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Fringed Myotis (Myotis thysanodes pahasapensis): Species Conservation Assessment

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Fringed Myotis
(*Myotis thysanodes pahasapensis*)

A Species Conservation Assessment
for
The Nebraska Natural Legacy Project

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The mission of the Nebraska Natural Legacy Project is to implement a blueprint for conserving Nebraska's flora, fauna and natural habitats through the proactive, voluntary conservation actions of partners, communities and individuals.

Purpose

The primary goal in development of at-risk species conservation assessments is to compile biological and ecological information that may assist conservation practitioners in making decisions regarding the conservation of species of interest. The Nebraska Natural Legacy Project recognizes the fringed myotis (*Myotis thysanodes pahasapensis*) as a Tier I at-risk species. Provided are some general management recommendations regarding the fringed myotis. Conservation practitioners will need to use professional judgment to make specific management decisions based on objectives, location, and a multitude of variables. This resource was designed to share available knowledge of the fringed myotis that will aid in the decision-making process or in identifying research needs to benefit the species. Species conservation assessments will need to be updated as new scientific information becomes available. Though the Nebraska Natural Legacy Project focuses efforts in the state's Biologically Unique Landscapes (BULs), it is recommended that whenever possible, practitioners make considerations for a species throughout its range in order to increase the success of conservation efforts.

Common Name	Fringed Myotis
Scientific Name	*Myotis thysanodes pahasapensis*
Order	Chiroptera
Family	Vespertilionidae
G-Rank	G4G5T2
S-Rank	S1
Goal	7
Distribution	Limited
Criteria for selection as Tier I	G2
Trends since 2005 in NE	Unknown
Range in NE	Pine forests in panhandle, including the Pine Ridge, Wildcat Hills, and Pine Bluffs area
Habitat	Ponderosa pine forests and woodlands, green ash-elm-cottonwood woodlands, cliffs and buttes
Threats	Unknown Climate Change Vulnerability Index: Moderately vulnerable (NatureServe 2013)
Research/Inventory	Conduct surveys to assess distribution and abundance; identify maternal roost and winter hibernacula habitat requirements; track movement patterns using telemetry
Landscapes	Pine Ridge, Wildcat Hills, and possibly other BULs in the panhandle

Status

According to the last review in 1996, the fringed myotis has a state Heritage status rank of S1, U.S. national status of N2, and global conservation rank of G4G5T2 (NatureServe 2009). The species is considered to be imperiled (NatureServe 2009). The Nebraska Natural Legacy Science Team set a goal of maintaining at least seven populations in the state (Schneider et al. 2011).

Principal Threats

Threats specific to the fringed myotis in Nebraska have not been documented. Threats to bats include disturbance, such as timber harvest or intense fire resulting from heavy fuel accumulation (Schmidt 2003), of roost sites (e.g., maternity, hibernacula, night, day), habitat alteration, overexposure to toxic insecticides, and poaching and poisoning by humans (Racey and Entwistle 2003, Keinath 2004, USGS 2006). Disturbance (even loud noise; Schmidt 2003) during pre-parturition is an important risk factor for bats (Schmidt 2003). Morrell and others (1999) found that bats that roost in ponderosa pine forests can suffer reduced reproductive success when intensive forest management takes place during summer months. Loss of foraging habitat has been a particular problem to bats living in temperate climate (Walsh and Harris 1996a, 1996b; Lacki and Baker 2007). Stream alterations and degraded wetlands reduce functioning riparian corridors that normally offer safe passageways for bats traveling from roosting sites to foraging grounds (Keinath 2004). Additionally, while "in general, the conservation community supports the development of wind energy as a means of reducing the impacts of climate change…. no energy source has yet been found to be without some degree of environmental costs and wind energy is no exception" (NGPC 2011). Wind energy development has the potential for substantial harm to migratory bats, but it is important to note that local, non-migratory species have also been observed dead under wind turbines (Johnson et al. 2003, Kunz et al. 2007, Arnett et al. 2008), indicating the likeliness of negative impacts to the fringed myotis. Another threat that is not yet prevalent in Nebraska but could likely become a concern in coming years is the fungal disease known as white-nose syndrome.

Description

Fringed myotis has brown fur with a paler ventral side (Lewis 1992). The posterior edge of the tail membrane has a fringe of light-colored hairs extending beyond the tail membrane (Lewis 1992). *M. t. pahasapensis* has larger ears, shorter forearms, and a smaller, narrower skull than the other subspecies (USGS 2006). The word "myotis" is derived from the bat appearing to be mouse-eared (Lewis 1992). Ears are 16–20 mm (1 in) and wingspan is 265–300 mm (10.4–11.8 in) (USGS 2006). Adults weigh 5.5–8.5 g (Lewis 1992).

Habitat and Range

M. t. pahasapensis is a geographically isolated subspecies that is resident year-round (migration may occur over relatively short distances to lower elevations; O'Farrell and Studier 1980) in southwestern South Dakota, eastern Wyoming, and western Nebraska (Hall 1981, Lewis 1992, NatureServe 2009). Distribution of *M. thysanodes* may be contracting regionally (Keinath 2004). *M. t. pahasapensis* has been documented in Jackson and Lawrence counties of South Dakota (Jones and

Choate 1978) and in Banner, Dawes, and Sioux counties of Nebraska; only one was reported in Keya Paha County east of Valentine (Czaplewski et al. 1979, Schmidt 2003).

In the Nebraska panhandle, the fringed myotis probably uses cliffs, buttes, and coniferous trees as roost sites (Panella 2010, Schneider et al. 2011). Lacki and Baker (2007) documented that selection of pine snags as roosting sites was relatively uncommon in comparison to other choices available to *M. thysanodes* in the Pacific Northwest. However, it is plausible but not confirmed that *M. t. pahasapensis* selects pine snags more frequently because of availability of these roosting objects in the bat's range relative to other options. For example in north-central Arizona, Warner (1985) frequently captured *M. thysanodes* (42% of bat species netted) in a ponderosa pine landscape. If snags are used for roosting, they may be larger in diameter-breast-height (>69 cm dbh) than surrounding trees (Barclay and Brigham 2001, Chambers et al. 2002, Lacki and Baker 2007) and have spaces created beneath peeling bark (Rabe et al. 1998). In northwest Arizona, roost snags were among forests consisting of a high density of diverse tree species with larger basal area than forests around random snags (Rabe et al. 1998). Roost snags may also have greater slope and/or be closer to water than random snag sites (Rabe et al. 1998). Pregnant females may choose lower elevations because of decreased precipitation and warmer temperatures (Cockrum et al. 1996, Cryan et al. 2000, Keinath 2004). They also may select horizontal crevices in rocks more often than vertical crevices (Lacki and Baker 2007). Crevice openings selected by the bats are likely to face southeast or southwest (Cryan 1997).

Bats use a variety of roosts. In some cases, bats will use buildings and bridges as roost structures (Lacki and Baker 2007). For example, fringed myotis was captured in a building at Fort Robinson in Nebraska and found in bridges in New Mexico (K. Geluso, unpubl. data). Adam and Hayes (2000) evaluated bridge types to find that bats chose most often concrete cast-in-place bridges for night roosting, possibly because the wall design best conserved heat by restricting air flow. Day roosts can differ from night roosts (Richardson 2002). Night roosts are used for resting between feedings and may be suitable locations for winter hibernation (Richardson 2002). Lacki and Baker (2007) found that roosts in the Pacific Northwest were normally within 1.4 km of a stream, likely because proximity to a water source influences the availability of an adequate prey base and offers hydration needed by maternity colonies with lactating females (Keinath 2004). The fringed myotis may roost with other bat species (O' Farrell and Studier 1980, Keinath 2004).

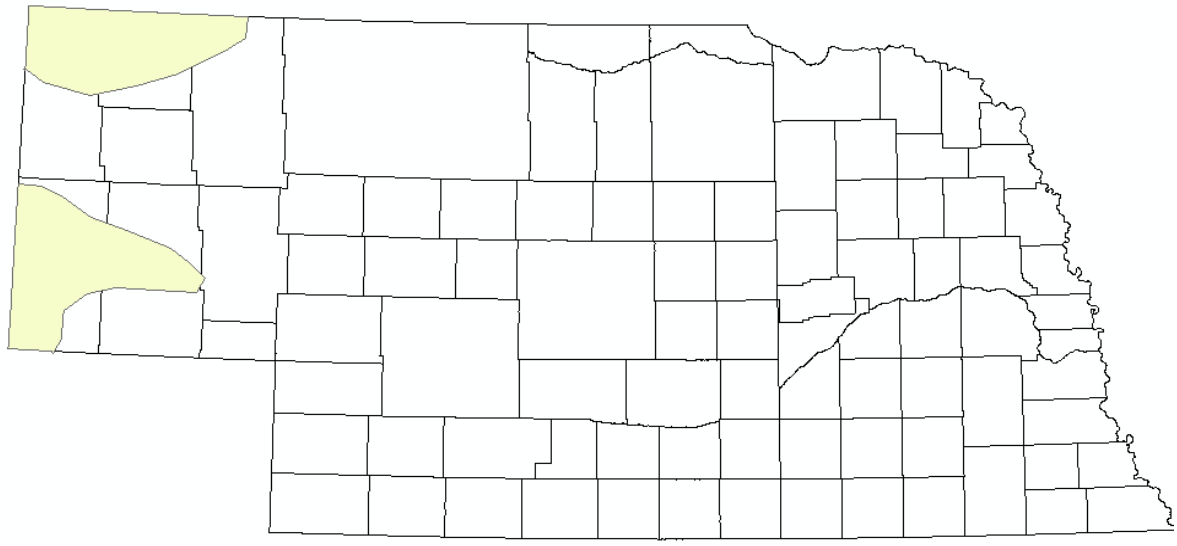

FIGURE 1. Current range of fringed myotis in Nebraska based on field observations, museum specimens, and expert knowledge. Map courtesy of Nebraska Natural Heritage Program, Nebraska Game and Parks Commission.

Area Requirements

M. thysanodes may regularly travel approximately 1.6 km (Lacki and Baker 2007); however, bat populations have a highly variable home range based on prey source and environmental variables (de Jong 1994, Keinath 2004). Bats will use multiple roosts (Lacki and Baker 2007). Nearest roost is typically 0.55 km away from another roost (Keinath 2004). Lactating females generally do not travel as far from roosting sites as males to forage (Keinath 2004). A reasonable estimate for the home range of *M. thysanodes* may be 38.3 ha (Keinath 2004). The bats may display higher fidelity to general locations of roosts than to actual roosts (Weller and Zabel 2001, Keinath 2004). No detailed information on local density estimates was found.

Foraging

M. T. pahasapensis is insectivorous and may consume up to half its body weight in one night (Whitaker 1988, Lewis 1992). Beetles (Black 1974, Rainey and Pierson 1996) and moths (Whitaker et al. 1977) may be the most important constituents of the diet (Turner and Jones 1968, AZGFD 1997, Keinath 2004). Diet of *M. thysanodes* is thought to vary regionally because of differences in prey availability (Kunz 1982). Bat fecal samples can be analyzed to determine specific local food items (Schmidt 2003).

In intermittent stream habitat of northwestern California, Seidman and Zabel (2001) found *M. thysanodes* foraging most often near streams median 7.0 ± 1.2 m wide than along medium 1.9 ± 0.0 m wide channels. It is expected that *M. thysanodes* begins foraging by 1 hour after sunset (Cockrum and Cross 1964, Weller and Zabel 2001) in habitats different but not disassociated from roosting habitats (Waldien and Hayes 2001, Keinath 2004). Food consumption peaks in preparation for winter hibernation

(O'Farrell et al. 1971, Keinath 2004). Daily torpor may be used by males when food resources are somewhat scarce and as means of energy conservation (Keinath 2004).

Reproduction

Generally, bat mating behavior starts in the fall and continues into winter (Panella 2010). Male bats of some species are known to mate with multiple females (Richardson 2002). Females store sperm in their bodies, and ovulation and fertilization are delayed until late winter or early spring (Richardson 2002). Pregnant females select warmer roosts than males in order to aid in the development of embryos; clustering also creates more warmth and can offer advantages in avoiding predators (Richardson 2002). A female may produce one young per year, normally in June or July; gestation is 50–60 days (O'Farrell and Studier 1980, USGS 2006). A group of females known as a maternity colony raises the offspring (Lewis 1992). Young are relatively precocial, capable of flight around 2.5–3 weeks of age (O'Farrell and Studier 1973, O'Farrell and Studier 1980, Keinath 2004). Mating does not occur again until the young wean (Keinath 2004). It is uncertain as to when *M. thysanodes* becomes sexually mature, but based on observations of lack of testicular activity, breeding may not take place until 2 years of age (O'Farrell and Studier 1980, Keinath 2004). O'Farrell and Studier (1973) thought mortality of neonates was ~1% at a maternity colony of *M. thysanodes* in New Mexico. Banding studies indicate a lifespan of at least 11 years (Paradiso and Greenhall 1967, Wilson and Ruff 1999), but maximum longevity is likely 20–30 years based on mark-recapture estimates of other North American *Myotis* species (Lewis 1992, Keinath 2004).

Research and Conservation Strategies

Taking action and doing it smartly and quickly can prevent extinctions. In recent times, failure to act until it was too late led to the loss of a bat species, the Christmas Island pipistrelle, known to be in sharp decline over many years before its ultimate demise (Martin et al. 2012). A multitude of factors should be considered before implementing any conservation actions for species. Within the guidelines of state and federal law, the Nebraska Natural Legacy Project recommends: 1) consider, but do not limit options to, scenarios that benefit both the species of interest and property owners, 2) consider species dispersal and landscape context, 3) plan for multiple years, and 4) do no harm.

In Nebraska, conservation considerations should be made for the fringed myotis in at least two Biologically Unique Landscapes: Pine Ridge and Wildcat Hills. The Nebraska Natural Legacy Project identified these landscapes as places that offer the best opportunities for conservation of the species in the state based on current knowledge. Given the principal threats identified, research and conservation efforts for the fringed myotis (summarized in Table 2) may want to employ the following management strategies:

1) Disturbance to roosts can negatively impact bat populations; therefore, roost protection is an important step one can take to protect the fringed myotis (Keinath 2004). Avoid intensive forest management during summer months in pine forests where bats are roosting (Morrell et al. 1999). Also, disruption of hibernation can be deadly to bats because they will be unable to find adequate food to replace expended energy (Lewis 1992). Models have stressed the importance of the protection of maternity colonies, in particular, in supporting population viability (Keinath

2004). Do not promote prescribed burning within 0.25-mile radius of active maternity roosts or hibernacula (Pierson et al. 1999). Restricted access to sites with roosting bats may be necessary to provide adequate protection to this at-risk species (Lewis 1992).

2) Make habitat management considerations for bats at a landscape-level. Accommodate for the variety of habitats needed for roosting, embryonic development, hibernation, protection from predators, migration, and foraging. (Keinath 2004). Priorities include the maintenance of old growth forest, with protection for larger dbh and cavity-forming trees (Keinath 2004). In ponderosa pine – mixed forests, a mean density of approximately 7–10 snags/ha could benefit the bats (Rabe et al. 1998). Maintain snags with loose bark, and consider thinning young trees to improve growth rates of remaining trees (Rabe et al. 1998). Stop declines of old growth forest and maintain corridors for safer bat navigation between roosting and foraging locations. Use timely prescribed fire. Discourage wind power development in areas frequented by bats.

3) Care in placement of turbines and associated infrastructure away from known bat roosting, foraging, migratory, and maternity areas is highly recommended to decrease likelihood of direct and indirect negative impacts to bat species (Panella 2010, NGPC 2011).

4) Reduce chemical exposure (Keinath 2004). A number of chemicals, including 'PCBs, lead, cadmium, blue-green algal toxins, effluent from cyanide extraction gold mines, and impounded sewage' (Keinath 2004), have been shown to affect bats (Clark and Shore 2001). Also, prey populations may be reduced from pesticides. Chemicals that target mosquitoes may impact other insects as well (Keinath 2004).

5) Maintain awareness about white-nosed syndrome (e.g., prevention, symptoms, transmission, damage control). The Wildcat Hills could become important as an isolated site where *M. t. pahasapensis* could be more protected from the fungus (Frick et al. 2010, K. Geluso, unpubl. data).

6) Use approved techniques to monitor populations (Keinath 2004). The use of mist nets and/or radiotransmitters can facilitate data collection of age, sex, fecundity, and habitat associations (Lacki and Baker 2007). While not perfect, acoustic monitoring during suitable environmental conditions is one option used to detect bat species and trends over time. One would normally want to conduct bat surveys during the summer months. Levels of bat activity can vary substantially from one day to the next and from year to year (Geluso and Geluso 2012), so multiple survey nights in multiple years are often required to adequately assess an area as potential bat habitat (Keinath 2004). Population monitoring will aid in the evaluation of the effectiveness of management actions.

7) Focus conservation efforts on maintaining and improving habitat. Captive propagation and reintroduction are not recommended at this time (Keinath 2004). If populations drastically decline, then intensive measures may be appropriate to prevent extirpation. Artificial roosts (e.g., resin, wood) may be used on a temporary or experimental basis to supplement bat habitat (Chambers et al. 2002).

8) Share facts about bats that dispute unfavorable stereotypes. It is accurate to say that bats ingest large quantities of insects, including those that are considered pests (Lacki et al. 2007).

Bats can benefit agriculture and gardens by fertilizing the ground and providing some level of control against insects (Lewis 1992, Rainey et al. 1992, Keinath 2004, Boyles et al. 2011). The estimated dollar value of bats to agriculture is in the billions per year (Boyles et al. 2011)! Additionally, several advances in the medical field have come from bat research (Lewis 1992). Bats do not attack hair (Lewis 1992). Caution should always be used when people come into contact with bats, but transmission of rabies from bats to humans is uncommon (Keinath 2004).

9) Numerous USDA-NRCS Farm Bill Programs might be used to benefit the fringed myotis, but each management approach should be scientifically tested, including:

CRP- CP 3, 3A, 11, 22, 29;
EQIP-528 – Prescribed Grazing, 314 – Brush Management, 666 – Forest Stand Improvement, 380 – Windbreak and Shelterbelt Establishment, 612 – Tree – Shrub Establishment, 650 – Windbreak and Shelterbelt Renovation;
WHIP – Wildlife Habitat Incentive Program;
FRLPP – Farm and Ranch Land Protection Program;
and WILD Nebraska.

Availability of programs may vary annually.

Information Gaps

Because of the nocturnal behavior of bats, research and data on them are scarce compared to many other groups of vertebrates such as birds. For conservation of the fringed myotis, it is important to find and protect known roosting sites, understand hibernacula availability and specifications, and understand seasonal activities and timing of reproductive activities (SDBWG 2004). Characteristics of possible migrations (Schmidt 2003) and foraging grounds (e.g., structure, species composition) are not well documented (Keinath 2004). Abundance estimates are unclear and long-term population data are unknown (Keinath 2004). Obtaining demographic information on the species could help biologists determine long-term viability of populations (Schmidt 2003). Little information of conflicting findings exists regarding the effects of grazing on bats (Chung-MacCoubrey 1996, Rabe et al. 1998, Schmidt 2003).

Considerations for Additional Species

At-risk species that share habitat with the fringed myotis should be considered in management plans for the bat. Conservation of the fringed myotis may affect or be influenced by at-risk species that can be found in the same Biologically Unique Landscapes as the bat. Table 1 lists a sample of at-risk species you may want to consider while planning for fringed myotis habitat. This list will not apply to all sites that *M. t. pahasapensis* occupies nor is the list all-inclusive.

TABLE 1. At-risk and other species identified in the Nebraska Natural Legacy Project that inhabit biologically unique landscapes with the fringed myotis (Schneider et al. 2011) may necessitate consideration in habitat management plans.

Animals

American Beaver (*Castor canadensis*)
Rocky Mountain Bighorn Sheep (*Ovis canadensis canadensis*)
Ferruginous Hawk (*Buteo regalis*)
Pinyon Jay (*Gymnorhinus cyanocephalus*)
Short-eared Owl (*Asio flammeus*)
Mottled Duskywing (*Erynnis martialis*)
Tawny Crescent (*Phyciodes batesii*)
Plains Topminnow (*Fundulus sciadicus*)

Plants

Dog-parsley (*Lomatium nuttallii*)
Matted Prickly-phlox (*Linanthus caespitosus*)

TABLE 2. Summary of suggested management for the fringed myotis in Nebraska. These are general guidelines based on the best available knowledge at the time of this publication. See Research and Conservation section of this document for more detail and Reference section for sources of additional information.

FOCUS	STRATEGIES	MITIGATION and CONSIDERATIONS
Inventory	Improve survey methods. Document distribution in Nebraska and obtain measure of abundance. See Geluso and Geluso (2012) for a better understanding of variable capture rates/population estimates	Mist net (during calm weather) and/or use ultrasonic detectors near known roosts or water sources in late spring – late summer. Molecular genetics from collected fecal pellets can be used to determine presence/absence of species (Ormsbee et al. 2002). A combination of survey methods may be needed based on objectives.
Prevent roost disturbance	Protect roosts, particularly maternity roosts. Consider restricting human access at roost sites to avoid bat abandonment.	Survival of reproductive females is the most important contributor to population viability. Sensitive to roost disturbance and human handling.
Maintain/improve habitat for roosting and foraging (large tree dbh, loose bark, and higher density of snags most important; Rabe et al. 1998)	Evaluate landscape matrix over approximately 38 ha of bat activity. Support habitats that minimize distances between roosting and foraging sites to lessen energetic expenditure. Habitat work is best within 1.6 km of known roosts (including man-made roosting structures). Conserve forest edge and wetlands 1–4 km apart from one another and from roosts. Maintain 7–10 snags > 69 cm dbh with exfoliating bark per hectare. Maintain travel corridors (e.g., fence rows and riparian buffers).	Warm (not hot) roosting sites that offer protection from predators are needed for maternity colonies. Locations near water support an abundant source of insects for food. Bats can benefit from increased foraging opportunities at wetland sources created by beaver dams. Snag maintenance will benefit numerous bird species as well.
Use prescribed fire to maintain thinned areas with tree snags, cavities, and crevices	Conduct prescription burns away from maternity roosts, not during pre-parturition of the species and only when fuel load is not heavy.	If intense wildfire occurs, it will for a time, decimate habitat for the bats as well as many other species

TABLE 2. (Cont.)

FOCUS	STRATEGIES	MITIGATION and CONSIDERATIONS
Recommend appropriate placement of wind turbines	Avoid placement in sensitive areas where bats are most likely to be negatively impacted	Consider roosting, foraging, and migration behavior.
Prevent and minimize bats' exposure to chemicals and disease	Discourage heavy use of pesticides near bat roosts and foraging grounds. Prevent pollution of waterways (establish/maintain riparian filter strips and implement wetland protection measures). Prevent transmission of white-nose syndrome (can even transfer on clothes laundered in standard fashion).	Chemicals targeted at mosquitoes may also kill other insects. Bats can use riparian corridors for navigation and foraging. Bat researchers/biologists should be diligent in defense against white-nose syndrome. Decontamination protocol available at: whitenosesyndrome.org
Education	Inform: Benefits agriculture and gardening by reducing pests and fertilizing with nitrogen-rich guano; benefits medical advances. A healthy bat that is not threatened does not attack or fly into a person's hair.	Contact with bats should be cautious, as with any wild animal, but transmission of rabies from bats to humans is rare. Bites/scratches should be treated immediately by a medical professional.

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