above. Found in pinyon-juniper in the northern portion of Nevada Test Site (D. B. Hall, personal communication). In northern Nevada common in pinyon-juniper and above, but also found in sagebrush and desert scrub habitats. Current Nevada records indicate this species is distributed between 690-3,090 m (mean = 2,072 m ± 342 m).

***Resident Status:*** Year round resident.

***Winter Status:*** Presumed to be non-migratory and to hibernate locally.

***Roost Sites:*** Day roosts in hollow trees, under exfoliating bark, crevices in small rock outcrops, and occasionally in mines, caves, and buildings. Has been found in rim rock in Oregon, in a road cut in southern California, and in a riprap boulder jumble in northern California. Found roosting in juniper snags in New Mexico. Night roosts have been found in caves, mines, and under bridges. Generally roost singly or in small groups.

***Reproduction:*** One young per year with birth occurring in June to July. Females may form small maternity colonies with generally less than 40 individuals. A colony of 200 individuals was found in a cave near Sequoia National Park, CA (P. E. Brown, personal communication).

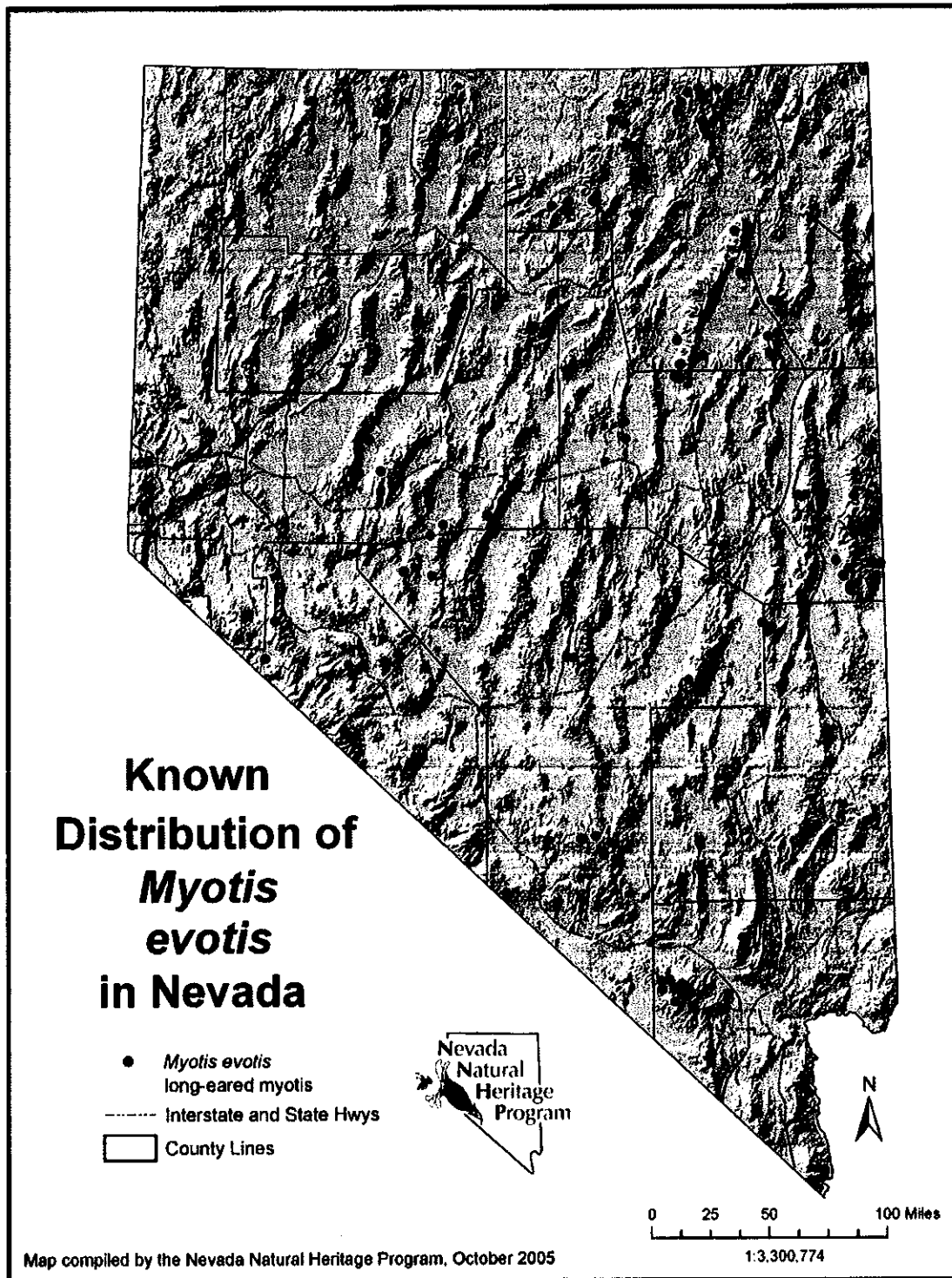
***Food Habits:*** Food items include moths, small beetles, and flies. Foraging occurs near vegetation and the ground. Appears to have a flexible foraging strategy, catching insects by both substrate and aerial pursuit. Forages along rivers and streams, over ponds, and within cluttered forest environment. Night roost use of caves and mines may involve feeding within the structure, gleaning moths from the rock walls.

***Current Nevada Status:*** State unprotected. Widely distributed but uncommon almost everywhere. Status not well understood. May need mature forest in portions of its range. A severe population decline has occurred in the Spring Mountains in southern Nevada (M. J. O'Farrell, personal communication). Formerly a Category 2 Candidate for federal listing as Threatened or Endangered. BLM: Sensitive. NNHP: G5S4.

***Conservation/Management Issues:*** Timber harvest; recreational caving; mine reclamation; renewed mining; water impoundments; highway projects; bridge replacement; building demolition; pest control. More information is needed about population trends, winter roost requirements, winter range, importance of snags, foraging requirements, and use and acceptance of bat gates.

***Relevant References:*** Bogan et al. (2005), Chung-MacCoubrey (1996), Cross (1976), Faure and Barclay (1994), Hall (1946), Manning and Jones (1989), Marcot (1984), Miner et al. (1996), O'Farrell (2002), Ports and Bradley (1996), Vonhof and Barclay (1997).





***Myotis thysanodes*— fringed myotis**

**Distribution:** Found throughout central and southern Nevada. Probably occurs in northern Nevada, as well.

**Habitat Characteristics:** Found in a wide range of habitats from low desert scrub habitats to high elevation coniferous forests. Found from upper elevation creosote bush desert to pinyon-juniper and white fir (2,150 m) in the White Pine Range (White Pine County). Current Nevada records indicate this species is distributed between 420-2,160 m (mean = 1,590 m ± 393 m).

**Resident Status:** Year round resident.

**Winter Status:** Hibernates but capable of periodic winter activity.

**Roost Sites:** Day and night roosts in mines, caves, trees, and buildings. The majority of roosts documented in California have been in buildings or mines. Two small nursery roosts have been found in very cool, wet mines in northern California. A maternity colony of approximately 200 individuals was found in a mine in creosote bush scrub in the Mojave Desert (>750 m; P. E. Brown, personal communication). Two maternity colonies have recently been found in mine adits on the Nevada Test Site in blackbrush habitat (D. B. Hall, 2004, personal communication). Has been radio tracked to tree hollows, particularly large conifer snags in Oregon and Arizona, and rock crevices in cliff faces in southern California. Known hibernacula are generally mines or caves.

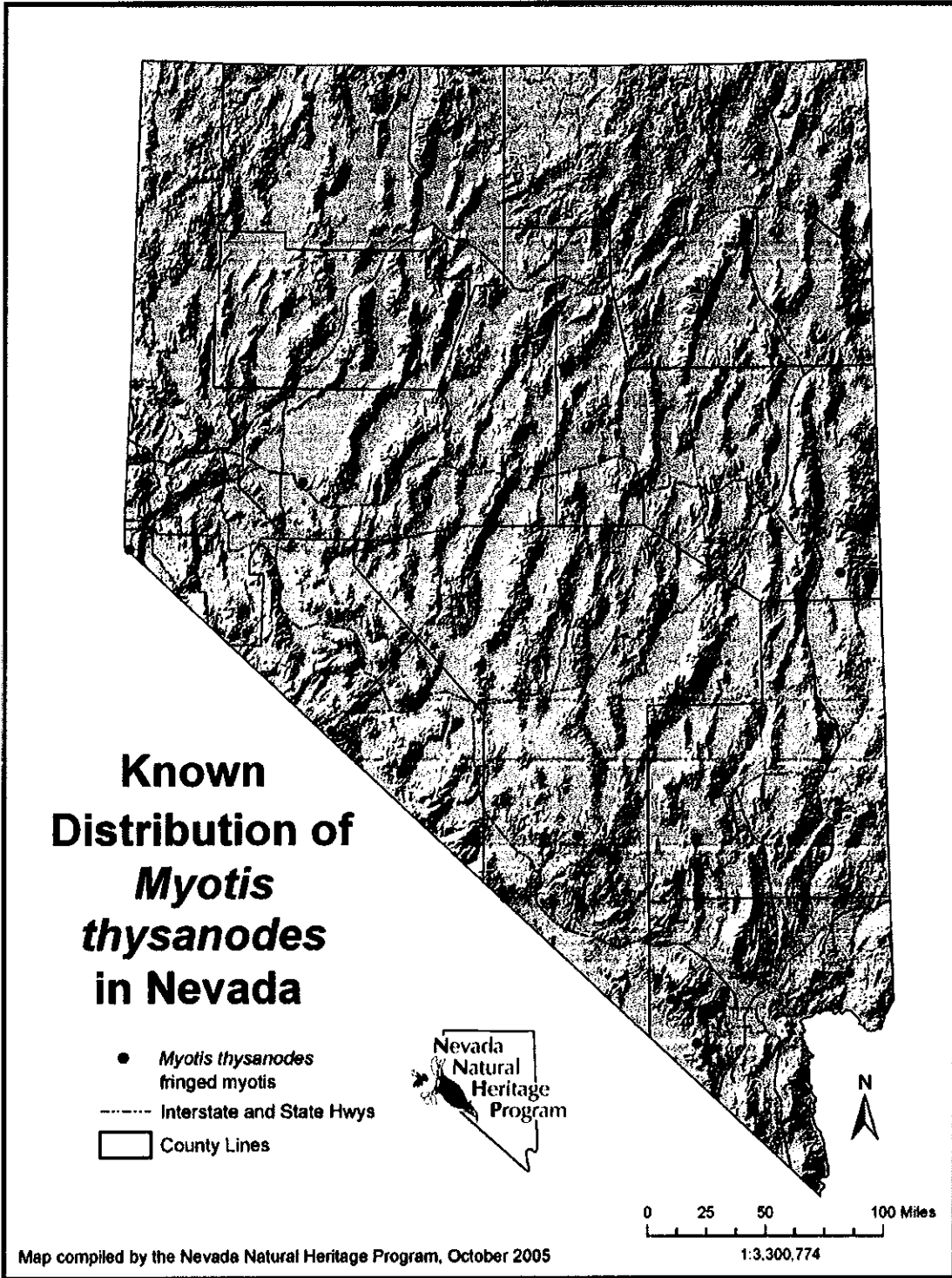
**Reproduction:** One young per year with birth occurring in May to June. Maternity roosts are comprised of adult females and may include several hundred individuals. Males roost singly or in small groups. Hibernating groups contain both sexes.

**Food Habits:** Food items vary but there appears to be a selection for small beetles. Foraging occurs in and among vegetation, with some gleaning activity. Diet is primarily beetles, but includes a variety of other taxa including moths. Radiotracking in southern California suggests foraging along forest edges and over the forest canopy. May fly moderate distances (13km, one-way) to suitable foraging areas.

**Current Nevada Status:** State Protected. Widely distributed but rare in Nevada. Relatively few records but an apparent increase in numbers or area occupied in southern Nevada over the past 20 years. Formerly a Category 2 Candidate for federal listing as Threatened or Endangered. BLM: Sensitive. NNHP: G4G5S2.

**Conservation/Management Issues:** Recreational caving; mine reclamation; renewed mining; water impoundments; building demolition; pest control; timber harvest; bridge replacement. Very sensitive to roost disturbance. Need more information about roosting requirements, particularly winter hibernacula. No major colony locations are known in Nevada – systematic surveys are critical.

**Relevant References:** Bradley and Ports (2005). Chung-MacCoubrey (1996), Deacon et al. (1964), Hall (1946), O'Farrell (2001c, 2002), O'Farrell and Studier (1973, 1975, 1980).



***Myotis volans*— long-legged myotis**

***Distribution:*** Found throughout the State but more widespread and common in the northern half. Occurs from mid to high elevations. Absent from the low desert.

***Habitat Characteristics:*** Found in pinyon-juniper, Joshua tree woodland, and montane coniferous forest habitats. Occasionally found in Mojave and salt desert scrub (D. B. Hall, personal communication), and blackbrush, mountain shrub, and sagebrush. Current Nevada records indicate this species is distributed between 930-3,420 m (mean = 2,067 m ± 420 m).

***Resident Status:*** Probably a year round resident.

***Winter Status:*** Hibernates but has the capability of winter activity. It is suspected that there are elevational and latitudinal movements between summer and winter roosts. Transient colonies in the spring on the east side of the Sierra Nevada.

***Roost Sites:*** Day roosts primarily in hollow trees, particularly large diameter snags or live trees with lightning scars. Also uses rock crevices, caves, mines, and buildings when available. Caves and mines may be used for night roosts. Hibernacula elsewhere are generally mines or caves.

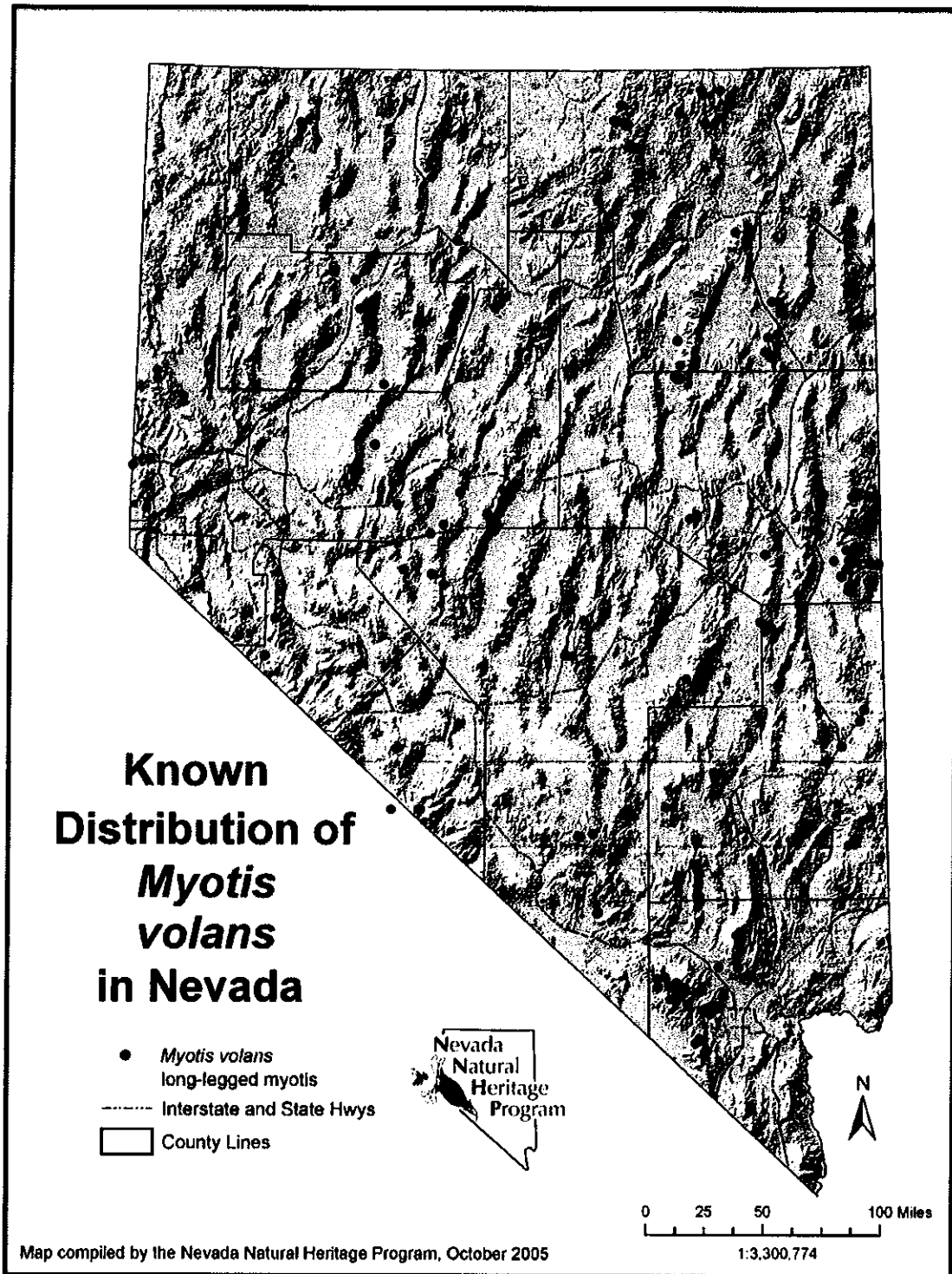
***Reproduction:*** One young per year with birth occurring in June to July. Maternity colonies of up to 200-500.

***Food Habits:*** Feeds primarily on moths but also feeds on other taxa, including beetles, flies and termites. Foraging occurs in open areas, often at canopy height.

***Current Nevada Status:*** State unprotected. Population declines have been observed in the Spring Mountains of southern Nevada (M. J. O'Farrell, personal communication). Formerly a Category 2 Candidate for federal listing as Threatened or Endangered. BLM: Sensitive. NNHP: G5S4.

***Conservation/Management Issues:*** Timber harvest; aerial pesticide spraying; recreational caving; mine reclamation; renewed mining; water impoundments; building demolition and pest control. More information is needed about population trends, roost and foraging requirements, and use and acceptance of bat gates.

***Relevant References:*** Bogan et al. (2005), Chung-MacCoubrey (1996), Fenton and Bell (1979), Hall (1946), Herder and Jackson (2000), O'Farrell and Bradley (1977), Ormsbee (1996), Ormsbee and McComb (1998), Ports and Bradley (1996), Saunders and Barclay (1992), Warner and Czaplewski (1984).



***Pipistrellus hesperus*— western pipistrelle**

***Distribution:*** Found throughout most of the state, primarily in the southern and western portions. Most common in low and middle elevations (1,800 m), although occasionally found at higher elevations (>2,450 m).

***Habitat Characteristics:*** Lower and Upper Sonoran desert habitats of blackbrush, creosote, salt desert shrub and sagebrush, with occasional occurrence in Ponderosa pine and pinyon-juniper, usually in association with rock features such as granite boulders and canyons. Current Nevada records indicate this species is distributed between 210-2,550 m (mean = 1,276 m ± 532 m).

***Resident Status:*** Year round resident.

***Winter Status:*** Hibernates but periodically arouses to actively forage and drink in winter.

***Roost Sites:*** Day roosts primarily in rock crevices but may include mines, caves, or occasionally in buildings and vegetation. Generally roost singly or in small groups.

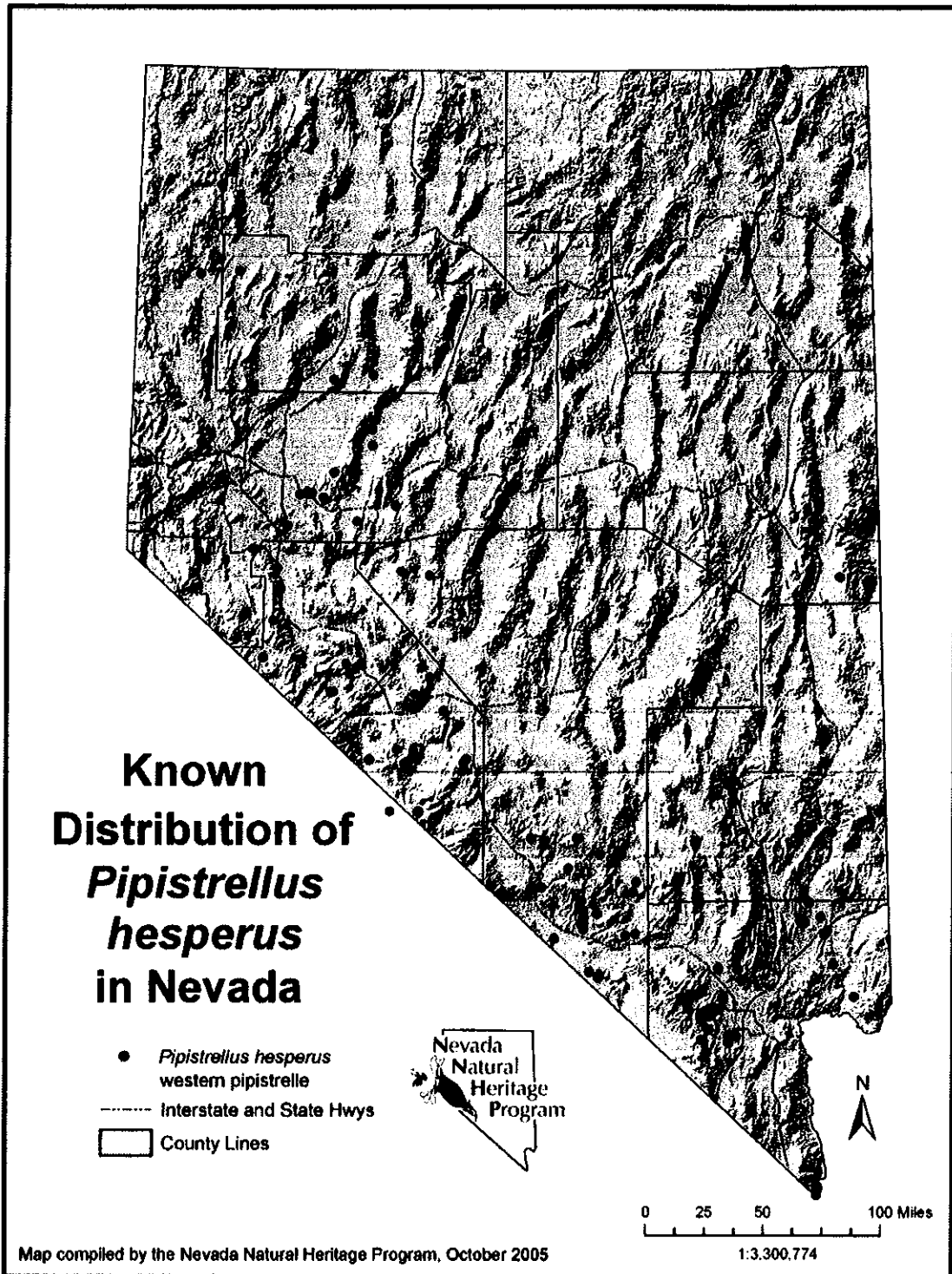
***Reproduction:*** Two young per year with birth occurring in June. Females may form small maternity colonies, usually less than 12 individuals.

***Food Habits:*** Food items include small moths, leafhoppers, mosquitoes, and flying ants. Foraging occurs in the open and is characterized by slow, erratic flight.

***Current Nevada Status:*** State unprotected. Common in appropriate habitat. Population declines have been noted in the Spring Mountains in southern Nevada (M. J. O'Farrell, personal communication). BLM: Sensitive. NNHP: G5S4

***Conservation/Management Issues:*** Destruction of roosting and foraging habitat by urban development; water impoundments; mine closure and reclamation. More information is needed about social structure, roost fidelity and microhabitat requirements, and foraging habits.

***Relevant References:*** Bradley and O'Farrell (1969), Brown (2005), Cross (1965), Hall (1946), Hayward and Cross (1979), Koford and Koford (1948), Moor et al. (1965), O'Farrell and Bradley (1970, 1977), Stager (1943), Von Bloeker (1932).



***Tadarida brasiliensis* — Brazilian free-tailed bat**

**Distribution:** Found through most of the state, ranging from low desert to high mountain habitats.

**Habitat Characteristics:** Found in a wide variety of habitats. Although predominantly a lower elevation species has been found from 220 to > 3,500 m in the Sierra Nevada. Recent acoustic surveys reveal it is more widespread and common, at least in southern Nevada, than previously thought. Current Nevada records indicate this species is distributed between 210-2,550 m (mean = 1,260 m ± 562 m).

**Resident Status:** Summer resident. Recent observations suggest pockets of year-round residents in southern Nevada (M. J. O'Farrell, personal communication).

**Winter Status:** Migrations of 1,840 km are documented for this species (Wilkins, 1989). Migrates away from colder regions and winters in areas with predominantly non-freezing temperatures but has been found to hibernate in northern California. Migratory animals appear to be active in the winter range. Winter activity has been observed recently in the low desert of southern Nevada.

**Roost Sites:** Select a variety of day roosts including cliff faces, mines, caves, buildings, bridges, and hollow trees. Although colonies number in the millions in some areas, colonies in Nevada are generally several hundred to several thousand (largest known colonies have been estimated at ca. 70,000-100,000). Some caves may be used as long term transient stopover roosts during migration. For example, some evidence suggests that the colony at Rose Cave arrives in July and departs in mid October.

**Reproduction:** One young per year, with birth occurring in June to July. Females form large maternity colonies, males segregate and may form smaller bachelor colonies.

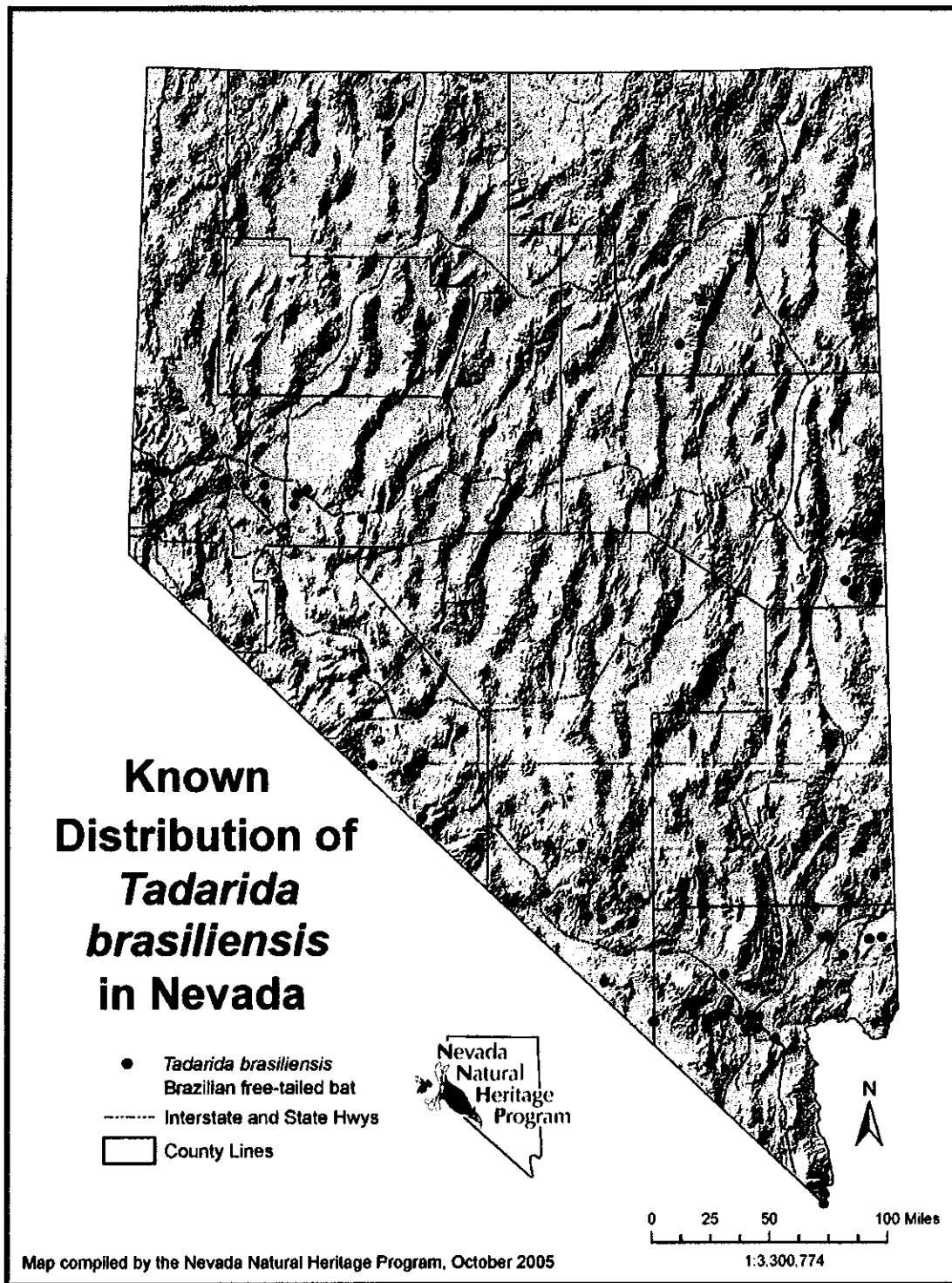
**Food Habits:** Food items include a variety of insects but moths predominate. Foraging occurs in the open and may range to high altitudes. Some individuals are known to travel more than 40 km to reach feeding grounds and feed more than 300 m above the ground.

**Current Nevada Status:** State Protected. Although *Tadarida brasiliensis* is one of the most common species in much of the west, its numbers may be well below what they were historically. A large population decline has been documented for the Rose Guano Cave, near Ely. The decline is likely due to the introduction of a second entrance, thereby altering the cave microclimate and allowing for easy access by humans (P.V. Bradley, personal communication). The artificial adit entrance was sealed in October 1996 in an attempt to reverse the declining population trend. BLM: Sensitive. NNHP: G5S3S4.

**Conservation/Management Issues:** Recreational caving; mine reclamation; renewed mining; historical guano mining; water impoundments; agricultural spraying; bridge replacement; pest control exclusion; highway projects; loss of foraging habitat due to urban/suburban expansion. More information is needed on seasonal patterns. The tendency of this species to roost in very large colonies makes it especially vulnerable to disturbance.

**Relevant References:** Adams and Hayes (2000), Barbour and Davis (1969), Bat Conservation International (2005), Brittingham and Williams (2000), Clark et al. (1996), Cockrum (1969), Constantine (1967), Hall (1946), Hoff et al. (1993), Keeley and Tuttle (1999), McCracken (1996), O'Farrell (1998), Simmons et al. (1978), Roberts et al. (1997), Romano et al. (1999), Texas Parks and Wildlife (2000), Thies et al. (1996), Wilkins (1989).





Eight bats should be considered widely distributed throughout the State: pallid bat, Townsend's big-eared bat, big brown bat, hoary bat, silver-haired bat, western small-footed myotis, long-eared myotis, and long-legged myotis. Six species have distributions limited to only the southern portion of the State: Mexican long-tongued bat, western mastiff bat, Allen's big-eared bat, western yellow bat, California leaf-nosed bat, and big free-tailed bat. Of these, Mexican long-tongued bats, western mastiff bats, western yellow bats, California leaf-nosed bats, cave myotis, and big free-tailed bats are known from only a few localities. Six species have unusual distributions in the state: 1) those with a majority of their records in the western and southern portions of the State, although there are records throughout the State (California myotis, fringed myotis, and western pipistrelle); 2) those having a northern distribution (little brown bat); 3) those having very few records in the northern portion of Nevada (Mexican free-tailed bat); and 4) those species having a patchy distribution, being distributed throughout most of the State but having a majority of the records concentrated in a few areas (Yuma myotis). Finally, there is insufficient data to determine an overall distribution pattern for spotted bats and western red bats.

## Summary of Threats

Threats facing Nevada's 23 bat species can be categorized into those that are primarily human-induced (anthropogenic) and those resulting from natural events and/or the natural history of the species. Threats can be further categorized as those with the potential to affect bat habitats (roosting, foraging, or migration corridor habitats) and those that would have the potential to cause direct bat population declines with no disturbance of habitats. All threats have the potential to affect roosting, foraging or migrating segments of the population. Many threats are interrelated, further complicating conservation issues.

### Anthropogenic Threats

- 1) **Abandoned Mine Closures** - Indiscriminate closure of abandoned mines is recognized as a threat to bats and their habitats. **Fix** - Bat-friendly closure techniques (fencing, hazard signs and gating) should be employed wherever possible. When hard closure techniques are the only option, adequate and proper bat surveys should precede any closure project. When bats are found, proper bat exclusion and off-site mitigation should precede any hard closure project.
- 2) **Renewed Mining in Historical Mine Sites** - Contemporary open pit gold mining often is associated with historical mining districts. Bat habitats have been destroyed when pits have come into contact with and/or totally removed historical mine workings (Brown, 1995). **Fix** - On-site bat exclusion and off-site mitigation.
- 3) **Camping** - When conducted in inappropriate areas, such as within and near riparian habitat, loss of important foraging habitat occurs. **Fix** - Education (See Strategies) and limitation of camping in or near riparian habitat that has been identified as key foraging or roosting sites.
- 4) **Eradication** - State funded projects designed to protect the public from rabies transmission target the elimination of bat colonies. **Fix** - Education.
- 5) **Inventory, Monitoring, and Scientific Research** - Research activities can depress, scatter or extirpate populations of sensitive bat species if conducted inappropriately (Perkins and Schommer 1991). **Fix** - Standardized survey protocol and, new non-intrusive, coordinated survey techniques (new permit requirements may be incorporated).
- 6) **Livestock Grazing** - Certain livestock grazing practices have contributed to the large-scale conversion of mesic riparian bat habitats (Swift, 1984) and xeric upland bat habitats to unproductive wildlife habitat. **Fix** - Improve stewardship of riparian and upland habitats on public and private lands throughout Nevada. Education.
- 7) **Off-Highway Vehicle Travel** - When conducted in inappropriate areas, such as within and near riparian habitat, loss of important foraging habitat occurs. **Fix** - Education and limitation of OHV travel in or near riparian habitat.
- 8) **Pesticide Spraying - Indirect** - Non-target insecticide sprays reduce numbers and species of insects available to bats (Brown and Berry, 1991). **Direct** - Bats may be at risk of direct poisoning as a result of their diets, high metabolic rates, high food intake and high rates of fat mobilization

- during migration, lactation and hibernation (Clark, 1988). **Fix** – Additional research and education (i.e. bats as an alternative to chemical insecticides).
- 9) **Recreational Caving and other Direct Human Disturbance** – Human disturbance during critical maternity, hibernation and leking time periods can depress, scatter and extirpate bat populations (Pierson and Rainey, 1996). **Fix** – Seasonal closures, education and research to determine degree of impacts.
  - 10) **State Regulatory Status** – Fourteen bat species remain unprotected by Nevada State Statute. In Nevada, an individual requires no hunting license to kill unprotected animals (Nevada NRS). **Fix** – Change NRS.
  - 11) **Timber Harvest** – Timber harvest impacts roosting and foraging habitats (Barclay and Brigham, 1996). **Fix** - Modify timber harvest techniques where significant bat roosting and foraging habitats exist and better assess bat use of these habitats in Nevada.
  - 12) **Toxic Material Impoundments** – Lethal concentrations of cyanide in ponds and atop ore piles associated with the processing of gold ore, killed at least 158 bats (species not identified) between 1986 and 1989 (Nevada Department of Wildlife, unpublished data). **Fix** – Preclude access to toxic impounds (using *exclusion netting, etc*) and chemical neutralization of cyanide.
  - 13) **Urban Development** – Loss of habitat to urban development removes natural foraging and roosting habitat. **Fix** – Education. Limit urban development in or around key areas, such as riparian habitat and colonial roosting locations.
  - 14) **Bridge/Highway Construction and Maintenance** – Certain bridges in Nevada provide critical roosting sites for bats. For example, our largest colony of Mexican free-tailed bats occurs in an urban bridge. Loss of these roosting structures can significantly impact bats. **Fix** – Partner with Nevada Department of Transportation and local municipalities to ensure that existing roosting habitat is maintained and during new construction, roosting habitat can be created if appropriate.
  - 15) **Vegetative Conversion/Invasive Species** – Millions of acres of native shrub steppe and thousands of acres of pinyon-juniper habitats have, through the agents of fire, livestock grazing, and mechanical and chemical vegetation manipulation, been permanently converted to monotypic exotic grasslands (*Bromus* and *Agropyron*). Several insect species, which bats rely on for food, such as most *Lepidopterans*, reproduce on shrubs, trees and flowering plants, and not on grasses. **Fix** - Stop the conversion to exotic grasslands and attempt to rehabilitate those areas from exotic to native rangelands.
  - 16) **Water Source Development** – Manipulation of water sources, such as natural springs and seeps, through ground water pumping or development for livestock and wild ungulate use can alter or reduce the amount of natural vegetation available for bats to forage over. Large-scale water transfers and pipelines may also be a significant threat to bats. **Fix** – Education. Research to determine the degree of impacts groundwater pumping has on riparian habitat loss. Partner with appropriate management agencies to ensure that bat conservation is considered in water development projects.
  - 17) **Artificial Water Sources** – Artificial water sources can injure or kill bats if not properly designed and maintained. **Fix** – Ensure that all artificial water sources have a properly installed and designed escape ramp and avoid the use of any obstacles to bats flight paths, such as wooden or wire braces, whenever possible.
  - 18) **Wind Energy Development** – Although research is preliminary (Arnett, 2005), it seems that some species of bats are highly susceptible to injury and death due to collisions with wind turbines. This is especially true for migrating species. Difficulty of detecting dead bats at wind turbine sites complicates this issue. **Fix** – Rigorous monitoring should be included in any wind turbine project to learn to what degree wind turbines are having an effect on local bat populations. As more details are learned, management and mitigation can be designed accordingly.

**Natural Threats**

- 1) **Behavioral Ecology** – The roosting behavior of most bats makes them highly vulnerable to disturbance. Such congregations place a large proportion of the population at risk from a single disruptive event. **Fix** – Protect roosts, and limit opportunities for anthropogenic disturbance.
- 2) **Population Ecology** – Low birth rates, high infant mortality, high roost fidelity, high longevity make most bat populations vulnerable to roost and foraging habitat disturbances and limits their ability to rebound quickly from population declines. **Fix** – Protect roosts and foraging habitats and limit opportunities for anthropogenic disturbance.
- 3) **Habitat Threats** – The loss of roosting and foraging habitats to natural erosion and fire is a factor. **Fix** – Rehabilitate areas damaged by fires and erosion.
- 4) **Predation** – Minor predation of bats by snakes, birds of prey and carnivores has been documented in Nevada. **Fix** – None – this is part of the natural ecosystem.

**Current Agency Designations for Bats Occurring in Nevada:**

Scientific Name	Common Name	USFWS	BLM	USFS	State	Grank	Srank
<i>Choeronycteris mexicana</i>	Mexican long-tongued bat	xC2				G4	SA
<i>Macrotus californicus</i>	California leaf-nosed bat	xC2	N,C	C	Sensitive	G4	S2
<i>Antrozous pallidus</i>	pallid bat		N,C	I	Protected	G5	S3
<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	xC2	N,C	S,I,L	Sensitive	G4	S2
<i>Eptesicus fuscus</i>	big brown bat		N			G5	S4
<i>Euderma maculatum</i>	spotted bat	xC2	S	S	Threatened	G4	S2
<i>Idionycteris phyllotis</i>	Allen's big-eared bat	xC2	N		Protected	G3G4	S1
<i>Lasionycteris noctivagans</i>	silver-haired bat		N			G5	S3
<i>Lasiurus blossevillii</i>	western red bat		N	I	Sensitive	G5	S1
<i>Lasiurus cinereus</i>	hoary bat		N			G5	S3
<i>Lasiurus xanthinus</i>	western yellow bat					G5	S1
<i>Myotis californicus</i>	California myotis		N			G5	S4
<i>Myotis ciliolabrum</i>	western small-footed myotis	xC2	N,C			G5	S3
<i>Myotis evotis</i>	long-eared myotis	xC2	N,C			G5	S4
<i>Myotis lucifugus</i>	little brown bat		N			G5	S3
<i>Myotis thysanodes</i>	fringed myotis	xC2	N,C		Protected	G4G5	S2
<i>Myotis velifer</i>	cave myotis	xC2	N,C			G5	S1
<i>Myotis volans</i>	long-legged myotis	xC2	N			G5	S4
<i>Myotis yumanensis</i>	Yuma myotis	xC2	N,C			G5	S3S4
<i>Pipistrellus hesperus</i>	western pipistrelle		N			G5	S4
<i>Eumops perotis</i>	greater western mastiff bat	xC2	N,C		Sensitive	G5	S1
<i>Nyctinomops macrotis</i>	big free-tailed bat	xC2	N			G5	S1S2
<i>Tadarida brasiliensis</i>	Brazilian free-tailed bat		N		Protected	G5	S3S4

**U. S. Fish and Wildlife Service (USFWS) Categories for Listing under the Endangered Species Act:**

<C2 Former USFWS Category 2 Candidate, now species of concern

**Bureau of Land Management (BLM) Species Classification:**

- S Nevada Special Status Species - USFWS listed, proposed or candidate for listing, or protected by Nevada state law
- N Nevada Special Status Species - designated Sensitive by State Office
- C California Special Status Species (see definition S and N)

**United States Forest Service (USFS) Species Classification:**

- S Region 4 (Humboldt-Toiyabe NF) sensitive species
- I Region 5 (Inyo NF) sensitive species
- L Region 5 (Lake Tahoe Basin Management Unit) sensitive species
- C Region 5 sensitive species, not yet known from Inyo NF or Lake Tahoe Basin Management Unit

**Nevada Natural Heritage Program Global (Grank) and State (Srank) Ranks for Threats and/or Vulnerability:**

- G Global rank indicator, based on worldwide distribution at the species level
- T Global trinomial rank indicator, based on worldwide distribution at the subspecific level
- S State rank indicator, based on distribution within Nevada at the lowest taxonomic level
  - 1 Critically imperiled and especially vulnerable to extinction or extirpation due to extreme rarity, imminent threats, or other factors
  - 2 Imperiled due to rarity or other demonstrable factors
  - 3 Vulnerable to decline because rare and local throughout its range, or with very restricted range
  - 4 Long-term concern, though now apparently secure; usually rare in parts of its range, especially at its periphery
  - 5 Demonstrably secure, widespread, and abundant
- A Accidental within Nevada
- B Breeding status within Nevada (excludes resident taxa)
- H Historical; could be rediscovered
- N Non-breeding status within Nevada (excludes resident taxa)

## TREE ROOSTING HABITAT (TR)

### *General Distribution*

Tree roosting habitat is found throughout the State in two primary locations: riparian areas across all elevations and mountain/valley regions above 1,500 m. Riparian woodland areas that offer suitable roosting habitat for bats are found at elevations as low as 150 m along the Colorado River, to 3,000 m or more at springs and in mountainous regions.

### *Riparian woodland areas*

Riparian woodland habitat in Nevada is associated with major river systems, streams, springs, or seeps occurring primarily below 3,000 m in the state. While there are an estimated 15,470 springs or seeps known in Nevada (M. O'Brian, personal communication; Geographic Names Information System), there are only five primary river systems: the Humboldt, Truckee, Carson, Walker, and Colorado Rivers and their tributaries. Total riparian habitat in Nevada is estimated at 110,800 hectares (ha; Nevada GAP Analysis, 1996). Woodland riparian habitat accounts for only a small fraction of the total riparian habitat available.

Dominant woody plant species in riparian woodland habitat includes cottonwoods (*Populus fremontii*, *P. angustifolia*), willows (*Salix* spp), water birch (*Betula occidentalis*), thinleaf alder (*Alnus tenuifolia*) and buffaloberry (*Shepherdia argentea*). Additionally, in southern Nevada velvet ash (*Fraxinus velutina*), desert willow (*Chilopsis linearis*), seep willow (*Baccharis salicifolia*) and mesquite (*Prosopis glandulosa* and *P. pubescens*) are also common plants in desert washes and riparian habitat. A number of bat species, including the Lasiurines, are known to roost in cottonwoods and palm trees. Observations of bats roosting in other riparian tree species in the State are lacking due to insufficient surveys.

Non-native California fan palms (*Washingtonia filifera*) occur along the Muddy River, and today exist primarily at the headwaters in the upper Moapa Valley and as ornamental landscaping plants in urban areas. This habitat provides the only known roosting location in the state for western yellow bats (*Lasiurus xanthinus*). However, additional research is expected to identify western yellow bats roosting secondarily in other riparian woodland species. For example, recent acoustic surveys along the Las Vegas Wash has regularly documented western yellow bats. Tamarisk (*Tamarix ramosissima*) is an aggressive exotic tree found in Nevada's river systems throughout the entire state. Hoary bats have been documented roosting in tamarisk stands in the Las Vegas Wash (J. A. Williams, personal communication) and in Palo Verde (P. E. Brown, personal communication). Russian olive (*Elaeagnus angustifolia*) is another successful exotic tree that has invaded the riparian communities of Nevada, and is most prevalent in the Great Basin.

### *Upland woodland areas*

Mountain and valley regions above 1,500 m in the State are inhabited by a variety of tree species that provide roosting resources for bats. Dominant species include Joshua tree (*Yucca brevifolia*), singleleaf pinyon pine (*Pinus monophylla*), juniper spp. (*Juniperus osteosperma* and *J. scopulorum*) and mountain mahogany (*Cercocarpus ledifolius*) on more xeric sites from 1,500 to 3,000 m. More mesic, higher elevation sites are dominated by larger pines (*Pinus longaeva*, *P. flexilis*, *P. ponderosa*, *P. jefferyi*, *P. albicaulis*), fir (*Abies concolor*, *A. lasiocarpa*, *Pseudotsuga menziesii*) and spruce (*Picea engelmannii*) from 1,500 m to tree line. In the Great Basin, aspen (*Populus tremuloides*) is found in patches between 1,800 m and 3,000 m, primarily where soil moisture is favorable. Bats are known to roost in singleleaf pinyon pine, juniper, and various large pine species. Observations of bats roosting in aspen in Nevada are limited. However, it is suspected that exfoliating bark is a significant roost habitat for some species. Further study is needed.

### *Historical and Current Condition*

Riparian areas are among the most disturbed habitats in the southwestern U.S.. Two decades ago, Swift (1984) estimated that riparian habitats have been reduced by more than 80% in the arid west and mid-west. Cottonwood trees alone are estimated to have been reduced 70-95% from their historical distributions only a century ago (Braatne et al., 1996). Riparian areas are extremely susceptible to anthropogenic disturbances, including water impoundments, urban and agricultural development, recreation, and livestock grazing.

Forested upland habitats above 1,500 m in the State are in varying degrees of health. Fire suppression, livestock grazing, exotic plant and animal introductions and historical mining practices, including the destruction of tens of thousands of hectares for charcoal production, have contributed to the current landscape condition.

Fire regimes should be restored to their proper historical level, taking into consideration the needs of nearby roosting bats. In some cases, fire may have deleterious impacts to local populations of bats. If timed poorly, smoke from a fire could kill substantial numbers of bats. A large fire may cause a substantial portion of a foraging habitat adjacent to a maternity roost to become unusable to forest gleaning species and may cause tree-roosting species to lose roost sites.

### *Opportunities for Conservation*

Where riparian areas occur, opportunities to manage or curtail disturbance should be considered. The popularity of these habitats in combination with their fragile state should be accounted for in conservation management planning efforts. Where historical riparian areas no longer exist, management efforts should be initiated to restore habitats or mitigate for their loss.

In forested uplands, management techniques should be altered to accommodate appropriate fire and timber management techniques, limitation of livestock grazing, and control and management of exotic species introductions. Restoration projects should emphasize management towards healthy woodland communities with a goal of restoring woodlands in Nevada to their historic distribution and abundance on the landscape. Forest plans should address bat habitat conservation (e.g. old growth, snags per acre, foraging habitat, bat diversity, etc.).

### ***Priority Bat Species***

#### *Primary Conservation Strategy*

- silver-haired bat
- western red bat
- hoary bat
- western yellow bat
- big brown bat
- Allen's big-eared bat
- California myotis
- western small-footed Myotis
- long-eared myotis
- little brown bat
- fringed myotis
- long-legged myotis

#### *Secondary Conservation Strategy*

- pallid bat

Townsend's big-eared bat  
 Yuma myotis  
 Brazilian free-tailed bat

<b>CONSERVATION STRATEGY:</b>	<b>TREE ROOSTING HABITAT</b>
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<b><i>OBJECTIVE – Maintain stable or increasing populations of woodland/forest bats that roost in tree foliage, snags or exfoliating bark throughout their range in Nevada through 2015.</i></b>
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**Strategy:** *Initiate research and monitoring to provide information on life history, population status and trends, location of key concentrations and conservation needs of woodland/forest bats using tree foliage, snags and exfoliating bark.*

**Action:** Identify and map key woodland/forest and riparian areas with concentrations of roosting bats. Identify woodland/forest and riparian areas with suitable features for bat roosting, and initiate surveys of likely sites to delineate the comprehensive distribution of tree roosting bats.

**Action:** Incorporate radio-telemetry and acoustic studies to locate key woodland/forest and riparian use areas. Document bat use, including number and location of roosts, roost fidelity, frequency of changes in roost occupancy, and associated foraging requirements to better understand bat use of woodland/forest stands and riparian areas and use to design practical conservation strategies.

**Action:** Identify the features of snags and woodland/forest and riparian stands that provide preferred bat roosting habitat for silver-haired bat, western red bat, hoary bat, western yellow bat, big brown bat, Allen's big-eared bat, California myotis, western small-footed Myotis, long-eared myotis, little brown bat, fringed myotis, and long-legged myotis (e.g. snags, tree species, age of timber stand, leaf litter, etc.).

**Action:** Document the importance of snags in woodland/forest and riparian habitats to the life history of Townsend's big-eared bat, pallid bat, Yuma myotis, and Brazilian free-tailed bat in Nevada.

**Action:** Conduct regular monitoring of key maternity and hibernation sites through the implementation of multi-agency coordinated monitoring plans to better understand the tree roosting requirements of bats in the State.

**Action:** Conduct routine and systematic bat surveys in likely habitat to inventory and document long-term population trends.

**Strategy:** *Conserve important roosting populations of woodland/forest and riparian bats.*

**Action:** Conserve and protect sites exhibiting substantial use by tree roosting bats. Conservation should focus on the suite of roosts used by bats within their ecological neighborhood (including day roosts, night roosts, and foraging/water areas). Site-specific peak activity periods may vary based on latitude and elevation.



**Action:** Identify historical locations of cottonwood galleries within current and historical riparian areas of Nevada's water sources and historical locations and conditions of woodland/forest habitats in Nevada.

**Action:** Promote the re-establishment and conservation management of cottonwood trees in riparian areas where cottonwood has been extirpated in Nevada, while demonstrating the importance of existing and potential cottonwood galleries in Nevada's riparian habitats. Protect existing stands of cottonwood trees from overgrazing, gravel mining, urbanization, and other non-natural deleterious threats.

**Action:** Document the importance of different seral stages of forest types for tree roosting bats and manage for the long-term maintenance of these resources. The importance of older seral stage living trees and the different decay classes of snags should be identified. Conservation of the important tree roosting resources bats require should be incorporated into forest management practices.

**Action:** Design and implement stand restoration projects that provide for the needs of roosting bats and incorporate these projects into land management planning efforts, particularly forest management plans, timber harvest plans, and riparian restoration plans.

**Action:** Evaluate land use and habitat modification projects in woodlands/forests for impacts to roosting bats. Provide expert input into the project design to ensure that bat habitat requirements are met. When unavoidable impacts occur within the project design, whenever possible, mitigate impacts by ensuring the availability of suitable roosting resources nearby.

**Action:** Design and implement conservation plans to maintain suitable roosting habitat in woodland/forest and riparian areas.

**Action:** Include known locations of important roost sites in regional fire prevention plans for consideration in fire management practices.

**Action:** Western yellow bats roost in California fan palms (*Washingtonia filifera*) in southern Nevada. The extent of these stands needs to be delineated. In sites where no or a negotiable conflict exists with critical habitat management of the endangered Moapa Dace (*Moapa coriacea*), incorporate remaining western yellow bat roost sites into land management-planning efforts, particularly riparian restoration plans. In such areas, achieve and maintain good to excellent condition of dead palm fronds. Continue to survey other areas with established California fan palms to document new occurrences of western yellow bats.

**Strategy:** *Create and implement an education program featuring the conservation of woodland/forest roosting bats.*

**Action:** Educate landowners and managers regarding the effects of management activities on bat populations through workshops, bulletins, and training.

**Action:** Develop a Position Statement from the Nevada Bat Working Group that outlines preferred roosting and foraging habitat for woodland/forest roosting species. The position statement would be provided to land-use agencies when comments to forest harvest plans are solicited.

***Assumptions - Research and Monitoring Needs***

The nature and extent of the use of trees for roosting is not well-documented in Nevada for any tree roosting bat including pallid bat, Townsend's big-eared bat, big brown bat, California myotis, western small-footed Myotis, little brown bat, fringed myotis, long-legged myotis, and Yuma myotis although several of these species have been well-studied in woodland habitats in other areas such as in Arizona and British Columbia. In California, Townsend's big-eared bats are known to roost in large trees that provide cave-like conditions. It is assumed that trees, particularly those on the eastern front of the Sierra Nevada and subalpine coniferous forests of the Great Basin may provide similar habitats in Nevada. Further research is necessary.

Data suggest a substantial decline in western red bat population levels throughout its range. This species has been encountered in recent sampling efforts with less frequency than it was historically. This is especially alarming considering researchers have much more efficient methods of sampling bats currently than historically. Although multiple factors are suspected, the drastic decline of cottonwood tree galleries in the western U.S is considered the prime factor affecting this obligate tree-roosting species. Recent acoustic surveys have increased the known distribution of the western red bat in Nevada. Although this species was thought to be a short-term seasonal migrant for the state, preliminary evidence indicates some protracted use throughout the summer months. The importance of leaf litter as roosting habitat is suggested from work conducted on the Eastern Red Bat.

Throughout its range, there is very little known about the roosting requirements of the western yellow bat. In southern Nevada, as well as other parts of its range, this species is known to heavily prefer roosting in the dead leaf skirts of palm trees. In Texas it has been observed roosting in the dead leaf skirts of yucca foliage. Within palm groves, research suggests that this species prefers exceptionally dense stands of palm tree groves. Future research should target identifying macro- and micro-roosting habitat requirements.

Allen's big-eared bat is found only in southern Nevada from a few locations with most being concentrated in the southern portion of the Spring Mountains in Clark County. Throughout its range, the distribution appears patchy. The species appears to breed in coniferous forest and winter at lower elevations. Two populations have been found breeding at low elevations in Arizona. During breeding, use of exfoliating bark appears to be important, with multiple roosts being used throughout a single season. Recent surveys in the Spring Mountains have documented fewer occurrences of Allen's big-eared bats than previous surveys had. The current status of the species is in question.

While most records of silver-haired bats have been during spring and fall migration periods, there is sufficient evidence that silver-haired bats are resident and breeding within the state. For example, 21 individuals of both sexes, including adults and juveniles were captured at a single spring in northeastern NV. Four lactating females were captured at McDonald Creek confirming that there is a maternity colony of silver-haired bats in high elevation (7200ft) mixed coniferous/deciduous forest (Bradley 2004). Although not confined to riparian woodlands, the majority of records indicate reliance upon these habitat corridors during migration. Occurrence of silver-haired bats in prior years within the upper Moapa Valley is in stark contrast to their absence throughout 2000 while intensive sampling occurred.

A possible summer resident at some localities throughout the state, hoary bats also migrate through the State in spring and presumably fall using riparian corridors and other wooded areas. Spring migration records of hoary bats have mostly documented females. As with other tree-roosting species, hoary bats are difficult to sample, particularly during migration. In other states, hoary bats have been documented to roost in coniferous forests. Similar forests in Nevada should be surveyed.

As with many species, historical records of California myotis and western small-footed Myotis found in tree roosts are exceedingly rare. This is suspected to be a result of sampling biases, as there have been very few tree roosting studies of any bat species within Nevada. We do know now that the western

small-footed *Myotis* will use boreal forest habitats, contrary to what Hall suggested in 1946.

Long-eared myotis are widespread throughout Nevada in upper elevation woodlands and forests. However, with the possible exception of pinyon-juniper forest habitats in the limestone mountain ranges of White Pine County and eastern Elko County, they tend not to be abundant anywhere. They do not form large roosts and appear to alternate roosts frequently. Population declines have been noted in the Spring Mountains of Clark County, possibly due to degradation of water sources. Additional information is needed on the specific requirements of the long-eared myotis as they relate to the structure and condition of pinyon-juniper forests in Nevada.

Long-legged myotis are widespread throughout Nevada in upper elevation woodlands and forests. Trees comprise the main maternity roosts. Although common, no studies have been conducted on population trends. Because it is a common and widespread species, declines in population trends could provide an early warning for other species utilizing the same resources.

There has been no known roosting studies conducted on tree-roosting bats in Nevada. The macro- and micro-habitat roosting requirements of tree roosting species in this state is critical information that needs to be determined in order to adequately include these species in land and wildlife management plans.

## **WATER SOURCE FORAGING AND WATERING HABITAT (WS)**

### *General Description*

Water sources within desert environments are critical for several wildlife species, including bats. Bats, birds and large ungulates come from distances of up to several kilometers to meet physiological water requirements. Water sources in Nevada's deserts are essentially magnets for bats, and at least partially determine the distribution and abundance of some of Nevada's bat species. Water sources in Nevada available to bats are either natural (e.g., springs, streams, rivers, wetlands, ponds and some lakes) or artificial (e.g., troughs, spring boxes, reservoirs, some lakes and urban pools).

Many insectivorous bats concentrate their activities around riparian and wetland habitats associated with water sources as riparian areas support high concentrations of insect prey (Brigham and Fenton 1991; Grindal et al 1999). Grindal et al. (1999) found that bat activity was 40 times greater in riparian habitat at all elevations than in upland areas. Ports and Bradley (1996) found that high elevation tree roosting bat species in eastern Nevada use habitats of coniferous and/or deciduous trees associated with open water in the form of beaver ponds, stock tanks, perennial streams and springs for foraging and drinking. Hall (2000) conducted acoustic road surveys in four different areas from Mojave Desert to Great Basin Desert habitat on the Nevada Test Site, and found that approximately 90% of all bat activity occurred at water sources.

Physiologically, bats are necessarily drawn to water for maintenance of water balance during key times of the year. At the hottest and driest time of the year throughout Nevada, female bats are pregnant and subsequently lactating. Energy and water demands are quadrupled during late pregnancy and lactation (Studier et al., 1973). During the winter, a number of species are periodically active (O'Farrell and Bradley, 1969). These species have special adaptations that allow activity at low ambient and body temperatures (Bradley and O'Farrell, 1969; Hirshfeld and O'Farrell, 1976; Nelson et al., 1977; O'Farrell and Bradley, 1977; O'Farrell and Schreiweiss, 1978). The proximate cause of winter activity is water balance and the need for periodic drinking for survival through the winter (O'Farrell and Bradley, 1977).

It should be noted that not all bats roost near a water source, nor require access to drinking water. Therefore, an area without a water source is not necessarily devoid of bats.

### *Springs/Riparian/Wetlands*

Ephemeral and perennial water should be accessible to bats. Springs are among the most widespread of the water source types, and are defined as groundwater that flows to the surface with small standing pools or sheeting flow. The majority of bats utilize both developed and undeveloped springs. Most springs serve as vital resources for bats. As bats drink on the wing, springs with accessible water offer drinking resources. Regardless of water accessibility, most springs rated in good to excellent condition sustain riparian vegetation resulting in a far richer insect fauna than surrounding upland areas. Bats congregate around these riparian areas due to the rich foraging base. Those spring riparian habitats rated in poor to fair condition typically sustain an insect forage base more reminiscent of surrounding upland habitats. Springs are a critical winter resource for several species of bats including, but not limited to: western pipistrelle, California myotis, Townsend's big-eared bats, fringed myotis and pallid bats (O'Farrell and Bradley, 1970, 1977; O'Farrell et al., 1967; M. J. O'Farrell (personal communication)]. Springs should be maintained in good ecological condition and managed at their point of origin.

When springs are developed using stock tanks or similar equipment, water should be kept available for in-flight drinking. Covers, lattice work, excessive wires, or similar structures can make artificial water sources unavailable to bats in flight and may cause injury or death. In areas with multiple springs relatively close to each other, it is important to realize that not all of these springs need to offer open

surface area for bats to drink from. This provides the land manager with more flexibility to manage these types of springs for multiple taxa or uses.

### *Stream/Riparian*

Riparian streams, both small and large, including large irrigation channels (e.g., those found in the Fallon/Fernley area) offer both water and foraging habitat for bats. Flowing channels of water, both ephemeral and perennial, offer valuable drinking sources for most bat species.

Hoary bats, western red bats and silver-haired bats, among others, require stream riparian systems for roosting, in addition to drinking and foraging. Regardless of water accessibility, most stream riparian habitats rated in good to excellent condition sustain riparian vegetation resulting in a richer insect fauna than surrounding upland areas. Bats congregate around these riparian areas due, in part, to the rich foraging base. Those stream riparian habitats rated in poor to fair condition sustain an insect forage base more reminiscent of surrounding upland habitats. Although data are inadequate to fully understand the dynamics and importance of riparian stream systems for bats, preliminary information indicates a richer, more diverse fauna than previously known (Williams, 2001).

### *Lakes and Reservoirs*

As with any water source, lakes, ponds, and reservoirs are important to bats. In particular, Yuma myotis and little brown bat require large ponds, reservoirs, and lakes for foraging habitat, and are typically found foraging 10-20 cm above the water surface (M. J. O'Farrell, personal communication).

### *Artificial Water Sources*

Artificial water sources can benefit wildlife by providing water in areas devoid of any natural source. Artificial water sources come in a variety of forms, including round stock tanks, rectangular troughs, and even old tractor tires. Open water tanks can be modified by placing a fence down the middle to separate two grazing pastures, or using various wires and boards to strengthen the trough. Water levels within these tanks can vary considerably. Some artificial water sources include a variety of escape ramps, including floating boards, rock piles, and ramps.

Bats typically drink on the wing during flight. Bat use rates at artificial water sources can be very high, with a new bat swooping in to drink every second (BCI, 2005). Depending on the shape, number of modifications, and water level, some artificial water sources can be a source of mortality for bats. Bat Conservation International (BCI) is currently studying this issue and plans on a peer-reviewed, technical document, complete with recommendations, to be produced in early 2006. Preliminary studies have shown artificial water sources with modifications such as wires across the top that impede direct flight patterns are a source of mortality for bats, as are troughs with low water levels. Other studies have shown that it typically takes more attempts for bats to successfully drink from modified structures when compared to unmodified structures, increasing the bat's chance of injury or death (Tuttle et al. in review). Coupled with water sources that either have no escape ramp or have inadequate escape ramps, water troughs can be a threat.

Preliminary recommendations have been developed by BCI based on results from their study. These recommendations include: (1) Escape ramps should be firmly attached to the rim, and extend all the way to the bottom of the water development; (2) Ramps should be made of grippable, durable, non-slick material like expanded metal grating; (3) Ramps should be positioned to intercept animals swimming along the trough edge/perimeter; (4) Ramps should not allow animals to be trapped underneath or behind the escape ramp and should have a maximum angle of 45 degrees; and (5) Obstacles such as wooden or wire braces crossing the surface of the water or fencing separating two pastures should be minimized as much as possible. Also, because low water levels can increase the chances of injury to bats, maintaining full water troughs is ideal.

*Threats to Water Source Foraging and Watering Habitat*

Anthropogenic disturbances that pose negative effects to water sources directly or indirectly affect these wildlife species. Bats and the foraging and roosting resources they require should without doubt be considered when dealing with management of water resources. Examples of threats to these sites include flow regulation or impediment, improper fire management practices, OHV use, improper grazing, large scale water transfers and pipelines, and habitat loss due to unfavorable habitat manipulation.

***Priority Bat Species****Obligates*

pallid bat  
 Mexican long-tongued bat  
 Townsend's big-eared bat  
 big brown bat  
 spotted bat  
 western mastiff bat  
 Allen's big-eared bat  
 silver-haired bat  
 western red bat  
 hoary bat  
 western yellow bat  
 California leaf-nosed bat  
 California myotis  
 western small-footed Myotis  
 long-eared myotis  
 little brown bat  
 fringed myotis  
 cave myotis  
 long-legged myotis  
 Yuma myotis  
 big free-tailed bat  
 western pipistrelle  
 Brazilian free-tailed bat

**CONSERVATION STRATEGY: WATER SOURCE FORAGING AND WATERING HABITAT**

***OBJECTIVE – Maintain healthy, available water sources for resident and migratory bat populations throughout the State by 2015.***

***Strategy:***     *Rehabilitate, maintain, and/or restore water sources in the State that bats frequent.*

**Action:** Identify and map springs, streams and lakes that bats frequent or have frequented in the past.

**Action:** Maintain bat access to these watering sites throughout the year, where appropriate.

**Action:** Coordinate with local entities to ensure that waters remain flowing to developed springs or stream riparian habitats during critical time periods, with emphasis on parturition, lactation and possibly, winter water stress periods.

**Action:** Negotiate conservation easements for protection and reestablishment of natural healthy conditions at springs and seeps, where possible.

**Action:** Manage for clean water sources at aforementioned sites by eliminating point source and non-point source pollutants, reducing upland erosion and maintaining stable bank-armoring vegetation on stream banks.

**Action:** Where liquids are ponded that are toxic to bats (e.g. cyanide ponds and ore dumps in gold processing operations, or oil field ponds), prevent access to and use of the ponds by bats.

**Action:** Initiate research to investigate the correlation between bat health and pesticide and herbicide levels in water sources, including chemicals from mining operations.

**OBJECTIVE – Maintain high quality foraging habitat adjacent to water sources for resident and migratory bat populations throughout the State by 2015.**

**Strategy:** *Restore, rehabilitate, maintain and/or enhance historical riparian habitat at spring heads, along stream corridors, and around other water sources throughout Nevada.*

**Action:** Identify and map water sources that bats frequent or have frequented in the past.

**Action:** Manage for good to excellent condition of aforementioned riparian habitats.

**OBJECTIVE – Use water sources in the design of a statewide all-bat monitoring program through 2015.**

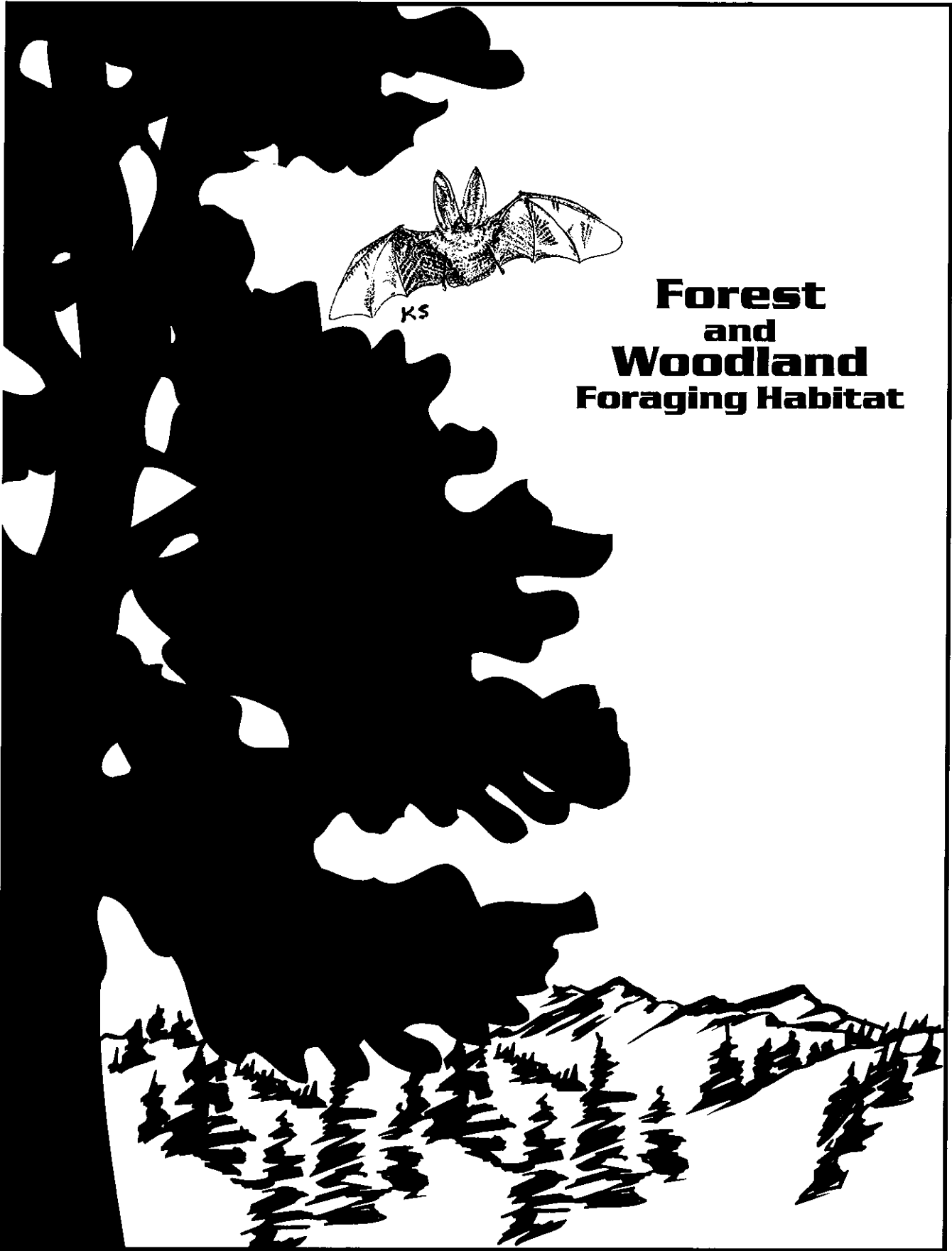
**Strategy:** *As part of a statewide all-bat monitoring project, employ a survey grid system at an appropriate scale (e.g., 1:100,000 m grid system) using passive long-term acoustic monitoring systems to identify long-term bat population and species composition trends throughout the state.*

**Action:** Array at least 60 spring and/or stream riparian survey sites (one near each grid intersection) across Nevada.

**Action:** In choosing sites, stratify water source locations to provide an equal effort in appropriate habitat types and elevation zones, placing additional emphasis on unusual sites (e.g. large size, habitat heterogeneity, etc). Consider the availability of historical bat data for candidate sites, the long-term viability of the available water sources and whether or not sites may provide a representative sample of the region.

**Assumptions - Research and Monitoring Needs**

It is assumed that most of Nevada’s bats are water source obligates and that healthy, available water and productive riparian habitat benefits most of Nevada’s bat species. Further research is needed to better define species/ habitat relationships. It is assumed that Yuma myotis and little brown bat require access to moderate or larger-sized bodies of water as key elements of their natural history.



**Forest  
and  
Woodland  
Foraging Habitat**





## FOREST AND RIPARIAN FORAGING HABITAT (FW)

### General Description

#### *Cottonwood, Willow and Alder*

Gallery cottonwood, willow and alder woodlands are primarily found along drainage systems with perennial water sources. Tree species within this habitat type can vary greatly from south to north and east to west in Nevada. However, most appear to provide comparable bat foraging habitat analogs throughout the state. Species of bats that roost in these types of woodlands, including western red bats, hoary bats and silver-haired bats, require these habitats for foraging as well. This type of riparian woodland habitat provides roosting and foraging habitat for several other bat species, including California myotis, long-eared myotis, little brown bat, long-legged myotis, cave myotis, big brown bats and Townsend's big-eared bats (Bradley, 2000a; Brown and Berry, 2003; Ports and Bradley, 1996). Woodland riparian habitat corridors are also critical resources for annual migrations of all three Lasiurine species, the silver-haired bat, and likely other species as well. Patches of cottonwoods and willows have been shown to furnish diverse and rich foraging sites for many species of bats (M. J. O'Farrell, personal communication).

#### Mesquite Bosque

Mesquite bosque habitat can be found along wash systems in the southern portion of the state. Spotted bats, western red bats and California myotis spend significant amounts of time in this habitat, presumably foraging (Williams, 2001).

#### Coniferous Forests and Woodlands

Coniferous woodlands of pinyon, juniper and mahogany as well as larger forests of pine, fir and spruce are found from 1,500 m to tree line near 3,500 m. Tree species within this elevation range vary greatly from south to north and east to west in Nevada. However, most of these forest types appear to provide comparable bat foraging habitat analogs throughout the state. Long-legged myotis and long-eared myotis appear to be dependent on pinyon-juniper, mountain mahogany, white fir and subalpine fir habitats for both roosting and foraging. The hoary bat has been observed roosting in Utah juniper trees in Nevada (J. A. Williams, personal communication) and has been observed spending a considerable amount of foraging/roosting time in Rocky Mountain juniper in east-central Nevada (P.V. Bradley, unpublished data), and in a mixed subalpine fir/aspen habitat type in extreme northern Nevada (M. A. Ports, unpublished data). One study found that female Townsend's big-eared bats concentrate their foraging activities within conifer forests of Utah juniper, Rocky Mountain juniper, mountain mahogany, little leaf mahogany, white fir, Englemann spruce, and bristlecone pine in August in east-central Nevada (Bradley, 2000a). Some individuals showed a high fidelity for foraging areas, returning night after night to the same pinyon/juniper stand, as far as 10 km from their maternity roost. This same telemetry data indicated no use of bajada shrub lands of sagebrush, salt desert shrub, valley bottom wetlands or agricultural lands (Bradley, 2000a). In western Arizona, Allen's big-eared bats have been observed traveling 40km one way to forage in pinyon-juniper habitat (Brown and Berry, 2004a,b). Two Townsend's big-eared bats were observed foraging at tree line in krumholz bristlecone pine and Engelmann spruce, some 1,600 m above their maternity roost at the pinyon-juniper/sagebrush ecotone.

### **Threats to Forest and Riparian Foraging Habitat**

Much of this type of foraging habitat is in degraded condition throughout the state. Many riparian areas are severely impacted by water diversions, improper grazing, altered flood regimes, dams, and competition with exotic species. Woodlands and forests are subject to degradation from fire suppression, vegetation conversions (particularly after catastrophic fires), and fragmentation. Mesquite bosque

habitats are rapidly being lost due to urban expansion, water regime alterations, and competition with exotic species. These factors affect available foraging habitat to varying degrees throughout the state with respect to quality as well as quantity. Ideally, these types of habitats should be restored or maintained in the highest quality state possible, not only benefiting bats that use the area, but also numerous other wildlife species.

Anthropogenic disturbances that pose negative effects to these habitats also certainly have the likelihood of directly or indirectly negatively affecting wildlife species. Bats and the foraging and roosting resources they require should be considered when managing natural fires and conducting fire management practices, OHV planning efforts, and habitat manipulation efforts, including for example, forest thinning practices.

### ***Priority Bat Species***

#### ***Primary Conservation Strategy***

Townsend's big-eared bat  
 spotted bat  
 Allen's big-eared bat  
 silver-haired bat  
 western red bat  
 hoary Bat  
 western yellow bat  
 California myotis  
 western small-footed Myotis  
 long-eared myotis  
 long-legged myotis  
 fringed myotis  
 western mastiff bat

#### ***Secondary Conservation Strategy***

big brown bat  
 little brown bat  
 big free-tailed bat  
 cave myotis  
 Yuma myotis

## **CONSERVATION STRATEGY: FOREST AND WOODLAND FORAGING HABITAT**

### ***OBJECTIVE – Maintain, enhance and/or restore forest/woodland and riparian bat foraging habitats throughout the State by 2015.***

**Strategy:** *Rehabilitate and/or maintain historical riparian woodland and mesquite bosque foraging corridors.*

**Action:** Identify and map existing and extirpated riparian woodland and mesquite bosque corridors.

**Action:** Manage corridors for good to excellent condition by controlling livestock grazing, recreational use, and discouraging the installation of new gravel mining operations and urbanization in woodland corridor floodplains and mesquite bosques.

**Action:** Restore existing riparian woodland corridors and mesquite bosques to healthy, productive, and self-sustaining conditions and reestablish extirpated riparian woodland sites to healthy, productive, and self-sustaining conditions.

**Strategy:** *Maintain a healthy mix of coniferous forest/woodland foraging habitats across the state.*

**Action:** Encourage the establishment of native plant communities following fire by seed application and by encouraging post-fire controls on livestock and feral horse grazing across the state.

**Action:** Restore woodlands that have been converted to exotic invasive annual grasslands.

**Action:** Where invasive exotic grasses and forbs are not an issue, encourage a natural fire regime to provide for the different seral stages of forest/woodland communities.

**Action:** Where invasive exotic grasses and forbs, such as cheatgrass and tumble mustard, have converted large tracts of sagebrush steppe (usually *Artemisia tridentata wyomingensis* below 30 cm rainfall) into unproductive rangeland, suppress wild land fires where applicable. Work in conjunction with land managers and encourage proper rehabilitation and temporary grazing closures on fire climax cheatgrass ranges.

**Action:** Conduct research (including using radio-telemetry) to determine an appropriate buffer zone around important Townsend's big-eared bat, long-eared myotis, western small-footed Myotis and long-legged myotis maternity and night roosts in pinyon-juniper woodland and subalpine coniferous forest designed to protect woodland foraging habitats near roosts. Once appropriate buffer zones are determined, these should be afforded high priority fire suppression in regional fire plans.

**Action:** Conduct research to determine how woodland management programs, such as mechanical and chemical removal of forest canopy, affect roosting and foraging practices of bats. Findings will help direct future woodland management practices, so that they may be conducted with minimal negative, and potential positive impacts to bats.

### ***Assumptions - Research and Monitoring Needs***

It is assumed that observations made of several bat species foraging in Nevada's woodlands are representative of a larger phenomenon. Many gaps exist in our knowledge of the foraging requirements for most species of bats. Further research is needed to better define species/habitat relationships.