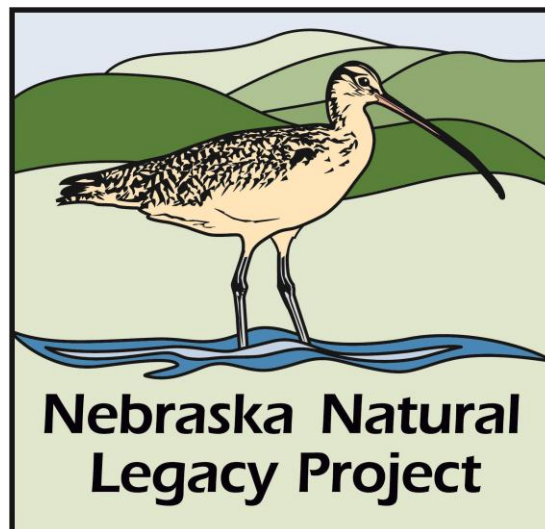


Bailey's Eastern Woodrat
(Neotoma floridana baileyi)

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 Bailey's eastern woodrat (*Neotoma floridana baileyi*) as a Tier I at-risk species. Provided are some general management recommendations regarding Bailey's eastern woodrats. Conservation practitioners will need to use professional judgment for specific management decisions based on objectives, location, and site-specific conditions. This resource was designed to provide an overview of our current knowledge of Bailey's eastern woodrats and may aid in decision-making for their conservation or in identifying research needs for the 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.

<u>Common Name</u>	Bailey's Eastern Woodrat	<u>Scientific Name</u>	<i>Neotoma floridana baileyi</i>
<u>Order</u>	Rodentia	<u>Family</u>	Cricetidae
<u>G-Rank</u>	G5T3	<u>S-Rank</u>	S2
		<u>Goal 10</u>	<u>Distribution</u>
			Endemic
<u>Criteria for selection as Tier I</u>	Endemic		
<u>Trends since 2005 in NE</u>	Increasing		
<u>Range in NE</u>	North-central Nebraska		
<u>Habitat</u>	Pines and bluffs, woodlands and rocks		
<u>Threats</u>	Habitat degradation; excessive fire		
	Climate Change Vulnerability Index: Not Vulnerable, Presumed Stable		
<u>Research/Inventory</u>	Conduct surveys to assess distribution, abundance, and dispersal		
<u>Landscapes</u>	Keya Paha, Middle Niobrara, Snake River		

Status

According to the last review in 1993, the Bailey's eastern woodrat has a state of Nebraska Heritage status rank of S2, a U.S. national status of N3, and a global conservation rank of G5T3 (NatureServe 2009). Natural Heritage conservation ranks range 1 to 5 with 1 being the most critically imperiled (for definitions of ranks, see Appendix 4 of Nebraska Natural Legacy Project; Schneider et al. 2011). The species is considered to be vulnerable (NatureServe 2009). Because Bailey's eastern woodrats are thought to be endemic to Nebraska (theoretically, they may occur in South Dakota), their survival is likely dependent on conservation in Nebraska (Schneider et al. 2011). The Nebraska Natural Legacy Science Team set a goal of maintaining at least ten populations in the state, assuming there is little movement between populations during the breeding season and fates of populations are not correlated (Schneider et al. 2011). Moderate viability (40% chance of survival) of each population gives >99% probability of at least one population surviving 100 years (Morris et al. 1999). (Schneider et al. 2011). According to Kansas State University Extension (2008), *Neotoma floridana* has a typical lifespan in the wild of 3 years.

Principal Threats

Bailey's eastern woodrats are geographically isolated from the other *N. floridana* populations. Given that *N. f. baileyi* is not a highly mobile species, it is vulnerable to habitat degradation (Schneider et al. 2011). Excessive fire can cause direct mortality to individuals, but also intense fire may clear too many woodland plants that the woodrats depend on for both shelter and food resources. Even prescribed fires within the range of the Bailey's eastern woodrat that do not take into account the habitat needs of the woodrat have the potential to cause damage to its population. Severe winters and factors that contribute to increased predation also have the potential to threaten eastern woodrat populations (Monty and Feldhamer 2002).

Species Description

The eastern woodrat is sometimes referred to as the packrat or trade rat. The dorsal side of the body is darkly colored while the underside and feet are white or light gray (K-State Extension 2008). It has large black eyes and thin hair on the ears (Wiley 1980). The tail length is less than the combined length of the body and head (K-State Extension 2008). The eastern woodrat's tail is completely furred with short hair, unlike the tail of the invasive Norway rat (*Rattus norvegicus*) that is scaly with very sparse hair (Mowbray 2005). See figures 1 and 2.

Average length of *N. floridana* is 32 – 36.9 cm (12.6 – 14.5 in) from nose to tip of tail (Wilson and Ruff 1999, Kays and Wilson 2009). Typical weight of male is 284 - 299 g (10 - 10.5 oz) and of female is 216 - 250 g (7.6 – 8.8 oz) (Monty 1997, Wilson and Ruff 1999, Kays and Wilson 2009). Female weight is most variable because of pregnancy (Monty and Feldhamer 2002). Male weights show variability in relation to season and breeding behavior, with peaks in February to March and again in late fall to winter (Rainey 1956).



FIGURE 1. The tail length of the Bailey's eastern woodrat is less than the combined length of the body and head. The tail is completely furred with short hair, unlike the scaly tail of the invasive Norway rat.



FIGURE 2. The dorsal side of the body is darkly colored while the underside and feet are white or light gray.

Habitat and Range of Species

There are three subspecies of eastern woodrat in Nebraska: *N. f. baileyi*, *N. f. attwateri*, and *N. f. campestris* (Graham et al. 2012). Bailey's eastern woodrats inhabit pines, bluffs, woodlands, and rocks (Schneider et al. 2011). While *N. floridana* can use mixed habitats, it is considered mostly a species of woodland (Kaufman et al. 2000) and woodland edge (Beckmann et al. 2001) and does not prefer grassland (Frost 2007). Recently, houses of Bailey's eastern woodrats were observed in plum thickets not associated with woodlands along the Snake River (Graham et al. 2012). The woodrats are well-suited to shelterbelts (Beckmann et al. 2001) and occur along the Middle Niobrara (Brumm and Hemsath 2003) and Snake rivers (Schneider et al. 2011, Graham et al. 2012). They can also be found in the Keya Paha Biologically Unique Landscape (Schneider et al 2011). While some range maps depict *N. floridana* in southern South Dakota, recent inventories have failed to locate *N. f. baileyi* in SD (Graham et al. 2012, USDA – FS 2012). Bailey's subspecies is a disjunct population from other eastern woodrat subspecies by approximately 100 miles of unsuitable habitat (Brumm and Hemsath 2003).

The solitary eastern woodrat builds a large house, up to 4 m long, 2 m wide, and 1 m high (Murphy 1952) for protection from predators and the elements (Wiley 1980) (Figure 4). The woodrat will often use rocks or the base of woody plants for supporting structure for its shelter (Wiley 1980). Woodrats primarily use twigs and leaves as construction materials (Rainey 1956), but numerous other natural and man-made items are used as well (Poole 1940, Murphy 1952, Nawrot and Klimstra 1976, Wiley 1980). Other types of wildlife, such as toads and small mammals like the eastern cottontail (*Sylvilagus floridanus*), are known to seek shelter in abandoned woodrat houses (Fitch and Rainey 1956, Wiley 1980).

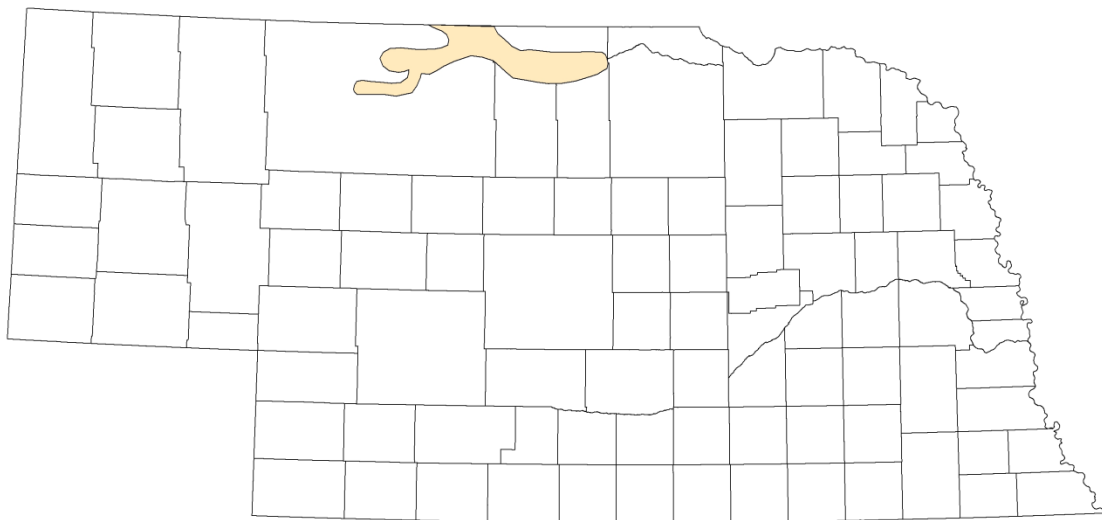


FIGURE 3. Current range of Bailey's eastern woodrats in Nebraska based on field observations, museum specimens, and expert knowledge. Map courtesy of Nebraska Natural Heritage Program, Nebraska Game and Parks Commission.

Dispersal, Home Range, and Population Density

Area requirements have yet to be measured for *N. f. baileyi* in Nebraska. However, using the best available knowledge obtained from researching the other subspecies, *N. floridana* adult males can travel a mean maximum of 105 meters (0 - 300 meters) and subadult and adult females travel 44 meters (0 - 200 meters). Males in breeding condition can travel the farthest (Fitch and Rainey 1956) in search of mates (Monty and Feldhamer 2002). Translocated eastern woodrats were able to return to home areas less than 305 meters away (75% return) and over 305 meters away (32% return), with males exhibiting the highest homing abilities (Classen 1968). But, the farther woodrats must travel to find resources and mates, the likelier they will be preyed upon (Monty and Feldhamer 2002). Prior work has shown *N. floridana* to use an average home range of 0.26 ha (0.64 a) for males and 0.17 ha (0.41 a) for females (Goertz 1970). Frost (2007) found Bailey's eastern woodrat density estimates in the Middle Niobrara River Valley to be 0.72/ha in both 2004 and 2005 (2004; 0.58-0.91, 2005; 0.56-0.90). Woodrats exhibit aggressive behavior in defending territories where they frequently injure or even kill a conspecific (Poole 1940, Wiley 1980); therefore, there is likely a minimum recommended patch size appropriate for minimizing conflicts in suitable habitat. Previous research has shown nest densities of 9.4 nests/ha in riparian woodlands and 55.5 nests/ha in shelterbelts.



FIGURE 4. Dr. David McCullough, professor of Biology at Wartburg College, finds an eastern woodrat house more than 2.4 m (8 ft) in diameter.

Diet

Bailey's eastern woodrat feeds mostly on vegetation. Genoways and others (1997) documented the relict woodrat population along the Niobrara River in Nebraska consuming 38 food types (37 of which were plant material) in the summer. The most common food items were smooth sumac (*Rhus glabra*), prickly pear (*Opuntia* sp.), and eastern redcedar (*Juniperus virginiana*). The woodrat also consumes insects (Genoways et al. 1997). Eastern woodrats do not cause significant crop damage (Murphy 1952, Rainey 1956). Evidence suggests that most foraging takes place within 23 m of a woodrat's house (Fitch and Rainey 1956). In September or October, *N. floridana* begins caching food in the top of its house (Rainey 1956, Wiley 1980) in preparation for scarcer seasonal food availability.

Reproduction

N. floridana gestation takes 33 - 35 days (Knoch 1968, Spencer 1968, Wiley 1980). Litter sizes range from one to seven, with two to four offspring typical (Rainey 1956, Goertz 1970, Wiley 1980, Farrar 2007). Two to three litters per year are expected (Schwartz and Schwartz 2001). Pups nurse approximately 1 month (Poole 1940, Monty and Feldhamer 2002). Evidence suggests that females sexually mature at 5 - 6 months of age, but usually first breeding is delayed until approximately 1 year of age (i.e., in the year following birth) (Rainey 1956, Wiley 1980). Life expectancy of eastern woodrats (i.e., approximately 3 years) is higher than that of many other small rodents (Fitch and Rainey 1956, Wiley 1980).

The breeding season of eastern woodrats varies geographically (Wiley 1980), and it is uncertain how many months through the year the Bailey's eastern woodrat breeds in Nebraska. Most *N. floridana* breeding in Kansas takes place from February to August (Rainey 1956). However, the Bailey's eastern woodrat breeding season may be shorter in northern Nebraska along the Niobrara because of the area's relative colder seasonal temperatures (K. Geluso, pers. comm.).

Research and Conservation Strategies

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 Bailey's eastern woodrats in at least three Biologically Unique Landscapes: Keya Paha, Middle Niobrara, and Snake River. These landscapes offer the best opportunities for the woodrat's conservation within Nebraska based on current knowledge. Many of the basic conservation recommendations given in this document are based on findings regarding *N. floridana*, but one may want to consider that subspecies *baileyi* may exhibit independent behaviors unknown at this time because of lack of study on the subject. Given the principal threats identified, conservation efforts for Bailey's eastern woodrats (summarized in Table 2) may want to employ the following management strategies:

1. There is some uncertainty as to the Bailey eastern woodrat's range boundaries and population trends. Recent inventory work is making strides toward describing the current limits (Graham et al. 2012, USDA – FSA 2012). Researchers can locate active nests during the day by searching for the woodrat houses with signs of upkeep and droppings (Brumm and Hemsath 2003). Red lights can be used to find woodrats at night (Finley 1959, Wiley 1971, Wiley 1980, Monty and Feldhamer 2002). Wiley (1971) describes conditions under which peak activity can be expected (Table 2). A potential trapping protocol would be to use live traps (Figure 5) baited with corn and sunflower seeds, set near den sites and runways, and checked for 3 nights every 3 weeks, avoiding extreme weather conditions (Wagle 1996, Monty 1997, Monty and Feldhamer 2002). Polyester fiber fill can be placed inside the traps (Monty and Feldhamer 2002). When sampling, Frank et al. (1997) preferred an enumeration estimation technique for a small sample size and low number of sequential trap nights.
2. Sites suitable for eastern woodrat house construction may be a limiting factor to the rodents (Rainey 1956). As part of a diverse management plan, conserve some trees commonly used for Bailey's eastern woodrat houses, including oaks, basswoods, cottonwoods, box elders, and ponderosa pines (Brumm and Hemsath 2003). Tree diversity appears to be positively correlated with Bailey's eastern woodrat population size (Brumm and Hemsath). The woodrats may also use shrubs and yucca for shelter and food (Finley 1958, Monty and Feldhamer 2002).
3. Numerous USDA-NRCS Farm Bill Programs may be used to benefit Bailey's eastern woodrats, including:
 - CRP- CP 3(Softwood Trees), 3A (Hardwood Trees), 4D, 4B (Wildlife Habitat Corridors), 5 (Field Windbreaks), 11 (Existing Trees), 16 (Shelterbelts), 17 (Living Snow Fences), 22 (Riparian Buffers), 25, 29
 - EQIP- 666 – Forest Stand Improvement, 380 – Windbreak and Shelterbelt Establishment, 612 – Tree – Shrub Establishment, 650 – Windbreak and Shelterbelt Renovation
 - WHIP, GRP, FRLPP, and WILD Nebraska.

Availability of programs may vary annually.



FIGURE 5. Researchers from Wartburg College use live traps to capture Bailey's eastern woodrats in order to collect data on their mass, age and sex.

Information Gaps

Research priorities to improve Bailey's eastern woodrat management include collecting information on the distribution, abundance, habitat preferences, and dispersal mechanisms of the species in Nebraska. The jury is still out on how Bailey's eastern woodrats may respond to prescribed fire. Although the Bailey's eastern woodrat has been positively associated with redcedar (Brumm and Hemsath 2003, Frost 2007), subjecting the woodrat's habitats to a low-frequency prescribed fire schedule may actually benefit the species and other small mammals (Higgins and Kruse 1989). And, there is no evidence of the woodrat population being negatively impacted from controlled burns (Brumm and Hemsath 2003). During eastern redcedar removal, you may create slash piles to provide cover and minimize stress to Bailey's eastern woodrats (Frost 2007). However, care must be taken not to later burn occupied slash piles. Diverse habitat types that include live cedars in low density can support a broad array of species (Frost 2007).

Considerations for Additional Species

At-risk species that share habitat with Bailey's eastern woodrats should be considered in management plans for the woodrat. On-the-ground conservation for Bailey's eastern woodrats may affect or be influenced by at-risk species that can be found in the same Biologically Unique Landscapes as the rodents. Table 1 lists a sample of at-risk species you may want to consider

while planning for Bailey's eastern woodrat habitat on the landscape. This list will not apply to all woodrat sites of occupancy nor is the list all-inclusive.

TABLE 1. At-risk species identified in the Nebraska Natural Legacy Project that inhabit biologically unique landscapes with Bailey's eastern woodrats (Schneider et al. 2011) may necessitate consideration in habitat management plans.

Animals

American Burying Beetle (*Nicrophorus americanus*)
Blacknose Shiner (*Notropis heterolepis*)
Finescale Dace (*Chrosomus neogaeus*)
Northern Redbelly Dace (*Chrosomus eos*)
Plains Topminnow (*Fundulus sciadicus*)
Blanding's Turtle (*Emydoidea blandingii*)
Bell's Vireo (*Vireo bellii*)
Loggerhead Shrike (*Lanius ludovicianus*)
Wood Thrush (*Hylocichla mustelina*)
Northern River Otter (*Lontra canadensis*)

Plants

Prairie Moonwort (*Botrychium campestre*)
Small White Lady's-slipper (*Cypripedium candidum*)

TABLE 2. Summary of suggested management and research for Bailey's eastern woodrat in Nebraska. The following should be interpreted as 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
Species inventory and monitoring	Locate dens and active nests. You may use red lights to locate woodrats near their shelters at night; mark/recapture as recommended.	Activity likely begins 30 minutes before sunset and peaks at 2030 to 2230 and on nights of new or quarter moon phases
Maintain house sites	Conserve a diversity of woody species and yucca. Woodland edges near herbaceous forage sites are ideal. Establish shelterbelts and restore woody riparian corridor.	House sites may be more limiting than presence of specific plants used for food
Research effects of prescribed fire	Before fire, you may create slash piles for shelter not to be burned. Leave some standing woody plants, including some eastern redcedar. Burns in primary habitat for <i>N. f. baileyi</i> should not be scheduled more than once every 4 - 5 years per plot.	Many small mammals may show a positive response to prescribed prairie fire after a few years because of the increased access to seeds on cleared ground

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