Species Status Assessment

Common Name: Allegheny woodrat **Date Updated:** January 15, 2024

Scientific Name: *Neotoma magister* **Updated By:** Sue Booth-Binczik

Class: Mammalia

Family: Cricetidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

The Allegheny woodrat (*Neotoma magister*) is closely related to the Eastern woodrat (*Neotoma floridana*) and was originally considered a subspecies of the Eastern woodrat. It was recognized as a separate species in the early 2000s, based on genetic analyses (Hayes and Harrison, 1992) demonstrating that it has a distinct evolutionary lineage. It was formerly found from southwestern Connecticut and southeastern New York down through the Appalachians to Tennessee and northern Alabama, with isolated populations in southern Indiana and southern Ohio. However, during the latter part of the 20th century, Allegheny woodrat populations declined all across the northern part of the range, leading to the species becoming extirpated from Connecticut and New York. Allegheny woodrats live in caves and large crevices in rocky cliffs and talus slopes.

I. Status

a. Current legal protected Status

i. **Federal:** Not listed **Candidate:** No

ii. **New York:** Endangered

b. Natural Heritage Program

i. **Global:** G3

ii. **New York:** S1 **Tracked by NYNHP?:** Yes

Other Ranks:
IUCN Red List: Near Threatened

Status Discussion:

A decline in the numbers and range of the Allegheny woodrat was first noticed in the 1960s and the decline was considered severe by the mid-1970s. The species was considered extirpated from New York by 1987 and was listed as Endangered in the 1990s.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Declining	Declining	50 years	Not listed	(blank)
Northeastern US	Yes	Declining	Declining	50 years		Yes
New York	Yes	Declining	Declining	50 years	Endangered	Yes
Connecticut	No	Choose an item.	Choose an item.		Special concern	No

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
Massachusetts	No	Choose an item.	Choose an item.		Not listed	No
New Jersey	Yes	Declining	Declining	50 years	Endangered	Yes
Pennsylvania	Yes	Declining	Declining	50 years	Threatened	Yes
Vermont	No	Choose an item.	Choose an item.		Not listed	No
Ontario	No	Choose an item.	Choose an item.		Not listed	(blank)
Quebec	No	Choose an item.	Choose an item.		Not listed	(blank)

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

In the summer and fall of 2021, camera-trapping for Allegheny woodrat was conducted at six of the sites that were last known to support woodrat populations in Storm King State Park, Schunnemunk Mountain State Park, and Minnewaska State Park Preserve, as well as closer to the New Jersey border in Tallman Mountain State Park and Palisades Interstate Park. Only one woodrat was detected, in Tallman Mountain State Park. It was subsequently live-trapped and determined to be a juvenile male that had evidently dispersed from the population in northern New Jersey.

Trends Discussion *(insert map of North American/regional distribution and status):*

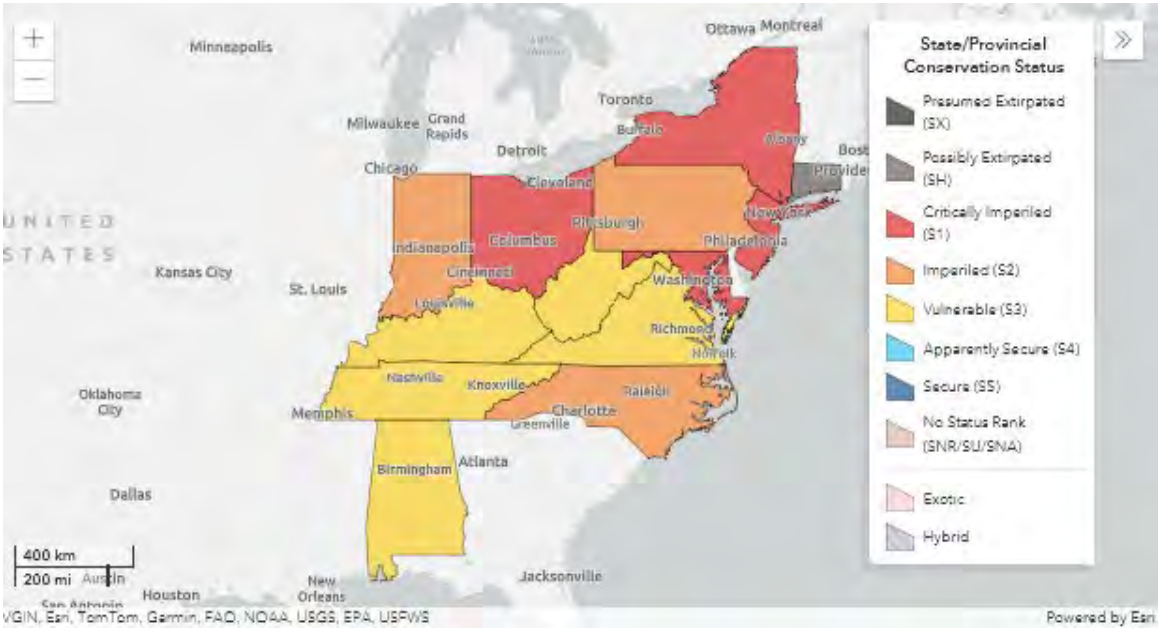

Figure 1. Conservation status of Allegheny woodrat in North America (NatureServe 2023).

Severe declines have occurred in recent decades all across the northern part of the species' range, apparently due to a combination of factors (LoGiudice, 2006), including the loss of a primary food source, the American chestnut (*Castanea dentata*), habitat fragmentation, and increased

exposure to raccoon roundworm (*Baylisascaris procyonis*), a parasite lethal to woodrats. Allegheny woodrats currently occupy approximately 30% of the sites in Pennsylvania that were previously known to be occupied (Moyer et al., 2023), and only one out of 11 previously documented populations remain in New Jersey (Grietzer, 2018).

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

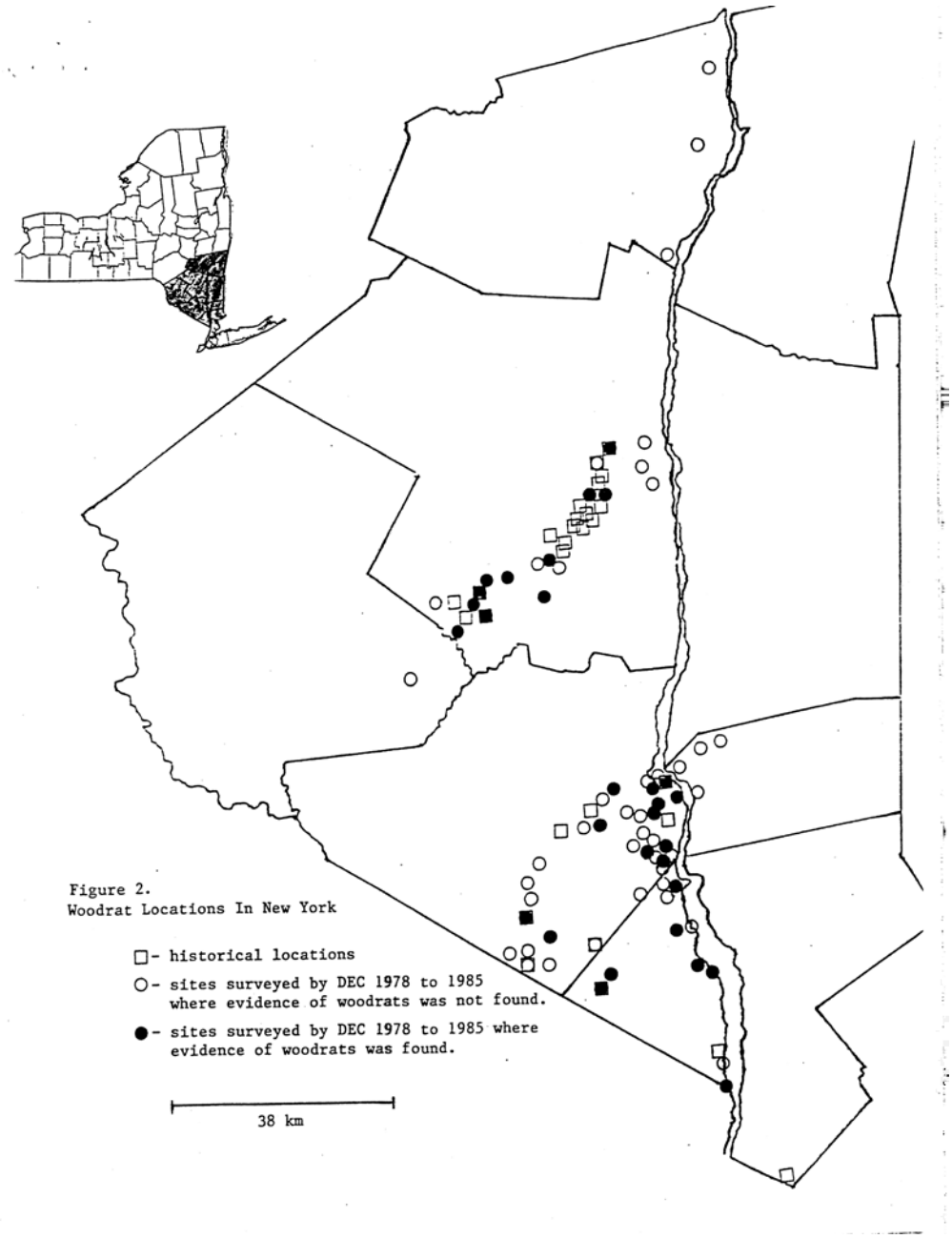

Figure 2. Historical records of Allegheny woodrat in New York; from Hicks, 1989b.

Years	# of Records	# of Distinct Populations	% of State
Pre-1995			
1995-2004	6		
2005-2014	0		
2015 - 2023	1		

Table 1. Recent records of Allegheny woodrat in New York. Records are individuals live-trapped.

Details of historic and current occurrence:

Historical records are known from 32 individual sites in four counties in New York (Hicks, 1989b). From 1987 to 1985, 70 sites (Figure 2) were searched by DEC staff, and evidence of woodrat presence was found at 30 of them (Hicks, 1989b).

In 1991, 29 woodrats from West Virginia were released at the Mohonk Preserve in Ulster County and monitored with radiotelemetry and frequent live-trapping. At least 14 litters were produced in the first year after release, with one female producing 5 litters during that period. However, after 18 months only 3 offspring and none of the originally released animals were known to be alive, with most of the mortalities apparently due to *B. procyonis* (McGowan, 1993).

Live-trapping efforts in Palisades Interstate Park in the early 2000s resulted in the capture of four individuals in 2001 and two in 2003. Live-trapping in Tallman Mountain State Park in 2021 resulted in the capture of one individual.

New York's Contribution to Species' North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Peripheral	200-400 miles

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Cliff and talus

b. Oak forest

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
Yes	No	Unknown	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Throughout the range, the Allegheny woodrat is associated with extensive rocky areas. The rocky areas where the woodrats make their dens include rock outcrops and ledges with associated boulders and talus slopes. (Howell, 1921; Poole, 1940). Woodrat habitat also includes caves and former mines in these rocky locations (e.g., old iron mines in the Hudson River Valley). Woodrats tend to avoid humans, but the species will sometimes use abandoned buildings (NatureServe, 2023). The habitats that formerly supported woodrat populations are generally at higher elevations, although in New York the species has been documented to occur along the Hudson River at or near sea level. During winter, woodrats tend to remain in caves and crevices.

Woodrats are primarily herbivores and eat a variety of food items including green leafy material, twigs, nuts, berries, and seeds (Hicks, 1989a; NatureServe, 2023). Fungi may be a significant part of the diet (Newcombe, 1930).

V. Species Demographics and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Choose an item.	Choose an item.	Yes	Yes	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

The generally nocturnal Allegheny woodrat is a solitary and territorial animal, except during the breeding season and when raising young (NatureServe, 2023). Allegheny woodrats are found in population clusters, largely due to the patchiness of the habitat that the species occupies (NatureServe, 2023), and these clusters function as metapopulations (Hassinger et al., 1996). Both males and females inhabit dens within the rocks, but individuals may move away when searching for food or mates, or during natal dispersal (Poole, 1940).

The home range is small and has been reported as 0.26 to 0.6 ha (approximately 0.6 to 1.5 acres) (Wright and Hall, 1996). However, in another study of 34 radio-tagged woodrats, mean home range for males was 6.5 +/- 1.8 ha and for females was 2.2 +/- 0.3 ha (Castleberry et al., 2001). Foraging takes place mainly within the rocky habitat, but may extend beyond the rocks for up to 160 meters (525 feet) (Wright and Hall, 1996). Woodrats can disperse significant distances between patches of suitable habitat, from 0.3 to 1 km (McGowan, 1993) or greater, but as distances increase, the odds of successfully traveling between patches of rock may decrease (NatureServe, 2023). An adult male was reported to have moved 3, 615 m in 49 days (Thomas, 2001). The longest movement recorded for a female was 405 m (Monty and Feldhamer, 2002).

Female woodrats become sexually mature in 5 to 6 months with some females breeding in the same season as their birth, although they usually become sexually mature the following spring (Hicks, 1989a). The breeding season is reported as late winter to late summer, with a gestation period of 30 to 38 days (Birney, 1973), and the young are born from March to September (Merritt, 1987; NatureServe, 2023). However, they may also reproduce throughout the year (Fitch and Rainey, 1956; McGowan, 1993; Mengak, 2002). Females usually produce 1 or 2 litters of 1 to 3

young annually (Hicks, 1989a), but may produce many more (McGowan, 1993). The maximum documented lifespan of a free-ranging Allegheny woodrat was more than four years (Mengak et al., 2002).

VI. Threats *(from NY 2015 SWAP or newly described):*

The American chestnut is believed to have been a major component of Allegheny woodrat diet (LoGiudice, 2006) before the species was devastated by introduced chestnut blight in the early 20th century. Acorns from various oak (*Quercus*) species were likely an important substitute after chestnuts disappeared, but acorn availability in the Northeast decreased in the latter half of the 20th century due to outbreaks of the introduced spongy moth (*Lymantria dispar*) and increased abundance of other acorn-eating species such as white-tailed deer (*Odocoileus virginianus*). Deforestation from increasing human development also fragmented habitat throughout this time, making it less likely that woodrats could travel between habitat patches and recolonize areas where populations had been extirpated. The final factor in Allegheny woodrat decline and disappearance has been the raccoon roundworm (LoGiudice, 2006), which is fatal to woodrats. Current threats therefore include parasitism, habitat fragmentation, and possibly food shortages.

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

The Allegheny woodrat is listed as Endangered in New York, which provides regulatory protection of the species and its habitat. In addition, most of the suitable habitat within former woodrat range in New York is protected within the New York State Parks system.

However, because the species is currently extirpated from the state, with the exception of occasional dispersers from New Jersey, and because suitable habitat is patchy and raccoon roundworm remains a severe threat to woodrat survival, recovery of the species will not be possible without active intervention to reduce the threats and restore the species.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Reduction of roundworm prevalence in raccoon populations via distribution of medicated baits has permitted re-establishment of Allegheny woodrats at previously extirpated sites in Indiana (Smyser et al., 2013) and is being used as a component of woodrat recovery efforts in New Jersey (G. Fowles, pers. comm.) and Ohio (C. Mollohan, pers. comm.) as well. Additional habitat management methods being used in Pennsylvania to try to reverse woodrat declines include food supplementation and creation of boulder piles to serve as stepping-stone habitat between occupied sites (G. Turner, pers. comm.).

Translocation of woodrats from larger populations in Pennsylvania has substantially increased genetic diversity in the one remaining population in New Jersey (Muller-Girard et al., 2022), and a similar translocation of woodrats from Virginia to Ohio took place in 2023 (C. Mollohan, pers. comm.). A captive breeding program involving multiple zoos is currently under development to provide a steady source of woodrats for re-introduction and population augmentation efforts across the species' range. Creating genetic exchange among populations in this way will partially compensate for the effects of habitat fragmentation and loss of natural metapopulation function.

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
1. Land/water management	Invasive/problematic species control
2. Species management	Species re-introduction
3. Species management	Species recovery

Table 2. Recommended conservation actions for Allegheny woodrat.

VII. References

Birney, E. C. 1973. Systematics of three species of wood rats (genus *Neotoma*) in central North America. Univ. Kansas Mus. Nat. Hist. Misc. Publ. No 58.

Castleberry, S. B., W. M. Ford, P. B. Wood, N. L. Castleberry, and M. T. Mengak. 2001. Movements of Allegheny woodrats in relation to timber harvesting. Journal of Wildlife Management 65:148-156.

Fitch, H. S. and D. S. Rainey. 1956. Ecological observations of the woodrat (*Neotoma floridana*). University of Kansas Pub. Mus. Nat. Hist. 8:499-533.

Hassinger, J. , C. Butchkoski, D. Diefenbach. 1996. Fragmentation effects on the occupancy of forested Allegheny woodrat (*Neotoma magister*) colony areas. Paper presented to Allegheny Woodrat Recovery Group Meeting. Ferrum College, Ferrum, Virginia.

Grietzer, E. 2018. The study and analysis of historic Allegheny woodrat (*Neotoma magister*) sites. M.S. thesis, Montclair State University. Montclair, New Jersey.

Hayes, J. P. and R. G. Harrison. 1992. Variation in mitochondrial DNA and the biogeographic history of woodrats (*Neotoma*) of the eastern United States. Systematic Biology 41:331-344.

Hicks, A. 1989a. Whatever happened to the Allegheny woodrat? New York State Conservationist, March-April: 34-38.

Hicks, A. 1989b. Draft New York State endangered species recovery plan for the Allegheny woodrat *Neotoma floridana magister*.

Howell, A. H. 1921. A biological survey of Alabama. North American Fauna 45.

LoGiudice, K. 2006. Toward a synthetic view of extinction: a history lesson from a North American rodent. BioScience 56:687-693.

McGowan, E. M. 1993. Draft report on experimental release and fate study of the Allegheny woodrat (*Neotoma magister*).

Mengak, M. T. 2002. Reproduction, juvenile growth and recapture rates of Allegheny woodrats (*Neotoma magister*) in Virginia. American Midland Naturalist 148:155-162.

Mengak, M. T., S. B. Castleberry, W. M. Ford, N. L. Castleberry, and J. L. Rodrigue. 2002. Longevity record for a wild Allegheny woodrat (*Neotoma magister*) in West Virginia. Virginia Journal of Science 53:167-170.

Merritt, J. F. 1987. Guide to the mammals of Pennsylvania. University of Pittsburgh, Pittsburgh, Pennsylvania, USA.

Monty, A. M. and G. A. Feldhamer. 2002. Conservation assessment for the Eastern woodrat (*Neotoma floridana*) and the Allegheny woodrat (*Neotoma magister*). USDA Forest Service, Eastern Region, Threatened and Endangered Species Program, Milwaukee, Wisconsin, USA.

Moyer, C., T. Smith, J. Duchamp, G. Turner, M. Giazzon, M. Scafini, and J. Vreeland. Allegheny woodrat distribution across Pennsylvania via baited camera traps. 78th Annual Northeast Association of Fish & Wildlife Agencies Conference.

Muller-Girard, M., G. Fowles, J. Duchamp, S. Kouneski, C. Mollohan, T. J. Smyser, G. G. Turner, B. Westrich, and J. M. Doyle. 2022. A novel SNP assay reveals increased genetic variability and abundance following translocations to a remnant Allegheny woodrat population. BMC Ecology and Evolution 22:137.

NatureServe. 2023. NatureServe Explorer. Page last published 1/5/2024. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.101808/Neotoma_magister Accessed January 15, 2024.

Newcombe, C. L. 1930. An ecological study of the Allegheny cliff rat (*Neotoma pennsylvanica* Stone). J. Mamm. 11:204-211.

Poole, E. L. 1940. A life history sketch of the Allegheny woodrat. Journal of Mammalogy 21: 249-270.

Smyser, T. J., S. A. Johnson, L. K. Page, C. M. Hudson, and O. E. Rhodes, Jr. 2013. Use of experimental translocations of Allegheny woodrat to decipher causal agents of decline. Conservation Biology 27:752-762.

Thomas, S. C. 2001. Allegheny woodrat monitoring. Kentucky Federal Aid Grant No. E-2. 54 pp.

Wiley, R. W. 1980. Neotoma floridana. Am. Soc. Mamm., Mammalian Species No. 139:1-7.

Wright, J. and J. S. Hall. 1996. Radio telemetry study of movements and resource use by Allegheny woodrats (*Neotoma magister*) in Pennsylvania. Report to Pennsylvania Game Comm. Wild. Res. Fund, Project #SP247621.

Originally prepared by	Jenny Murtaugh
Date first prepared	March 12, 2012
First revision	February 26, 2014 (Samantha Hoff)
Latest revision	

Species Status Assessment

Common Name: American pygmy shrew **Date Updated:** 1/16/2024

Scientific Name: *Sorex hoyi* **Updated By:** J. Vanek

Class: Mammalia

Family: Soricidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

This tiny shrew is also in contention for the status of one of the world's smallest mammals with adults weighing 2-3 g (Feldhammer et al. 2007, Saunders 1988). In the Eastern U.S. they are distributed from Maine westward through New York, Michigan and Wisconsin south to North Carolina (Hamilton 1943). In North America the pygmy shrew occurs throughout most of the boreal and northern temperate forests, and along a narrow corridor extending southward in the Appalachians into North Carolina (Saunders 1988). Within these regions pygmy shrews inhabit deciduous, coniferous, and mixed forests, marshes, bogs, and disturbed areas. Moist forest floors with accumulated debris provide optimum habitat (Saunders 1988). Also use grassland- herbaceous and shrubland-chaparrel habitats. This shrew appears to prefer grassy openings of boreal forest (Nature Serve 2012). These shrews make tiny burrows beneath stumps, fallen logs and the leaf carpet of the forest (Hamilton 1943). This species is considered secure in Canada but either not ranked or no information for other states adjacent to New York with the exception of "Vermont which considers it imperiled. Nine records exist for Essex County otherwise population trends or extent of occurrence in New York outside of the Adirondacks is little known.

I. Status

a. Current legal protected Status

i. **Federal:** Not listed **Candidate:** No

ii. **New York:** Not listed

b. Natural Heritage Program

i. **Global:** G5

ii. **New York:** S4? **Tracked by NYNHP?:** No

Other Ranks:

IUCN: Least Concern

Status Discussion:

From NatureServe 2024: "This species is widespread, fairly common, known from many localities, and does not appear to be declining." There are few historical records from New York, as well as a lack of recent records from New York, pending results from the NYS Mammal Survey.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Stable	Stable			Choose an item.
Northeastern US	Yes	Unknown	Unknown			Choose an item.
New York	Yes	Unknown	Unknown			Yes
Connecticut	No data	Choose an item.	Choose an item.			Choose an item.
Massachusetts	No	Choose an item.	Choose an item.			Choose an item.
New Jersey	No data	Choose an item.	Choose an item.			Choose an item.
Pennsylvania	No data	Choose an item.	Choose an item.		Not ranked	Choose an item.
Vermont	Yes	Declining	Declining		Imperiled	Choose an item.
Ontario	Yes	Stable	Stable		Apparently secure	Choose an item.
Quebec	Yes	Stable	Stable		Secure	Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

No regular monitoring. The NYS Mammal Survey is currently underway and will be completed in 2025.

Trends Discussion *(insert map of North American/regional distribution and status):*

Relatively stable and on a global scale there is little reason to believe that a significant decline has occurred (Nature Serve 2012). In New York which is on the periphery of its habitat little is known about the distribution of this species outside of the Adirondacks. Pitfall trapping surveys could be used to define its range in New York and extent of occupied habitat.

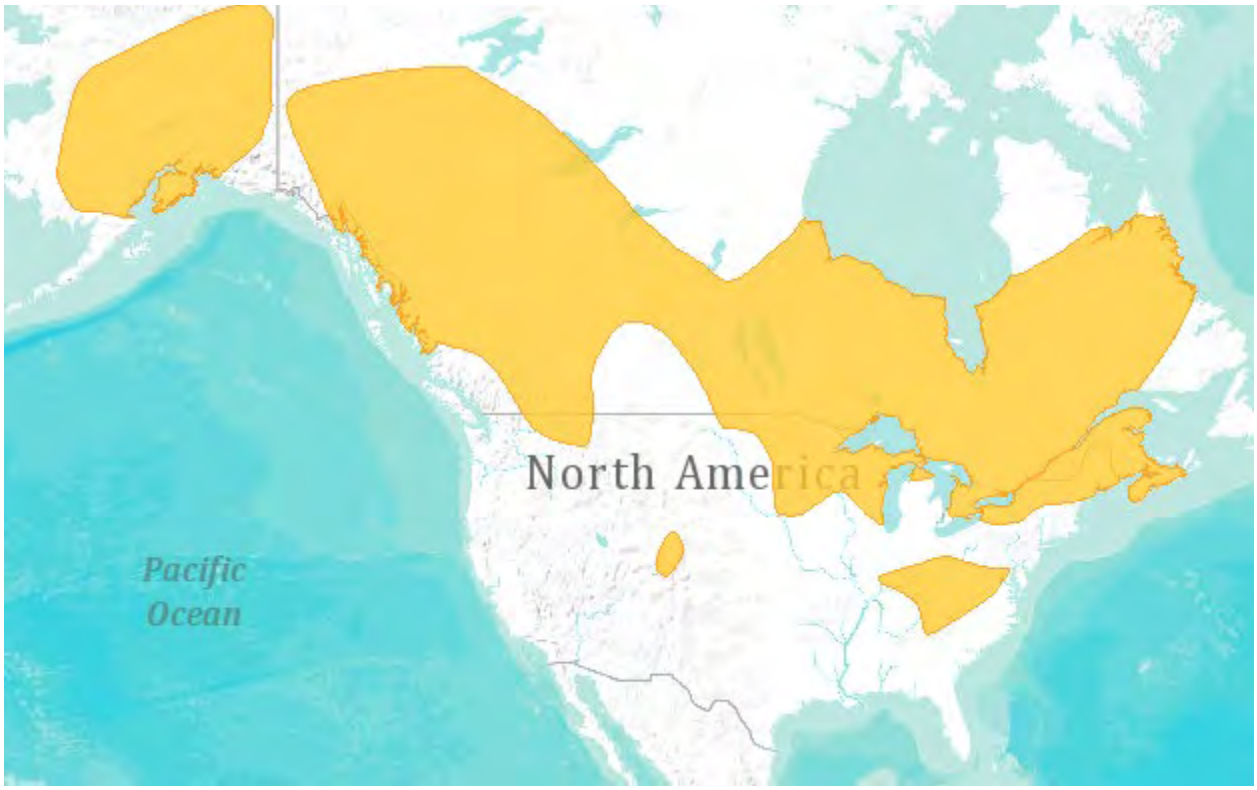

Figure 1: Distribution of pygmy shrew in North America (IUCN 2013)

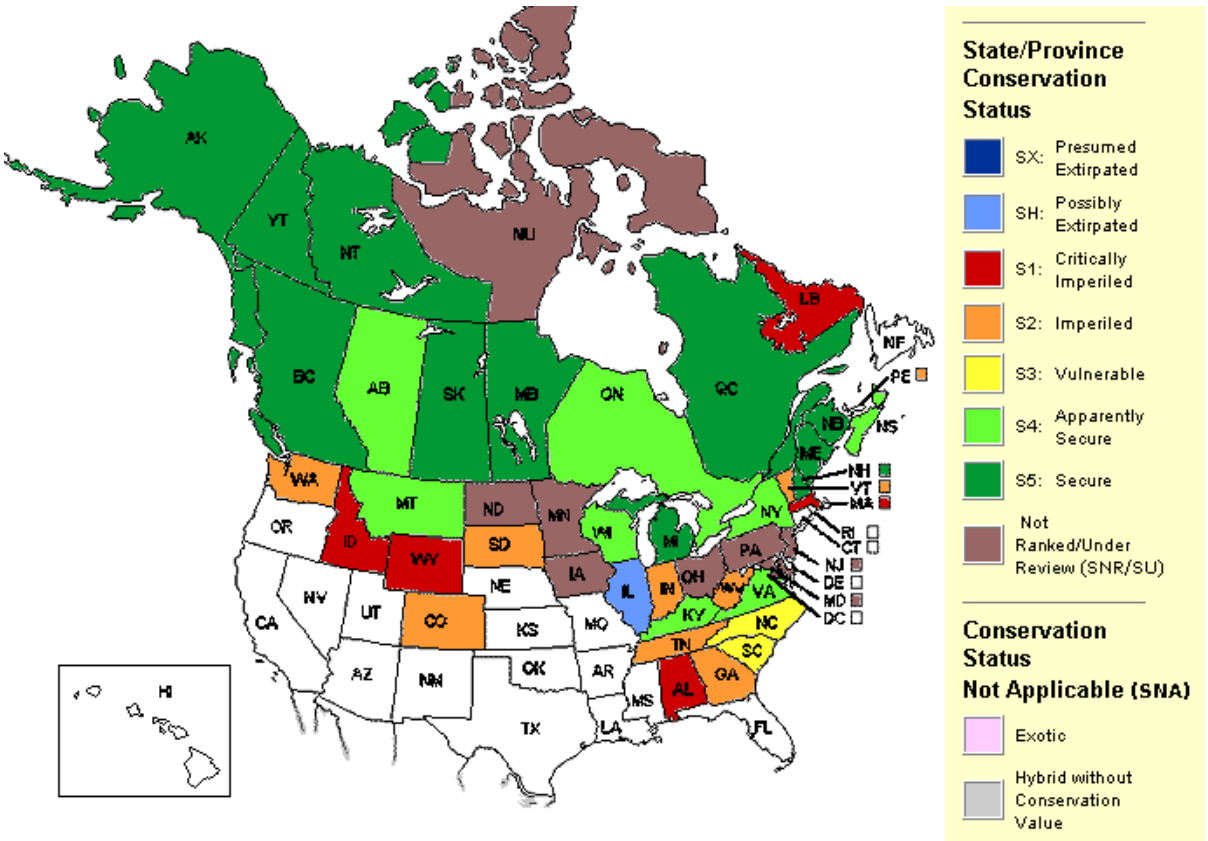

Figure 2: Conservation status of pygmy shrew in North America (IUCN 2013)

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

This species may be more abundant in the Adirondacks than museum records indicate due to bias in capture methods (Saunders 1988). Pygmy shrews are quite rare in collections and little is known of their habits (Hamilton 1943). Recent examination short-eared owl pellets collected over several years in Western New York have failed to detect this species.

Years	# of Records	# of Distinct Populations	% of State
Pre-1995	11 _____	_____	_____
1995-2004	_____	_____	_____
2005-2014	_____	_____	_____
2015 - 2023	_____	_____	_____

Table 1. Records of American pygmy shrew in New York.

Details of historic and current occurrence:

Hall and Kelson (1959) list 3 locations in New York. Saunders (1988) mentions 9 locations in the Adirondacks. A search of the Buffalo Museum of Science collection and the former St. Bonaventure collections catalog found no specimens of Pygmy Shrew. No recent information for this species in New York was found.

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Peripheral	

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

1. Mixed Northern Hardwoods

2. Spruce-Fir Forest and Flats

3. Mountain Spruce-Fir Forests

4. Boreal Forest Peatland

5. Mixed Hardwood Swamp

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
Yes	No	Stable	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

The pygmy shrew occurs throughout boreal and northern temperate forests in New York, occurring in deciduous, coniferous, and mixed forests, marshes, bogs, and disturbed areas (such as clear cuts) (Saunders 1988). Moist forest floors with an accumulation of debris offer optimum habitat, providing ideal sites for tunnels that form the burrow system.

V. Species Demographic and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Choose an item.	Choose an item.	Yes	Yes	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Breeding records suggest pygmy shrews have several litters during the year with the usual number being five or six (Hamilton 1943). Information from trapped females indicates they bear a single litter of 3-8 young in June-August which is unusual for Soricids (Saunders 1988). Known predators include garter snakes and broad-winged hawks (Saunders 1988). In Michigan this species was found in densities of .2-2 individuals per acre (Nature Serve 2012).

VI. Threats *(from NY 2015 SWAP or newly described):*

Predation by domestic cats may be considered a threat, but not enough information was available to add it to the table. As habitat specialists and prey specialists, pygmy shrews have increased vulnerability to a wide range of possible disturbances. Due to their short life span, any disturbance affecting reproduction in even a single season could imperil the persistence of the population. Natural processes such as drought or insect infestation reduce and fragment habitat and climatic changes such as unusually early or even late freezes and snowfall could affect pygmy shrews by reducing the abundance of prey.

Threats to NY Populations	
Threat Category	**Threat**
1. Residential & Commercial Development	Housing & Urban Areas (habitat loss)
2. Invasive & Other Problematic Species and Genes	Invasive Non-Native/Alien Species (hemlock woolly adelgid)
3. Climate Change & Severe Weather	Habitat Shifting & Alteration
4. Pollution	Industrial & Military Effluents (Heavy metals)

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: _____ **No:** _____ **Unknown:** _x_

If yes, describe mechanism and whether adequate to protect species/habitat:

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Trapping or other surveys are needed to determine the extent of occupied habitat in New York, especially outside the Adirondacks for which little information is available.

Population monitoring:

* If the species is found within the historic range, extend surveys to likely habitat outside of the known historic range.

* Conduct trapping efforts for both species in likely habitats within their known historic distribution in the state.

VII. References

Feldhamer, G. A., L. C Drickamer, S. H. Vessey, J. F. Merritt and C. Krajewski . 2007. Mammalogy. The John Hopkins University Press, Baltimore, Maryland, USA.

Hall, E. R. and K.R. Kelson 1959. The Mammals of North America, Vol. I. The Ronald Press Company, New York, New York, USA.

Hamilton, W. J., Jr. 1943 Mammals of Eastern United States. Comstock Publishing Co., Ithaca, New York, USA.

NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. <http://www.natureserve.org/explorer>. Accessed December 3, 2013.

NatureServe. 2024. NatureServe Explorer [web application]. NatureServe, Arlington, Virginia. <http://www.natureserve.org/explorer>. Accessed January 16, 2024.

Saunders, D. A. 1988. Adirondack Mammals. State University of New York, College of Environmental Science and Forestry, Syracuse, New York, USA.

Originally prepared by	Kenneth Roblee
Date first prepared	December 3, 2013
First revision	February 26, 2014 (Samantha Hoff)
Latest revision	

Species Status Assessment

Common Name: Canada lynx **Date Updated:** January 15, 2024

Scientific Name: *Lynx canadensis*

Class: Mammalia

Family: Felidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

The distribution of the Canadian lynx (*Lynx canadensis*) in North America is closely associated with the distribution of North American boreal forest. In Canada and Alaska, lynx inhabit the boreal forest ecosystem known as the taiga. The range of lynx populations extends south from the classic boreal forest zone into the subalpine forest of the western United States, and the boreal/hardwood forest ecotone in the eastern United States. Forests with boreal features extend southward into the contiguous United States along the North Cascade and Rocky Mountain ranges in the west, the western Great Lakes region, and northern Maine. Within these general forest types, lynx are most likely to persist in areas that receive deep snow and have high-density populations of snowshoe hares, the principal prey of lynx (USFWS 2013b). Regionally, the only known viable population exists in northern Maine. Lynx are believed to be extirpated from New Hampshire, Vermont, and New York (Kart 2005).

I. Status

a. Current legal protected Status

i. **Federal:** Threatened **Candidate:** No

ii. **New York:** Threatened

b. Natural Heritage Program

i. **Global:** G5

ii. **New York:** SX **Tracked by NYNHP?:** Yes

Other Ranks:
IUCN Red List: Least Concern

Northeast Regional SGCN: RSGCN

Status Discussion:

Canadian lynx numbers in the Unites States have been falling for the last 30 years. In the 1980s, states began restricting lynx trapping (Maine stopped trapping earlier, in 1963). Trapping was banned altogether with Endangered Species Act protection in 1973 (Kart 2005).

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Declining	Declining	1980s to 2015		Choose an item.
Northeastern US	Yes	Declining	Declining	1980s to 2015		Yes
New York	No	Extirpated	Extirpated		Threatened	No
Connecticut	No	Choose an item.	Choose an item.		Not listed	No
Massachusetts	No	Choose an item.	Choose an item.		Not listed	No
New Jersey	No	Choose an item.	Choose an item.		Not listed	No
Pennsylvania	No	Choose an item.	Choose an item.		Not listed	No
Vermont	Yes	Choose an item.	Choose an item.		Endangered	Yes
Ontario	Yes	Stable	Stable		Not listed	Choose an item.
Quebec	Yes	Stable	Stable		Not listed	Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

None.

Trends Discussion *(insert map of North American/regional distribution and status):*

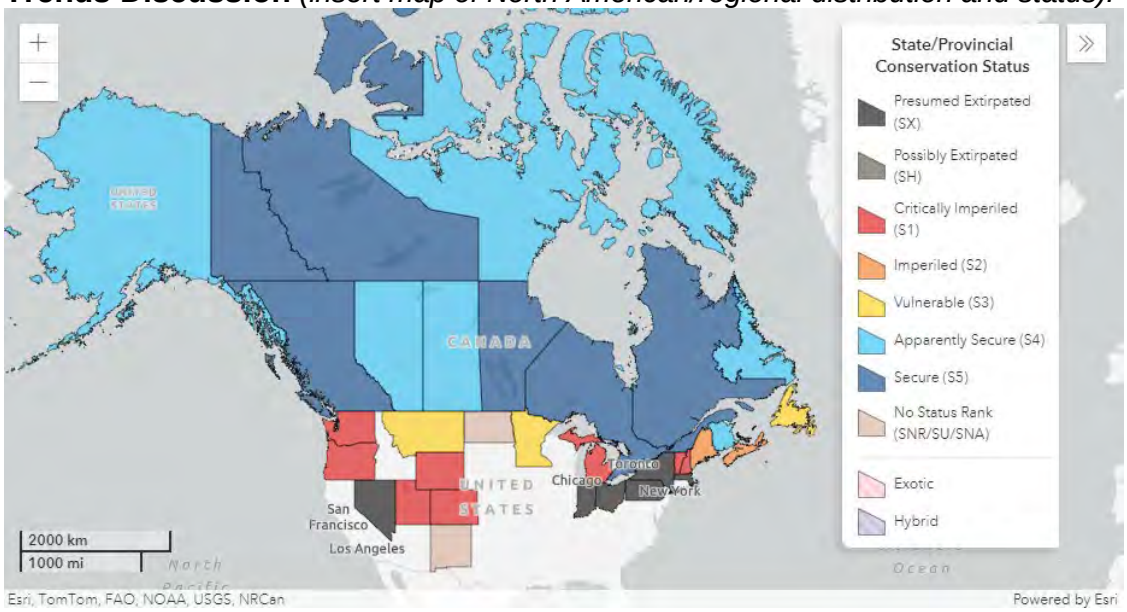

Figure 1. Conservation status of Canada lynx in North America (NatureServe 2024)

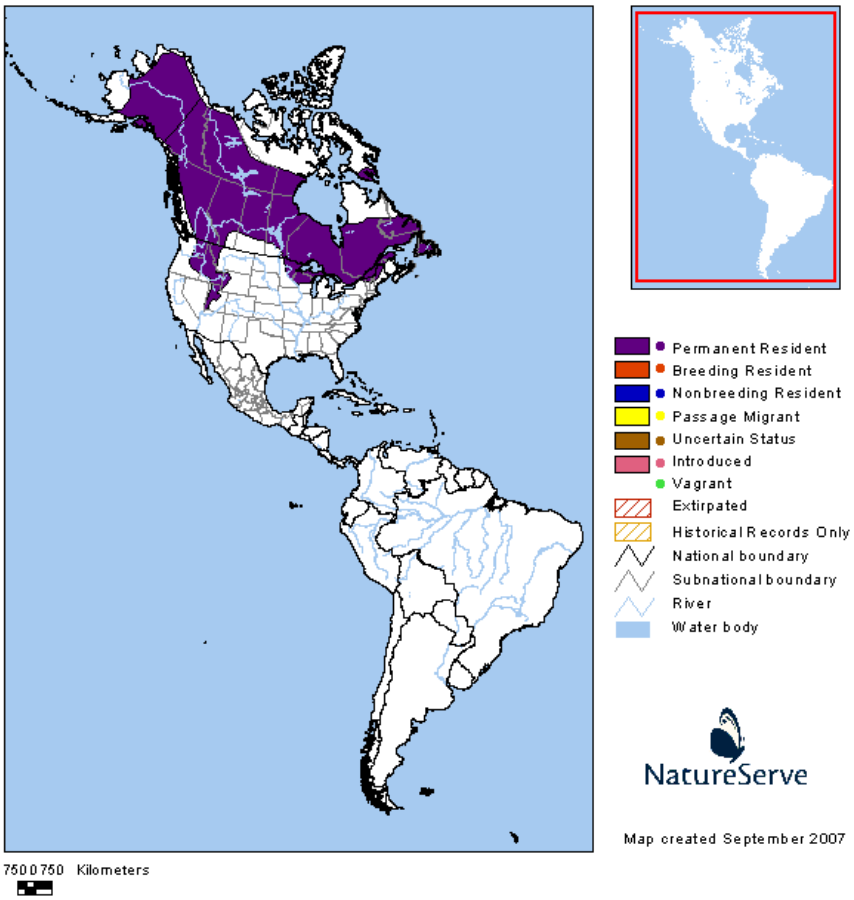

Figure 2. Distribution of Canada lynx in North America (NatureServe 2012).

From the Vermont 2015 Wildlife Action Plan:

Since 2003, nine lynx sightings have been confirmed in Vermont. Eight of the sightings were recorded in Essex County and one in Orleans County (unpublished data, VFWD). Since 2012, Intensive snow track and remote camera surveys have successfully detected lynx in the Nulhegan Basin (Bernier 2011 & 2013). Reproduction was first documented in 2012 in the Nulhegan Basin when the tracks of three lynx, a presumed family group, were observed travelling together in late February (Bernier 2011).

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Years	# of Records	# of Distinct Populations	% of State
Pre-1995	_____	_____	_____
1995-2004	_____	_____	_____
2005-2014	_____	_____	_____
2015 - 2023	_____	_____	_____

Table 1. Records of Canada lynx in New York.

Details of historic and current occurrence:

There are no current records of lynx in New York.

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
0%	Peripheral	~400 miles

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Spruce-Fir Forest and Flats

b. Mountain Spruce-Fir Forests

c. Mixed Northern Hardwoods

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
Yes	No	Declining	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Lynx habitat can generally be described as moist boreal forests that have cold, snowy winters and a high-density snowshoe hare prey base. The predominant vegetation of boreal forest is conifer trees, primarily species of spruce (*Picea* spp.) and fir (*Abies* spp.). In the contiguous United States, the boreal forest type transitions to deciduous temperate forest in the Northeast and Great Lakes, and to subalpine forest in the west. In mountainous areas, the boreal forests that lynx use are characterized by scattered moist forest types with high hare densities in a matrix of other habitats (e.g., hardwoods, dry forest, non-forest) with low hare densities. In these areas, lynx incorporate the matrix habitat (non-boreal forest habitat elements) into their home ranges and use it for traveling between patches of boreal forest that support high hare densities where most foraging occurs (USFWS 2013b).

V. Species Demographic, and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
No	(blank)	No	No	No	(blank)

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Canadian lynx require large hunting areas. Home ranges in the Unites States are highly variable and can be from 12 to 83 square miles depending on abundance of prey, the animal's gender and age, season, and the density of lynx populations (USFWS 2013b). Where snowshoe hare densities are high, territories average 22 square miles for males and 10 square miles for females (USFWS 2013a). Home ranges are larger in winter. A male's territory may contain or overlap with the range of two or three females and their young (USFWS 2013a).

Lynx also make long distance exploratory movements outside their home ranges. Preliminary research supports the hypothesis that lynx home ranges at the southern extent of the distribution are large compared to those in Canada, indicating a relative reduction of food resources in these areas (USFWS 2013b). Snowshoe hare make up 75% or more of the lynx's diet, and the populations of these two species are highly linked. Snowshoe hare numbers rise over a nearly 10-year period to a peak before crashing, and lynx follow the same pattern closely behind. However, in the Northeast, there is currently no evidence of natural snowshoe hare cycling; hare densities are more likely affected by forest practices than by 10-year cycles (USFWS 2013a). Without high densities of snowshoe hares, lynx are unable to sustain populations, despite utilizing a multitude of alternate prey species which include red squirrel (*Tamiasciurus hudsonicus*), grouse (*Bonasa umbellus*, *Dendragopus* spp., *Lagopus* spp.), flying squirrel (*Glaucomys sabrinus*), ground squirrel (*Spermophilus parryii*, *S. Richardsonii*), porcupine (*Erethrizon dorsatum*), beaver (*Castor canadensis*), mice (*Peromyscus* spp.), voles (*Microtus* spp.), shrews (*Sorex* spp.), fish, and ungulate carrion (USFWS 2013b).

Breeding occurs through March and April in the north. Kittens are born in May to June. The male lynx does not help with rearing young. Yearling females may give birth during periods when hares are abundant but otherwise females begin breeding during their second year. During periods of hare abundance in the northern taiga, litter size of adult females averages 4 to 5 kittens. Litter sizes are typically smaller in lynx populations in the contiguous United States (USFWS 2013b).

VI. Threats *(from NY 2015 SWAP or newly described):*

Threats to NY Populations	
Threat Category	**Threat**
Climate Change & Severe Weather	Habitat shifting & alteration
Agriculture & Aquaculture	Annual & perennial non-timber crops
Natural Systems Modifications	Other ecosystem modifications
Transportation & Service Corridors	Roads & railroads
Human Intrusions & Disturbance	Recreational activities
Biological Resource Use	Logging & wood harvesting

Timber harvest and recreation, and their related activities, are the predominant land uses affecting lynx habitat in the United States (Hoving 2001). Past land use practices and poorly planned logging has resulted in a reduction of habitat and the fragmentation of habitat corridors between populations, limiting dispersal (Ruediger *et al.* 2000).

The primary factor that caused the lynx to be listed as federally threatened was the lack of guidance for the conservation of lynx and snowshoe hare habitat in plans for federally managed lands. Methods of timber harvest can either enhance or destroy lynx habitat; movements may be negatively affected by high traffic volume on roads that bisect suitable lynx habitat, and in some areas, mortalities due to road kill are high (USFWS 2013b). A lack of connectivity between habitats is often the result of poor land management for species such as lynx.

Competition from coyote (*Canis latrans*) and fisher (*Martes pennanti*) (Ray *et al.* 2002) as well as genetic isolation and hybridization with bobcats may limit any recovery efforts.

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

The Canada lynx is protected by its status as state- and federally listed threatened. The species is classified by New York state law as a small game animal, but regulations do not permit lynx harvest. As a state-listed threatened species in New York, it is protected by Environmental Conservation Law (ECL) section 11-0535 and the New York Code of Rules and Regulations (6 NYCRR Part 182). A permit is required for any proposed project that may result in a take of a species listed as threatened or endangered, including, but not limited to, actions that may kill or harm individual animals or result in the adverse modification, degradation or destruction of habitat occupied by the listed species.

The Adirondack Park was created by the New York State Legislature in 1892. State-owned Forest Preserve comprises 2.6 million acres (42%) and is protected by the state constitution as "forever wild." One million acres of the Forest Preserve is further classified as wilderness.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

A reintroduction effort would require that a suitable prey base of “X” hares/hectare be established, which could be measured by the number of acres of snowshoe hare habitat within potential lynx range. Connectivity of habitat must also be maintained (Kart 2005).

A 1982 study found that lynx restoration was feasible in the Adirondack Park's north-east sector, which is relatively free of deer and bobcats and which harbors a good population of snowshoe hares. Brocke and Gustafson (1992) estimated that hare densities (170 hares/km^2) would support a lynx population of 70 animals. A Canadian Lynx Restoration Project was launched in 1989 as a cooperative effort between the NYSDEC and the State University of New York College of Environmental Science and Forestry’s Adirondack Wildlife Program. A total of 50 lynx were released in the High Peaks Region during the winters of 1989-1990, and another 30-40 during the winter of 1990-1991 (Gustafson 1991). It did not succeed in establishing a viable population. Out of 83 releases (48 females, 35 males), there have been 32 known mortalities. Twelve were killed by vehicles, the largest single source of known mortality. Five died out of state, usually by accidental shooting. Three lynx were raiding livestock pens.

Six animals were lost to miscellaneous causes. In one case, a young lynx was apparently killed by a large male lynx (Brocke and Gustafson 1992).

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
Species Management	Species reintroduction

Table 2. Recommended conservation actions for Canada lynx

The Comprehensive Wildlife Conservation Strategy (NYSDEC 2005) includes recommendations for the following actions for large mammals that have been extirpated in New York.

Habitat research:

____ Conduct biological assessment for species shown to be socially acceptable.

Other actions:

____ Conduct public attitude surveys when decision makers are of the opinion that there is a reasonable chance of public support for the restoration of an extirpated species.

Relocation/ reintroduction:

____ Restore species believed likely to succeed and that are socially acceptable and monitor their progress.

VII. References

Brocke, R.H. and K.A. Gustafson. 1992. Lynx in New York state. Cat News 17: Autumn 1992. IUCN/SSC Cat Specialist Group, Bougy-Villars, Switzerland.

Gustafson, K.A. 1991. Lynx restoration update. New York State Department of Environmental Conservation Furbearer Management Newsletter. Winter 1991, 2:1.

Hoving, C.L. 2001. Historical occurrence and habitat ecology of Canada lynx (*Lynx canadensis*) in eastern North American. Thesis, University of Maine, Orono, USA.

IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Accessed 22 March 2013.

Kart, J., R. Regan, S.R. Darling, C. Alexander, K. Cox, M. Ferguson, S. Parren, K. Royar, and B. Popp, editors. 2005. Vermont's Wildlife Action Plan. Vermont Fish & Wildlife Department. Waterbury, Vermont. <www.vtfishandwildlife.com>. Accessed 25 March 2013.

NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. <http://www.natureserve.org/explorer>. Accessed 22 March 2013.

NatureServe. 2024. NatureServe Explorer. Page last published 1/5/2024. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.102126/Lynx_canadensis Accessed January 22, 2024.

New York State Department of Environmental Conservation (NYSDEC). 2005 New York State Comprehensive Wildlife Conservation Strategy. Albany, NY. https://extapps.dec.ny.gov/docs/wildlife_pdf/cwcs2005.pdf

Novak, M.J., J. Baker, M. Obbard, and M. Mallock, editors. 1987. Wild furbearer management and conservation in North America. Ontario Ministry of Natural Resources, Toronto, Canada.

Ray, J.C., J F. Organ, and M.S. O'Briend. 2002. Canada lynx (*Lynx canadensis*) in the Northern Appalachians: Current knowledge, research priorities, and a call for regional cooperation and action. Report of a meeting held in Portland, Maine, April 2002.

Ruediger, B., J. Claar, S. Gniadek, B. Holt, L. Lewis, S. Mighton, B. Naney, G. Patton, T. Rinaldi, J. Trick, A. Vandehay, F. Wahl, N. Warren, D. Wenger, and A. Williamson. 2002. Canada lynx conservation assessment and strategy. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, USDI National Park Service, Missoula, Montana, USA.

Therres, G.D. 1999. Wildlife species of regional conservation concern in the northeastern United States. Northeast Wildlife 54:93-100.

U.S. Fish and Wildlife Service (USFWS). 2013a. Canada lynx fact sheet. <http://www.fws.gov/northeast/pdf/canalynx.pdf>. Accessed 25 March 2013.

U.S. Fish and Wildlife Service (USFWS). 2013b. Species profile for Canada lynx. <http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=A073>. Accessed 22 March 2013.

Originally prepared by	Jenny Murtaugh
Date first prepared	March 28, 2013
First revision	February 26, 2014 (Samantha Hoff)
Latest revision	

Species Status Assessment

Common Name: Cougar **Date Updated:** April, 2024

Scientific Name: *Puma concolor* **Updated By:** S. Booth-Binczik, D. Rosenblatt

Class: Mammalia

Family: Felidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

The cougar (*Puma concolor*), also known as puma, mountain lion and panther, was formerly the most widely distributed terrestrial mammal species in the western hemisphere, ranging from New Brunswick and northern British Columbia to southern Chile (Sunquist and Sunquist, 2002). As were other large carnivore species, it was extirpated from much of its range in North America during European settlement, and the last historical record of cougars in New York was from 1903 in the Adirondacks (Whitaker and Hamilton, 1998). However, in recent decades cougars have been spreading eastward from populations in the western U.S. to recolonize parts of their former range. Populations of cougars are now established in Nebraska and both North and South Dakota, and between 2010 and 2020 there were 180 confirmed observations of cougars in Minnesota, Wisconsin and Michigan (Gantchoff et al., 2021). In 2010 a cougar from South Dakota was documented traveling through the Adirondacks; it ended up being hit by a car and killed in Connecticut in 2011 (Kerwin, 2012; Hawley et al., 2016). There is habitat suitable for supporting cougar populations in the Adirondacks (Laundré, 2013; Winkel et al., 2022) and parts of New England (Glick, 2014; Winkel et al., 2022). Taxonomically, cougars were originally split into 32 subspecies, but genetic analyses indicate that classifying them into six subspecies would be more appropriate, and that all North American cougars appear to belong to a single subspecies (Culver, 2009).

I. Status

a. Current legal protected Status

i. **Federal:** Not listed, except in Florida **Candidate:** No

ii. **New York:** Endangered

b. Natural Heritage Program

i. **Global:** G5

ii. **New York:** SX **Tracked by NYNHP?:** Yes

Other Ranks:

IUCN Red List: Least Concern

COSEWIC: Data Deficient

CITES: Appendix II

Status Discussion:

Cougars were effectively extirpated from eastern North America in the 1800s, with the exception of a remnant population in Florida. In the 1990s, eight cougars were translocated from Texas to Florida to increase genetic diversity, and they were included in the legal protection due to similarity of appearance. The global status of cougars is considered secure because they have such a broad distribution and are still abundant in parts of their range.

The US Fish and Wildlife Service listed eastern cougar as an endangered species in 1973. It was removed from the list is 2018, based on the determination that it was extinct in the northeast (USFWS 2018).

Cougars are considered to be extirpated from New York. Extirpation does not mean a species is extinct, but rather that it no longer occurs in a wild state within New York. Although cougars historically bred in New York, no breeding has been documented in over a century.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Increasing	Increasing	50 years	Not listed	Choose an item.
Northeastern US	No	Choose an item.	Choose an item.		NA	No
New York	No	Extirpated	Extirpated		Endangered	No
Connecticut	No	Choose an item.	Choose an item.		Special Concern, Believed Extirpated	No
Massachusetts	No	Choose an item.	Choose an item.		not listed	No
New Jersey	No	Choose an item.	Choose an item.		not listed	No
Pennsylvania	No	Choose an item.	Choose an item.		not listed	No
Vermont	No	Choose an item.	Choose an item.		Endangered	Yes
Ontario	Yes	Unknown	Unknown		Endangered	Choose an item.
Quebec	Yes	Unknown	Unknown		Likely to be listed as Threatened or Endangered	Choose an item.

Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

None.

Trends Discussion *(insert map of North American/regional distribution and status):*

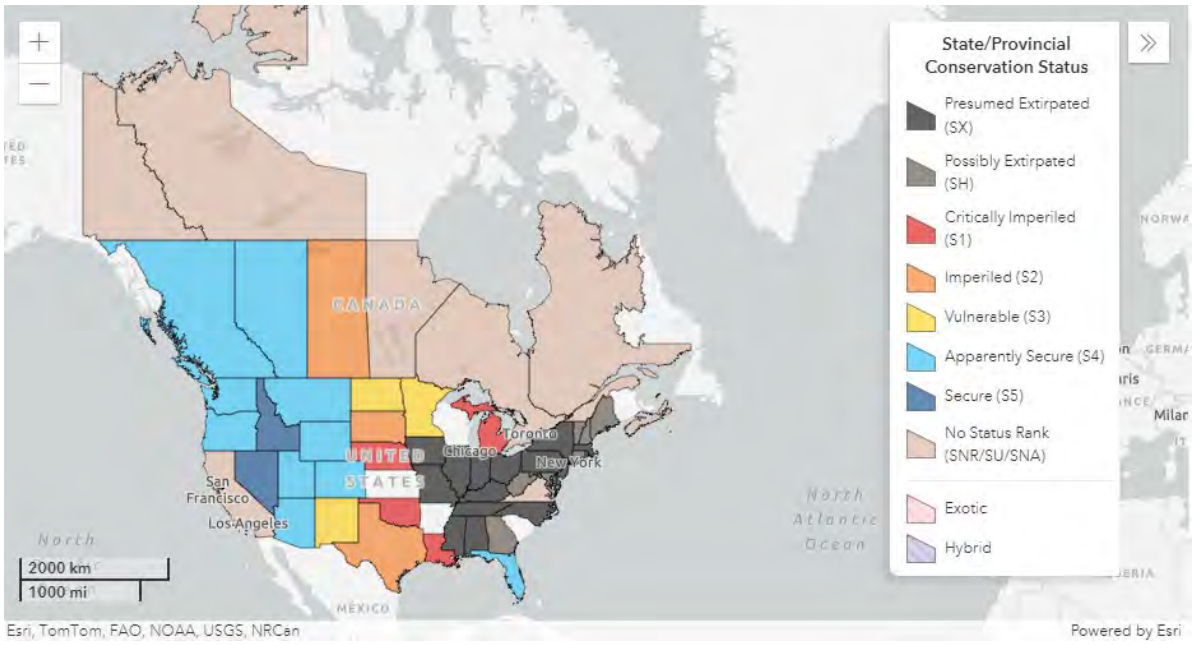

Figure 1. Conservation status of cougar in North America (NatureServe 2024)

Cougars have been gradually reoccupying the eastern part of their range in North America, expanding eastward through the Midwest (LaRue et al., 2012; Gantchoff et al., 2021; Winkel et al., 2022). Between 1996 and 2010, cougars of North American origin were confirmed at six different locations in Quebec and one in New Brunswick through genetic analysis (Lang et al., 2013.) Between 2017 and 2021, there were fifteen cougar occurrences documented in southwestern Ontario (COSSARO, 2022), where they presumably crossed the border from Minnesota.

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Years	# of Records	# of Distinct Populations	% of State
Pre-1995			
1995-2004	0		
2005-2014	1		
2015 - 2023	0		

Table 1. Records of cougar in New York.

Details of historic and current occurrence:

The only wild cougar confirmed to have been in New York in the past century was seen in the town of Lake George in December 2010 (Kerwin, 2012). It was subsequently confirmed through DNA analysis of hair found at the Lake George site to be the same three-year-old male cougar that was killed on a road in Connecticut six months later. The animal was further documented by DNA evidence to have been in Minnesota and Wisconsin in the winter of 2009-2010, and the genetic analyses indicated that it originally came from the Black Hills, South Dakota population (Hawley, 2016).

New York's Contribution to Species' North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
Choose an item.	Choose an item.	>1,000 miles

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Oak-pine Forest

b. Oak Forest

c. Mixed Northern Hardwoods

d. Spruce-fir Forest and Flats

e. Mountain Spruce-fir Forest

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
No	No	Unknown	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Cougars have a broad ecological niche; they can thrive from boreal regions through the tropics and are found in a wide variety of landscapes, including mountains, swamps, deserts, agricultural areas and even the city of Los Angeles. Although they typically inhabit forested regions, they are increasingly being documented in more open habitat types such as steppe (Elbroch and Wittmer, 2012) and open woodland (Zanón-Martínez et al., 2016). Prior to European settlement, they may have been functionally excluded from such habitats in North America by the presence of other large carnivores such as wolves and grizzlies (Elbroch and Wittmer, 2012), and the current absence of those species may allow them to use a wider range of habitat types as they expand eastward.

As ambush predators, cougars require concealing cover from which to stalk their prey. This cover can be provided by vegetation, and it can also be provided by landforms such as rock outcrops, boulder piles, and riverbanks or other steep slopes (Sunquist and Sunquist, 2002). Modeling indicates that rugged terrain contributes to habitat quality (Dickson et al., 2013; Gantchoff et al., 2021), and cougars are found at elevations up to 5800 m above sea level (Sunquist and Sunquist, 2002).

The Adirondacks provide the highest quality cougar habitat in New York (Winkel et al., 2022). Laundré (2013) modeled habitat suitability for cougars within the Adirondack Park and concluded that the Park would be able to support between 150 and 350 cougars, based on habitat quality and

estimated white-tailed deer (*Odocoileus virginianus*) densities. Various cervid species are the principal prey of cougars in most of North America (Sunquist and Sunquist, 2002), but smaller species such as beaver and porcupine, both of which are abundant in the Adirondacks, can also form a significant component of their diet (Knopff et al., 2010; Lowrey et al., 2016).

The most likely route for natural cougar recolonization of New York would be through dispersal from the Midwest. Several modeling studies have indicated that northern Minnesota, Wisconsin and Michigan contain abundant suitable cougar habitat (Sampson, 2013; O'Neil et al., 2014; Mbuh and Vruno, 2018; Gantchoff et al., 2021; Winkel et al., 2022). Gantchoff et al. (2021) identified 191 patches of suitable habitat (covering approximately 114,000 km^2) in those three states that were large enough to contain at least one adult female cougar home range, and O'Neil et al. (2014) concluded that a population of approximately 500 cougars could be supported in northern Wisconsin and Michigan alone. These three states are the area through which the cougar that reached New York in 2010 was documented to have traveled (Hawley et al., 2016), and modeling indicates that there are habitat corridors suitable for dispersal between this area and the existing cougar population in North Dakota (Winkel et al., 2022). Although most long-distance dispersal is by males, based on recent data from the upper Midwest it has been projected that female cougars will occupy northern Minnesota within 20 years (LaRue and Nielsen, 2016).

V. Species Demographics and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
No	No	No	No	No	(blank)

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

As is typical for felids, cougars are solitary, but they sometimes have extensive intrasexual home range overlap (Sunquist and Sunquist, 2002). Males' home ranges are larger than those of females and typically include or overlap several females' home ranges. Both sexes mate polygamously.

Cougars typically reach sexual maturity at 24 to 36 months (Eaton and Velander, 1977; Maehr et al., 1991) and the average age at first reproduction is 2.2 years (Belden and Schulz, 2007). Cougars can breed year-round (Lechleitner, 1969), and females typically reproduce every 2 to 3 years if their cubs survive to independence (Sunquist and Sunquist, 2002). Gestation is 82 to 96 days (Hansen, 1992) and litter sizes range from 1 to 6, with a mean of 2.6 (Anderson, 1983). Cubs are born in caves, under uprooted trees, or in dense thickets (Young and Goldman, 1946).

Juveniles typically disperse between the ages of 14 to 21 months (Sunquist and Sunquist, 2002). All males and approximately half of females disperse from their natal ranges (Sweanor et al., 2000; Stoner et al., 2013). Females disperse short distances, averaging 18 mi (29.0 km) (Ashman et al., 1983). Males usually occupy a series of small home ranges as transients until they find an area to occupy as a permanent territory (Beier, 1995). Average dispersal distance is 31 to 100 mi. (49.9 to 160.9 km) for males (Ashman et al., 1983; Hornocker, 1970), but cougars have been known to disperse up to 600 to 1,000 mi (965 to 1609 km) from their birthplace (Logan and Sweanor, 2000; Thompson and Jenks, 2005). The average life span for cougars is about eight years.

VI. Threats *(from NY 2015 SWAP or newly described):*

Most cougar mortality in recently re-occupied parts of the species' range is human-caused, primarily through lethal removal by management agencies and vehicle accidents (Thompson et al., 2014; Benson et al., 2023). The rate of management killing in California appears to be more closely related to local residents' attitudes than to factors such as the density of vulnerable livestock (Benson et al., 2023)

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

Cougars are listed as endangered in New York, which provides a regulatory mechanism for protecting the species and its habitat. However, legal protection may not be sufficient to prevent human-caused mortality from having population-level impacts (Benson et al., 2023), and the ability of cougars to re-occupy more of their former range may depend largely on levels of human tolerance for the species (Knopff et al., 2014).

McGovern and Krester (2015) examined the social acceptability of natural recolonization of cougars in the Adirondack Park. They found that approximately 70% of respondents were in favor of cougars recolonizing the Adirondacks, with respondents' opinion on the threat posed by cougars to livestock being the factor with the strongest influence on their responses. Degree of knowledge about cougars also influenced the level of support for the return of the species, suggesting that educational outreach could increase support.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

With abundant forest cover, including in large areas that are protected from development, and a return of healthy populations of white-tailed deer (Gilbert et al., 2017), New York has ample suitable habitat for cougar re-establishment. If cougars were to return to the state, human-caused mortality would be the main threat to their recovery, so conservation actions in the near term should be focused on reducing the potential need for management killing and any potential inclination some residents might have to kill cougars illegally. This could include general education about cougar ecology and the cost/benefit balance of co-existing with cougars, as well as specific training on topics such as preventing cougar depredation of livestock.

If cougars do not continue their eastward spread and public support for restoring cougars to New York increases, a management re-introduction of the species could be considered.

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
1. Education & Awareness	Awareness & communications

2. Education & Awareness	Training

Table 2. Recommended conservation actions for cougar.

VII. References

Anderson, A.E. 1983. A critical review of the literature on puma (*Felis concolor*). Colorado Division of Wildlife Special Report No. 54.

Ashman, D.G. C. Christensen, M C. Hess, G.K. Tsukamoto, and M.S. Wichersham. 1983. The mountain lion of Nevada. Nevada Department of Wildlife, Reno, Nevada, USA.

Beier, P. 1995. Dispersal of juvenile cougars in fragmented habitat. Journal of Wildlife Management 59: 228-237.

Belden, R.C., and C. Schulz. 2007. Florida panther (*Puma concolor coryi*) 5-year review: Summary and evaluation. U.S. Fish and Wildlife Service, South Florida Ecological Services Office, Vero Beach, Florida, USA.

Benson, J.F., K.D. Dougherty, P. Beier, W.M. Boyce, B. Cristescu, D.J. Gammons, D.K. Garcelon, J.M. Higley, Q.E. Martins, A.C. Nisi, S.P.D. Riley, J.A. Sikich, T.R. Stephenson, T.W. Vickers, G.M. Wengert, C.C. Wilmers, H.U. Wittmer, and J.A. Dellinger. 2023. The ecology of human-caused mortality for a protected large carnivore. PNAS 120: e2220030120.

Committee on the Status of Species at Risk in Ontario (COSSARO). 2022. Ontario species at risk evaluation report for cougar (*Puma concolor*).

Culver, M. 2009. Lessons and insights from evolution, taxonomy, and conservation genetics. Pp. 27-40 in: Cougar: Ecology and Conservation (M. Hornocker and S. Negri, eds.). University of Chicago Press, Chicago, Illinois.

Dickson, B.G., G.W. Roemer, B.H. McRae and J.M. Rundall. 2013. Models of regional habitat quality and connectivity for pumas (*Puma concolor*) in the southwestern United States. PLoS ONE 8:e81898.

Eaton, R.L. and K.A. Velander. 1977. Reproduction in the puma: biology, behavior, and ontogeny. World's Cats 3: 45-70.

Elbroch, L.M. and H.U. Wittmer. 2012. Puma spatial ecology in open habitats with aggregate prey. Mammalian Biology 77:377-384.

Gantchoff, M.G., J.D. Erb, D.M. MacFarland, D.C. Norton, J.L. Price Tack, B.J. Roell and J.L. Belant. 2021. Potential distribution and connectivity for recolonizing cougars in the Great Lakes region, USA. Biological Conservation 257:109144.

Gilbert, S.L., K.J. Sivy, C.B. Pozzanghera, A. DuBour, K. Overduijn, M.M. Smith, J. Zhou, J.M. Little and L R. Prugh. 2017. Socioeconomic benefits of large carnivore recolonization through reduced wildlife-vehicle collisions. Conservation Letters 10:431-439.

Glick, H.B. 2014. Modeling cougar habitat in the Northeastern United States. Ecological Modelling 285:78–89.

Hansen, K. 1992. Cougar: The American lion. Northland Publishing, Flagstaff, Arizona, USA.

Hawley, J.E., P.W. Rego, A.P. Wydeven, M.K. Schwartz, T.C. Viner, R. Kays, K.L. Pilgrim, and J.A. Jenks. 2016. Long-distance dispersal of a subadult male cougar from South Dakota to Connecticut documented with DNA evidence. Journal of Mammalogy 97:1435-1440.

Hornocker, M.G. 1970. An analysis of mountain lion predation upon mule deer and elk in the Idaho Primitive Area. Wildlife Monograph No. 21. The Wildlife Society, Washington, D.C., USA.

Kerwin, J. 2012. Far from home: wild western cougar travels through New York. The New York State Conservationist, October 2012, pp. 8-11.

Knopff, A.A., K.H. Knopff, M.S. Boyce, and C.C. St. Clair. 2014. Flexible habitat selection by cougars in response to anthropogenic development. Biological Conservation 178:136-145.

Knopff, K.H., A.A. Knopff, A. Kortello and M.S. Boyce. 2010. Cougar kill rate and prey composition in a multiprey system. Journal of Wildlife Management 74:1435-1447.

Lang, L., N. Tessier, M. Gauthier, R. Wissink, H. Jolicoeur, and F.J. Lapointe. 2013. Genetic confirmation of cougars (*Puma concolor*) in eastern Canada. Northeastern Naturalist 20(3): 383-396.

LaRue, M.A. and C.K. Nielsen. 2016. Population viability of recolonizing cougars in midwestern North America. Ecological Modelling 321:121-129.

LaRue, M.A., C K. Nielsen, M. Dowling, K. Miller, B. Wilson, H. Shaw, and C.R. Anderson, Jr. 2012. Cougars are recolonizing the Midwest: analysis of cougar confirmations during 1990-2008. Journal of Wildlife Management 76:1364-1369.

Laundré, J.W. 2013. The feasibility of the north-eastern USA supporting the return of the cougar *Puma concolor.* Oryx 47:96-104.

Lechleitner, R.R. 1969. Wild mammals of Colorado: Their appearance, habits, distribution, and abundance. Pruett Publishing Company, Boulder, Colorado, USA.

Logan, K.A. and L.L. Sweanor. 2000. Puma. Pages 347-377 in S. Demarais and P. Krausman, editors. Ecology and management of large mammals of North America. Prentice-Hall, Englewood Cliffs, New Jersey, USA.

Lowrey, B., L.M. Elbroch and L. Broberg. 2016. Is individual prey selection driven by chance or choice? A case study in cougars (*Puma concolor*). Mammal Research 61:353-359.

Maehr, D.S., E.D. Land, and J.C. Roof. 1991. Social ecology of Florida panthers. National Geographic Research and Exploration 7: 414-431.

McGovern, E.B. and H.E. Kretser. 2015. Predicting support for recolonization of mountain lions (*Puma concolor*) in the Adirondack Park. Wildlife Society Bulletin 39:503-511.

NatureServe. 2024. NatureServe Explorer. Page last published 1/5/2024. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.101637/Puma_concolor Accessed January 22, 2024.

New York State Department of Environmental Conservation (NYSDEC). 2019. List of Endangered, Threatened and Special Concern Fish and Wildlife Species of New York State. https://dec.ny.gov/nature/animals-fish-plants/biodiversity-species-conservation/endangered-species/lists. Accessed January 22, 2024.

Stoner, D., M.L. Wolfe, C. Mecham, M. B. Mecham, S. L. Durham and D. M. Choate. 2013. Dispersal behaviour of a polygynous carnivore: Do cougars, *Puma concolor*, follow source-sink predictions? Wildlife Biology 19(3):289-301.

Sunquist, M. and F. Sunquist. 2002. Wild Cats of the World. University of Chicago Press. Chicago, Illinois, USA.

Sweanor, L.L., K.A. Logan, and M.G. Hornocker. 2000. Cougar dispersal patterns, metapopulation dynamics, and conservation. Conservation Biology 14:798-808.

Thompson, D.J. and J.A. Jenks. 2005. Long distance dispersal by a subadult male cougar from the Black Hills, South Dakota. Journal of Wildlife Management 69: 818-820.

Thompson, D.J., J.A. Jenks, and D.M. Fecske. 2014. Prevalence of human-caused mortality in an unhunted cougar population and potential impacts to management. Wildlife Society Bulletin 38:341-347.

United States Fish and Wildlife Service. USFWS. 2018. Environmental Conservation Online System. Eastern puma (=cougar) (*Puma (=Felis) concolor cougar*). https://ecos.fws.gov/ecp/species/441.

Whitaker, J.O., Jr., W. J. Hamilton, Jr. 1998. Mammals of the Eastern United States. Cornell University Press. Ithaca, New York, USA.

Winkel, B.M., C.K. Nielsen, E.M. Hillard, R.W. Sutherland, and M.A. LaRue. 2022. Potential cougar habitats and dispersal corridors in Eastern North America. Landscape Ecology https://doi.org/10.1007/s10980-022-01538-1.

Young, S.P. and E.A. Goldman. 1946. The puma: Mysterious American cat. American Wildlife Institute, Washington, D.C., USA.

Zanón-Martínez, J.I., M.J. Kelly, J.B. Mesa-Cruz, J.H. Sarasola, C. DeHart and A. Travaini. 2016. Density and activity patterns of pumas in hunted and non-hunted areas in central Argentina. Wildlife Research 43:449-460.

Originally prepared by	Jenny Murtaugh
Date first prepared	March 28, 2013
First revision	December 2, 2014 (K. Corwin)
Latest revision	

Species Status Assessment

Common Name: Eastern red bat **Date Updated:** 12/28/2023

Scientific Name: *Lasiurus borealis* **Updated By:** Ashley Meyer

Class: Mammalia

Family: Vespertilionidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

Taxonomy is somewhat confused, primarily at the geographic extremes of distribution, with several forms variously treated as either distinct species or subspecies.

Population trends are unknown. The short-term trends in New York distribution appear to be stable from 2009-2022 (NYSDEC unpub. data) and the populations trends are unknown. The long-term trends are not known for New York. There is evidence that this species could be declining in at least parts of its range.

It is a solitary, tree- or shrub-roosting bat found in edge habitats.

The eastern red bat's summer range includes the central and eastern United States east of the Continental Divide, and southern Canada and northeastern Mexico. The winter range of the eastern red bat is predominantly in the southeastern United States; however, they have been found farther north. Most aspects of the species' life history, abundance and distribution, and threats are poorly understood.

I. Status

a. Current legal protected Status

i. **Federal:** Not listed **Candidate:** No

ii. **New York:** Not listed; SGCN

b. Natural Heritage Program

i. **Global:** G3G4

ii. **New York:** S3S4B **Tracked by NYNHP?:** No

Other Ranks:

IUCN Red List: Least Concern

Northeast Regional SGCN: Moderate Concern

Status Discussion:

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.
Northeastern US	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.
New York	Yes	Stable	Stable	2009 - 2022	Not listed	Yes
Connecticut	Yes	Choose an item.	Choose an item.	2015	Special Concern	Yes
Massachusetts	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.
New Jersey	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.
Pennsylvania	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.
Vermont	Yes	Choose an item.	Choose an item.		Not listed	Yes
Ontario	Yes	Declining	Choose an item.		Endangered	Choose an item.
Quebec	Yes	Declining	Choose an item.		Endangered	Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

State-wide acoustic surveys regularly detect Eastern red bats. They are also commonly caught incidentally during mist net surveys targeting Indiana bats.

Trends Discussion *(insert map of North American/regional distribution and status):*

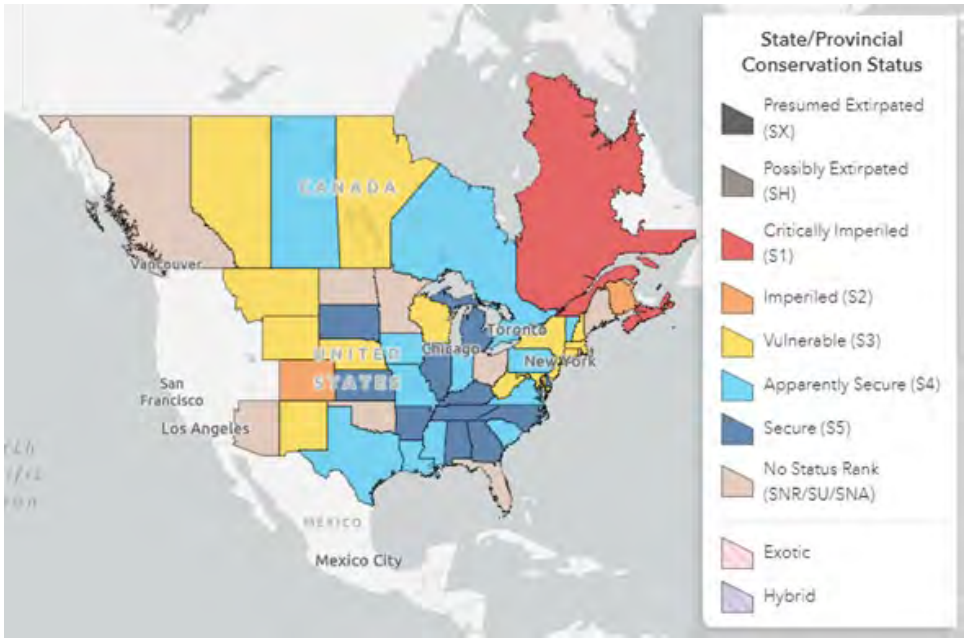

Figure 1. Conservation status of the eastern red bat in North America (NatureServe 2023)

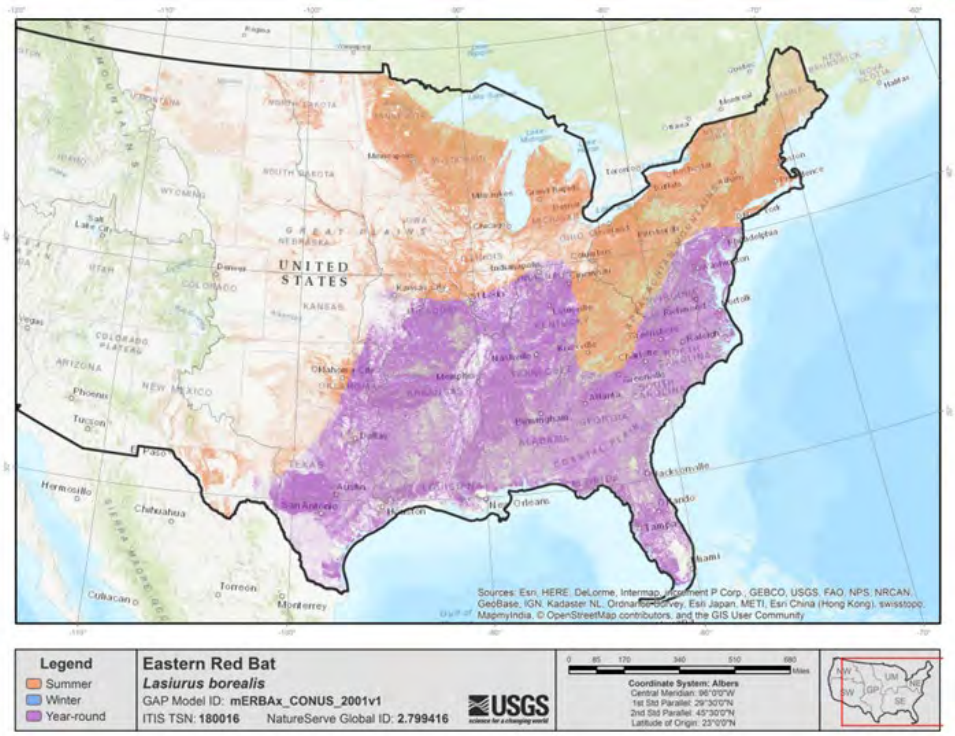

Figure 2. Distribution of the eastern red bat (USGS 2017)

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Years*	# of Records	# of Distinct Populations	% of State**
Pre-1995	_____	1	_____
1995-2004	_____	1	_____

2005-2014	2169	1	100
2015 - 2023	4115	1	100

Table 1. Records of eastern red bat in New York from mobile acoustic monitoring program.

*The acoustic monitoring program began in 2009, so data in unavailable prior to that year.

**Mobile acoustic survey routes are evenly distributed across the state, except for Long Island where these surveys are not completed due to logistical difficulties. However, Eastern red bats are commonly observed on stationary acoustic surveys throughout Long Island.

Details of historic and current occurrence:

No reliable data are available prior to 2009.

Acoustic surveys detect the species throughout the state during the maternity period, suggesting the species is widespread.

Outside of the migration period most records for NY are the result of the state-wide acoustic survey. Red bats are also frequently caught during mist net surveys. These surveys suggest the species is widespread and not uncommon in NY.

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Peripheral	

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Northeastern Upland Forest

b. Northeastern Wetland Forest

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
No	No	Unknown	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Roosting in tree foliage, shrubs, leaf litter, dense grass and under house shingles in edge habitat, near canopy gaps or urban areas. Forage over open areas including water, parks, pasture lands, forest edges, in canopy gaps and clearcut harvests (NYNHP 2023).

V. Species Demographic and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Choose an item.	Choose an item.	Yes	No	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Eastern red bats are solitary but may forage or migrate with other individuals. Average home range sizes of 68 and 94 hectares have been reported.

Young are born in late June or July and there is some variation in the number of offspring produced ranging between 1 and 5, and averaging 2.3. The young nurse until 35-42 days old when they become independent and disperse.

Little is known about age of first breeding and longevity of the red bat, but the potential life span may be 12 years.

VI. Threats *(from NY 2015 SWAP or newly described):*

Red bats are killed when they collide with wind turbines in New York, particularly during fall migration. Bats may be particularly sensitive to environmental toxins including those found in herbicides and pesticides. They are highly susceptible to DDT residue and this chemical was widely used as a pesticide to control bat infestations in houses in the 1940s (U.S. Geological Survey 2013).

Wind turbines pose a threat primarily during the fall migration period. Although resident animals may not be threatened by turbines located in NY, presumably they face the threat in areas to our south during migration (Cryan 2011).

The threat related to forest management is presumed, uncertain and described only qualitatively (Hayes and Loeb 2007).

Threats to NY Populations	
Threat Category	**Threat**
Energy Production & Mining	Renewable Energy (wind turbines)
Pollution	Industrial & Military Effluents (environmental contaminants including flame retardants, mercury, etc.)

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

Research indicates that raising cut-in speeds (i.e., wind speed at which turbines first start rotating and generating electrical power) of wind turbines during peak activity times may limit the number of migratory tree bats killed at large-scale turbines. Large-scale (>25MW) wind energy projects are required to implement a 5.5m/s cut-in speed during the migratory period. Higher cut-in speeds could be applied to all wind energy projects to reduce this threat further.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

- Review and respond to projects involving tall structures that are likely to adversely affect the population (ongoing).
- Conduct surveys of migrants to determine the timing, distribution, species composition and elevation of migrating bats. This is likely to include combinations of acoustical monitoring, radar, and visual monitoring (partially completed).
- Conduct summer surveys of tree bats that will include capturing individuals and acoustical monitoring (ongoing).

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
1. Land/water protection	
2.	

Table 2. Recommended conservation actions for eastern red bat.

VII. References

Cryan, P.M. 2011. “Wind Turbines as Landscape Impediments to the Migratory Connectivity of Bats.” Environmental Law 41:355–370.

Hayes, J. P., & Loeb, S. C. (2007). The influences of forest management on bats in North America. Bats in forests: conservation and management (MJ Lacki, JP Hayes, and A. Kurta, eds.). Johns Hopkins University Press, Baltimore, Maryland, 207-235.

IUCN 2023. IUCN Red List of Threatened Species. Version 20231. <www.iucnredlist.org>. Accessed 26 December 2023.

Murtaugh, J. 2013. NYSDEC SWAP 2015 Species Status Assessment for eastern red bat. Prepared on June 26, 2013. Revised by Samantha Hoff on January 29, 2014.

NatureServe Explorer 2.0. (2023, November 3). https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.799416/Lasiurus_borealis. Accessed 21 November 2023.

New York Natural Heritage Program (NYNHP). 2023. Online Conservation Guide for *Lasiurus borealis*. Available from: https://guides.nynhp.org/eastern-red-bat/. Accessed November 21, 2023.

U.S. Geological Survey (USGS) - Gap Analysis Project (GAP), 2018, Eastern Red Bat (Lasiurus borealis) mERBAx_CONUS_2001v1 Habitat Map: U.S. Geological Survey data release, https://doi.org/10.5066/F70P0XD2. Accessed 21 November 2023.

Originally prepared by	Jenny Murtaugh
Date first prepared	June 26, 2013
First revision	January 29, 2014 (Samantha Hoff)
Last revision	December 28, 2023 (Ashley Meyer)

Species Status Assessment

Common Name: Eastern small-footed bat **Date Updated:** 12/28/2023

Scientific Name: *Myotis leibii* **Updated By:** Ashley Meyer

Class: Mammalia

Family: Vespertilionidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

Overall, Small-footed Myotis have been recorded from approximately 26% of all sites surveyed. The species is most often recorded at hibernacula in northern New York with most of the large sites being located in the Adirondacks. Hibernacula are also located in eastern and central New York caves, and southern and western New York mines. Small-footed Myotis have been captured at summer foraging locations in central New York and southern New York. The range extends from New England, southeastern Ontario, and southwestern Quebec south and west to southeastern Oklahoma, Arkansas, northern Alabama, northern Georgia, and northwestern South Carolina. Within this range, the distribution is very spotty, and the bulk of the occurrences and largest populations are in New York, Pennsylvania, West Virginia, and western Virginia.

Because this species often hides in crevices and may use smaller, unsurveyed hibernacula, there is significant uncertainty surrounding whether the apparent measured declines of 31% (2007-2015) are due to sampling error. It seems likely that populations are stable or declining slightly. Prior to WNS populations were thought to be relatively stable. Trends from historic populations are unknown but this species was always likely relatively uncommon. There is a large margin of error surrounding the hibernacula surveys reporting trends of between 13% (2012) to 30% (2015) decline.

Small-footed bats winter in caves and mines, and openings deep within rock crevices in outcrops. Several individuals have been mist-netted in deciduous forests during the summer months in southeastern and central New York, but the species is likely to be more widespread in the state during the summer months.

I. Status

a. Current legal protected Status

i. **Federal:** Not listed **Candidate:** Yes

ii. **New York:** Special Concern; SGCN

b. Natural Heritage Program

i. **Global:** G4

ii. **New York:** S1S3 **Tracked by NYNHP?:** Yes

Other Ranks:

IUCN Red List: Endangered

Northeast Regional SGCN: RSGCN

Status Discussion:

The small-footed bat is listed as rare or imperiled throughout its range. The rounded Global and National Heritage Status of small-footed bat is a “2,” meaning that the species is imperiled throughout its range.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Choose an item.	Choose an item.			Choose an item.
Northeastern US	Yes	Choose an item.	Choose an item.			Yes
New York	Yes	Stable	Stable	1985-2022	Special Concern	Yes
Connecticut	Yes	Choose an item.	Choose an item.		Endangered	Yes
Massachusetts	Yes	Choose an item.	Choose an item.		Endangered	Yes
New Jersey	Yes	Choose an item.	Choose an item.		Not listed	Yes
Pennsylvania	Yes	Choose an item.	Choose an item.		Threatened	Yes
Vermont	Yes	Choose an item.	Choose an item.		Threatened	Yes
Ontario	Yes	Choose an item.	Choose an item.		Endangered	Choose an item.
Quebec	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

Small-footed bats are monitored via winter hibernacula surveys, summer acoustic surveys and summer mist netting (non-target species for surveys mostly aimed at detecting presence of Indiana bats).

Trends Discussion *(insert map of North American/regional distribution and status):*

Figure 1. Conservation status of the small-footed bat in North America (NatureServe 2023)

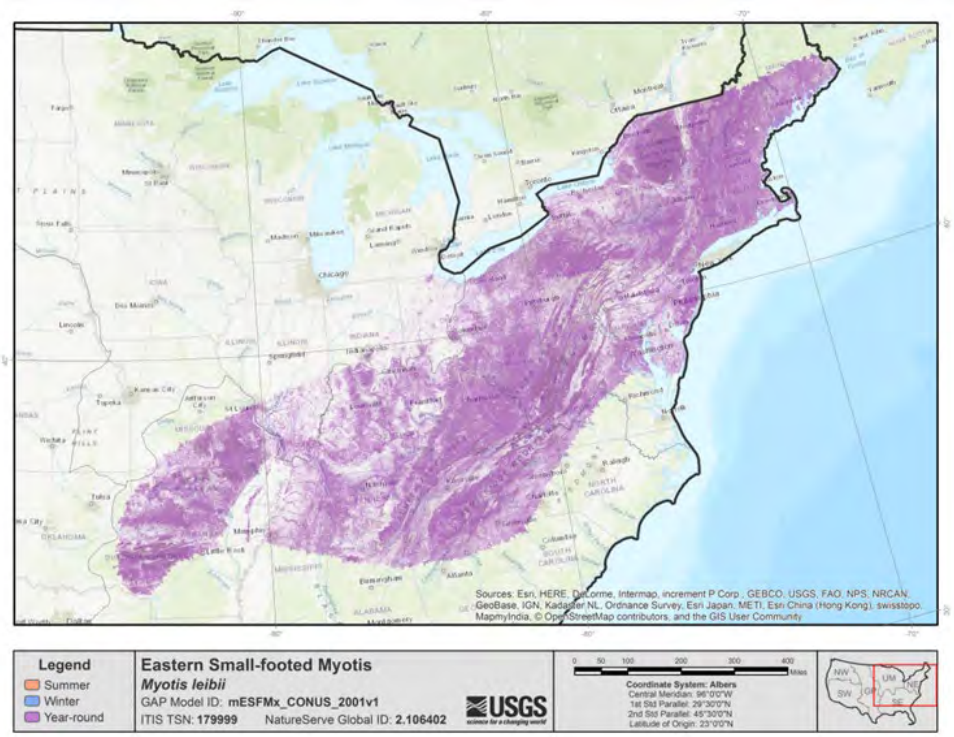

Figure 2. Distribution of the Eastern small-footed bat (USGS 2018)

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Years	# of Records	# of Distinct Populations	% of State

Pre-1995	_____	_____	_____
1995-2004	_____	_____	_____
2005-2014	_____	_____	_____
2015 - 2023	_____	_____	_____

Table 1. Records of eastern small-footed bat in New York.

Details of historic and current occurrence:

The abundance of *M. leibii* is difficult to measure and most records come from hibernacula counts. As of 2006, the species had been documented in 125 hibernacula (Amelon and Burhans 2006). Most of these occur in New York, Pennsylvania, West Virginia and Virginia. A rough count of 3,000 individuals has been derived from surveys in known hibernacula; 60% of this number can be found in two hibernacula in New York (Amelon and Burhans 2006).

Although the species has been recorded from 40 hibernacula, there are just 9 overwintering locations with approximately 50 or more individuals (including one site with a high count of 46). Many of the hibernacula contain few individuals. The small number of total individuals statewide and the small number of high-quality occurrences are the primary ranking considerations (NYNHP 2013).

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Peripheral	

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Cliff and talus

b. Caves and tunnels

c. Mine/artificial cave community

d. Northeastern upland forest

e. Northeastern wetland forest

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
Yes	No	Unknown	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Small-footed bats winter in caves and mines, and openings deep within rock crevices in outcrops. The largest overwintering populations are currently known from mines in the northern part of the state. Several individuals, including a few lactating females, have been mist-netted in deciduous forests during the summer months in southeastern and central New York, but the species is likely to be more widespread in the state during the summer months. Several studies in the northeast and southeast have indicated that Small-footed Myotis roost and form maternity colonies in fractures in rock ledges and talus areas. This type of roosting behavior may contribute to the low numbers observed during winter hibernacula counts in New York because many individuals may not be readily detectable on the cave or mine walls. Instead they may hide within crevices or in piles of rubble on the cave or mine floor.

V. Species Demographic and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Choose an item.	Choose an item.	Yes	Yes	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Active gestation lasts probably two months, with a single offspring born annually, probably in early July (Merritt 1987). Survival rates are significantly lower for females (42%) than for males (76%) (van Zyll de Jong 1985). One individual is reported to have lived 12 years (Hitchcock 1965). Colonies are usually small (fewer than 15 individuals), although a few number in the hundreds up to approximately 2,000.

Several studies in the northeast and southeast have indicated that Small-footed Myotis roost and form maternity colonies in fractures in rock ledges and talus areas. The small-footed bat is not known to form large maternity colonies as some other species of bats do. Instead, their colonies usually consist of small groups of bats.

VI. Threats *(from NY 2015 SWAP or newly described):*

Some mines may suffer from collapse or closure and a few cave occurrences are probably threatened or reduced in quality due to the commercialization or frequent winter visitation by spelunkers. The main threat is disturbance during the winter hibernation period and, although this currently does not appear to be a major threat at the best sites (mines), it could be a problem at some of the cave sites.

Threats to NY Populations	
Threat Category	**Threat**

Human Intrusions & Disturbance	Recreational Activities (recreational spelunking)
Energy Production & Mining	Renewable Energy (wind turbines)
Human Intrusions & Disturbance	Recreational Activities (rock climbing)
Energy Production & Mining	Renewable Energy (pumped storage hydroelectric project near Barton Mine)
Invasive & Other Problematic Species & Genes	Invasive Non-Native/Alien Species (disease: white nose syndrome)
Pollution	Industrial & Military Effluents (environmental contaminants)
Human Intrusions & Disturbance	Work & Other Activities (disturbance from research in hibernacula)

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

Fencing around openings may be sufficient at some of the more remote locations. Gates or fences will need monitoring to ensure that they remain effective. Gates over entrances must be designed in accordance with specifications that allow easy entrance by bats and do not restrict or alter air movement patterns within subterranean systems.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
1.	
2.	

Table 2. (need recommended conservation actions for eastern small-footed bat).

VII. References

Amelon, S. and D. Burhans. 2006. Conservation assessment: Myotis leibii (Eastern small-footed myotis) in the eastern United States. In USDA Forest Service General Technical Report NC-260: Conservation Assessments for Five Forest Bat Species in the Eastern United States.

Hitchcock, H. B., R. Keen, and A. Kurta. 1984. Survival rates of Myotis leibii and Eptesicus fuscus in southeastern Ontario. Journal of Mammalogy 65(1): 126-130.

IUCN 2023. The IUCN Red List of Threatened Species. Version 2023-1. https://www.iucnredlist.org Accessed 28 December 2023.

NatureServe Explorer 2.0. (2023, November 3). https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.106402/Myotis_leibii. Accessed 21 November 2023.

New York Natural Heritage Program (NYNHP). 2013. Element Occurrence Database. Albany, NY.

New York Natural Heritage Program (NYNHP). 2023. Online Conservation Guide for *Myotis leibii*. Available from: https://guides.nynhp.org/eastern-small-footed-myotis/. Accessed November 22, 2023.

U.S. Geological Survey (USGS) - Gap Analysis Project (GAP), 2018, Eastern Small-footed Myotis (Myotis leibii) mESFMx_CONUS_2001v1 Range Map: U.S. Geological Survey data release, https://doi.org/10.5066/F7GX49MK.

Originally prepared by	Jenny Murtaugh
Date first prepared	April 29, 2013
First revision	January 259, 2014 (Samantha Hoff)
Latest revision	

Species Status Assessment

Common Name: Hoary bat **Date Updated:** 12/28/2023

Scientific Name: *Lasiurus cinereus* **Updated By:** Ashley Meyer

Class: Mammalia

Family: Vespertilionidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

The taxonomy of the hoary bat is generally stable. Three subspecies are recognized, with only *L. c. cinereus* found in continental North America.

Distributions of hoary bats appear to be biased by gender in North America during the summer, with females more common in the eastern part of North America and males in the mountainous regions of the west.

The short-term trends in distribution appear to be stable from 2009-2013 (NYSDEC unpub. data) and the population trends are unknown. The long-term trends of this species in New York are unknown.

Hoary bats roost in deciduous and coniferous trees among foliage and may use a variety of tree species. Although roosts may be typically located in forests or wooded areas, hoary bats forage in open areas and avoid dense vegetation or cluttered habitats for this activity.

I. Status

a. Current legal protected Status

i. **Federal:** Not listed **Candidate:** No

ii. **New York:** SGCN

b. Natural Heritage Program

i. **Global:** G3G4

ii. **New York:** S3S4B **Tracked by NYNHP?:** No

Other Ranks:
IUCN Red List: Least Concern

Northeast Regional SGCN: RSGCN

Status Discussion:

Hoary bats are considered widespread in the state during the summer, migrate out of the state for the winter, and travel through the state during migration. The population trends of hoary bats in New York are unknown and this information is needed to accurately assess the status of this species in the state.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Choose an item.	Choose an item.			Choose an item.
Northeastern US	Yes	Choose an item.	Choose an item.			Yes
New York	Yes	Unknown	Unknown		Not listed	Yes
Connecticut	Yes	Choose an item.	Choose an item.		Special Concern	Yes
Massachusetts	Yes	Choose an item.	Choose an item.		Not listed	Yes
New Jersey	Yes	Choose an item.	Choose an item.		Not listed	Yes
Pennsylvania	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.
Vermont	Yes	Choose an item.	Choose an item.		Not listed	Yes
Ontario	Yes	Choose an item.	Choose an item.		Endangered	Choose an item.
Quebec	Yes	Choose an item.	Choose an item.		Endangered	Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

State-wide acoustic survey regularly detects hoary bats in low numbers.

Trends Discussion *(insert map of North American/regional distribution and status):*

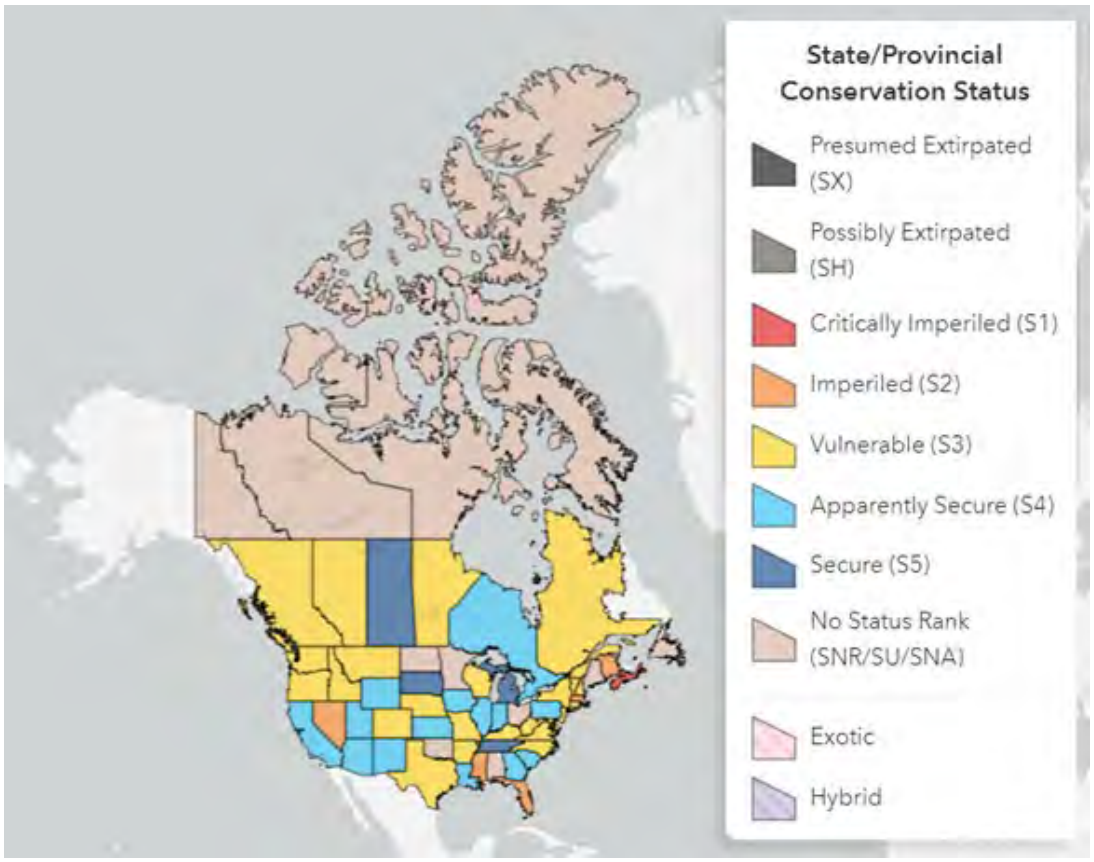

Figure 1. Conservation status of hoary bat in North America (NatureServe 2023)

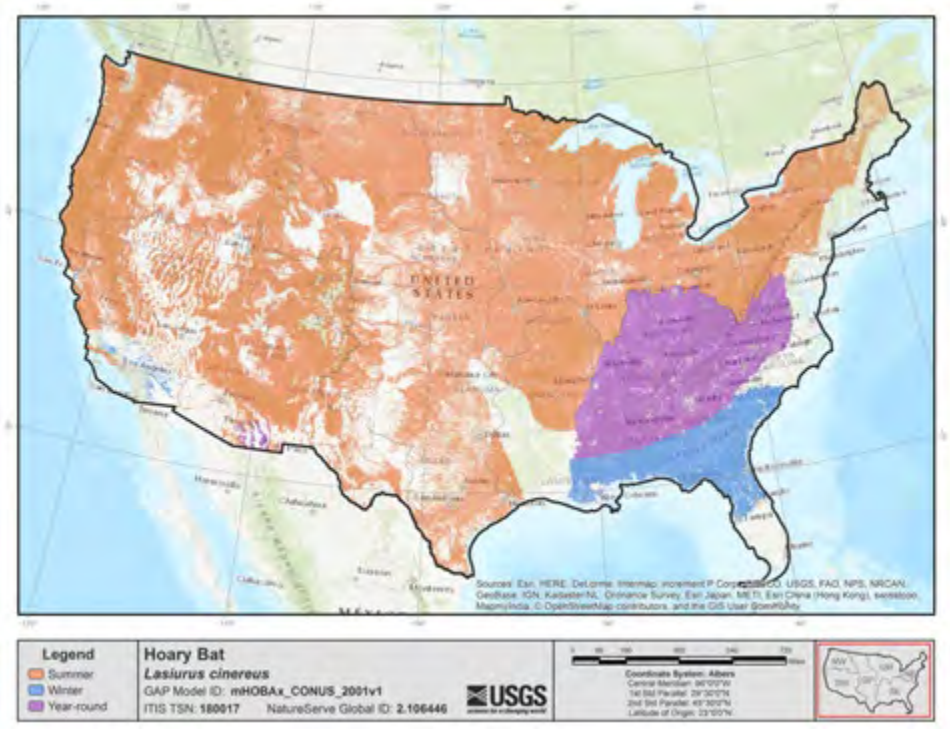

Figure 2. Range of hoary bat in the United States (USGS 2018)

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Years*	# of Records	# of Distinct Populations	% of State**
Pre-1995			
1995-2004			
2005-2014	3592	1	100
2015 - 2023	7561	1	100

Table 1. Records of hoary bat in New York.

*The acoustic monitoring program began in 2009, so data in unavailable prior to that year.

**Mobile acoustic survey routes are evenly distributed across the state, except for Long Island where these surveys are not completed due to logistical difficulties.

Details of historic and current occurrence:

Carcasses are commonly encountered at all large wind turbine facilities in NY during the late-summer migration period. Acoustic surveys commonly detect the species, normally in low numbers (Carl Herzog, pers. comm.).

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Peripheral	

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Northeastern Upland Forest

b. Northeastern Wetland Forest

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
No	No	Stable	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Hoary bats roost in deciduous and coniferous trees among foliage and may use a variety of tree species. Roost heights of 3-5 m above the ground have been reported; however, heights averaging around 16m have also been reported. Although roosts may be typically located in forests or wooded areas, hoary bats forage in open areas and avoid dense vegetation or cluttered habitats for this activity. They typically forage in forest openings, over water, or around trees. Hoary bats have been reported to forage over clearcut harvests and over reservoirs and large ponds.

V. Species Demographic and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Choose an item.	Choose an item.	Yes	Choose an item.	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Two young are born in June or early July. Young are able to fly after about a month and are independent soon after.

Reported maximum longevity in the wild of 14 years.

VI. Threats *(from NY 2015 SWAP or newly described):*

Hoary bats are killed when they collide with wind turbines in New York, particularly during fall migration.

Threats to NY Populations	
Threat Category	**Threat**
Energy Production & Mining	Renewable Energy (wind turbines)
Pollution	Industrial & Military Effluents (environmental contaminants including flame retardants, mercury, etc.)

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

Research indicates that raising cut-in speeds (i.e., wind speed at which turbines first start rotating and generating electrical power) of wind turbines during peak activity times may limit the number of

migratory tree bats killed at large-scale turbines. Large-scale (>25MW) wind energy projects are required to implement a 5.5m/s cut-in speed during the migratory period. Higher cut-in speeds could be applied to all wind energy projects to reduce this threat further.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
1. In-place land/water protection	
2.	

Table 2. Recommended conservation actions for hoary bat.

VII. References

NatureServe Explorer 2.0. (2023, November 3). https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.103130/Lasiurus_cinereus. Accessed 21 November 2023.

New York Natural Heritage Program (NYNHP). 2023. Online Conservation Guide for *Lasiurus cinereus*. Available from: https://guides.nynhp.org/hoary-bat/. Accessed November 24, 2023.

U.S. Geological Survey (USGS) - Gap Analysis Project (GAP), 2018, Hoary Bat (Lasiurus cinereus) mHOBAx_CONUS_2001v1 Habitat Map: U.S. Geological Survey data release, https://doi.org/10.5066/F73B5XJ7.

Originally prepared by	Jenny Murtaugh
Date first prepared	June 25, 2013
First revision	January 29, 2014 (Samantha Hoff)
Latest revision	

Species Status Assessment

Common Name: Indiana bat **Date Updated:** 12/28/2023

Scientific Name: *Myotis sodalis* **Updated By:** Ashley Meyer

Class: Mammalia

Family: Vespertilionidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

Indiana myotis was first described by Miller and Allen (1928). Prior to that, it was confused with other *Myotis* species, especially *M. lucifugus.* Taxonomy for the species has since been stable, although the common name was formerly Indiana bat. No subspecies are recognized.

Seventeen Indiana bat hibernacula are known to be extant. These hibernacula occur in the following counties: Albany (2), Essex (2), Jefferson (2), Onondaga (1), Orange (1), Putnam (1), Ulster (7), and Warren (1). The range of the Indiana bat includes much of the eastern half of the United States, from Vermont south to Massachusetts, Connecticut, and northern New Jersey, southwest to northwestern Florida and eastern Oklahoma, and north to southwestern Wisconsin.

The maximum total count increased from approximately 13,000 to 41,000 Indiana bats from 2001-2006. This increase in numbers was largely the result of discovery of new hibernacula and improved methods of counting overwintering bats but may also have reflected an increase in the overall size of the population. Winter hibernacula surveys from 2007-2015 documented population declines of 71%. The long-term trends are unknown but is likely greater than a 70% reduction in population numbers since historic times; despite an apparent increase, or at least stable period, from 2001-2006.

Indiana bats hibernate in caves and mines during the winter. These bats show a strong preference for woodland and wooded riparian habitat over cropland.

I. Status

a. Current legal protected Status

i. **Federal:** Endangered **Candidate:** _____

ii. New York: Endangered

b. Natural Heritage Program

i. Global: G2

ii. New York: S1 **Tracked by NYNHP?:** Yes

Other Ranks:

IUCN Red List: Near threatened

Northeast Regional SGCN: RSGCN

Status Discussion:

Indiana myotis was listed as Endangered prior to the arrival of white-nose disease. Population declines since 2008 have strengthened the argument that such protection is warranted.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Choose an item.	Choose an item.			Choose an item.
Northeastern US	Yes	Choose an item.	Choose an item.			Yes
New York	Yes	Declining	Declining	2007 - present	Endangered	Yes
Connecticut	Yes	Choose an item.	Choose an item.		Endangered	Yes
Massachusetts	Yes	Choose an item.	Choose an item.		Endangered	Yes
New Jersey	Yes	Choose an item.	Choose an item.		Endangered	Yes
Pennsylvania	Yes	Choose an item.	Choose an item.		Endangered	Yes
Vermont	Yes	Choose an item.	Choose an item.		Endangered	Yes
Ontario	No	Choose an item.	Choose an item.			Choose an item.
Quebec	No	Choose an item.	Choose an item.			Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

Winter hibernacula surveys, summer acoustic survey and mist netting efforts are all monitoring efforts used to target Indiana bats in New York.

Trends Discussion *(insert map of North American/regional distribution and status):*

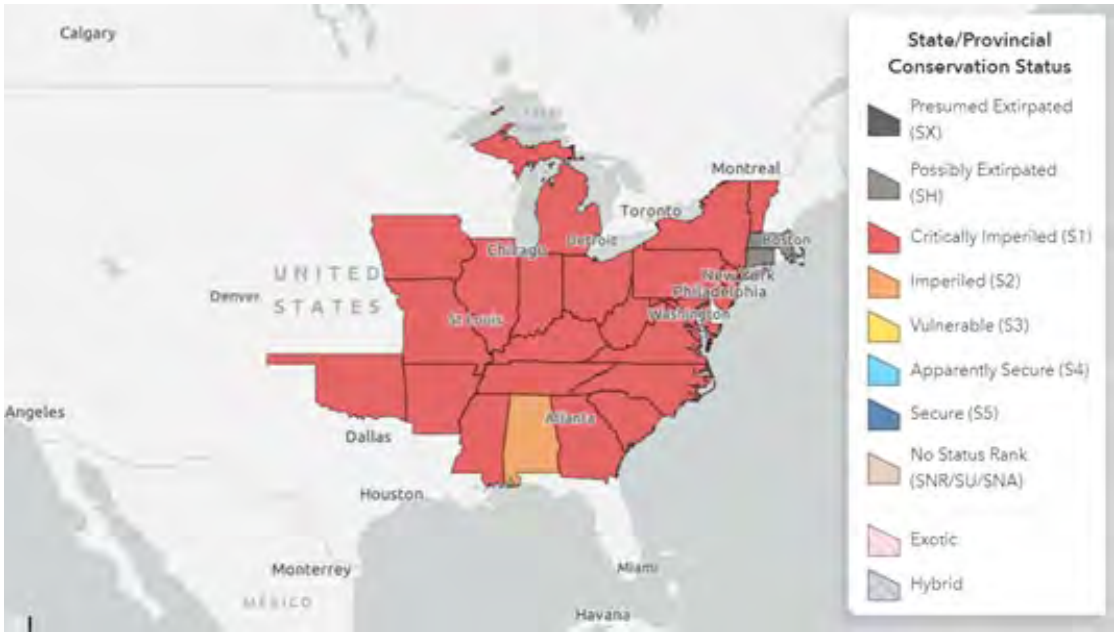

Figure 1. Conservation status of the Indiana bat in North America (NatureServe 2023)

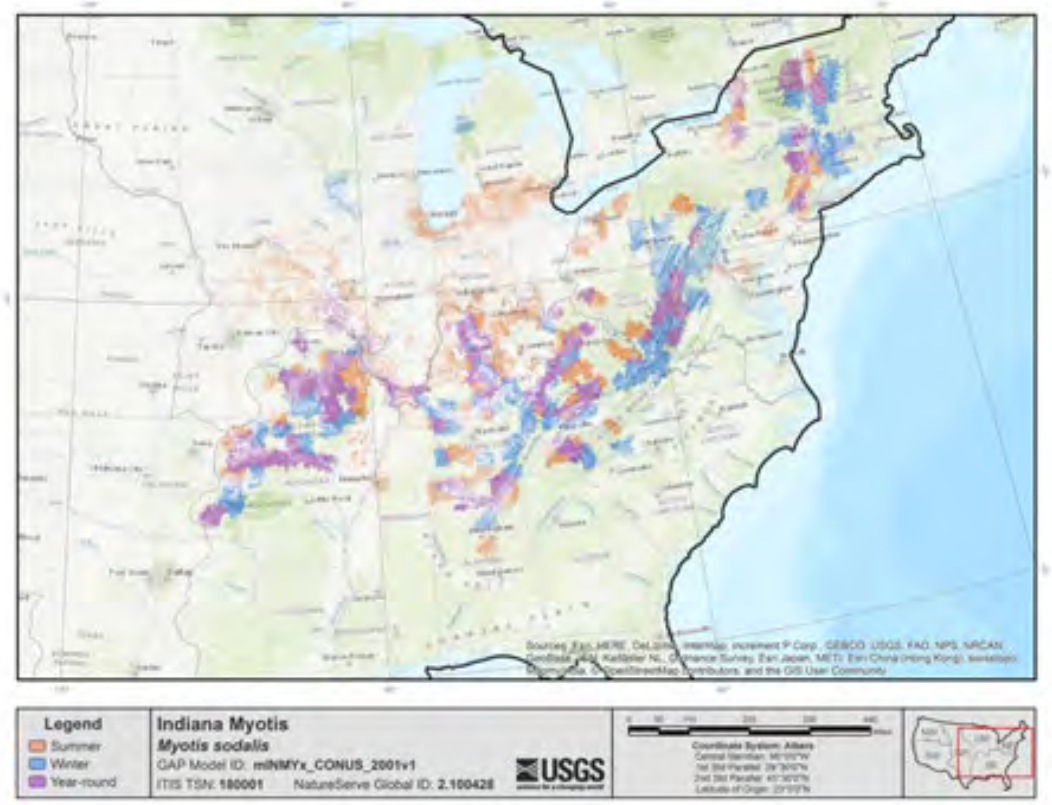

Figure 2. Range of Indiana bat (USGS 2018)

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Years	# of Records	# of Distinct Populations	% of State
Pre-1995	_____	_____	_____
1995-2004	_____	_____	_____
2005-2014	_____	_____	_____
2015 - 2023	~13,000	_____	_____

Table 1. Records of Indiana bat in New York.

Details of historic and current occurrence:

In New York, approximately 13,000 Indiana bats are known to exist in 8 of the 120 sites searched to date.

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Peripheral	1,000 km

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Caves and tunnels

b. Mines/Artificial Cave Community

c. Northeast Upland Forest

d. Northeastern Wetland Forest

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
Yes	No	Unknown	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Indiana bats hibernate in caves and mines during the winter. These bats show a strong preference for woodland and wooded riparian habitat over cropland. Predominately female Indiana bats radio-tracked from hibernacula in Jefferson, Essex, and Ulster Counties were found to move between approximately 12 and 40 miles to roost location on their foraging grounds. The roosts consisted of living, dying, and dead trees in both rural and suburban landscapes (NYNHP 2023).

V. Species Demographic and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Choose an item.	Choose an item.	Yes	Yes	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Maternity colonies have been identified through radio-telemetry studies and mist-net captures in Cayuga, Columbia, Dutchess, Essex, Jefferson, Onondaga, Orange, Oswego, Seneca, and Ulster counties. Bachelor colonies have also been identified through radio-telemetry studies and mist-net captures in Albany, Cayuga, Dutchess, Jefferson, Onondaga, Orange, and Ulster counties. Female Indiana bats form maternity colonies, giving birth and raising their young in these tree roosts.

Females congregate in nursery colonies, only a handful of which have ever been discovered. These were located along the banks of streams or lakes in forested habitat, under the loose bark of dead trees, and contained from 50-100 females. A single young is born to each female, probably late in June, and is capable of flight within a month. With luck, it may approach the ripe old age of 31, a record set by the little brown bat.

VI. Threats *(from NY 2015 SWAP or newly described):*

The largest threat to Indiana bats in New York is white-nose syndrome (WNS) which was first discovered among bats in a cave in Schoharie County, New York in 2006. Tree cutting can impact this species when felled trees contain colonies or roosting individuals. Habitat loss from development is also a threat which can limit suitable habitat. Bats may be particularly sensitive to environmental toxins including those found in herbicides and pesticides. Although no studies have targeted Indiana bats in New York directly, elevated levels of persistent organic pollutants including especially PCBs, DDT, Chlordanes, and PBDEs have been found in a similar species, the little brown bat, in the Hudson River Valley in New York (NYNHP 2023).

Threats to NY Populations	
Threat Category	**Threat**
Invasive & Other Problematic Species & Genes	Invasive Non-Native/Alien Species (disease: white nose syndrome)
Human Intrusions & Disturbance	Recreational Activities (recreational spelunking)
Energy Production & Mining	Renewable Energy (wind turbines)
Energy Production & Mining	Renewable Energy (pumped storage hydroelectric project near Barton Mine)
Residential & Commercial Development	Housing & Urban Areas (habitat loss, fragmentation)
Biological Resource Use	Logging & Wood Harvesting (silviculture)
Pollution	Industrial & Military Effluents (environmental contaminants)
Human Intrusions & Disturbance	Work & Other Activities (disturbance from research in hibernacula)

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

The Indiana bat is listed as an endangered species in New York and is protected by Environmental Conservation Law (ECL) section 11-0535 and the New York Code of Rules and Regulations (6 NYCRR Part 182). A permit is required for any proposed project that may result in a take of a species listed as Threatened or Endangered, including, but not limited to, actions that may kill or harm individual animals or result in the adverse modification, degradation or destruction of habitat occupied by the listed species. It is also protected as a federally-listed endangered species.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Prevention of intrusions into hibernacula is the only currently known management action able to reduce the impact of WNS.

Continue to monitor populations at hibernacula every other year as recommended by the United States Fish and Wildlife Service. Forest cover in agricultural landscapes, including small, isolated patches, should be conserved for foraging and roosting bats and maternity colonies. Snags should be left standing when possible during forest management activities.

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
1. In-place research and monitoring	
2.	

Table 2. Recommended conservation actions for Indiana bat.

VII. References

IUCN 2023. The IUCN Red List of Threatened Species. Version 2023-1. https://www.iucnredlist.org. Accessed December 28, 2023.

Miller, G.S., Jr. and G.M. Allen. 1928. The American bats of the genus Myotis and Pizonyx. Bulletin of the United States National Museum 114:1-218.

NatureServe Explorer 2.0. (2023, November 3). https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.100428/Myotis_sodalis. Accessed November 21, 2023.

New York Natural Heritage Program. 2023. Online Conservation Guide for Myotis sodalis. Available from: https://guides.nynhp.org/indiana-bat/. Accessed November 24, 2023.

U.S. Geological Survey (USGS) - Gap Analysis Project (GAP), 2018, Indiana Myotis (Myotis sodalis) mINMYx_CONUS_2001v1 Habitat Map: U.S. Geological Survey data release, https://doi.org/10.5066/F7P26WH8.

Originally prepared by	Jenny Murtaugh
Date first prepared	June 14, 2013
First revision	January 29, 2014 (Samantha Hoff)
Latest revision	

Species Status Assessment

Common Name: Least weasel **Date Updated:** 1/4/2024

Scientific Name: *Mustela nivalis* **Updated By:** M. Schlesinger

Class: Mammalia

Family: Mustelidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

The least weasel has a large range, occurring to the south, west and north of New York State, although it is sporadically distributed or rarely encountered across much of its range (Svendsen 1982). The species occurs throughout Canada and south into the east-central United States, from extreme western New York and western Pennsylvania southward into the mountains of North Carolina and Tennessee and westward through northeastern Kentucky, Ohio, northern Indiana and Illinois, and all of Michigan and Wisconsin (Whitaker and Hamilton 1998). There were previously only five records of least weasel in two locations in New York, all occurring prior to 1981 in Chautauqua County. On 28 July 2011, a road-killed least weasel was found on route 77 in Bennington, Wyoming County, which prompted a change in status in New York from SH to S1. Recent surveys in far western New York have not detected least weasels.

I. Status

a. Current legal protected Status

i. **Federal:** Not listed **Candidate:** No

ii. **New York:** Not listed

b. Natural Heritage Program

i. **Global:** G5

ii. **New York:** S1 **Tracked by NYNHP?:** Y

Other Ranks:

IUCN Red List: Least Concern

Northeast Regional SGCN: Watchlist (Assessment Priority)

Status Discussion:

Because of its small size, nocturnal habits, and secretive nature, the least weasel is perceived as rare but may simply be underdetected (Merritt 1987). However, many surveys targeting carnivores have occurred within the likely historical range of least weasels in NY (Western NY and the Southern Tier), including in the vicinity of the Wyoming Co. roadkill and older records from Chautauqua Co., suggesting that if populations of this species persist in New York, they are quite small and localized. Recent surveys in neighboring Pennsylvania have not detected them (C. Eichelberger, PA Natural Heritage Program, personal communication).

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Unknown	Stable			Choose an item.
Northeastern US	Yes	Unknown	Declining			Yes
New York	Yes	Unknown	Unknown			Yes
Connecticut	No	Unknown	Choose an item.			No
Massachusetts	No	Unknown	Choose an item.			No
New Jersey	No	Unknown	Choose an item.			No
Pennsylvania	Yes	Declining	Declining			Yes
Vermont	No	Unknown	Choose an item.			No
Ontario	Yes	Unknown	Unknown			Choose an item.
Quebec	Yes	Unknown	Unknown			Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

Trends Discussion *(insert map of North American/regional distribution and status):*

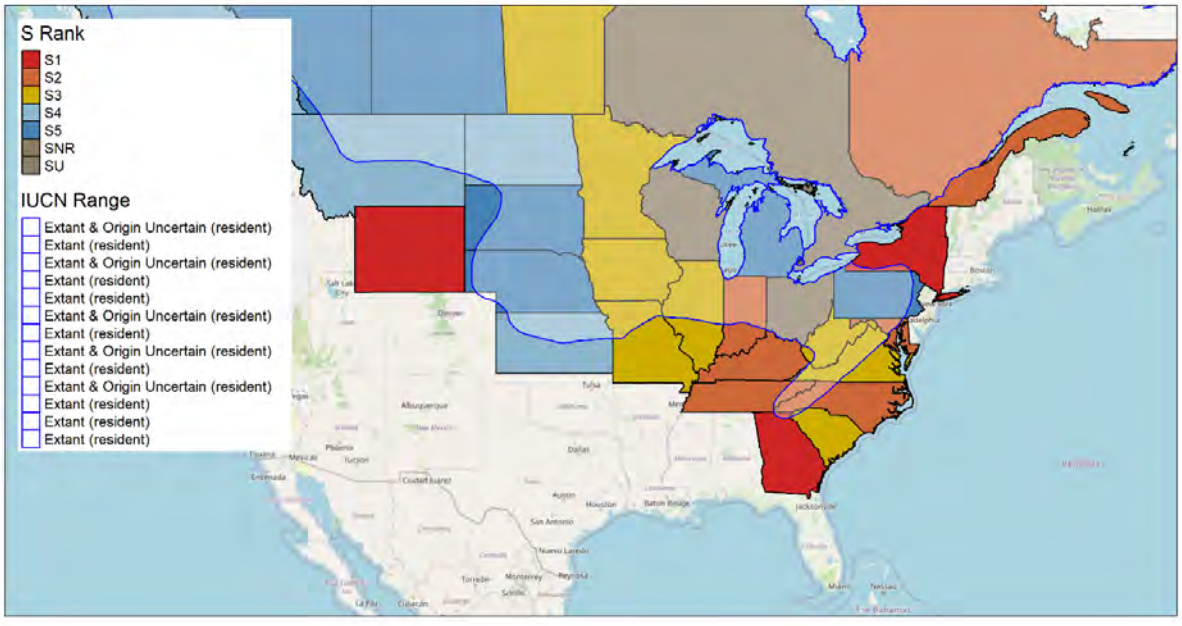

Figure 1. Conservation status of least weasel in North America (NatureServe/IUCN)

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

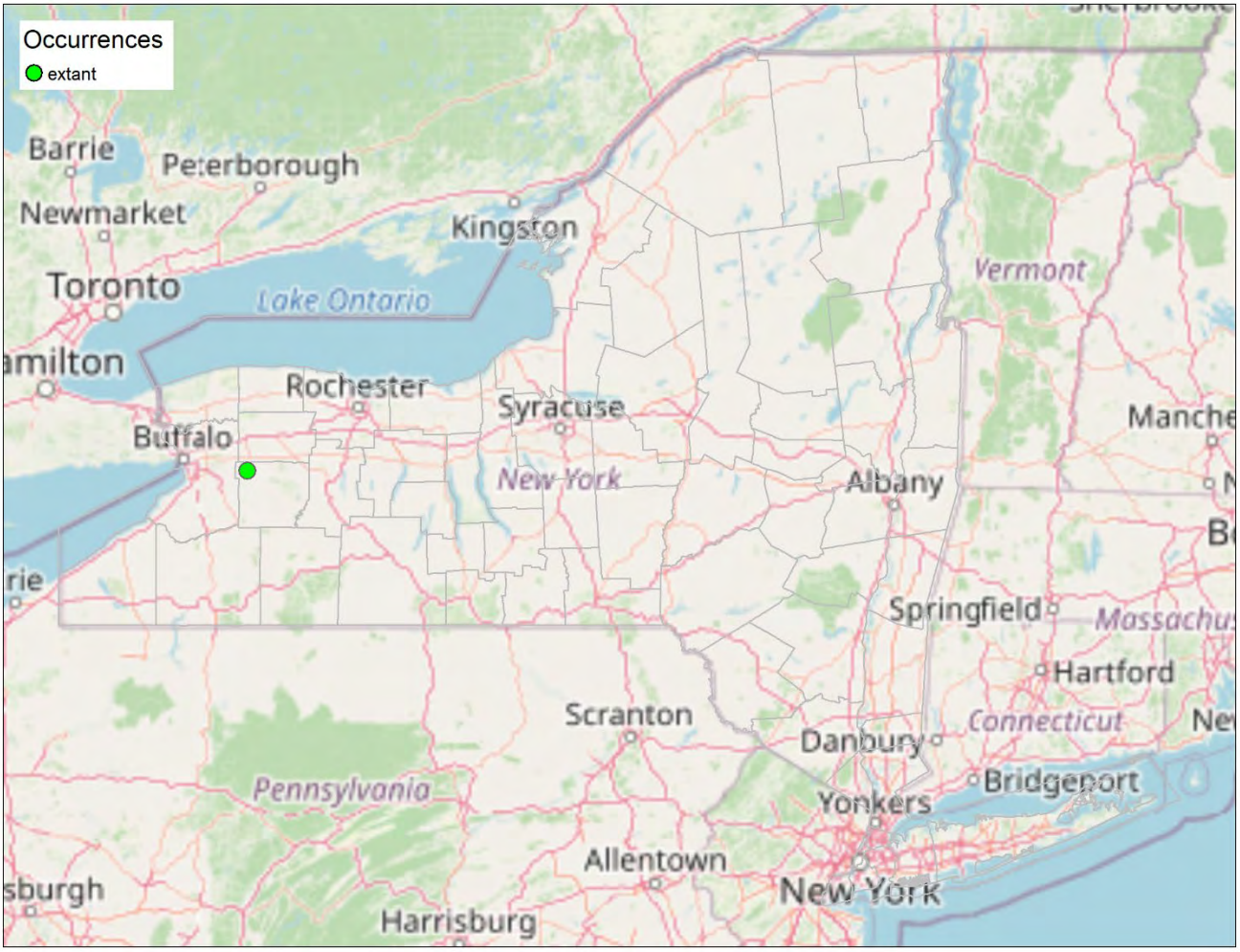

Figure 2. Records of least weasels in New York. Older records from Chautauqua Co. are not depicted.

Years	# of Records	# of Distinct Populations	% of State
Pre-1995	5		1%
1995-2004	0		1%
2005-2014	1		1%
2015 - 2023	0		

Table 1. Records of least weasel in New York.

Details of historic and current occurrence:

The least weasel has only been reported on 6 occasions in New York State. Four were reported taken by trappers in the Pennsylvania border regions of Chautauqua County in the late 1940s, of which one was examined and its identification was confirmed (Cook 1951). Another was collected

within a mile of Fredonia, Chautauqua County in 1981; the specimen is currently in the collection of the New York State Museum (Svendsen 1982). On 28 July 2011, a road-killed least weasel was found on route 77 in Bennington, on the shoulder of the west side of the road, near a small drainage way under the road near a tributary to Right Branch Cayuga Creek. The surrounding landscape is composed of agriculture with small remnant woodlots and riparian corridors. The weasel was found near one of these small riparian corridors (Somerville 2011). The identification was confirmed by New York State Museum Scientist Roland Kays and the skin is housed at the Museum.

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Peripheral	1,000 miles

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Old Field Managed Grasslands
b. Powerline
c. Pasture/Hay
d. Wet Meadow/Shrub Swamp
e. Oak Forests

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
No	No	Declining	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Least weasel habitat varies geographically and includes open forests, farmlands and cultivated areas, grassy fields and meadows, riparian woodlands, hedgerows, alpine meadows, scrub, steppe and semi-deserts, prairies, coastal dunes, and sometimes rural residential areas. Snow cover is not an obstacle, but the least weasel generally avoids deep dense forest and sandy desert (NatureServe 2012). Although many sources cite least weasels as habitat generalists (Kurta 1998, Merritt 1987), others state that the species tends to favor mixed grasslands, hedgerows, and meadows and marshes where prey is abundant (Merritt 1987, Wilson and Ruff 1999, Whitaker and Hamilton 1998). Weasels are seldom found far from water and in Central New York they are common in swampy lowlands and around marsh borders (DNR 1984).

V. Species Demographic and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Choose an item.	Choose an item.	Yes	Yes	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item

Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Least weasels are active year-round during both night and day. They are seldom seen and are very fast, darting up to 10 kph (6 mph) to escape a predator or capture prey. When hunting, they move throughout their home range, at a walk or run, and will climb trees and bushes after the nests of birds or squirrels. Because of its small size, this weasel can pursue its major prey within their own burrows. It is a specialist on small mammals, but birds (including eggs and nestlings) and insects are also eaten (Whitaker and Hamilton 1998).

Unlike the larger weasels, least weasels do not have a prolonged gestation with delayed implantation and have two or more litters per year, with 1 to 6 young per litter. Breeding can occur throughout the year but is concentrated in spring and late summer. Gestation is 34 to 37 days. The young are well furred and eating meat at 18 days, by 3 weeks have attainted adult pelage, and by 40 days can kill their own prey. Females become sexually mature at 4 months, although seldom produce litters during the same year of their birth even if from an early litter themselves, and males become sexually mature at 8 months (Whitaker and Hamilton 1998).

Males inhabit a home range of 7 to 15 ha (17 to 37 acres) while females inhabit a much smaller home range of 1 to 4 ha (2 to 10 acres). A male and female may occupy overlapping home ranges, but each defends a central territory against others of the same sex (Kurta 1995). Throughout their territory, least weasels may have several dens or temporary shelters for resting and for escaping predators. Least weasel nests are constructed of grasses lined with fur or feathers, and have been found beneath corn shocks, in shallow burrows bordering streams, and in other sheltered places including the nests and burrows of their prey species (Whitaker and Hamilton 1998).

The density of least weasels in an area varies with the density of the prey species, and it is thought that least weasels can reproduce rapidly to take advantage of high vole populations. Least weasel numbers can decline rapidly, and there is a high population turnover. Average annual mortality for least weasels is 75%-90% and the average life span is less than one year (Sheffield and King 1994, Svendson 1999).

Hawks and owls pose the most significant predatory threat to this species, but any larger predator will kill least weasels. Predation can be heavy at times. Even another larger weasel, such as a long-tailed weasel, will kill a least weasel (Whitaker and Hamilton 1998).

VI. Threats *(from NY 2015 SWAP or newly described):*

Threats to NY Populations	
Threat Category	**Threat**
1. Residential & Commercial Development	Housing & Urban Areas (loss of habitat)
2. Agriculture & Aquaculture	Annual & Perennial Non-timber Crops (shift to corn, soybeans from hayfields and pastures)
3. Pollution	Agriculture & Forestry Effluents (pesticides, herbicides, rodenticide)
4. Energy Production & Mining	Oil & Gas Drilling (Hydraulic fracturing)
5. Transportation & Service Corridors	Roads & Railroads (Road mortality)
6. Invasive & Other Problematic Species & Genes	Invasive Non-Native/Alien Species (House cats, feral cats)
7. Biological Resource Use	Hunting & Collecting Terrestrial Animals (Trapping)

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes:_____ **No:** _X__ **Unknown:**_____

If yes, describe mechanism and whether adequate to protect species/habitat:

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Continued inventory to locate populations of least weasels is the primary need.

As a grassland species, the least weasel may benefit from habitat management on private lands under New York's Landowner Incentive Program (LIP) for Grassland Protection and Management. The program provides incentives and technical advice to private landowners to enhance grassland habitat by following recommended mowing schedules and by removing trees, shrubs, and hedgerows. Although monitoring is targeted at birds, practices should benefit a wide range of grassland wildlife.

The drawback to grassland programs for species such as the least weasel is that hedgerows provide excellent habitat (Anne Rothrock, pers. comm.).

Weasel hunting and trapping is regulated by Section 6.2 in NYCRR and Article 11, Title 11 in New York State's Environmental Conservation Law.

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
1.	
2.	

Table 2. (need recommended conservation actions for least weasel).

VII. References

Brittingham, M., R. Criswell, T. Marget, J. Rawlins, J. Stauffer, R. Steele, editors. 2005. Pennsylvania Comprehensive Wildlife Conservation Strategy. The Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission. <http://www.pgc.state.pa.us/>. Accessed 4 April 2013.

Cook, A. H. 1951. The least weasel in New York. Journal of Mammalogy 32: 225.

Department of Natural Resources (DNR). 1984. Weasels. New York State College of Agriculture and Life Sciences Pub. 2, Cornell University, Ithaca New York.

IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>. Accessed 5 April 2013.

Jachowski, D., Kays, R., Butler, A., Hoylman, A.M. and Gompper, M.E., 2021. Tracking the decline of weasels in North America. PLoS One, 16(7), p.e0254387.

Kurta, A. 1995. Mammals of the Great Lakes Region. The University of Michigan Press, East Lansing, Michigan, USA.

McDonald, R. A., S. Harris, G. Turnbull, P. Brown, and M. Fletcher. 1998. Anticoagulant rodenticides in Stoats (Mustela erminea) and Weasels (Mustela nivalis) in England. Environmental Pollution 103:17-23.

Merritt, J. F. 1987. Guide to the mammals of Pennsylvania. University of Pittsburgh Press, Pittsburgh, Pennsylvania, USA.

Minnesota Department of Natural Resources (Minnesota DNR). 2013. Rare species guide: Least weasel. <http://www.dnr.state.mn.us/ets/index.html>. Accessed 5 April 2013.

NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. <http://www.natureserve.org/explorer>. Accessed 4 April 2013.

New York State Department of Environmental Conservation (NYSDEC). 2005 New York State

Comprehensive Wildlife Conservation Strategy. Albany, NY. https://extapps.dec.ny.gov/docs/wildlife_pdf/cwcs2005.pdf

Sheffield, S. R., and C. M. King. 1994. Mustela nivalis. Mammalian Species 454:1-10.

Somerville, T. J. 2011. Furbearer observation report. New York State Department of Environmental Conservation, Region 9.

Svendsen, G.E.1982. Weasels. Pages 613-628 in Wild mammals of North America. J. A. Chapman and G.A. Feldhammer, editors. The Johns Hopkins University Press, Baltimore, Maryland, USA.

Svendsen, G. E. 1999. The Least Weasel (Mustela nivalis). Pages 173-174 in D. E. Wilson and S. Ruff, editors. The Smithsonian Book of North American Mammals. Smithsonian Institution Press in association with the American Society of Mammalogists, Washington, D.C., USA.

Whitaker, J. O., Jr., W. J. Hamilton, Jr. 1998. Mammals of the Eastern United States. Comstock Publishing Associates, Ithaca, New York, USA.

Wilson, D. E., and D. M. Reeder, editors. 2005. Mammal species of the world: a taxonomic and geographic reference. Third edition. The Johns Hopkins University Press, Baltimore, Maryland, USA. <http://www.bucknell.edu/msw3/>. Accessed 5 April 2013.

Wilson, D. O., and S. Ruff, editors. 1999. The Smithsonian Book of North American Mammals. Smithsonian University Press, Washington, D.C., USA.

Originally prepared by	Jenny Murtaugh
Date first prepared	April 5, 2013
First revision	February 26, 2014 (Samantha Hoff)
Latest revision	

Species Status Assessment

Common Name: Little brown bat **Date Updated:** 12/28/2023

Scientific Name: *Myotis lucifugus* **Updated By:** Ashley Meyer

Class: Mammalia

Family: Vespertilionidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

The little brown bat appears to still occur throughout most of New York as of 2013 (NYSDEC unpublished data). However, it is unclear whether die-offs associated with white-nose syndrome (WNS) may have reduced the summer distribution in some areas of the state. The distribution of the little brown myotis is widespread in North America spanning from southern Alaska and Canada through most of the contiguous United States, though the species is generally absent from the southern Great Plains region (NatureServe 2023).

Little brown myotis populations declined approximately 84% in abundance from 2007 to 2015. There was an increase of 900 bats counted in 2012 (totaling 2,400), up from around 1,500 in 2011 during annual hibernacula surveys. It is not clear whether this represented an actual increase in numbers due to improved survival or fecundity or whether it was caused by movements of bats from other areas. Frick et al. (2010) predicted a 99% chance of extinction of the little brown myotis by 2026. The long-term trends were presumed to be stable or increasing prior to the appearance of white-nose syndrome in 2006 (NYSDEC unpub. data).

The little brown myotis uses a variety of forest types and they are somewhat of a habitat generalist. They occur in deciduous, mixed, and coniferous forest stands. At a landscape-scale in New York, they are associated with habitats that have a higher composition of wetlands and shrub cover and lower amounts of agriculture (NYNHP unpub. data).

I. Status

a. Current legal protected Status

i. **Federal:** Not listed **Candidate:** Yes

ii. **New York:** Not listed; proposed Special Concern

b. Natural Heritage Program

i. **Global:** G3G4

ii. **New York:** S1S2 **Tracked by NYNHP?:** No

Other Ranks:

IUCN Red List: Endangered

Northeast Regional SGCN: RSGCN

Status Discussion:

Regulatory status in NY seems at odds with elsewhere in the Northeast. Current hibernation counts (considered the best method of population tracking for this species) suggest the little brown Myotis in NY is stable at approximately 15 - 20% of their pre-WNS number (NYSDEC unpublished data).

Although this represents a significant decline, the species seems to be doing much better here than in most of the adjacent states and provinces.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Declining	Stable	2006-2020		Choose an item.
Northeastern US	Yes	Declining	Declining	2006-2020		Yes
New York	Yes	Declining	Declining	Rapid decline from 2006-2020	Not listed; proposed Special Concern	Yes
Connecticut	Yes	Declining	Stable	Rapid decline from 2008-2020	Endangered	Yes
Massachusetts	Yes	Declining	Declining	Rapid decline from 2008-2020	Endangered	Yes
New Jersey	Yes	Declining	Declining	Rapid decline from 2009-2020	Not listed; proposed Endangered	Yes
Pennsylvania	Yes	Declining	Declining	Rapid decline from 2009-2020	Endangered	Yes
Vermont	Yes	Declining	Declining	Rapid decline from 2009-2020	Endangered	Yes
Ontario	Yes	Declining	Unknown	Rapid decline from 2010-2020	Endangered	Choose an item.
Quebec	Yes	Declining	Unknown	2010-2020	Endangered	Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

Winter hibernation counts, statewide acoustic monitoring project, and mist net reports submitted by various permit holders contribute to monitoring of this species in New York.

Trends Discussion *(insert map of North American/regional distribution and status):*

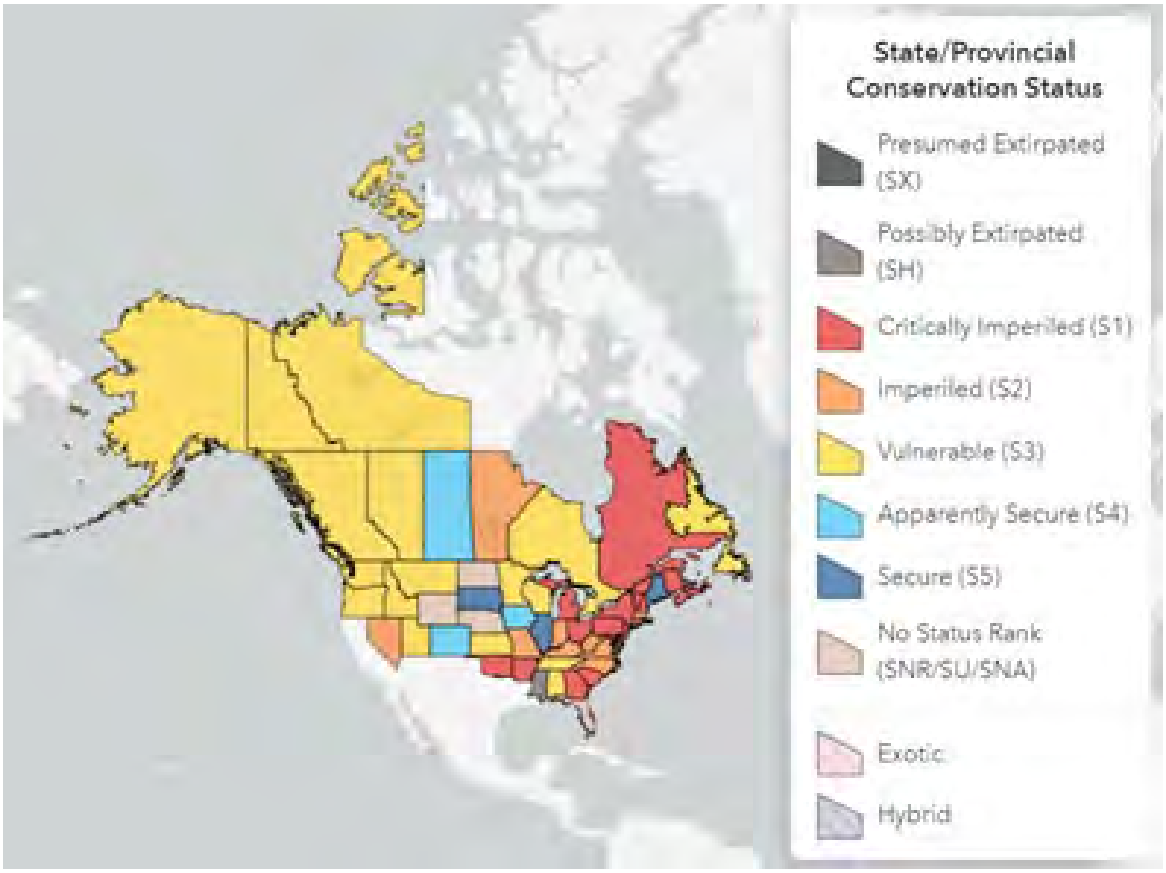

Figure 1. Conservation status of the little brown bat in North America (NatureServe 2023)

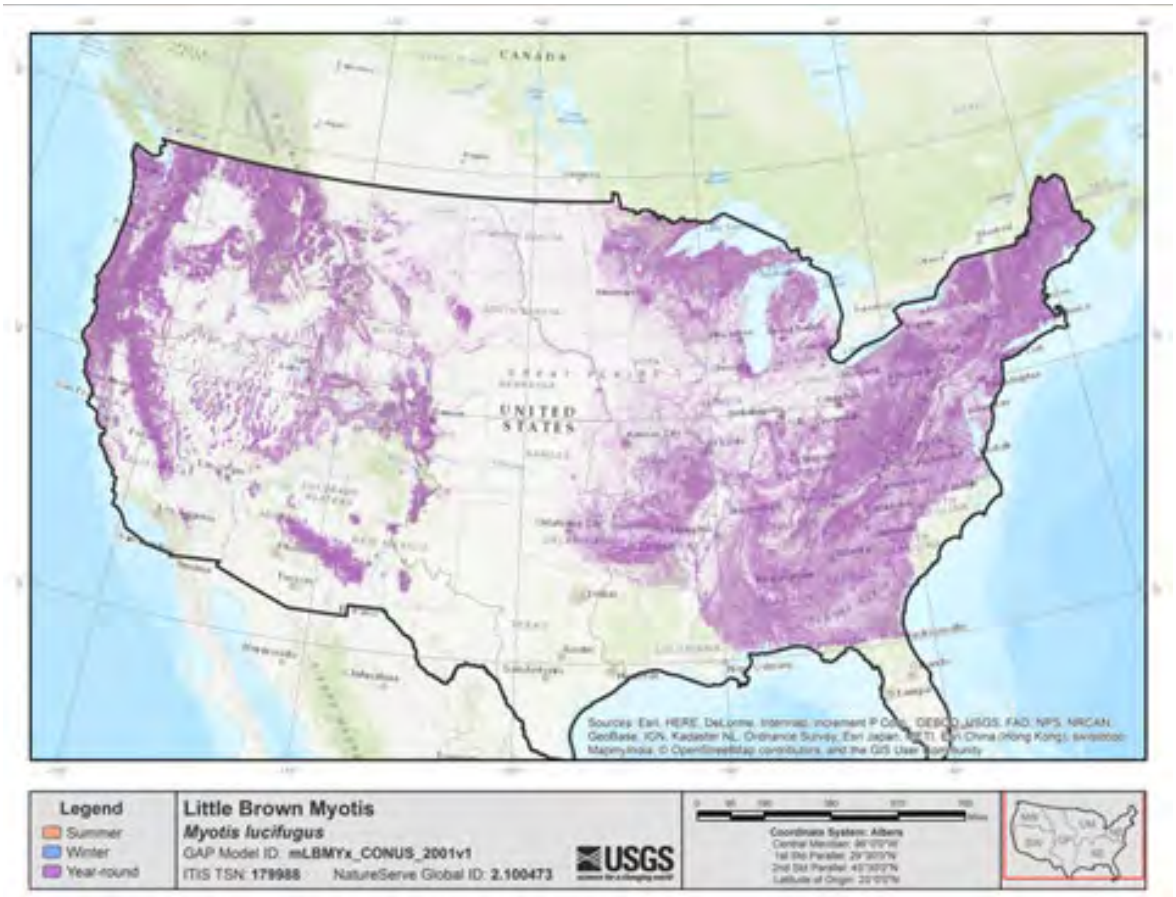

Figure 2. Range of little brown bat in the United States (USGS 2018)

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Years	# of Records	# of Distinct Populations	% of State
Pre-1995	_____	_____	100%
1995-2004	_____	_____	_____
2005-2014	_____	_____	_____
2015 - 2023	_____	_____	_____

Table 1. Records of little brown bat in New York.

Details of historic and current occurrence:

Believed to be the most common bat in NY immediately prior to WNS, the verified hibernating population exceeded 470,000 and was estimated at 1.5 million total for the State (NYSDEC unpublished data).

Current verified hibernating population is approximately 95,000 (representing 20% of the previous number). Distribution is still statewide but with very uneven density and some areas of local extirpation likely (NYSDEC unpublished data).

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Core	

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Caves and Tunnels

b. Mines/Artificial Cave Community

c. Commercial/Industrial and Residential

d. Northeastern Upland Forest

e. Northeast Wetland Forest

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
Yes	No	Stable	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

The little brown bat uses a variety of forest types and they are somewhat of a habitat generalist. They occur in deciduous, mixed, and coniferous forest stands. At a landscape-scale in New York, they are associated with habitats that have a higher composition of wetlands and shrub cover and lower amounts of agriculture (NYNHP unpub. data). They are known to occur at elevations up to 657 m (2,155 ft) in the Adirondacks during summer (NYNHP 2023).

Little brown myotis frequently forage over wetlands and open water. One study in Massachusetts found they used a variety of foraging habitats including an open-canopied reservoir, large ponds, and beaver meadows and closed canopy vernal pools; uplands and streams were used less often. During summer little brown myotis roosts in trees, buildings, under rocks, in piles of wood, and less frequently in caves. Maternity roosts occur in hollow trees or in buildings that tend to have southwesterly exposure which creates warmer roost temperatures.

In winter, little brown myotis hibernate in caves and mines in areas with high humidity and temperatures that are typically above freezing. Their presence was positively related to mine entrance width and height in West Virginia (NYNHP 2023).

V. Species Demographic and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Choose an item.	Choose an item.	Yes	Yes	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

The little brown bat, like most bats, breed in the late summer to early fall; they swarm and mate near the cave or mine entrance. Ovulation occurs in the spring which coincides with emergence from winter hibernacula. Females give birth to one young approximately 50-60 days later. Young are weaned and can fly after 21-28 days.

During summer, females form large maternity colonies, while males and non-reproductive females may roost individually or in small groups and may use torpor to balance energy needs. During winter, both genders roost together in large groups. Site fidelity to summer colonies and winter hibernacula is common. However, for individuals that do relocate between hibernacula, females may be more likely to switch sites than males.

Maximum reported longevity is 34 years but the oldest individuals are invariably males. Median lifespan for bats that survive their first year is approximately 7 years.

VI. Threats *(from NY 2015 SWAP or newly described):*

By far the largest threat to the little brown bats in New York is white-nose syndrome (WNS) which was first discovered among bats in a cave in Schoharie County, New York in 2006. Bats may be particularly sensitive to environmental toxins including those found in herbicides and pesticides. Elevated levels of persistent organic pollutants including especially PCBs, DDT, Chlordanes, and PBDEs have been found in little brown bats, in the Hudson River valley in New York.

Threats to NY Populations	
Threat Category	**Threat**
Invasive & Other Problematic Species & Genes	Invasive Non-Native/Alien Species (disease: white nose syndrome)
Human Intrusions & Disturbance	Recreational Activities (recreational spelunking)
Energy Production & Mining	Renewable Energy (wind turbines)
Energy Production & Mining	Renewable Energy (pumped storage hydroelectric project near Barton Mine)
Biological Resource Use	Hunting & Collecting Terrestrial Animals (nuisance control)
Pollution	Industrial & Military Effluents (environmental contaminants)
Human Intrusions & Disturbance	Work & Other Activities (disturbance from research in hibernacula)

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

Neither the species nor its habitat is specifically protected in NY. Most hibernation habitat benefits from umbrella protection from the frequent hibernaculum cohabitant, northern long-eared bat (*Myotis septentrionalis*).

Gating mines and caves can prevent human entry allowing the bats unobstructed access. Following proper specifications and monitoring bat populations before and after gate installation are important, however, as gating can affect the airflow and temperature in the cave, making areas of the cave uninhabitable for certain species. Buildup of debris at cave entrance gates can also have the same effect.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) -
https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions

Action Category	Action
1. In-place education	
2.	

Table 2. Recommended conservation actions for little brown bat

VII. References

Frick, W. F., J. F. Pollock, A. Hicks, K. Langiwg, D. S. Reynolds, G. G. Turner, C. Butchowski, T. H. Kunz. 2010. An emerging disease causes regional population collapse of a common North American bat species. Science 329:679-682.

IUCN 2023. The IUCN Red List of Threatened Species. Version 2023-1. https://www.iucnredlist.org. Accessed December 28, 2023.

NatureServe Explorer 2.0. (2023, November 3). https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.100473/Myotis_lucifugus. Accessed November 21, 2023.

U.S. Geological Survey (USGS) - Gap Analysis Project (GAP), 2018, Little Brown Myotis (Myotis lucifugus) mLBMYx_CONUS_2001v1 Habitat Map: U.S. Geological Survey data release, https://doi.org/10.5066/F7GF0RXN

Originally prepared by	Jenny Murtaugh
Date first prepared	March 8, 2013
First revision	January 29, 2014 (Samantha Hoff)
Second revision	October 29, 2020 (Carl Herzog)
Latest revision	

Species Status Assessment

Common Name: Moose **Date Updated:** 11/21/23

Scientific Name: *Alces alces* **Updated By:** Dave Kramer

Class: Mammalia

Family: Cervidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

The scientific name has changed since 2015 from *Alces americanus* to *Alces alces*, with *A. americanus* now a sub-species.

The largest member of the deer family and second largest land mammal in North America, the moose, has returned to New York State after more than a century of absence. As a circumpolar species, moose occur in boreal forests throughout the northern hemisphere, from Alaska eastward to the Atlantic Ocean, southward into the Rocky Mountains, northern Great Lakes, and New England. In New York, most moose are located in the northeastern part of the state in the Adirondack Mountains and the Taconic Highlands along the Massachusetts and Vermont borders (NYSDEC 2014). Moose began entering the state on a continuous basis in the 1980s and the current population is estimated at about 700 individuals as of 2018 (Hinton et al. 2022). Population trends are currently unknown, and any potential population expansion is likely limited by resource availability (Kramer et al 2022).

I. Status

a. Current legal protected Status

i. **Federal:** None **Candidate:** No

ii. **New York:** Not listed; No Hunting Season

b. Natural Heritage Program

i. **Global:** G5

ii. **New York:** S3S4 **Tracked by NYNHP?:** No

Other Ranks:

IUCN Red List: Least Concern

Northeast Regional SGCN: Watchlist (Assessment Priority)

Status Discussion:

This species is very widespread and extremely abundant despite intense hunting pressures in parts of its range and recent localized declines across the southern edge of their range in the states of Minnesota, Michigan and throughout New England.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Stable	Stable	2015-2023		(blank)
Northeastern US	Yes	Declining	Stable	2015-2023		Yes
New York	Yes	Unknown	Unknown	2015-2023	Not listed	Yes
Connecticut	Yes	Stable	Stable	2015-2023		No
Massachusetts	Yes	Stable	Stable	2015-2023		No
New Jersey	No	N/A	N/A	2015-2023		No
Pennsylvania	No	N/A	N/A	2015-2023		No
Vermont	Yes	Declining	Stable	2015-2023		No
Ontario	Yes	Stable	Stable	2015-2023		(blank)
Quebec	Yes	Declining	Stable	2015-2023		(blank)

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

Starting in 2015, a collaborative partnership between NYSDEC, SUNY-ESF and Cornell University was developed with goals of evaluating the population status of moose, quantifying population abundance and distribution, and assessing the relationships between moose and their habitat. As part of this partnership, aerial surveys were conducted from 2015-2019 with the objective of estimating a population baseline and to develop a population monitoring approach that the agency could redeploy to assess the long-term population trajectory (Hinton et al. 2022).

Additionally, twenty-six moose were captured in the Adirondacks from 2015-2017. Each animal was fitted with a GPS radio collar and released. The movements of the moose were remotely tracked, and the animals were monitored for calf production and survival. During the winter, researchers used helicopters to fly transects across the Adirondacks to survey for moose. During the summers of 2016 and 2017, researchers used trained detection dogs to locate and collect moose scat, which can be used to generate a population estimate as well as provide data about moose diet and health (Wong 2018). Researchers also tracked collared moose to understand their diet selection and sampled vegetation across the Adirondack Park to assess the quantity and quality of available food sources (Peterson 2020).

Trends Discussion *(insert map of North American/regional distribution and status):*

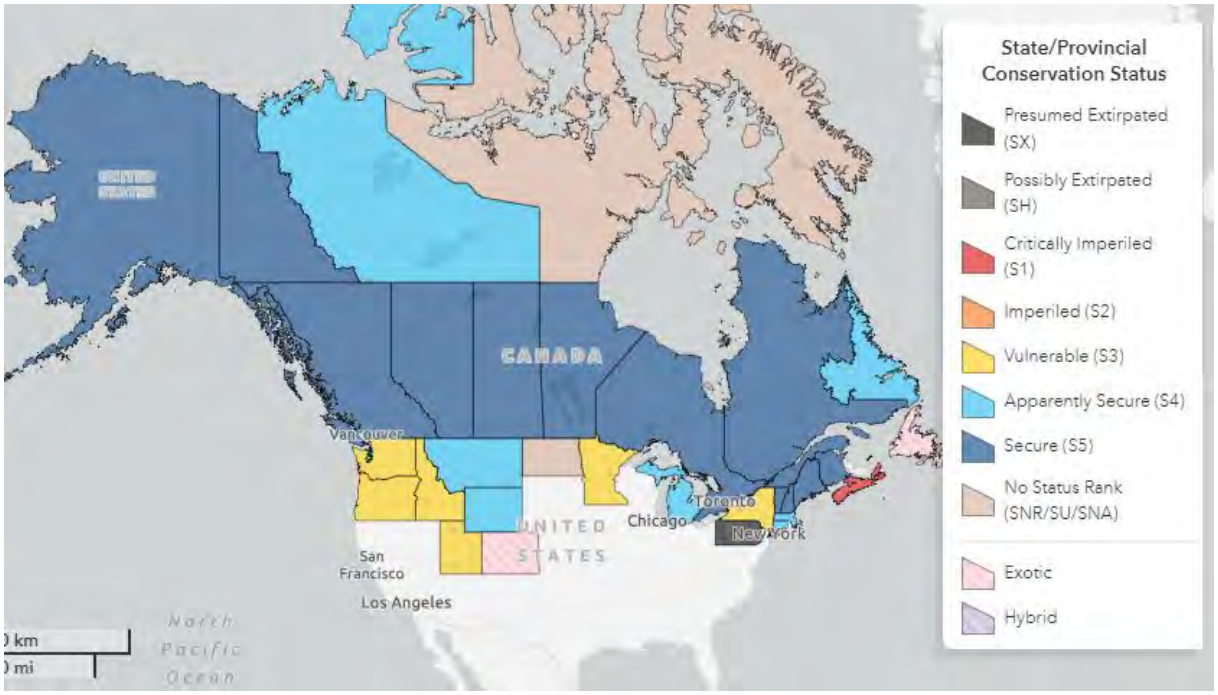

Figure 1. Conservation status of moose in North America (NatureServe 2023).

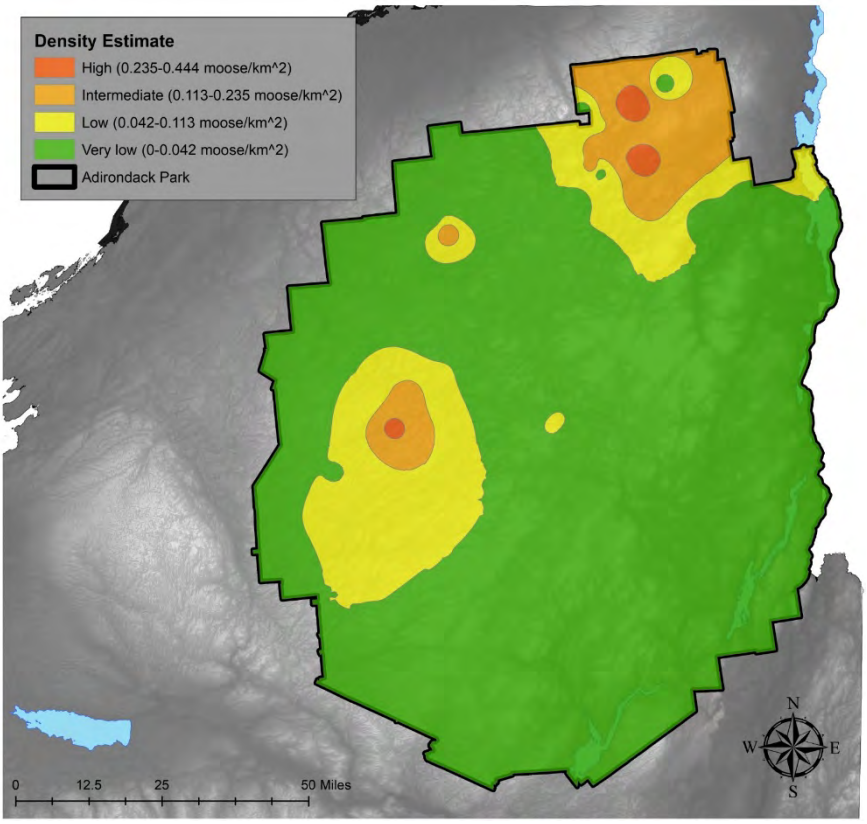

Figure 2. Moose density estimate for New York in 2018 (Hinton et al. 2022)

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Years	# of Records	# of Distinct Populations	% of State
Pre-1995		1	5
1995-2004		1	10
2005-2014		1	20
2015 - 2023		1	25

Table 1. Records of moose in New York.

Details of historic and current occurrence:

Moose (*Alces alces*) have long been present in the State of New York prior to the settlement of European settlers. Historical records that date as far back as the Pleistocene suggest that moose have always been present in the northern tier of the state, north of the Mohawk River (Fischer 1955, Ritchie 1969, Ritchie and Funk 1973). The decline of moose in New York corresponded with the expansion of European settlements into the northern tier of New York. European settlement expansion was followed by a period of intense logging for agricultural clearing and timber sales, resulting in the removal of over 75% of the state's forest by the 1880's. Following intense forest harvest and market hunting, moose were deemed extirpated from the landscape by as early as 1861 (Grant 1894). In response to the local extirpation, there were four small-scale restoration efforts that occurred between the 1870 and 1902 to repatriate moose on to the northern New York landscape. The largest of the four events only involved 12 animals, but all efforts eventually failed (Colvin 1880, Wish 1902, Barnham 1909, Bump 1940). There had been evidence that a small number of moose periodically occupied the landscape between 1935-1980, none were known to have taken up permanent residence (Hicks and McGowan 1992a). Regular documentation of individual non-resident moose immigrating from neighboring states and provinces (i.e., Quebec and Vermont [Rosenblatt et al. 2022]) began by the late 1950's (Severinghaus and Jackson 1970). It wasn't until the mid-1980's that moose became a permanent fixture on the northern New York landscape once again, with early minimum estimates of 6-11 moose by 1986 (Hicks 1986).

By 1990, the estimated population has increased to 20, with a sex ratio skewed to males 3:1, indictive of a pioneering dispersion (Garner and Porter 1990). In 1992, NYSDEC drafted a proposal for a coordinated population restoration effort, however the plan was abandoned following substantial public safety concerns (Hicks and McGowan 1992a, Hicks and McGowan 1992b, Lauber and Knuth 1996). It is unclear exactly where these moose originated, New York moose exhibit a strong genetic resemblance to moose in Vermont, New Hampshire, Maine, New Brunswick, and the portion of Quebec that's south of the St. Lawrence River (Kretser et al. 2016, Rosenblatt et al. 2022), and it is suspected that they came from either Vermont and/or Quebec (Hicks 1986). Since the 1980s, DEC has collected public reports of sightings as an informal way of monitoring the species' progress. Though the methods for collecting reports have changed over time due to technology advancements, they are still useful as an index of population density and monitoring their presence on the landscape. During the early 1990s, DEC drafted an Environmental Impact Statement and conducted a series of public meetings on moose. As a result, DEC instituted several actions to follow until the moose population, or our understanding of it, changed substantially. DEC (1) supported the return of moose in the northern 14 counties of the state; (2) rejected a proposal to accelerate the natural return of moose through a translocation program; (3) recognized the need to monitor the species' progress, both to ensure its success and to meet public demand for information about moose; and (4) recognized the need to address nuisance situations (Hicks and McGowan 1992a).

While NYSDEC lacked an estimate of moose abundance, the agency determined that moose population was securely established and believed to be permanent by 1998 (Hicks 1999). This belief was driven by a steady increase in public sightings, increasing from under 100 in the late 1980's to over 200 by the late 1990's (Figure xx; Hicks 1997). However, the consensus was that the moose population was unlikely large enough to support regulated hunting, nor large enough to generate widespread concerns related to conflict and vehicular collision. The agency had yet to initiate a long-term monitoring program to assess future population growth but chose to discontinue the public sighting request due to a limited utility in 1999 (Hicks 1999). While the agency was able to deploy a series of telemetry collars from 1996-2002, there was a reduced opportunity to deploy additional collars and a decrease in the frequency of periodic monitoring flights to check on active collars by 2002 (Hicks 2002).

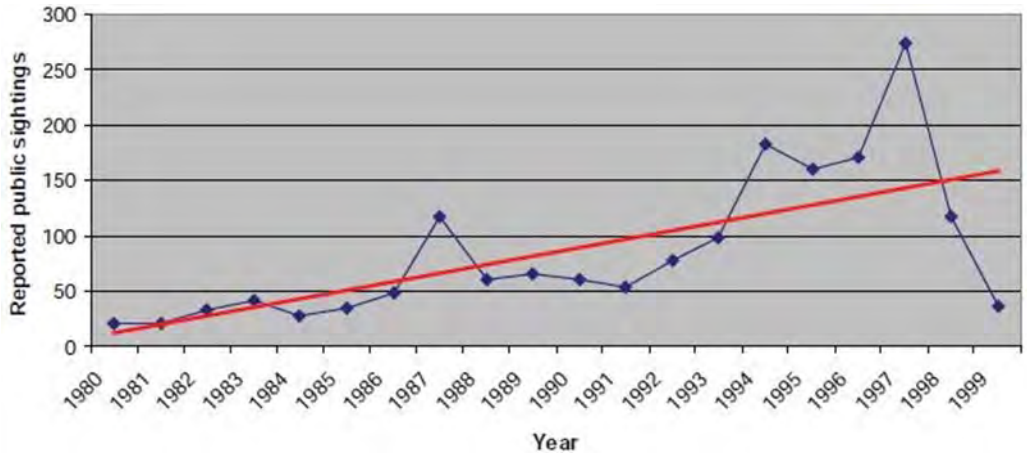

Figure 3. Moose sightings in the Adirondack Park reported by the public to DEC from 1980-1999.

Attempts to monitor the moose population using either fixed-wing aircraft or helicopters began again in earnest as early as 2007. Periodic aerial surveys have been conducted as early as 2007. However, the data collected from these flights are limited to potential population distributions and did not produce a population estimate. Additionally, an attempt was made in 2008 to quantify the quality and distribution of desirable moose habitat in the Adirondacks (Hickey 2008). The study suggested that most of the landscape was considered suitable for moose (73%), but only a small portion <35% was the highest quality of habitat that is often associated with mixed age stands interspersed with patched timber harvest and regenerating forest (Peek 1997). The study sought to utilize public sightings to validate the landscape prediction, however there seemed to be inherit bias where public sightings occurred (i.e., areas of higher population densities or regions with increased recreational opportunities), which questions the utility of public submitted moose sightings.

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Peripheral	

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Boreal Upland Forest

b. Boreal Wetland Forest

c. Laurentian-Acadian Northern Hardwood Forest

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
Yes	No	Stable	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

As a circumpolar species, moose primarily inhabit boreal forests and tundra regions of the world including Europe, Asia, and North America. In New York, most individuals are located in the northeastern part of the state in the Adirondack Mountains and the Taconic Highlands along the Massachusetts and Vermont borders. Moose require large quantities of food as well as high quality forage, with adults consuming 40 to 60 pounds of browse every day. Foods favor considerably, but in general are early successional woody vegetation resulting from disturbances such as logging, fire, clearing, and flooding (Franzmann 1981). Trees and shrubs constitute 87% of their diet and favored plant species include willows, birches, maples, balsam fir, viburnums, aspen, and mountain ash (Franzmann 1981, NYSDEC 2014). They will also graze on grasses, forbes, lichens and mushrooms. After fall frosts or winter snows that kill or bury non-woody foods, moose may strip and eat the barn from small trees, mostly ash and maples. Moose utilize different habitats from summer to winter; they are excellent swimmers and feed heavily on aquatic plants of ponds and wetlands in the summer. They can dive up to 18 feet for these preferred foods which are highly sought after due to their concentration of macroelements such as sodium, calcium, and phosphorus, all important for antler development, lactation, and body growth (VTF&W). Because moose can suffer from overheating during the summer months, they must have access to dense shade and cooling waters. Lowland softwood forests are important for this reason, and beaver ponds or other shallow bodies of water are favorite spring and summer habitats for moose (VTF&W). Clearcuts are used throughout the year with individuals moving to hardwoods located near softwood cover in the fall because these forest types usually provide more winter food. Moose will seek softwood shelter when snow depths reach approximately 35 inches, the snow gets a heavy crust, or during extreme cold of windy situations (VTF&W). Garner and Porter (2000) reported 36 km^2 for summer and 8 km^2 for winter home ranges of males in the Adirondack Mountains.

V. Species Demographic and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Choose an item.	Choose an item.	Yes	Yes	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

A typical moose lifespan is 10-12 years, with peak productivity around the age of 4-6. Moose cows can birth their first calve at 1 ½ years of age, but the first age of production is typically 2 ½. The breeding period occurs in the fall, the months of September through November. When in good body condition, twin calves are not uncommon, with twinning rates around 30-40%. Calves will stay with their mother for at least a year, until the cow will drive them off prior to the next calving season. Female calves will typically take up residence in the same areas to which it was born, while male calves are more likely to disperse farther distances before establishing a home range.

VI. Threats *(from NY 2015 SWAP or newly described):*

Threats to NY Populations	
Threat Category	**Threat**
1. Climate Change & Severe Weather	Habitat Shifting & Alteration
2. Climate Change & Severe Weather	Temperature Extremes
3. Invasive & Other Problematic Species & Genes	Problematic Native Species (Parasites, brainworm)

Throughout much of its range, threats are primarily human-caused habitat alteration. Forestry and agricultural practices have caused extensive reductions in the extent of boreal forest in southern Canada, leading to increased occupation of white-tailed deer and therefore increased cases of brainworm in moose (Geist et al. 2008). Deer are not negatively impacted by the brainworm but this parasite is detrimental to moose, which infects the nervous system and usually leads to death, and may limit their populations in areas where deer are common. Other parasites such as liver flukes and lungworm can weaken moose and make them susceptible to secondary infections or nutritional deficiencies (Murray et al. 2006, NYSDEC 2014). Winter ticks have become a main mortality factor in other states with higher moose density. Long-term winter warming trends have led to less snow and a rise in tick populations, and ultimately a decrease in moose survival. Vehicular collisions are also a significant mortality factor in New York and throughout their range, especially where road densities are high, and the number of moose mortalities due to vehicle collisions has steadily increased in the state since 1990. In New York there are no natural predators of adult moose but black bears are a significant predator of calves and coyotes may occasionally take a calf.

The moose was classified as “presumed stable/increase likely” to predicted climate change in an assessment of vulnerability conducted by the New York Natural Heritage Program. Available evidence suggests that abundance and/or range extent within the geographical area assessed is likely to increase by 2050 (Schlesinger et al. 2011). A study performed by Lenarz et al. (2009) in northern Minnesota hypothesized that survival rates would be a function of the frequency and magnitude that ambient temperatures exceeded the upper critical temperature of moose. They found that models based on January temperatures above the critical threshold were inversely correlated with subsequent survival and explained > 78% of variability in spring, fall and annual survival. Their analysis suggests that temperatures may have a cumulative influence on survival and acceleration of current climate trends will result in decreased survival, a decrease in moose density, and ultimately a retreat of moose northward from current distributions.

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

The Adirondack Park was created by the New York State Legislature in 1892. State-owned Forest Preserve compromises 2.6 million acres (42%) and is protected by the state constitution as "forever wild". One million acres of the Forest Preserve is further classified as wilderness.

Although the New York State Conservation Council began lobbying state legislators in 2011 to initiate the process of creating a moose hunting season, hunting moose is still illegal at this time.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

The legislature needs to grant NYSDEC that ability to set a moose hunting season to use as a tool to manage populations should a parasitic epidemic (i.e. winter tick) spreads into the population. NYSDEC could decrease the likelihood of a winter tick epidemic by artificially suppressing the population at a low density.

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
1.	
2.	

Table 2. (need recommended conservation actions for moose).

VII. References

Barnham, J. S. 1909. Report of the chief game protector for 1909 in State of New York. Fish and Game Commission annual reports. 407 pp.

Bump, G. 1940. The introduction and transportation of game birds and animals into the state of New York. North American Wildlife Conference 5:409-412.

Colvin, V. 1880. Topographic survey of the Adirondack region of New York. 7th Annual Report. Weed, Parsons and Co., Albany, N.Y.

Fischer, D. W. 1955. Prehistoric mammals of New York. The New York Conservationist 9(4):18-22.

Garner, D., and W. Porter. 1990. Movements and seasonal home ranges of bull moose in a pioneering Adirondack population. Alces 26:80-85.

Grant, M. 1894. The vanishing of moose and their extermination in the Adirondacks. Century Magazine. 47:345-356.

Hickey, L. 2008. Assessing re-colonization of moose in New York with HSI models. Alces 44:117-126.

Hicks, A. 1986. The history and current status of moose in New York. Alces 22:245-252.

Hicks, A. 1997. Summary of moose events in New York 1980-1997. New York State Department of Environmental Conservation 1pp.

Hicks, A. 1999. Moose (Alces alces) status and management in New York State: Fiscal year 1998-1999 annual report. New York Department of Environmental Conservation 7pp.

Hicks, A. 2002. Moose (Alces alces) status and management in New York State: Fiscal year 2001-2002 annual report. New York Department of Environmental Conservation 10pp.

Hicks, A., and E. McGowan. 1992a. Restoration of moose in northern New York state: Environmental impact statement. New York State Department of Environmental Conservation 62pp.

Hicks, A., and E. McGowan. 1992b. Proposed moose translocation to northern New York. Alces 28:243-248.

Hinton, J., R. Wheat, P. Schuette, J. Hurst, D. Kramer, J. Stickles, and J. Frair. 2022. Challenges and opportunities for robust population monitoring of moose along their southern range in eastern North America. Journal of Wildlife Management. 86 https://doi.org/10.1002/jwmg.22213

Kramer, D., T. Prebyl, N. Nibbelink, K. Miller, A. Royo, and J. Frair. 2022. Managing moose from home: determining landscape carrying capacity for Alces alces using remote sensing. Forests 13:150. https://doi.org/10.3390/f13020150

Kretser, H., M. Glennon, A. Whitelaw, A. Hurt, K. Pilgrim, and M. Schwartz. 2016. Scat-detection dogs survey low density moose in New York. Alces 52:55-66.

Lauber, T. B., and B. A. Knuth. 1996. Citizens' and agency staff members' evaluation of decision-making procedures: A case study of the New York state moose reintroduction issue. Human Dimensions Research Unit Publ. Series 96-1. Dept. Of Nat. Resources., Coll. Agric. And Life Sci., Cornell Univ., Ithaca, NY. 109 pp.

NatureServe. 2023. NatureServe Explorer. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.104982/Alces_alces Accessed November 21, 2023.

New York State Department of Environmental Conservation (NYSDEC). 2014. Moose management. <http://www.dec.ny.gov/animals/74663.html>. Accessed 8 May, 2014.

Peek, J. M. 1997. Habitat Relationships. Pages 351-375 in A. W. Franzman and C. C Schwartz, editors. Ecology and management of the North American moose. Smithsonian Institution Press, Washington, D.C., USA.

Ritchie, W. A. 1969. The archeology of New York State. The Natural History Press. Garden City, N.Y. 357pp.

Ritchie, W. A., and R. E. Funk. 1973. Aboriginal settlement patterns in the Northeast. New York State Museum and Science Memoir 20. 378pp.

Rosenblatt, E., K. Gieder, T. Donovan, J. Murdoch, R. Smith, M. Heaton, T. Kalbfleisch, B. Murdoch, S. Bhattarai, E. Pacht, E. Verbist, V. Basnayake, and S. McKay. 2022. Genetic diversity and connectivity of moose (Alces americanus americanus) in eastern North America. Conservation Genetics https://doi.org/10.1007/s10592-022-01496-w.

Severinghaus, C. W., and L. W. Jackson. 1970. Feasibility of stocking moose in the Adirondacks. New York Fish and Game Journal 17(1): 19-32.

Wish, J. D. 1902. Report of the secretary of the Commission in: Eighth report of the Forest, Fish and Game Commission. Albany, N.Y. 456 pp.

Originally prepared by	Samantha Hoff
Date first prepared	May 13, 2014
First revision	
Latest revision	

Species Status Assessment

Common Name: New England cottontail **Date Updated:** January 12, 2024

Scientific Name: *Sylvilagus transitionalis* **Updated By:** Sue Booth-Binczik

Class: Mammalia

Family: Leporidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

The New England cottontail (*Sylvilagus transitionalis*) is the only rabbit native to the northeastern United States from the Hudson River Valley of New York eastward. Taxonomists have recognized the New England cottontail (NEC) as a separate species since the 1990s, when it was split off from the Appalachian cottontail (*Sylvilagus obscurus*) on the basis of chromosomal differences, morphology, and geographic separation (Fuller and Tur, 2012). The NEC looks virtually identical to the Eastern cottontail (*Sylvilagus floridanus*), but identifying characteristics include shorter ears, the presence of a black spot between the ears, the absence of a white spot on the forehead, and a black line on the anterior edge of the ears (Litvaitis et al., 1991). However, external characteristics alone are not completely diagnostic, and cranial differences provide a more reliable means of distinguishing the two species (Johnston, 1972; Chapman and Ceballos, 1990).

The NEC was previously widely distributed in New England, but its range has been greatly reduced by habitat fragmentation due to human development, competition with the introduced eastern cottontail (EC), and loss of suitable habitat through natural succession. Remnant populations have been estimated to occupy approximately 14% of the historic range (Figure 1) and are restricted to five regions: 1) seacoast region of southern Maine and New Hampshire, 2) Merrimack River Valley of New Hampshire, 3) a portion of Cape Cod, Massachusetts, 4) eastern Connecticut and Rhode Island, and 5) portions of western Connecticut, eastern New York, and southwestern Massachusetts (Litvaitis et al., 2006). Recent analyses suggest continued declines in distribution and abundance (Rittenhouse and Kovach, 2020; Kovach et al., 2022; Bischoff et al., 2023). Research is ongoing to elucidate the defining characteristics of NEC habitat, but recent data indicate that high-quality NEC habitat consists of dense shrubs under a partial tree canopy (Buffum et al., 2015; Cheeseman et al., 2018; Gottfried Mayer et al., 2018).

I. Status

a. Current legal protected Status

i. **Federal:** Not listed **Candidate:** No

ii. **New York:** Special Concern; proposed Threatened

b. Natural Heritage Program

i. **Global:** G3

ii. **New York:** S1S2 **Tracked by NYNHP?:** Yes

Other Ranks:
IUCN Red List: Vulnerable

Northeast Regional SGCN: RSGCN

Status Discussion:

In 2006, the NEC was designated a candidate for listing under the federal Endangered Species Act (USFWS, 2006). A collaborative conservation strategy was developed by the wildlife agencies in the six states that currently have NEC, working with the USFWS, NRCS, and other organizations (Fuller and Tur, 2012). Efforts were focused on creating and protecting habitat and restoring and expanding NEC populations in order to ensure continued persistence of the species. Due to this strategy and the progress made in the first few years of this collaborative effort, the NEC was removed from consideration for federal listing in 2015 (USFWS, 2015).

The NEC is currently listed as Endangered in Maine and New Hampshire and as Special Concern in New York and Rhode Island. In 2019, New York issued a "pre-proposal" proposing to list the NEC as Threatened (NYSDEC, 2019).

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Unknown	Declining	15 years	Not listed	Choose an item.
Northeastern US	Yes	Unknown	Declining	15 years	N/A	Yes
New York	Yes	Unknown	Declining	15 years	Special Concern; proposed threatened	Yes
Connecticut	Yes	Unknown	Declining	15 years	Not listed	Yes
Massachusetts	Yes	Unknown	Stable	15 years	Not listed	Yes
New Jersey	No	Choose an item.	Choose an item.		Not listed	No
Pennsylvania	No	Choose an item.	Choose an item.		Not listed	No
Vermont	No	Choose an item.	Choose an item.		Not listed	Yes
Ontario	No	Choose an item.	Choose an item.		Not listed	Choose an item.
Quebec	No	Choose an item.	Choose an item.		Not listed	Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

Range-wide occupancy monitoring has been conducted under the auspices of the New England Cottontail Technical Committee since 2015. Annual surveys of sites where NEC have been documented and sites with suitable habitat where NEC have not been detected are conducted throughout NEC range in New York. Rabbit scat samples are collected in accordance with a protocol designed to maximize the chances of detecting NEC (Rittenhouse, 2024) and genetically

analyzed to identify the species that deposited them. Vegetation data are collected at survey sites in an effort to identify important habitat characteristics for NEC.

Trends Discussion *(insert map of North American/regional distribution and status):*

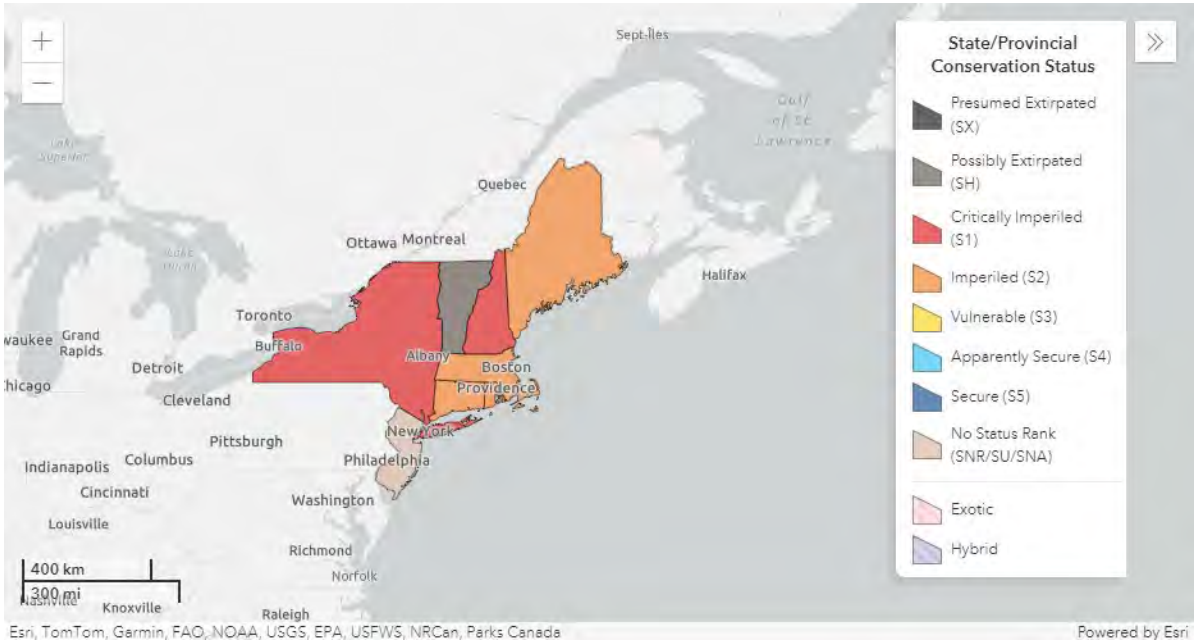

Figure 1. Conservation status of New England cottontail in North America (NatureServe 2024)

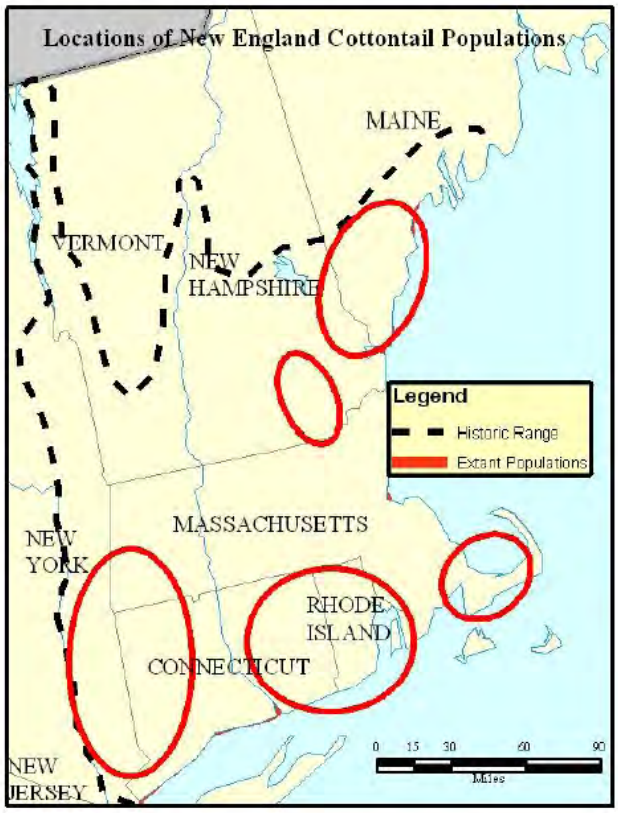

Figure 2. Historic and recent New England cottontail distribution (Fuller and Tur, 2012)

Despite the efforts of the participants in the range-wide conservation initiative, NEC occupancy of suitable habitat patches continues to decline (Rittenhouse and Kovach, 2020). Research in Connecticut has shown that patch extinction rates exceed colonization rates (Bischoff et al., 2023).

In 2014, biologists in the range states estimated the total extant population at 16,687 (Fuller and Tur, 2015). In 2023, the total range-wide estimate was 8,381 (New England Cottontail Technical Committee, 2024). Recent population density data suggest that even that figure may be an overestimate (Kovach et al., 2022).

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

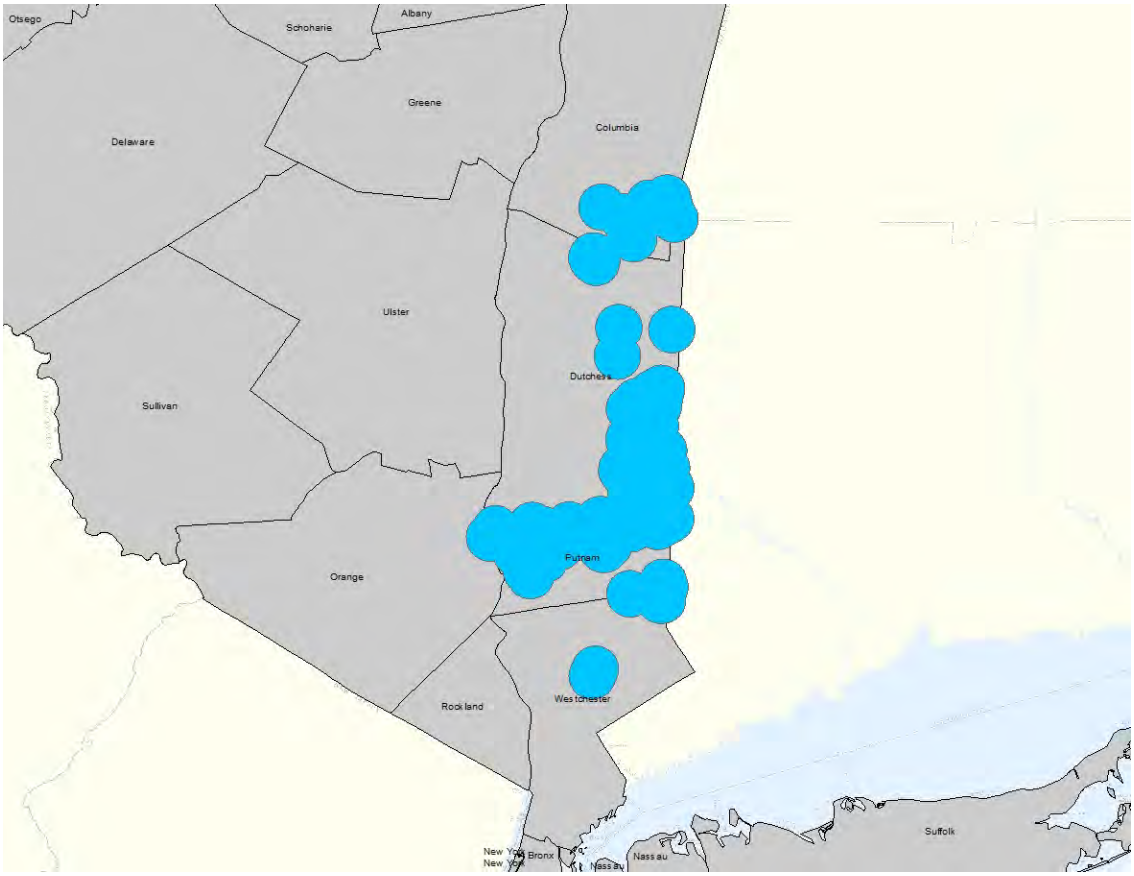

Figure 3. Known distribution of New England cottontail in New York, 2002-2023. Known locations are mapped with a buffer.

Years	# of Records	# of Distinct Populations	% of State
Pre-1995	_____	_____	_____
1995-2004	17	_____	_____
2005-2014	835	_____	_____

2015 - 2023	3840		

Table 1. Records of New England cottontail in New York. Records are scat samples that were genetically confirmed to be NEC. The number of records has increased over time as survey intensity of known occupied sites has increased. It is unknown how many individual rabbits produced these samples.

Details of historic and current occurrence:

Accounts from the late nineteenth century describe native cottontails as “common,” and robust populations apparently persisted into the mid-twentieth century (Litvaitis, 1993). Historical records exist for NEC in Warren and Rensselaer Counties, as well as Long Island and Staten Island (Connor, 1971). There is one record from Albany County with no date. The species was last documented in Rensselaer County in the 1960s (Benton and Atkinsin, 1964).

Based on historical data, seven Focus Areas that were believed or suspected to contain NEC were defined in the state as part of the range-wide conservation strategy (Fuller and Tur, 2012). No NEC have been detected in subsequent surveying in three of those areas, including in two habitat patches where NEC were documented in 2004, and it’s believed that those three Focus Areas no longer contain NEC (Novak, 2019).

New York currently has approximately 60 individual habitat patches identified that are known to support NEC (Figure 2). Patches range in size from 4 to 214 acres, with most being less than 50 acres.

New York’s Contribution to Species’ North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
26-50%	Core	

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

The portion of the species’ range that covers eastern New York, western Connecticut and southwestern Massachusetts contains most of the sites that are currently known to be occupied. Assuring adequate connectivity among habitat patches to create a functioning metapopulation in this region could therefore provide the best chance for long-term survival of the species.

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Oak-pine forest

b. Mixed northern hardwoods

c. Hardwood swamp

d. Non-native shrublands

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
Yes	Choose an item.	Unknown	

Column options

Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Although the species was originally thought of as occupying early successional habitat, modeling indicates that NEC are typically found in sites with considerable overstory tree canopy cover (Buffum et al., 2015), and capture rates in areas of sympatry with EC indicate that early successional shrublands are dominated by the latter species (Cheeseman et al., 2021). Data from radiotracking of sympatric NEC and EC suggest that the presence of EC causes NEC to select areas with dense canopy closure above one meter in height, because those areas are avoided by EC (Cheeseman et al., 2018). Comparison of vegetation within the home ranges of individuals of the two species revealed that core use areas of NEC had greater canopy closure and basal area coverage than core use areas of EC (Gottfried Mayer et al., 2018).

Based on research in Maine and Connecticut, EC seem to occur at higher densities than NEC, both at sites with only one of the species present and sites containing both (Kovach and Kristensen, 2017). However, capture rates from a radiotracking study suggest that in New York, ericaceous shrubland with a blueberry (*Vaccinium* spp.) and/or mountain laurel (*Kalmia latifolia*) understory and forested wetland with a sweet pepperbush (*Clethra alnifolia*) and swamp azalea (*Rhododendron viscosum*) understory are habitat types where NEC may be consistently more abundant than EC and not at a competitive disadvantage (Cheeseman et al., 2021).

The range-wide occupancy modeling has consistently found higher NEC occupancy rates at sites without habitat management than at managed sites (Rittenhouse, 2022), suggesting that management efforts may not be having the intended effect. In Connecticut, NEC occurrence is more closely associated with shrubland than regenerating forest (Bischoff et al., 2023). Based on research results in New York, SUNY-ESF researchers developed recommendations for habitat management that were intended to make it more beneficial for NEC (Cheeseman and Cohen, 2019). In an experiment to test these recommendations, selective cutting of canopy trees that left approximately 40-90% canopy closure produced habitat patches that were preferentially used by NEC but not selected for by EC (Eline et al., 2023).

V. Species Demographics and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	(blank)	No	Yes	Yes	(blank)

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Although NEC demographics and life history have been assumed to be very similar to those of EC, little research has been done to evaluate those assumptions, and the NEC Technical Committee considers research on NEC vital rates, especially litter size, number of litters per year, and neonatal survival, to be a top priority.

Winter mortality is substantial, especially in years with high snowfall. In a study in New Hampshire, 15 of 38 radio-collared rabbits died during the 70-day study period in late winter and early spring (Barbour and Litvaitis, 1993). In New York, NEC survival rate from November through April was found to be 0.43 (Cheeseman et al., 2021). Juvenile survival from May through October, on the other hand, was 0.95 (Cheeseman et al., 2021).

NEC home range size in New York has been documented to be approximately 1 ha for females and 1.5 ha for males (Cheeseman et al., 2019). Dispersal is male-biased, and averaged 0.9 km in New York, with a maximum recorded dispersal distance of 3.8 km (Cheeseman, 2017). This suggests that habitat patches need to be very close together for successful colonization to occur.

VI. Threats*:*

The principal threats to NEC persistence are habitat fragmentation and competition from EC. Suitable habitat tends to occur in small patches throughout most of the range, since dense shrubs usually occur as a stage of ecological succession after some type of disturbance. NEC density at most sites appears to be less than one rabbit per hectare (Kovach and Brubaker, 2012; Kovach and Bauer, 2021), and EC presence reduces NEC abundance (Bischoff et al., 2023). However, density and survival of NEC appear to be higher than those of EC in naturally self-sustaining forested shrubland habitat types in New York, suggesting that the nature of the competitive relationship varies with habitat type (Cheeseman et al., 2021).

The combination of small habitat patches, low population density and limited dispersal capability results in small, isolated populations that have been shown to have little genetic diversity and critically low effective population sizes, both in New York (Cheeseman et al., 2019) and elsewhere in the species' range (Fenderson et al., 2014; McGreevy et al., 2021). This casts into doubt the long-term viability of any existing populations. Adequate data for estimation of population size are available for relatively few sites, and determining population sizes and viability throughout the species' range are additional top research priorities of the NEC Technical Committee.

Two recently identified threats may increase the obstacles to NEC recovery. The first is Rabbit Hemorrhagic Disease Virus 2 (RHDV2), which appeared in two wild lagomorph species in New Mexico in spring of 2020 and within months was detected in at least four species in at least seven states (Lankton et al., 2021). RHDV2 is a highly infectious and virulent disease that was able to spread across the continent of Australia in less than two years (Mahar et al., 2018). To date, it has not spread as quickly in North America, but by the end of 2023 it had been documented in wild lagomorphs in 14 states across the West and Midwest (https://www.aphis.usda.gov/aphis/maps/animal-health/rhd). An outbreak in NEC range could devastate the species. In September 2022, RHDV2 was detected for the first time in captive rabbits within NEC range (CT DEEP, September 13, 2022), substantially raising that risk.

The second new threat is that multiple instances of NEC-EC hybridization have been documented and fertility of hybrids has been confirmed (New England Cottontail Technical Committee, 2019; 2022), raising the specter of potential genetic swamping. Hybridization is believed to be rare, but insufficient data are available to confirm that at this time.

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

The NEC is categorized as a game species in New York, with a five-month hunting season and a daily bag limit of six animals. It's unclear how much of an impact hunting currently has on population viability or species persistence.

There are currently no regulatory mechanisms that protect the species' habitat. Since the NEC is a habitat specialist with limited dispersal capability, ensuring that suitable habitat is available and adequately connected will be key to long-term persistence of NEC in New York.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

To date, habitat conservation efforts for NEC have focused primarily on habitat management to create young forest habitat, including public outreach and funding to promote voluntary habitat management by private landowners. However, recent research indicates that this type of habitat management is more likely to benefit EC than NEC (Cheeseman et al., 2021; Bischoff et al., 2023), suggesting that an alternate approach is needed if adequate habitat for long-term species persistence is to be maintained.

Although shrub habitat is often a transitional stage of succession and therefore temporary, the habitat types where NEC appears to have higher density and survival than EC are naturally self-sustaining (i.e. not temporary) forested shrublands such as oak-mountain laurel uplands and forested wetlands (Cheeseman et al., 2021). Preserving these self-sustaining shrub habitats would therefore address the two principal threats of habitat loss and competition with EC. Listing the NEC as Threatened or Endangered in New York would provide a mechanism for DEC to protect high-quality NEC habitat and require adequate mitigation for habitat that is destroyed or compromised.

However, it's unlikely that sufficient habitat of these types exists in the state to support a viable metapopulation of NEC. Active management of both habitat and the species will likely be needed if NEC populations that are large enough and interconnected enough for long-term viability are to be created. Maintaining corridors of successional shrub habitat would allow NEC to move between patches of higher-quality habitat, and where that is unfeasible, translocating animals between populations or introducing captive-bred animals could help maintain genetic diversity.

Captive breeding and release of offspring has been the second major component of the range-wide conservation program, and to date has mainly focused on creating new NEC populations in the northern part of the species' former range. Captive breeding has taken place in two zoos and a few outdoor enclosures at field sites. Some of the offspring from those efforts have also been released onto two offshore islands to create island colonies that can be used as source populations for translocation of rabbits to mainland sites.

Although a great deal of effort has been devoted to developing and improving the captive breeding program, the participating zoos don't have adequate space to hold large numbers of animals for breeding and haven't had the resources needed to expand their capacity. Pregnancy rates and neonatal survival have both been persistently low, so production of offspring remains far below the levels anticipated a decade ago and needed to create sustainable populations via reintroduction (Kovach et al., 2022). Annual survival to weaning has averaged 47% over eleven years (New England Cottontail Technical Committee Population Management Work Group, 2021), and in most years the ratio of released offspring to adult females in the breeding program has been approximately 2:1, even though each female is paired with a male for breeding several times each year.

Survival of NEC released from the captive breeding program is low overall and highly variable from year to year (New England Cottontail Technical Committee Population Management Work Group, 2017), at least partially due to variation in the severity of winter weather (Bauer et al., 2020). Only 26% of 132 rabbits released from 2012 to 2017 survived their first winter (New England Cottontail Technical Committee Population Management Work Group, 2017). High mortality of released individuals, which has been observed in restoration programs for other rabbit species as well (e.g. Columbia Basin pygmy rabbits, Gallie and Hayes, 2020), appears to be limiting the success of NEC reintroduction efforts (Bauer et al., 2020). Of 42 NEC released at one site in New Hampshire, only six were determined by genetic analyses to have reproduced after release, and after four years of releases, despite documented reproduction by offspring of released animals, the estimated total population size at the release site was only eight individuals (Bauer et al., 2020). Other reintroduction sites in New Hampshire and Maine have shown recent indications of greater

success: at one site 25 NEC were detected after 60 individuals had been released over three years (Bauer and Kovach, 2021b), and at another site 26 NEC were detected after 37 individuals had been released over two years (Bauer and Kovach, 2021a).

Releasing large numbers of individuals could be a way to compensate for high post-release mortality, but if releases continue at current levels, reintroduction efforts may accomplish little for species recovery. The island colonies may be the most promising approach for supplying large numbers of animals for release. Two island colonies are now estimated to contain several hundred NEC each, and modeling suggests that removing 100 animals per year per island may be sustainable. If NEC and their habitat were protected in New York, some of those animals could be released into NEC populations in the state to increase genetic diversity.

New York also needs to develop a RHDV2 response plan to prepare for the eventual arrival of RHDV2 to the state. This may involve capturing and vaccinating rabbits in core populations, as has been done for the riparian brush rabbit (*Sylvilagus bachmani riparius*) (USFWS, 2022), which is listed as Endangered in California. Proactive vaccination is a potentially important approach to protect critically small populations from being wiped out by viral outbreaks (Doak et al., 2013; Bakker et al., 2020). Experiments to evaluate the susceptibility of NEC to RHDV2 and modeling to determine the potential population-level benefits of a vaccination effort would be valuable steps in the development of a response plan.

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
1. Law and policy	Policies and regulations
2. Land/water protection	Resource and habitat protection
3. Land/water management	Habitat and natural process restoration
4. Species management	Species recovery
5. Species management	Species re-introduction

Table 2. Recommended conservation actions for New England cottontail.

VII. References

Bakker, V. J., T. S. Sillett, W. M. Boyce, D. F. Doak, T. W. Vickers, W. K. Reisen, B. S. Cohen, M. T. Hallworth and S. A. Morrison. 2020. Translocation with targeted vaccination is the most effective strategy to protect an island endemic bird threatened by West Nile virus. Diversity and Distributions 26:1104-1115.

Barbour, M.S., and J.A. Litvaitis. 1993. Niche dimensions of New England cottontails in relation to habitat patch size. Oecologia 95:321-327.

Bauer, M. L., B. Ferry, H. Holman, and A. I. Kovach. 2020. Monitoring a New England cottontail reintroduction with noninvasive genetic sampling. Wildlife Society Bulletin 44:110-121.

Bauer, M. and A. Kovach. 2021a. Rollinsford winter pellet survey summary 2021.

Bauer, M. and A. Kovach. 2021b. Wells Reserve winter pellet survey summary 2021.

Benton, A.H. and T. Atkinson. 1964. Notes on the New England cottontail in eastern New York. N.Y. Fish and Game J. 11(2):154-156.

Bischoff, K. E., T. A. G. Rittenhouse, and C. D. Rittenhouse. 2023. Introduced competitor reduces abundance of an imperiled cottontail. Biological Invasions 25:3553-3566.

Buffum, B., T. J. McGreevy, Jr., A. E. Gottfried, M. E. Sullivan, and T. P. Husband. 2015. An analysis of overstory tree canopy cover in sites occupied by native and introduced cottontails in the northeastern United States with recommendations for habitat management for New England cottontail. PLoS ONE 10(8): e0135067. doi:10.1371/journal.pone.0135067.

Chapman, J.A., and G. Ceballos. 1990. Chapter 5, "The Cottontails," pages 95-110 in Rabbits, Hares,and Pikas: Status Survey and Conservation Plan., J.A. Chapman and J.E.C. Flux, editors. International Union of Conservation and Nature, Gland, Switzerland.

Cheeseman, A. E. 2017. Factors limiting recovery of the New England cottontail in New York. Ph.D. dissertation, State University of New York College of Environmental Science and Forestry. Syracuse, New York.

Cheeseman, A. E. and J. B. Cohen. 2019. Best management practices for the New England cottontail: New York.

Cheeseman, A. E., J. B. Cohen, S. J. Ryan, and C. M. Whipps. 2021. Is conservation based on best available science creating an ecological trap for an imperiled lagomorph? Ecology and Evolution 11:912-930.

Cheeseman, A. E., J. B. Cohen, C. M. Whipps, A. I. Kovach, and S. J. Ryan. 2019. Hierarchical population structure of a rare lagomorph indicates recent fragmentation has disrupted metapopulation function. Conservation Genetics 20:1237-1249.

Cheeseman, A. E., S. J. Ryan, C. M. Whipps, and J. B. Cohen. 2018. Competition alters seasonal resource selection and promotes use of invasive shrubs by an imperiled native cottontail. Ecology and Evolution 8:11122-11133.

Connecticut Department of Energy and Environmental Protection. 2022. The Connecticut Department of Agriculture confirms incidence of Rabbit Hemorrhagic Disease Virus in Hartford County. CT DEEP press release, September 13, 2022.

Connor, P. F. 1971. The mammals of Long Island, New York. New York State Museum & Science Service Bulletin 416. 78 pp.

Doak, D. F., V. J. Bakker and W. Vickers. 2013. Using population viability criteria to assess strategies to minimize disease threats for an endangered carnivore. Conservation Biology 27:303-314.

Eline, D. V., J. B. Cohen, C. M. Whipps, and A. E. Cheeseman. 2023. Habitat management to reduce competitive interactions: case study of native and invading cottontails. Journal of Wildlife Management 87.

Fenderson, L. E., A. I. Kovach, J. A. Litvaitis, K. M. O'Brien, K. M. Boland, and W. J. Jakubas. 2014. A multiscale analysis of gene flow for the New England cottontail, an imperiled habitat specialist in a fragmented landscape. Ecology and Evolution 4: 1853-1875.

Fuller, S. and A. Tur. 2012. Conservation strategy for the New England cottontail (Sylvilagus transitionalis).

Gallie, J. and G. Hayes. 2020. Columbia Basin pygmy rabbit reintroduction and genetic management plan 2019. Washington Department of Fish and Wildlife.

Gottfried Mayer, A. E., T. J. McGreevy, Jr., M. E. Sullivan, B. Buffum, and T. P. Husband. 2018. Fine-scale habitat comparison of two sympatric cottontail species in eastern Connecticut. Current Trends in Forest Research 119, DOI: 10.29011/ 2638-0013.100019.

Johnston, J.E. 1972. Identification and Distribution of Cottontail Rabbits in Southern New England. M.S. thesis, University of Connecticut, Storrs.

Kovach, A. and M. Bauer. 2021. Demonstrating the efficacy of early successional forest restoration in creating functioning landscapes for New England cottontail. Final Report to National Fish & Wildlife Federation New England Forests and Rivers Fund Grant # 0405.17.057704.

Kovach, A. and D. Brubaker. 2012. Estimating abundance of New England cottontail populations using fecal DNA collected from winter pellet surveys. Report for Northeast Association of Fish and Wildlife Agencies Regional Conservation Needs Grant #2009-04.

Kovach, A. I., A. E. Cheeseman, J. B. Cohen, C. D. Rittenhouse, and C. M. Whipps. 2022. Separating proactive conservation from species listing decisions. Environmental Management 70:710-729.

Lankton, J. S., S. Knowles, S. Keller, V. I. Shearn-Bochsler, and H. S. Ip. 2021. Pathology of Lagovirus europaeus GI.2/RHDV2/b (Rabbit Hemorrhagic Disease Virus 2) in native North American lagomorphs. Journal of Wildlife Diseases 57:694-700.

Litvaitis, J.A. 1993. Response of early successional vertebrates to historic changes in land use. Conservation Biology 7: 866-873.

Litvaitis, J.A., D.L. Verbyla, and M.K. Litvaitis. 1991. A field method to differentiate New England and eastern cottontails. Transactions of the Northeast Section, the Wildlife Society 48:11-14.

Litvaitis, J.A., J.P. Tash, M.K. Litvaitis, M.N. Marchand, A.I. Kovach, and R. Innes. 2006. A range-wide survey to determine the current distribution of New England cottontails. Wildlife Society Bulletin 34(4):1190-1197.

Mahar, J. E., R. N. Hall, D. Peacock, J. Kovaliski, M. Piper, R. Mourant, N. Huang, S. Campbell, X. Gu, A. Read, N. Urakova, T. Cox, E. C. Holmes, and T. Strive. 2018. Rabbit Hemorrhagic Disease Virus 2 (RHDV2; GI.2) is replacing endemic strains of RHDV in the Australian landscape within 18 months of its arrival. Journal of Virology 92:e01374-17. https://doi.org10.1128/JVI.01374-17.

McGreevy, T. J. Jr., S. Michaelides, M. Djan, M. Sullivan, D. M. Beltrán, B. Buffum, and T. Husband. 2021. Location and species matters: variable influence of the environment on the gene flow of imperiled, native and invasive cottontails. Frontiers in Genetics 12:708871. doi: 10.3389/fgene.2021.708871.

NatureServe. 2024. NatureServe Explorer. Page last published 1/5/2024. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.791204/Sylvilagus_transitionalis Accessed January 22, 2024.

New England Cottontail Technical Committee. 2019. New England cottontail regional initiative FY 2018 performance report.

New England Cottontail Technical Committee. 2022. Young forest conservation regional initiative New England cottontail technical committee FY 2021 performance report.

New England Cottontail Technical Committee. 2024. Young forest conservation regional initiative New England cottontail technical committee FY 2023 performance report.

New England Cottontail Technical Committee Population Management Work Group. 2017. NEC population management work group report 2017.

New England Cottontail Technical Committee Population Management Work Group. 2021. Population management work group report 2021.

New York State Department of Environmental Conservation. 2019. Draft List Under Part 182.5 Pre-proposal—October 2019.

Novak, P. 2019. New England Cottontail Focus Area Status Screening Template – Central Dutchess.

Rittenhouse, C. D. 2022. Range-wide monitoring of the New England cottontail: report on the 2020-2021 survey with summary of the 2016-2017 through 2020-2021 surveys.

Rittenhouse, C. D. 2024. Protocol for range-wide monitoring of the New England cottontail in 2023-2024.

Rittenhouse, C.D., and A.I. Kovach. 2020. Assessment of alternative sampling designs for range-wide monitoring of New England cottontail. Wildlife Society Bulletin 44:798–806.

USFWS (United States Fish and Wildlife Service). 2006. Endangered and threatened wildlife and plants; review of native species that are candidates or proposed for listing as endangered or threatened; annual notice of findings on resubmitted petitions; annual description of progress on listing actions. Federal Register 71:53755-53835.

USFWS (United States Fish and Wildlife Service). 2015. Endangered and Threatened Wildlife and Plants; 12-month findings on a petition to list the New England cottontail as an endangered or threatened species. Federal Register 80:55286-55304.

USFWS (United States Fish and Wildlife Service). 2022. Rabbit Hemorrhagic Disease confirmed for first time in endangered riparian brush rabbits. Press release. https://www.fws.gov/press-release/2022-05/rabbit-hemorrhagic-disease-confirmed-first-time-endangered-riparian-brush

Originally prepared by	Jenny Murtaugh
Date first prepared	April 18, 2013
First revision	February 26, 2014
Latest revision	

Species Status Assessment

Common Name: North American least shrew **Date Updated:** 1/16/2024

Scientific Name: *Cryptotis parva* **Updated By:** J. Vanek

Class: Mammalia

Family: Soricidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

Shrews are classified as insectivores, not rodents, and are among the smallest living mammals. The North American least shrew (*Cryptotis parva*) is the smallest of the North American shrews. It occurs from southern Wisconsin, southern Michigan, and central New York southward throughout the eastern United States. Across the Mississippi, it occurs to southern South Dakota, northeastern Nebraska, eastern Texas, and south through much of Central America (Whitaker and Hamilton 1998). At least in the northern parts of its range, it inhabits grassy, weedy, and brushy fields (Hamilton 1934, Komarek and Komarek 1938, Davis and Joeris 1945, Howell 1954, Layne 1958, Lindsay 1960, Gottschang 1965, Mumford 1969, Paradiso 1969, Choate 1970, Whitaker 1974). Least shrew has not been documented in New York since the 1930s and only a handful of records exist prior to that. The nearest population is in Connecticut where the species is listed as endangered.

I. Status

a. Current legal protected Status

i. **Federal:** Not listed **Candidate:** No

ii. **New York:** Not listed

b. Natural Heritage Program

i. **Global:** G5

ii. **New York:** SH **Tracked by NYNHP?:** Yes

Other Ranks:

IUCN Red List: Least concern

Northeast Regional SGCN: Watchlist

Status Discussion:

The northern limit in the eastern part of the range of the least shrew may have contracted, but the species is secure overall (NatureServe 2012). In New York, the Natural Heritage Program has ranked least shrew as SH, which indicates that although only historic records exist, there is a possibility that unknown populations exist in the state.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Stable	Stable			Choose an item.
Northeastern US	Yes	Declining	Declining			Choose an item.
New York	Yes	Choose an item.	Choose an item.			Yes
Connecticut	Yes	Declining	Declining		Endangered (S1)	Yes
Massachusetts	No	Choose an item.	Choose an item.			Choose an item.
New Jersey	No data	Choose an item.	Choose an item.		Not listed (SNR/SU)	Choose an item.
Pennsylvania	Yes	Declining	Declining		Endangered (S1)	Choose an item.
Vermont	No	Choose an item.	Choose an item.			Choose an item.
Ontario	Yes	Choose an item.	Choose an item.		Not listed (SH)- possibly extirpated	Choose an item.
Quebec	No	Choose an item.	Choose an item.			Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

There are no regular monitoring activities. During the 1950s, John Whitaker set thousands of traps in fields in New York without collecting any. He has subsequently captured over 150 in Indiana (NYSDEC 2005), which suggests that it was not a capture rate issue. The NYS Mammal Survey is currently ongoing and will commence in 2025.

Trends Discussion *(insert map of North American/regional distribution and status):*

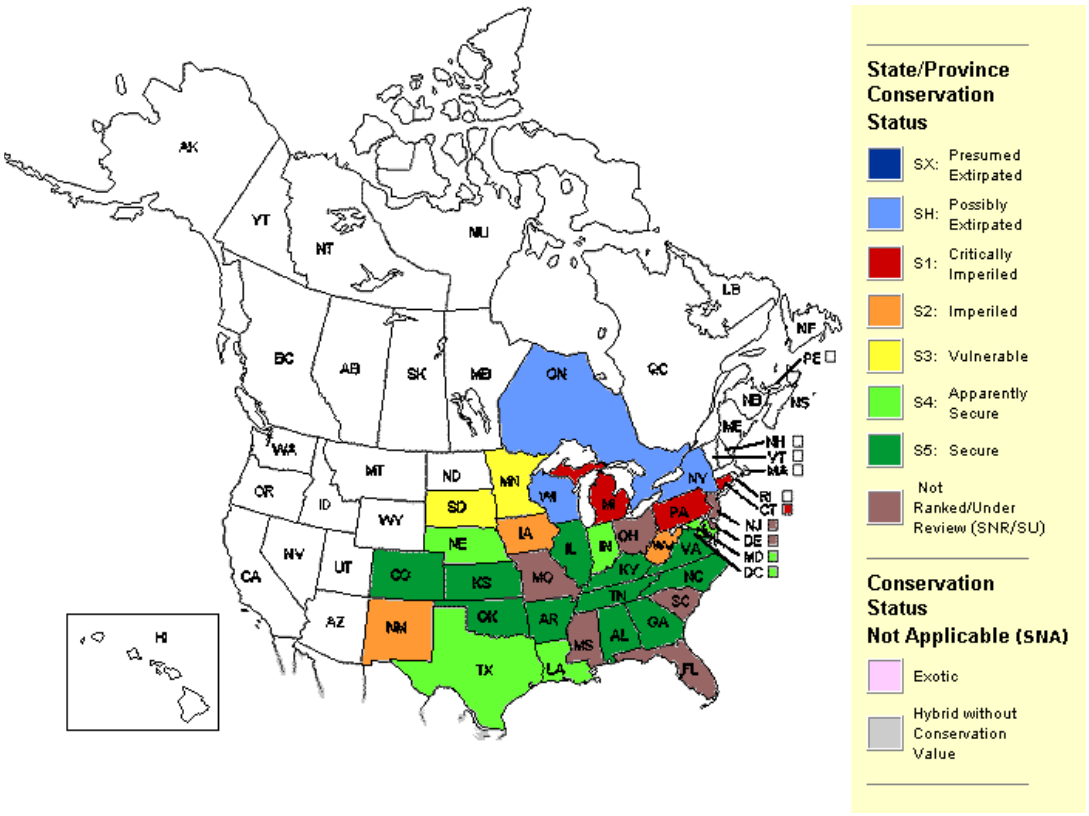

Figure 1. Conservation status of least shrew in North America (NatureServe 2012).

Figure 2. Distribution of least shrew in North America (IUCN 2103).

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

New York is on the northern fringe of the distribution for least shrew. The species is not known to be at risk over the majority of its range, but it is rarely encountered in some areas. It is listed as endangered in Connecticut and Pennsylvania. It has diminished substantially in Pennsylvania and is now known from only one location in the south-central portion of the state (NYSDEC 2005).

Years	# of Records	# of Distinct Populations	% of State
Pre-1995	<15 _____	_____	_____
1995-2004	_____	_____	_____
2005-2014	_____	_____	_____
2015 - 2023	_____	_____	_____

Table 1. Records of North American least shrew in New York.

Details of historic and current occurrence:

The least shrew is so rarely encountered in the state (only about a dozen specimens exist) that it is impossible to identify a population trend. Earliest records for New York include a specimen from West Point, Orange County in 1900 and North Rose, Wayne County in October 1913. Records also occur from Staten Island, Tompkins County and Long Island, though none have been reported in the state since the 1930s (NYSDEC 2005). There are no current records of least shrew in New York, pending results from the NYS Mammal Survey.

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Peripheral	~400 miles

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

1. Old Field Managed Grasslands
2. Powerline
3. Meadow
4. Pastureland

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
Yes	No	Declining	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

The least shrew is a grassland species restricted to habitats that are free from grazing and intensive agricultural practices (Butchkoski 2010). Preferred habitats include meadows, pastures, and old fields (PNHP 2013). Least shrews create runways in the grass and burrows that are approximately 13 mm high and 18 mm wide (Whitaker and Hamilton 1998). The least shrew has been called the “bee shrew” or “bee mole” because it has been known to build its nest in beehives and feed upon the bees and their larvae (Whitaker and Hamilton 1998, Butchkoski 2010).

V. Species Demographic and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Choose an item.	Choose an item.	Yes	Yes	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Least shrews are active year-round, mostly during the evening hours. The species commonly forages for food in runways created by meadow voles, but also constructs its own narrow passageways within vegetation for foraging and dispersal (Butchkoski 2010). The nest is a ball of shredded leaves and grasses under a rock slab, stump, or log, or in a shallow tunnel (Whitaker and Hamilton 1998). Data which cites occurrences of 2-25 individuals in one nest indicate that least shrews are colonial or at least somewhat social, a behavior not typically associated with Soricidae (Davis and Joeris 1945, McCarley 1959, Jackson 1961).

The least shrew eats a variety of small insects, mollusks, spiders, and earthworms (Whitaker and Mumford 1972). It averages more than its own weight in food per day (Whitaker and Hamilton 1998). It occasionally exhibits hoarding behavior, which is unusual among shrews (Butchkoski 2010).

Breeding is from March to November in the north, but may occur year-round in the south. Gestation takes 21-23 days. A least shrew produces several litters each year, numbering 2 to 7 (mean 4.9) young. Young are not weaned until nearly three weeks old (Whitaker and Hamilton 1998). Because of their high metabolic rates and food needs, least shrews are not good dispersers and seem to be very restricted locally (Butchkoski 2010).

Howell (1954) estimated the home range of one female to be 0.23 ha (0.57 acre) and 0.17 ha (0.41 acre) for one male. He estimated population density to be at least 1.7 per ha (0.7 per acre), but thought the actual density may be 5 per ha (2 per acre).

The least shrew only lives a short time, usually a little over a year (Connecticut DEEP 1997). No precise estimate of longevity has been made in the wild, but one captive individual lived to the age of 21 months old (Pfeiffer and Gass 1963). Hawks, snakes, and predatory mammals such as dogs and cats all take shrews (Whitaker and Hamilton 1998). Owls are likely the top source of mortality by predators for this shrew. In an examination of barn owl pellets, Davis (1938) found that least shrews comprised 41% of the mammals taken.

VI. Threats *(from NY 2015 SWAP or newly described):*

The loss of croplands to development and more intensive use of remaining farmlands may be contributing to the apparent decline and current rarity of this shrew. Traditional farming practices have been replaced by extensive agricultural monocultures, resulting in loss of hayfields, meadows, and fencerows (Butchkoski 2010).The availability of grasslands on these farms has been further reduced by the shift to crop monocultures such as corn, soybeans, and winter wheat, which provide little or no habitat compared with the diverse, beneficial mixes of grasses and legumes that are common in hayfields and pastures (Audubon New York 2009). This conversion, plus the regeneration of forestlands, and housing or industrial development of other lands, has reduced the availability of least shrew habitat (Butchkoski 2010). Grassland habitat is fragmented in many areas where it does still exist, isolating shrew populations and increasing the possibility of chance events leading to localized eradication of a population (Butchkoski 2010). Two-thirds of New York's farmland has been lost over the past century (Audubon New York 2009). While most of these threats are changes that have happened well outside the window when least shrews were last reported, these remain threats to any potentially unidentified remaining populations or to populations across the range.

Other threats include pesticides and pollutants that contaminate food and habitat (Connecticut DEEP 1997). DDT use may also have caused a decline in the population (PNHP 2013).

Threats to NY Populations	
Threat Category	**Threat**
1. Residential & Commercial Development	Housing & Urban Areas (loss of habitat)
2. Residential & Commercial Development	Commercial & Industrial Areas (loss of habitat)
3. Agriculture & Aquaculture	Annual & Perennial Non-timber Crops (shift to corn, soybeans from hayfields and pastures)
4. Pollution	Agriculture & Forestry Effluents (pesticides, herbicides)
5. Natural System Modifications	Other Ecosystem Modifications (natural succession)

*Not enough information to assess threats

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: _____ **No:** _____ **Unknown:** _x_

If yes, describe mechanism and whether adequate to protect species/habitat:

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Conservation Actions	
Action Category	**Action**
No conservation actions have been identified.	

Table 2: (need recommended conservation actions for North American least shrew)

The Comprehensive Wildlife Conservation Strategy (NYSDEC 2005) includes recommendations for the following actions for small mammals of uncertain or questionable residency, and for least shrew in particular.

Population monitoring:

* If the species is found within the historic range, extend surveys to likely habitat outside of the known historic range.

* Conduct trapping efforts for both species in likely habitats within their known historic distribution in the state.

Management practices beneficial for the short-eared owl and other conservation efforts, such as the Landowner Incentive Program, should also benefit this species.

VII. References

Audubon New York. 2009. Managing habitat for farmland (grassland) birds. <http://ny.audubon.org/grassland-bird-conservation>. Accessed 3 April 2013.

Butchkoski, E. 2010. Least shrew (*Cryptotis parva*). Pennsylvania Game Commission, Harrisburg, Pennsylvania, USA.

Choate, J. R. 1970. Systematics and zoography of middle American shrews of the genus *Cryptotis*. University of Kansas Publications, Kansas, Missouri, USA.

Connecticut Department of Energy and Environmental Protection (Connecticut DEEP). 2007. Least shrew (*cryptotis parva*) fact sheet. <http://www.ct.gov/deep/cwp/view.asp?a=2723&q=326034&depNav_GID=1655>. Accessed 3 April 2013.

Davis, W. B., and L. Joeris. 1945. Notes on the life history of the little short-tailed shrew. Journal of Mammalogy 26: 136-138.

Hamilton, W. J., Jr. 1934. Habits of *Cryptotis parva* in New York. Journal of Mammalogy 15: 154-155.

Howell, J. C. 1954. Populations and home ranges of small mammals on an overgrown field. Journal of Mammalogy 35: 177-186.

Gottschang, J. L. 1965. Winter populations of small mammals in old fields of southwestern Ohio. Journal of Mammalogy 46: 44-52.

Jackson, H. H. T. 1961. Mammals of Wisconsin. University of Wisconsin Press, Madison, Wisconsin, USA.

Komarek, E. V., and R. Komarek. 1938. Mammals of the Great Smoky Mountains. Bulletin of Chicago Academy of Sciences 5: 137-163.

Layne, J. N. 1958. Notes on mammals of southern Illinois. American Midland Naturalist 60: 219-254.

Lindsay, D. M. 1960. Mammals of Ripley and Jefferson counties, Indiana. Journal of Mammalogy 41: 253-262.

McCarley, W. H. 1959. An unusually large nest of *Cryptotis parva*. Journal of Mammalogy 40:243.

Mumford, R. E. 1969. Distribution of the mammals of Indiana. Monographs of the Indiana Academy of Sciences 1: 1-114.

Murtagh, J. 2013. NYSDEC SWAP 2015 Species Status Assessment for North American Least Shrew. Prepared on 4 April, 2013. Revised February 26 2014.

NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. <http://www.natureserve.org/explorer>. Accessed 2 April 2013.

New York State Department of Environmental Conservation (NYSDEC). 2005 New York State Comprehensive Wildlife Conservation Strategy. Albany, NY. https://extapps.dec.ny.gov/docs/wildlife_pdf/cwcs2005.pdf

Paradiso, J. L. 1969 Mammals of Maryland. North American Fauna 66:1-193.

Pennsylvania Natural Heritage Program (PNHP). 2013. Least shrew (Cryptotis parva) fact sheet. <http://www.natureserve.org/explorer>. Accessed 3 April 2013.

Pfeiffer, C. J., and G. H. Gass. 1963. Note on the longevity and habits of captive *Cryptotis parva*. Journal of Mammalogy 44: 427-428.

Therres, G.D. 1999. Wildlife species of regional conservation concern in the Northeastern United States. Northeast Wildlife 54:93-100.

Whitaker, J. O, Jr. 1974. Mammalian Species: *Cryptotis parva*. Monographs of the American Society of Mammalogists 43: 1-8.

Whitaker, J. O., Jr., W. J. Hamilton, Jr. 1998. Mammals of the Eastern United States. Comstock Publishing Associates, Ithaca, New York, USA.

Originally prepared by	Jenny Murtaugh
Date first prepared	April 4, 2013
First revision	February 26, 2014 (Samantha Hoff)
Latest revision	

Species Status Assessment

Common Name: Northern long-eared bat **Date Updated:** 12/28/2023

Scientific Name: *Myotis septentriolanis* **Updated By:** Ashley Meyer

Class: Mammalia

Family: Vespertilionidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

The northern Myotis *(Myotis septentrionalis*), also called the northern bat and the northern long-eared bat, was formerly regarded as conspecific with Keen's myotis (*Myotis keenii*). Since van Zyll de Jong (1979, 1985) and Jones *et al.* (1992) *M. keenii* and *M. septentrionalis* have been regarded as separate species. Most literature under the name *M. keenii* actually pertains to *M. septentrionalis*. No subspecies are recognized.

During summer the northern myotis occurs in a patchy distribution and may be found throughout most of the state including Long Island. It is unknown whether the statewide distribution has declined since WNS began. Winter surveys prior to the start of WNS had recorded this species in all regions of the state where mines and caves have been surveyed. The northern Myotis is widespread throughout much of Canada and the eastern half of the United States. Prior to the onset of WNS it was more common in the northern parts of its range. Whether or not its distribution has changed since the start of WNS is unknown.

Northern myotis have declined approximately 99% since white-nose syndrome began in New York in 2006 through 2015. Similar declines have occurred in the northeastern part of their range. Numbers dropped from 911 to only 18 individuals counted among 36 hibernacula sites repeatedly surveyed from 2007-2012. These numbers do not represent complete counts of the statewide population, however, since this species may roost individually and in crevices prohibiting a complete count of the remaining population. The long-term trends were presumed to be stable or increasing prior to the appearance of white-nose syndrome in 2006.

Northern myotis are typically associated with mature interior forest and tend to avoid woodlands with significant edge habitat. Northern myotis may most often be found in cluttered or densely forested areas including in uplands and at streams or vernal pools. Northern myotis may use small openings or canopy gaps as well.

I. Status

a. Current legal protected Status

i. **Federal:** Endangered **Candidate:** _____

ii. New York: Endangered

b. Natural Heritage Program

i. Global: G2G3

ii. New York: S1 **Tracked by NYNHP?:** Yes

Other Ranks:

IUCN Red List: Near threatened

Northeast Regional SGCN: RSGCN

Status Discussion:

The northern long-eared myotis was formerly common in New York. Since 2008 it has been one of the least frequently encountered bats and is now considered rare.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Declining	Declining	1985-2020	Endangered	Choose an item.
Northeastern US	Yes	Declining	Declining	1985-2020		Yes
New York	Yes	Declining	Declining	1985-2020	Endangered	Yes
Connecticut	Yes	Declining	Declining	1990-2019	Endangered	Yes
Massachusetts	Yes	Declining	Unknown	1987-2012	Endangered	Yes
New Jersey	Yes	Declining	Unknown	1990-2019	Endangered	Yes
Pennsylvania	Yes	Declining	Unknown	2004-2019	Endangered	Yes
Vermont	Yes	Declining	Unknown	2004-2019	Endangered	Yes
Ontario	Yes	Declining	Unknown	Through 2019	Endangered	Choose an item.
Quebec	Yes	Declining	Unknown	Through 2019	Threatened	Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

Winter hibernacula surveys, summer acoustic surveys and mist netting efforts are all used to monitor this species in New York.

Trends Discussion *(insert map of North American/regional distribution and status):*

The northern long-eared bat was formerly common in NY and regularly encountered throughout northeastern North America. Since the arrival of white-nose syndrome (WNS), the species has become rare throughout the region, with observed decline in NY exceeding 98% (NYSDEC data). Encounters are currently so infrequent that assessment of trends since 2011 has been uncertain.

Since 2012 NYSDEC has been studying an apparently remnant population of the species on eastern Long Island. The trend there is unclear, but some evidence suggests it, too, is in decline (NYSDEC data).

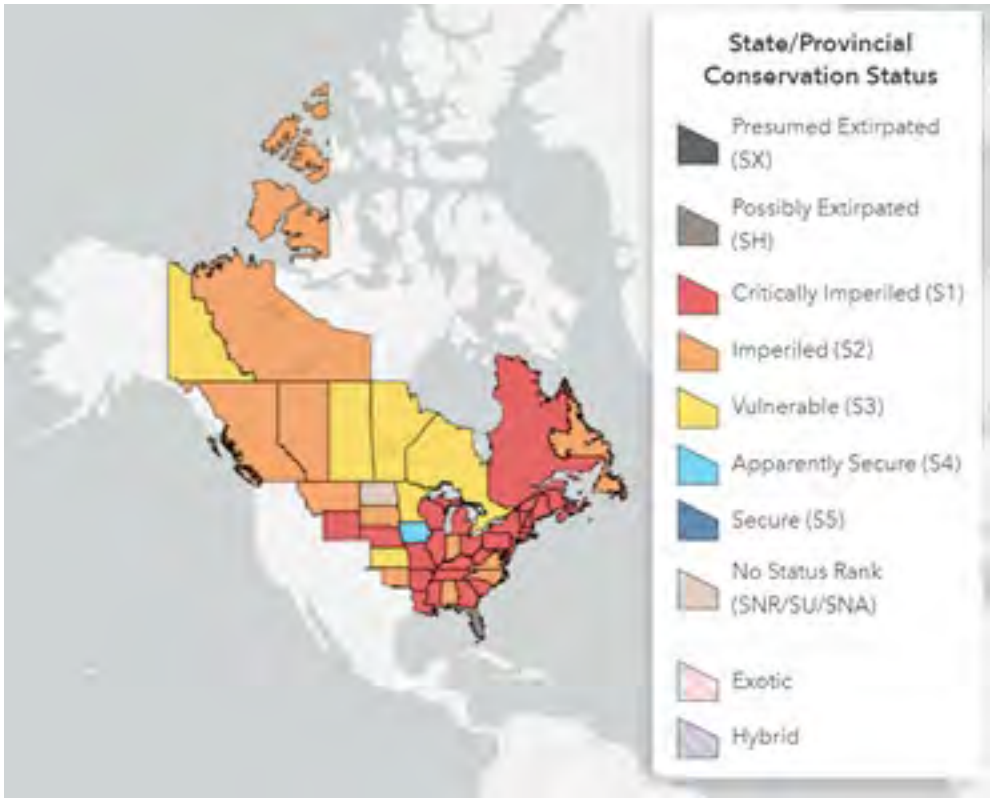

Figure 1. Conservation status of northern long-eared bat in North America (NatureServe 2023)

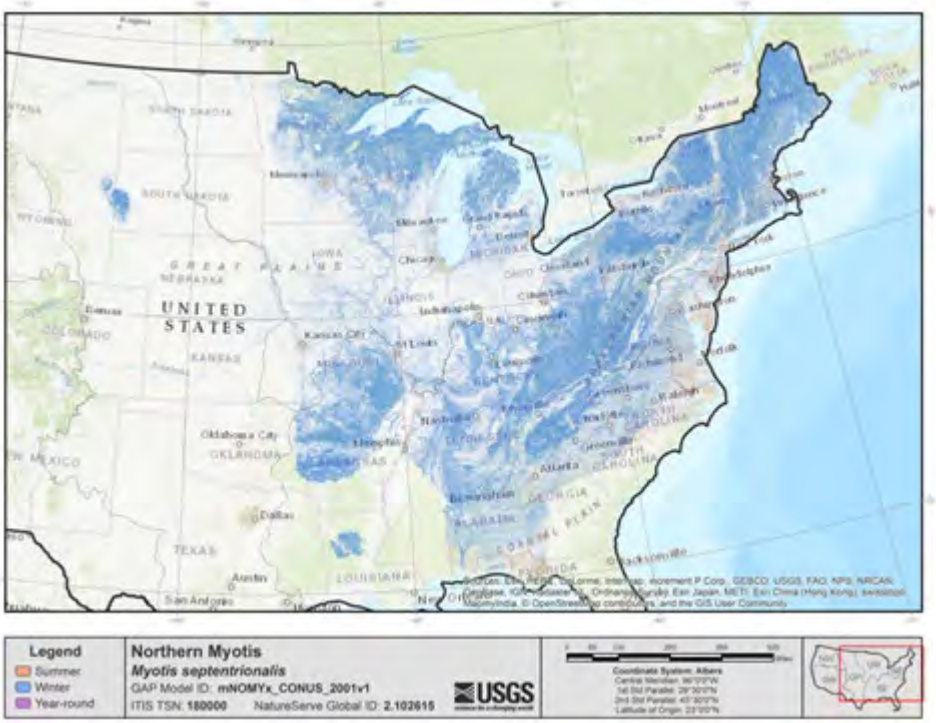

Figure 2. Range of northern long-eared bat (USGS 2018)

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Years	# of Records	# of Distinct Populations	% of State
Pre-1995	_____	_____	100%
1995-2004	_____	_____	_____
2005-2014	_____	_____	_____
2015 - 2023	_____	_____	_____

Table 1. Records of northern long-eared bat in New York.

Details of historic and current occurrence:

The northern long-eared bat was observed in 80% of hibernacula that contained at least 10 bats of any species prior to 2007 (NYSDEC unpub. data). Summer records exist from every county outside NYC and from most towns.

Encounters in NY hibernacula have declined by >98% in sites where WNS has been present for 2 or more years (NYSDEC unpub. data).

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Core	

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Caves and Mines

b. Mixed northern hardwoods

c. Oak-pine forest

d. Oak forest

e. Residential/Rural

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
No	No	Stable	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Northern long-eared bats are typically associated with mature interior forest and tend to avoid woodlands with significant edge habitat. Northern myotis may most often be found in cluttered or densely forested areas including in uplands and at streams or vernal pools. Northern myotis may use small openings or canopy gaps as well. In one study in northwestern South Carolina, detection of northern myotis was best predicted in mature stands but also in areas with sparse vegetation. Some research suggests that northern myotis forage on forested ridges and hillsides rather than in riparian or floodplain forests. Captures from NY suggest that northern myotis may also be found using younger forest types. Northern myotis select day roosts in dead or live trees under loose bark, or in cavities and crevices, and may sometimes use caves as night roosts. They may also roost in buildings or behind shutters. A variety of tree species are used for roosting. The structural complexity of surrounding habitat and availability of roost trees may be important factors in roost selection. Roosts of female bats tend to be large diameter, tall trees, and in at least some areas, located within a less dense canopy. Northern myotis hibernates in caves and mines where the air temperature is constant, preferring cooler areas with high humidity (NYNHP 2023).

V. Species Demographic and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Choose an item.	Choose an item.	Yes	Yes	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

The northern long-eared bat, like most bats, breeds in the fall; they swarm and mate near the cave entrance. Females store sperm over the winter until ovulation occurs in the spring which coincides with emergence from winter hibernacula. Females give birth to one young approximately 50-60 days later.

Northern myotis are short-distance migrants. They have been documented traveling up to 168 miles from hibernacula to summer colonies. They have also been documented to move between hibernacula during the winter.

Northern myotis may roost in small colonies or individually and they switch roosts often. Genetic research has indicated that there may be male-biased dispersal and site fidelity in females for this species as is common in mammals. This means that females often return to the same areas to raise pups and males travel farther than females to find mates. There also appear to be unbalanced sex ratios in favor of males in some regions.

This species is long-lived, with the oldest recorded individual found dead in the cave where it had been banded 19 years before.

VI. Threats *(from NY 2015 SWAP or newly described):*

By far the largest threat to northern myotis in New York is white-nose syndrome (WNS) which was first discovered among bats in a cave in Schoharie County, New York in 2006. Some forest management

practices may not be compatible with this species. Since northern myotis are adapted to exploit mature interior forest, harvests that remove significant canopy cover can reduce habitat for this species. Direct mortality could occur when felled live trees contain colonies or roosting individuals and timber management may reduce or fragment the mature interior forest habitat required by this species. Bats may be particularly sensitive to environmental toxins including those found in herbicides and pesticides. Although no studies have targeted northern myotis directly, elevated levels of persistent organic pollutants including especially PCBs, DDT, Chlordanes, and PBDEs have been found in a similar species, the little brown bat, in the Hudson River Valley in New York.

Threats to NY Populations	
Threat Category	**Threat**
Human Intrusions & Disturbance	Recreational activities
Invasive & Other Problematic Species & Genes	Invasive non-native/alien species
Biological Resource Use	Logging & wood harvesting
Natural Systems Modifications	Dams & water management/use
Natural Systems Modifications	Other ecosystem modifications
Human Intrusions & Disturbance	Work & other activities
Pollution	Industrial & military effluents
Energy Production & Mining	Renewable energy

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

The species is listed as Endangered under both NYS and federal endangered species statutes. Gating mines and caves can prevent human entry while allowing the bats unobstructed access. Following proper specifications and monitoring bat populations before and after gate installation are important, however, as gating can affect the airflow and temperature in the cave, making areas of the cave uninhabitable for certain species. Retaining large trees and unfragmented blocks of late-seral stage forests of mixed age classes may be important for this species. Harvests that substantially reduce the forest canopy may not be compatible with habitat management for this species.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
1. In-place land/water protection	
2.	

Table 2. Recommended conservation actions for northern long-eared bat

VII. References

IUCN 2023. The IUCN Red List of Threatened Species. Version 2023-1. https://www.iucnredlist.org. Accessed December 28, 2023.

Jones, J. K., Jr., R. S. Hoffman, D. W. Rice, C. Jones, R. J. Baker, and M. D. Engstrom. 1992. Revised checklist of North American mammals north of Mexico, 1991. Occasional Papers, The Museum, Texas Tech University 146:1-23.

NatureServe. 2023. NatureServe Explorer 2.0. (2023, November 3). https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.102615/Myotis_septentrionalis Accessed November 21, 2023.

New York Natural Heritage Program. 2023. Online Conservation Guide for Myotis septentrionalis. Available from: https://guides.nynhp.org/northern-long-eared-bat/. Accessed November 24, 2023.

U.S. Geological Survey (USGS) - Gap Analysis Project (GAP), 2018, Northern Myotis (Myotis septentrionalis) mNOMYx_CONUS_2001v1 Habitat Map: U.S. Geological Survey data release, https://doi.org/10.5066/F79C6VTK.

van Zyll de Jong, C. G. 1979. Distribution and systematic relationships of long-eared MYOTIS in western Canada. Canadian J. Zool., 57:987-994.

van Zyll de Jong, C. G. 1985. Handbook of Canadian Mammals. Volume 2. Bats. National Museums of Canada, Ottawa, Ontario, Canada.

Originally prepared by	Jenny Murtaugh
Date first prepared	April 30, 2013
First revision	January 29, 2014 (Samantha Hoff)
Second revision	November 2, 2020 (Carl Herzog)
Latest revision	

Species Status Assessment

Common Name: Silver-haired bat **Date Updated:** 12/28/2023

Scientific Name: *Lasionycteris noctivagans* **Updated By:** Ashley Meyer

Class: Mammalia

Family: Vespertilionidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

Taxonomy is widely accepted. No subspecies are recognized.

The distribution of silver-haired bats is unknown. Records of this species in New York during summer are sparse and come from occasional mist-net captures and carcasses found at wind turbines in Steuben, Wyoming, Franklin, Lewis, Jefferson, Clinton, Onondaga, Oswego, Madison and Oneida County counties. Silver-haired bats occur across a broad range that spans a large portion of North America. They range from far southeastern Alaska across most of the middle to southern latitudes in Canada and throughout the United States except for far southern latitudes including Florida and southern California.

Silver-haired bats occur in forested habitats, perhaps especially ones dominated by conifers. However, specific habitat in New York and their eastern range remains understudied. The silver-haired bat is often characterized (along with the *Lasiurus* species) as a "migratory tree bat" that overwinters in southern latitudes and roosts in trees. They are known to roost under bark or in cracks or cavities, and occasionally in caves and buildings such as sheds with outdoor access.

I. Status

a. Current legal protected Status

i. **Federal:** Not listed **Candidate:** No

ii. **New York:** Not listed; SGCN

b. Natural Heritage Program

i. **Global:** G3G4

ii. **New York:** S2S3B **Tracked by NYNHP?:** No

Other Ranks:

IUCN Red List: Least concern

Northeast Regional SGCN: RSGCN

Status Discussion:

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Choose an item.	Choose an item.			Choose an item.
Northeastern US	Yes	Choose an item.	Choose an item.			Yes
New York	Yes	Stable	Stable	2009 - present	Not listed	Yes
Connecticut	Yes	Choose an item.	Choose an item.		Special Concern	Choose an item.
Massachusetts	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.
New Jersey	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.
Pennsylvania	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.
Vermont	Yes	Choose an item.	Choose an item.		Not listed	Yes
Ontario	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.
Quebec	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

State-wide mobile acoustic surveys and post-construction mortality monitoring on wind farms in central and northern NY.

Trends Discussion *(insert map of North American/regional distribution and status):*

Trends are unknown.

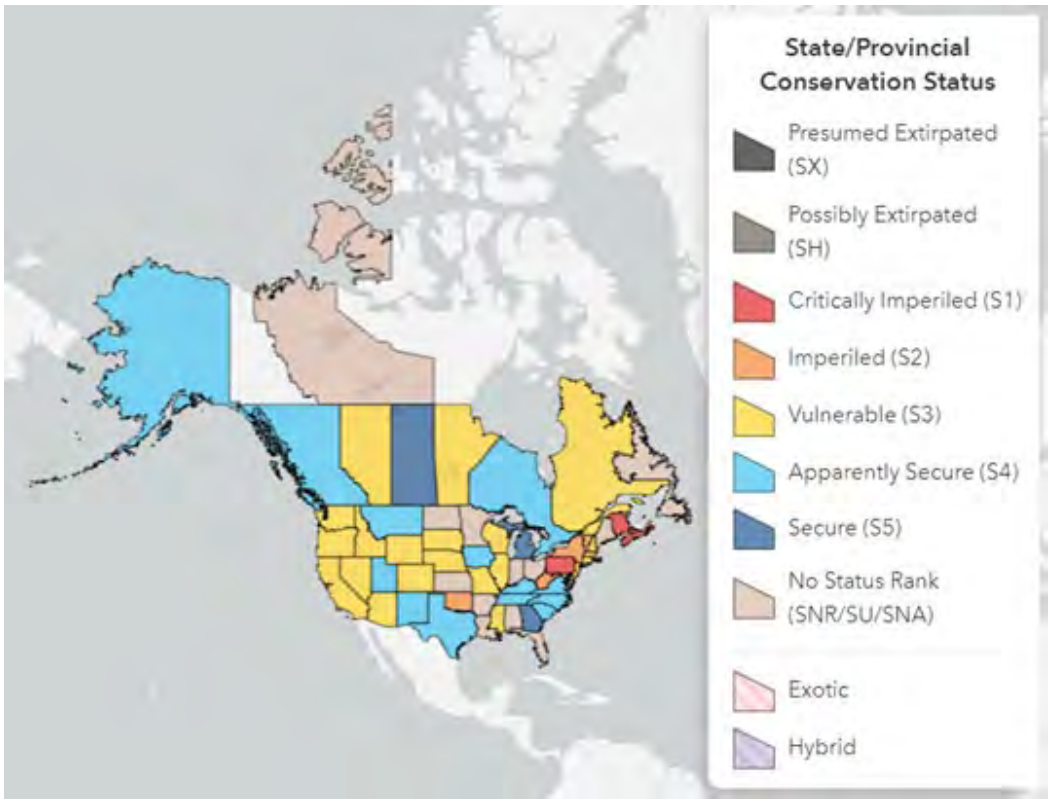

Figure 1. Conservation status of silver-haired bat in North America (NatureServe 2023)

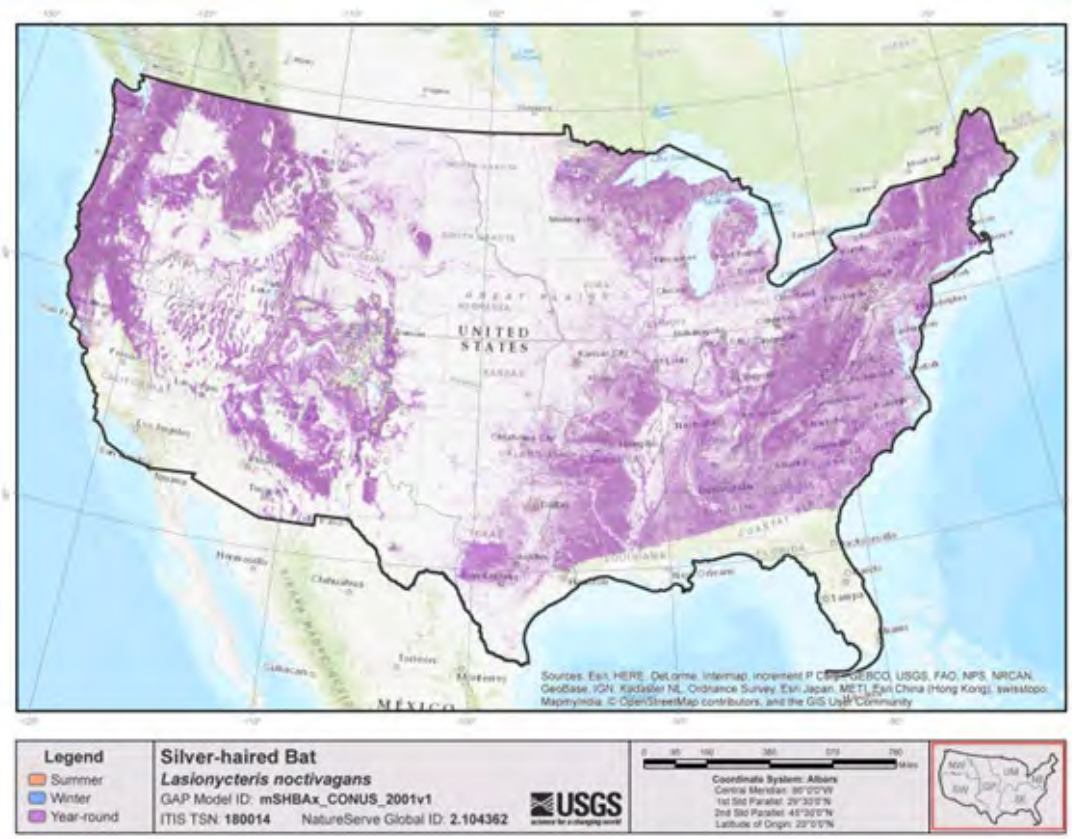

Figure 2. Range of silver-haired bat in the United States (USGS 2018)

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Years*	# of Records	# of Distinct Populations	% of State**
Pre-1995			
1995-2004			
2005-2014	6568	1	100
2015 - 2023	10457	1	100

Table 1. Records of silver-haired bat in New York.

*The acoustic monitoring program began in 2009, so data in unavailable prior to that year.
**Mobile acoustic survey routes are evenly distributed across the state, except for Long Island where these surveys are not completed due to logistical difficulties.

Details of historic and current occurrence:

Merriam (1886) claimed it was the commonest bat in the Adirondack region, "far outnumbering all other species combined." Nichols and Nichols (1934) reported collecting pregnant females on Long Island.

No reliable recent data are available for resident animals. Carcasses are commonly encountered at all large wind turbine facilities in NY during the late-summer migration period. Records outside of the migration period are extremely infrequent suggesting that the number of resident animals is very low.

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Peripheral	

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Northeastern Wetland Forest

b. Northeastern Upland Forest

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
No	No	Stable	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Silver-haired bats occur in forested habitats, perhaps especially ones dominated by conifers. However, specific habitat in New York and their eastern range remains understudied. They forage in or near forests and water sources. It's reported that silver-haired bats notably foraged over water in the Adirondacks including over streams, rivers, lakes, and ponds and also along the edges and in the canopy of hardwoods.

The silver-haired bat is often characterized (along with the *Lasiurus* species) as a "migratory tree bat" that overwinters in southern latitudes and roosts in trees. They are known to roost under bark or in cracks or cavities, and occasionally in caves and buildings such as sheds with outdoor access. Migrating individuals have also been observed within ground debris and in rock crevices (NYNHP 2023).

V. Species Demographic and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Choose an item.	Choose an item.	Yes	Choose an item.	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Silver-haired bats breed in late September and fertilization occurs in spring. Females give birth to one, or more frequently, two young 50-60 days later in early summer. Silver-haired bats roost individually except for reproductive females which may roost in very small colonies with a few other reproductive females. Segregation of the sexes by habitat and perhaps even by distribution during the summer months has been reported for silver-haired bats. There are generally two offspring per year, which are thought to be sexually mature at the end of the first summer. Longevity is 12 years (NYNHP 2023).

VI. Threats *(from NY 2015 SWAP or newly described):*

Silver-haired bats migrate rather than congregate in caves over the winter and have not suffered the same dramatic population declines due to White-nose syndrome. Silver-haired bats are killed when they collide with wind turbines in New York, particularly during fall migration. It is unknown whether the numbers of bats killed at turbines during migration is high enough to impact population numbers. Incompatible forest management practices could pose a threat; however, preferred characteristics of forest stand structure for this species are unknown in the east and more research is needed. Bats may be particularly sensitive to environmental toxins including those found in herbicides and pesticides. Bats are highly susceptible to DDT residue and this chemical was widely used as a pesticide to control bat infestations in houses in the 1940s.

Threats to NY Populations	
Threat Category	**Threat**
Energy Production & Mining	Renewable Energy (wind turbines)
Pollution	Industrial & Military Effluents (environmental contaminants including flame retardants, mercury, etc.)
Biological Resource Use	Logging & Wood Harvesting (direct mortality of maternity colonies from silviculture)

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

Research indicates that raising cut-in speeds (i.e., wind speed at which turbines first start rotating and generating electrical power) of wind turbines during peak activity times may limit the number of migratory tree bats killed at large-scale turbines. Large-scale (>25MW) wind energy projects are required to implement a 5.5m/s cut-in speed during the migratory period. Higher cut-in speeds could be applied to all wind energy projects to reduce this threat further.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
1. In-place land/water protection	
2.	

Table 2. Recommended conservation actions for silver-haired bat

VII. References

IUCN 2023. IUCN Red List of Threatened Species. Version 2023-1. <www.iucnredlist.org>. Accessed December 28, 2023.

Merriam, C. Hart. 1886. The Mammals of the Adirondack Region. New York: Henry Holt and Co.

NatureServe Explorer 2.0. (2023, November 3). https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.104362/Lasionycteris_noctivagans. Accessed 21 November 2023.

New York Natural Heritage Program. 2023. Online Conservation Guide for Lasionycteris noctivagans. Available from: https://guides.nynhp.org/silver-haired-bat/. Accessed November 24, 2023.

Nichols, D. G., & Nichols, J. T. (1934). Notes on Long Island, New York, bats. J. Mamm, 15, 156. Pearson, E. W. (1962). Bats hibernating in silica mines in southern Illinois. Journal of Mammalogy, 27-33.

U.S. Geological Survey (USGS) - Gap Analysis Project (GAP), 2018, Silver-haired Bat (Lasionycteris noctivagans) mSHBAx_CONUS_2001v1 Habitat Map: U.S. Geological Survey data release, https://doi.org/10.5066/F7902257.

Originally prepared by	Jenny Murtaugh
Date first prepared	June 24, 2013
First revision	January 29, 2014 (Samantha Hoff)
Latest revision	

Species Status Assessment

Common Name: Tricolored bat **Date Updated:** 12/28/2023

Scientific Name: *Perimyotis subflavus* **Updated By:** Ashley Meyer

Class: Mammalia

Family: Vespertilionidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

This species has undergone taxonomic revision over the last two decades. Most of the literature is published under the name *Pipistrellus subflavus*. Hoofer *et al.* (2006) revised the generic status to *Perimyotis*. The common name “tricolored bat” came into usage as a result.

Prior to the start of white-nose syndrome (WNS) tri-colored bats were recorded in winter hibernacula in all regions of the state where mines and caves have been surveyed. They were more common (>10 individuals) in hibernacula in southern and western New York. The remaining distribution of tri-colored bats in New York is not known. Their statewide range may have contracted since the start of WNS. Tri-colored bats are found in eastern North America along the east coast as far south as Georgia and north into Nova Scotia and southern Quebec and Ontario. Their western range extent includes eastern Minnesota in the north and Texas to the northeast corner of Mexico in the south.

Tri-colored bat populations have declined approximately 96% in New York State since 2007. There were only 118 tri-colored bats counted in 2012 compared with 2,285 among the same 37 hibernacula surveyed in 2007. Tri-colored bat numbers are presumed to have been stable or increasing prior to the start of WNS in 2006.

Tri-colored bats over-winter in humid areas deep within caves and mines with a constant temperature of around 52-55F. Surveys of hibernacula in New York conducted by the New York State Department of Environmental Conservation found tri-colored bats segregated from other species in warmer areas of the cave with high humidity. Wooded riparian areas are likely an important foraging habitat for this species during the summer. Tri-colored bats may roost in habitats including open woods near water and they may select roosts in buildings, crevices of cliffs and rocks, or in or below the canopy of live or recently dead trees that retain some dead or live leaves.

I. Status

a. Current legal protected Status

i. **Federal:** Not listed **Candidate:** Yes

ii. **New York:** Not listed; proposed Threatened

b. Natural Heritage Program

i. **Global:** G3G4

ii. **New York:** S1 **Tracked by NYNHP?:** Yes

Other Ranks:
IUCN Red List: Vulnerable

Northeast Regional SGCN: RSGCN

Status Discussion:

Outside of hibernation, records for this species have always been infrequent in New York. *S*ince 2008, *P. subflavus* has been one of the least frequently encountered bats and it is now presumed to be very rare. Its current listing status in NY thus does not reflect the current population trends and abundance.

The tricolored bat is proposed to be added as a Threatened species to the New York State list of endangered, threatened and special concern species. (NYSDEC 2019).

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Choose an item.	Choose an item.			Choose an item.
Northeastern US	Yes	Choose an item.	Choose an item.			Yes
New York	Yes	Unknown	Unknown		Not listed; proposed Threatened	Yes
Connecticut	Yes	Choose an item.	Choose an item.		Endangered	Yes
Massachusetts	Yes	Choose an item.	Choose an item.		Endangered	Yes
New Jersey	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.
Pennsylvania	Yes	Choose an item.	Choose an item.		Endangered	Yes
Vermont	Yes	Choose an item.	Choose an item.		Endangered	Yes
Ontario	Yes	Choose an item.	Choose an item.		Endangered	Choose an item.
Quebec	Yes	Choose an item.	Choose an item.		Not listed	Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

Winter hibernacula surveys, summer acoustic surveys and mist netting efforts (non-target species for surveys mostly aimed at detecting presence/absence of Indiana bats) are all monitoring methods to track this species in New York.

Trends Discussion *(insert map of North American/regional distribution and status):*

Figure 1. Conservation status of tricolored bat in North America (NatureServe 2023)

Figure 2. Range of tricolored bat (USFWS 2023)

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Years	# of Records	# of Distinct Populations	% of State
Pre-1995	_____	_____	_____

1995-2004	_____	_____	_____
2005-2014	_____	_____	_____
2015 - 2023	_____	_____	_____

Table 1. Records of tricolored bat in New York.

Details of historic and current occurrence:

Pre-WNS distribution was Statewide. The species was observed in 83 % of hibernacula surveyed within NY that hosted more than 10 bats of any species, although mostly in small numbers (NYSDEC unpub. data).

Summer records were infrequent and sporadic even prior to the recent decline, suggesting the species may have always been relatively rare in NY (NYSDEC unpub. data) although the degree to which this reflects capture-related bias is unknown.

The species has been extirpated from many hibernation sites since the arrival of white-nose disease and has suffered severe decline in virtually all others. State-wide population decline for the species is estimated at >97%, based on hibernation counts (NYSDEC unpub. data). Consistent with the observed severe decline in hibernation sites, no summer mist net captures have been reported for the species in NY since 2010 (NYSDEC unpub. data).

New York's Contribution to Species North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
1-25%	Peripheral	

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Caves and Tunnels

b. Mine/Artificial Cave Community

c. Northeastern Upland Forest

d. Northeastern Wetland Forest

e. Residential/Commercial

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
No	No	Stable	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item

Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

Tri-colored bats over-winter in humid areas deep within caves and mines with a constant temperature of around 52-55F. A study in Arkansas found tri-colored bats selected larger caves with a wide range of temperatures within a season, but little variability among temperature between seasons. Surveys of hibernacula in New York conducted by the New York State Department of Environmental Conservation found tri-colored bats segregated from other species in warmer areas of the cave with high humidity.

Wooded riparian areas are likely an important foraging habitat for this species during the summer. One study in coastal South Carolina, found that tri-colored bats were more frequently found in riparian areas than in upland sites and especially, riparian areas that were wooded or highly vegetated. They may also forage in woods or along waterways or forest edges. Although tri-colored bats are typically considered a clutter-adapted species capable of foraging within forested areas, they also forage over early successional and open habitats.

Tri-colored bats may roost in habitats including open woods near water and they may select roosts in buildings, crevices of cliffs and rocks, or in or below the canopy of live or recently dead trees that retain some dead or live leaves. They are occasionally reported from caves during the summer and have been known to form maternity colonies in barns, in clusters of dead leaves in oaks or pines, and in Nova Scotia in lichen. Tri-colored bats tended to select roosts that were away from roads, in unharvested woods with high habitat heterogeneity, or in the unharvested riparian buffer of a partially harvested stand. Some habitat characteristics may vary regionally. Tri-colored bats in mature forest stands with a hardwood component and a complex vertical structure and dense midstory. However, Tri-colored bats favored open habitats with less dense mid-story vegetation and a dense understory (NYNHP 2023).

V. Species Demographic and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Choose an item.	Choose an item.	Yes	Yes	Choose an item.

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Tri-colored bats breed in the fall and may breed again in the spring, coinciding with ovulation. They swarm and mate near the cave entrance. Females store sperm over the winter until ovulation occurs in the spring, which coincides with emergence from winter hibernacula. Females generally give birth to two young.

Tri-colored bats are usually solitary but may be found roosting in small colonies; especially females which form maternity colonies in summer.

Typical lifespan is thought to be four to eight years in the wild with higher probability of survival for males and relatively high juvenile mortality. A male holds the maximum reported longevity record of fifteen years.

VI. Threats *(from NY 2015 SWAP or newly described):*

By far the largest threat to tri-colored bats in New York is white-nose syndrome (WNS) which was first discovered among bats in a cave in Schoharie County, New York in 2006. Bats may be particularly sensitive to environmental toxins including those found in herbicides and pesticides. Although no studies have targeted tri-colored bats directly, elevated levels of persistent organic pollutants including PCBs, DDT, Chlordanes, and PBDEs have been found in a similar species, the little brown bat, in the Hudson River Valley in New York.

Threats to NY Populations	
Threat Category	**Threat**
Invasive & Other Problematic Species & Genes	Invasive Non-Native/Alien Species (disease: white nose syndrome)
Human Intrusions & Disturbance	Recreational Activities (recreational spelunking)
Energy Production & Mining	Renewable Energy (wind turbines)
Pollution	Industrial & Military Effluents (environmental contaminants)
Human Intrusions & Disturbance	Work & Other Activities (disturbance from research in hibernacula)

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

Gating mines and caves can prevent human entry while allowing the bats unobstructed access. Following proper specifications and monitoring bat populations before and after gate installation are important, however, as gating can affect the airflow and temperature in the cave, making areas of the cave uninhabitable for certain species.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated

subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
1.	
2.	

Table 2. (need recommended conservation actions for tricolored bat)

VII. References

IUCN 2023. IUCN Red List of Threatened Species. Version 2023-1. <www.iucnredlist.org>. Accessed December 28, 2023.

NatureServe Explorer 2.0. (2023, November 3). https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.102580/Perimyotis_subflavus. Accessed 21 November 2023.

New York Natural Heritage Program (NYNHP). 2023. Online Conservation Guide for Perimyotis subflavus. Available from: https://guides.nynhp.org/tri-colored-bat/. Accessed November 24, 2023.

New York State Department of Environmental Conservation (NYSDEC). 2019. List of Endangered, Threatened and Special Concern Fish and Wildlife Species of New York State. https://dec.ny.gov/nature/animals-fish-plants/biodiversity-species-conservation/endangered-species/lists. Accessed January 22, 2024.

US. Fish & Wildlife Service (USFWS). Environmental Conservation Online System (ECOS). https://ecos.fws.gov/ecp/species/10515. Accessed December 28, 2023.

Originally prepared by	Jenny Murtaugh
Date first prepared	May 17, 2013
First revision	January 29, 2014 (Samantha Hoff)
Latest revision	

Species Status Assessment

Common Name: Wolf **Date Updated:** April, 2024

Scientific Name: *Canis lycaon, C. lupus lycaon,* or *C. lupus x C. lycaon*

Updated By: S. Booth-Binczik, D. Rosenblatt

Class: Mammalia

Family: Canidae

Species Synopsis *(a short paragraph which describes species taxonomy, distribution, recent trends, and habitat in New York):*

Although the wolves that originally inhabited the northeastern US and southeastern Canada were previously thought to be *Canis lupus*, the gray wolf, recently a separate species known as the eastern wolf, *Canis lycaon*, has come to be recognized (Wilson et al., 2000; Chambers et al., 2012; Vilaça et al., 2023). However, the taxonomic situation remains complicated, as many of the wolves currently inhabiting the Great Lakes region of the U.S. and southeastern Canada appear to be of mixed origin, containing both *Canis lupus* and *Canis lycaon* genetic signatures (Wheeldon and White, 2009; Mainguy et al., 2017; Vilaça et al., 2023). These wolves of mixed origin are often referred to as Great Lakes wolves.

Over the past 50 years wolves have spread eastward from Minnesota into Wisconsin and Michigan (van den Bosch et al., 2022). They are also widespread in Quebec north of the St. Lawrence (Mainguy et al., 2017), but are rarely documented south of it (Villemure and Jolicoeur, 2004).

I. Status

a. Current legal protected Status

i. **Federal:** *C. lupus*: Endangered; *C. lycaon*: not listed **Candidate:** No

ii. **New York:** *C. lupus*: Endangered; *C. lycaon*: Not listed

b. Natural Heritage Program

i. **Global:** *C. lupus*: G5; *C. lycaon*: G2

ii. **New York:** *C. lupus*: SX; *C. lycaon*: not listed **Tracked by NYNHP?:** Yes

Other Ranks:

IUCN Red List: *C. lupus*: Least Concern; *C. lycaon*: not listed

COSEWIC: *C. lycaon*: Threatened

Status Discussion:

There is considerable controversy over what type (species/subspecies) of wolf is native to New York, with recent publications coming to contrary conclusions regarding whether the native wolf of New York was a gray wolf (as currently recognized and listed by the US Fish and Wildlife Service), the red wolf (Paquet et al.,1999) or the eastern (formerly Algonquin) wolf (COSEWIC, 2015; COSSARO, 2022). This is confounded by the DNA testing of the only two recent records of potentially wild wolves in New York matching most closely to the Great Lakes subpopulation of the gray wolf. Regardless of which wolf may have been in New York, wolves are considered to be

extirpated from New York (NYSDEC, 2015). Extirpation does not mean a species is extinct, but rather that it no longer occurs in a wild state within New York. Although wolves historically bred in New York, no breeding has been documented in recent decades.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Unknown	Increasing	50 years		Choose an item.
Northeastern US	No	Choose an item.	Choose an item.			No
New York	No	Extirpated	Extirpated		Endangered	No
Connecticut	No	Choose an item.	Choose an item.		Special Concern, Believed Extirpated	No
Massachusetts	No	Choose an item.	Choose an item.		Not listed	No
New Jersey	No	Choose an item.	Choose an item.		Not listed	No
Pennsylvania	No	Choose an item.	Choose an item.		Not listed	No
Vermont	No	Choose an item.	Choose an item.		Not listed	Yes
Ontario	Yes	Unknown	Unknown		Threatened	Choose an item.
Quebec	Yes	Unknown	Unknown		Not listed	Choose an item.

Column options
Present?: Yes; No; Unknown; No data; (blank) or Choose an Item
Abundance and Distribution: Declining; Increasing; Stable; Unknown; Extirpated; N/A; (blank) or Choose an item
SGCN?: Yes; No; Unknown; (blank) or Choose an item

Monitoring in New York *(specify any monitoring activities or regular surveys that are conducted in New York):*

NYSDEC is currently seeking reports from trappers and hunters of large (> 50 lbs) canids for evaluation, and is in the process of developing protocols to assess reports of suspect animals.

Trends Discussion *(insert map of North American/regional distribution and status):*

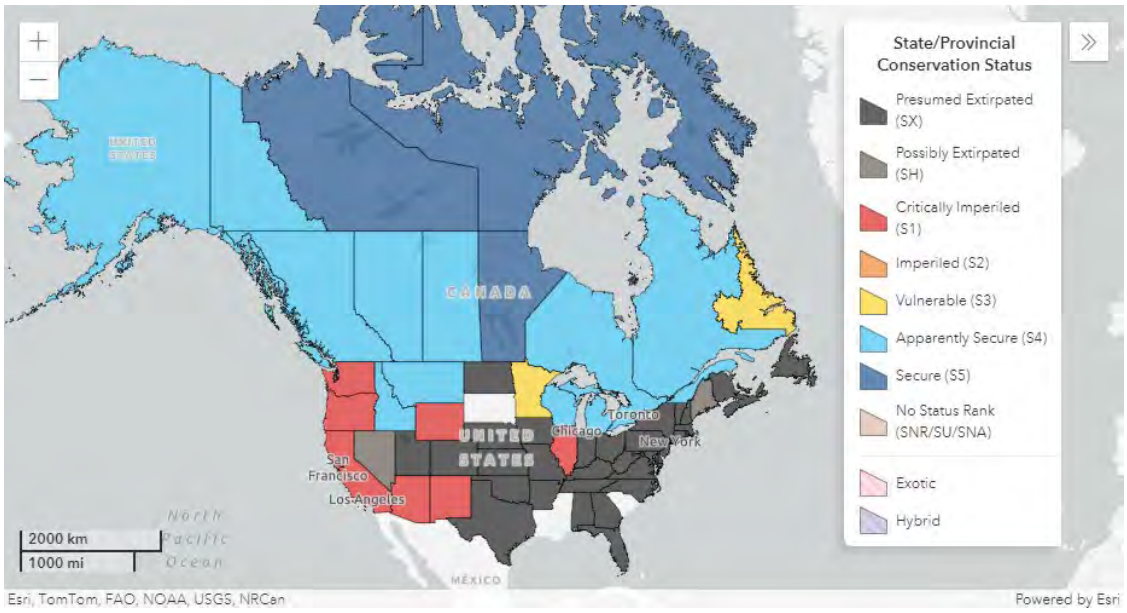

Figure 1. Conservation status of wolf in North America (NatureServe 2024)

III. New York Rarity *(provide map, numbers, and percent of state occupied)*

Years	# of Records	# of Distinct Populations	% of State
Pre-1995	_____	_____	_____
1995-2004	1	_____	_____
2005-2014	_____	_____	_____
2015 - 2023	1	_____	_____

Table 1. Records of wolf in New York.

Details of historic and current occurrence:

Wolves were present in New York until the late 1800s, with the last recorded bounty for a wolf being paid in 1899. By the late 1800's, the vast majority of habitat for wolves had also been removed from the landscape as forests were cleared for timber and agriculture. This resulted in not only the loss of the wolf, but also the loss of moose and elk along with drastic declines in most of the alternative prey of wolves: turkey, deer, and beaver. There has been significant positive change on the landscape since the last wolf was reported, with forest cover expanding to cover over 60% of New York's landscape and the return of plentiful populations of turkey, deer, and beaver. Moose have made their way back to New York and there is now a small, relatively stable population.

In 2001, a wolf was shot in Saratoga County by a hunter who mistook it for a coyote, and isotope analysis indicated that it was a wild wolf, not a released captive (Kays and Feranec, 2011). In 2021, a wolf was shot in Otsego County by a hunter who mistook it for a coyote, and isotope analysis similarly indicated that it was a wild wolf. Genomic analysis identified it as a "Great Lakes wolf" (vonHoldt, 2022). This suggests that it may have originated in the upper Midwest or Ontario,

Canada, the location of the samples used in the study to represent Great Lakes wolf. The closest US population of Great Lakes gray wolves is currently in northern Michigan. It is also possible that it may have originated from Quebec, where there have been individuals detected with similar with Great Lakes wolf genetics approximately 75 miles from the New York border (Mainguy et al., 2017).

The core population of eastern wolf is in Algonquin Provincial Park in Canada (COSEWIC, 2015), which is approximately 150 miles from the New York border. There is not a breeding population of wolves in New York.

New York's Contribution to Species' North American Range:

Percent of North American Range in NY	Classification of NY Range	Distance to core population, if not in NY
Choose an item.	Choose an item.	150 miles

Column options
Percent of North American Range in NY: 100% (endemic); 76-99%; 51-75%; 26-50%; 1-25%; 0%; Choose an item
Classification of NY Range: Core; Peripheral; Disjunct; (blank) or Choose an item

IV. Primary Habitat or Community Type *(from NY crosswalk of NE Aquatic, Marine, or Terrestrial Habitat Classification Systems):*

a. Mixed northern hardwoods

b. Spruce-fir forests and flats

c. Mountain spruce-fir forests

Habitat or Community Type Trend in New York

Habitat Specialist?	Indicator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
No	No	Unknown	

Column options
Habitat Specialist and Indicator Species: Yes; No; Unknown; (blank) or Choose an item
Habitat/Community Trend: Declining; Stable; Increasing; Unknown; (blank) or Choose an item

Habitat Discussion:

The wolf prefers core forest areas with limited human access: road densities of <1 mile of road per 1 square mile of habitat. Wolves prefer areas with fewer than 8 people per square kilometer (<3 mi^2) and requires an adequate prey base consisting primarily of deer, moose, and/or beaver.

Estimates by Mladenoff and Sickley (1998) and Harrison and Chapin (1998) suggested that 20,000 mi^2 to 25,000 mi^2 of wolf habitat remains in northern New England and 6,000 mi^2 in the Adirondack Park. They based their estimates on road densities, human densities, and available forested habitat. A New York-specific study concluded that through there is suitable habitat within the Adirondack Forest Preserve for wolves, this habitat would not be capable of sustaining a population for more than a few decades (Paquet et al., 1999).

Mladenoff and Sickley (1998) suggested that 20,000 mi^2 of habitat could support 700 to 1,439 wolves. Wolves are considered to be habitat generalists and usually select habitat to maximize predation success rather than for specific vegetation characteristics *per se* (Mech and Boitani, 2003). Mech (2006) found that Mladenoff and Sickley's predictive model for wolf recolonization in Wisconsin (and potentially for the Northeast) failed to account for the wolf's adaptability and

capacity to colonize areas deemed <50% probable, including 22% of colonized areas with low probability. There is considerable evidence of wolves crossing highways and areas used intensively by humans in both Europe and North America (Merrill and Mech, 2000, reviewed by Boitani, 2003), suggesting that wolves might be able to successfully navigate the fragmented New England and Adirondack landscape if provided protection from intentional killing. A maximum of 30.8 wolves per 100 km^2 was documented in northeastern Minnesota (Mech and Tracy, 2004).

V. Species Demographics and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
No	No	No	No	No	(blank)

Column options
First 5 fields: Yes; No; Unknown; (blank) or Choose an item
Anadromous/Catadromous: Anadromous; Catadromous; (blank) or Choose an item

Species Demographics and Life History Discussion *(include information about species life span, reproductive longevity, reproductive capacity, age to maturity, and ability to disperse and colonize):*

Wolves are exceedingly social animals, living in family groups or packs consisting of two to eight members, although packs of up to 21 have been reported (Eastern Timber Wolf Recovery Team, 1992). As described by Mech (1970), a pack starts with a breeding pair and expands with the addition of the first litter. Between one and two years of age, some offspring disperse to form new packs, but others stay with their natal pack. There is a dominance hierarchy within each pack, and generally only the dominant pair breeds, although there are exceptions (Packard et al., 1983).

Pups are born from early April through early May, and under good conditions litter sizes average four to seven (Mech, 1970; Fuller, 1989). Pups depend on their mother's milk for the first month. The pups first emerge from the den at about three weeks old, and are weaned by approximately week five. When the pups are about two months old, the natal den, which is often a hole in the ground (but may also be a rock crevice, hollow log, under a stump, or some other protected place), is abandoned and the young are moved to one of a series of "rendezvous sites" above ground (Whitaker and Hamilton, 1998).

By the time pups are seven to eight months old they are almost fully grown and begin traveling with the adults. Between their first and second years, young wolves may leave to try to find a mate and form a pack. Lone, dispersing wolves have traveled as far as 600 miles in search of a mate or territory (USFWS, 2011).

Some offspring will remain with the pack, and others leave the territory as they mature. These individuals become lone wolves and either live nomadically over areas of 1,000 square miles (2,500 km^2) or more, or disperse out of the area, sometimes moving more than 500 miles (800 km) (Fritts, 1983). If they find a member of the opposite sex and suitable range that is not already occupied, they may settle into a territory, mate, and begin their own pack (Eastern Timber Wolf Recovery Team, 1992).

Wolves mature in their second year, but most do not breed until their third (Whitaker and Hamilton, 1998). Mates sometimes form a lifelong bond (USFWS, 2011). They can live 13 years and breed past 10 years of age (USFWS, 2011).

There are two main periods in the annual lives of wolves: the first, from April to late fall, has them centering around the pups and the natal den and later rendezvous sites; the second period, which

consumes the remaining months of the year, has the wolves engaged in maintaining their territory (Whitaker and Hamilton, 1998).

Wolves travel over large areas to hunt, as far as 30 miles in a day (USFWS, 2011).

VI. Threats *(from NY 2015 SWAP or newly described):*

Wolves that leave protected areas in Ontario and Quebec are subject to high levels of human-caused mortality from hunting and trapping (Wydeven et al., 1998). This has the effect of limiting dispersal. If this harvest pressure were reduced, more wolves might be able to reach New York and other Northeastern states.

Are there regulatory mechanisms that protect the species or its habitat in New York?

Yes: ✓ **No:** _____ **Unknown:** _____

If yes, describe mechanism and whether adequate to protect species/habitat:

Canis lupus is currently listed as endangered in New York, which provides a regulatory mechanism for protecting the species and its habitat. If the listed name is changed or expanded to include *Canis lycaon* and *C. lupus* x *C. lycaon*, potential dispersers from the closest populations in Canada and the Midwestern US will be legally protected. However, illegal killing due to misidentification as coyotes and anti-predator sentiment would still be a threat to re-establishment of wolves in New York.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

Conservation efforts should focus on understanding attitudes of New York residents toward wolf recovery, providing education that could reduce illegal killing of wolves, and preserving and improving habitat linkages to existing wolf populations in Canada and suitable habitat in other Northeastern states (Wydeven et al., 1998; van den Bosch et al., 2022) through partnerships such as The Staying Connected Initiative. Enforcing compliance by coyote hunters with protections on wolves will also be necessary if wolves that disperse into the state are to have a chance to become established.

If wolves are unable to return to the state unassisted and public support for restoring wolves to New York is sufficiently high, a management re-introduction of the species should be considered.

Complete Conservation Actions table using IUCN conservation actions taxonomy at link below. Use headings 1-6 for Action Category (e.g., Land/Water Protection) and associated subcategories for Action (e.g., Site/Area Protection) - https://www.iucnredlist.org/resources/conservation-actions-classification-scheme

Conservation Actions	
Action Category	**Action**
1. Education & Awareness	Awareness & communications
2. External Capacity Building	Alliance & partnership development

3. Compliance & Enforcement	Sub-national level

Table 2. Recommended conservation actions for wolf.

VII. References

Boitani, L. 2003. Wolf conservation and recovery. In: Mech, L.D., and Boitani, L. (ed.), Wolves: Ecology, Behavior, and Conservation. University of Chicago Press, pp. 317-340.

Chambers, S.M., S.R. Fain, B. Fazio, and M. Amaral. 2012. An account of the taxonomy of North American wolves from morphological and genetic analyses. North American Fauna 77:1-67.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2015. Assessment and status report on the Eastern wolf *Canis* sp. cf. *lycaon* in Canada.

Committee on the Status of Species at Risk in Ontario (COSSARO). 2022. Ontario species at risk evaluation report for Eastern wolf (*Canis* sp.).

Eastern Timber Wolf Recovery Team. 1992. Recovery plan for the Eastern timber wolf. U.S. Fish and Wildlife Service, Twin Cities, Minnesota, USA.

Fuller, T.K. 1989. Population dynamics of wolves in north-central Minnesota. Wildlife Monograph 105.

Kays, R. and R.S. Feranec. 2011. Using stable carbon isotopes to distinguish wild from captive wolves. Northeastern Naturalist 18:253-264.

Mainguy, J., M. Hénault, H. Jolicoeur, and E. Dalpé-Charron. 2017. Identification génétique et répartition spatiale des grands canidés sauvages au Québec. Ministère des Forêts, de la Faune et des Parcs, Direction de l'expertise sur la faune terrestre, l'herpétofaune et l'avifaune et Direction de la gestion de la faune de Lanaudière et des Laurentides. 82 p.

Mech, L.D. 1970. The Wolf. Natural History Press, Doubleday Publishing Company, New York, New York, USA.

Mech, L.D. 2006. Prediction Failure of a Wolf Landscape Model. Wildlife Society Bulletin 34(3): 874-877.

Mech, L.D., and L. Boitani. 2003. Wolf social Ecology. In: Mech, L.D., and Boitani, L. (ed.), Wolves: Ecology, Behavior, and Conservation. University of Chicago Press, pp. 1-34.

Mech, L.D. and S. Tracy. 2004. Record High Wolf, *Canis lupus*, Pack Density. Canadian Field Naturalist 118(1): 127-129.

Mladenoff, D.J. and T.A. Sickley. 1998. Assessing potential grey wolf restoration in the northeastern United States: a spatial prediction of favorable habitat and potential population levels. Journal of Wildlife Management 62:1–10.

NatureServe. 2024. NatureServe Explorer. Page last published 1/5/2024. https://explorer.natureserve.org/Taxon/ELEMENT_GLOBAL.2.105212/Canis_lupus Accessed January 22, 2024.

New York State Department of Environmental Conservation (NYSDEC). 2019. List of Endangered, Threatened and Special Concern Fish and Wildlife Species of New York State. https://dec.ny.gov/nature/animals-fish-plants/biodiversity-species-conservation/endangered-species/lists. Accessed January 22, 2024.

Packard, J. M., L.D. Mech, and U.S. Seal. 1983. Social influences on reproduction in wolves. Pages 78-85 in L. Carbyn, editor. Proceedings of the Canadian Wolf Workshop, Canada Wildlife Service, Ottawa, Canada.

Paquet, P.C., J.R. Strittholt, and N.L. Staus. 1999. Wolf Reintroduction Feasibility in the Adirondack Park. Prepared for the Adirondack Citizens Advisory Committee on the Feasibility of Wolf Reintroduction.

U.S. Fish and Wildlife Service. 2011. Gray wolf (*Canis lupus*) Biologue. <http://www.fws.gov/midwest/wolf/aboutwolves/biologue.htm>. Accessed 29 March 2013

van den Bosch, M., D.E. Beyer, Jr., J.D. Erb, M.G. Gantchoff, K.F. Kellner, D.M. MacFarland, D.C. Norton, B.R. Patterson, J.L. Price Tack, B.J. Roell, and J.L. Belant. 2022. Identifying potential gray wolf habitat and connectivity in the eastern USA. Biological Conservation 273:109708.

Vilaça, S.T., M.E. Donaldson, A. Benazzo, T.J. Wheeldon, M.T. Vizzari, G. Bertorelle, B.R. Patterson, and C.J. Kyle. 2023. Tracing Eastern wolf origins from whole-genome data in context of extensive hybridization. Molecular Biology and Evolution 40:msad055.

Villemure, M. and H. Jolicoeur. 2004. First confirmed occurrence of a wolf, *Canis lupus*, south of the St. Lawrence River in over 100 years. The Canadian Field-Naturalist 118:608-610.

vonHoldt, B. 2022. Genomic ancestry of 85-lb New York canid. Report to New York State Department of Environmental Conservation.

Wheeldon, T. and B.N. White. 2009. Genetic analysis of historic western Great Lakes region wolf samples reveals early *Canis lupus/lycaon* hybridization. Biology Letters 5:101-104.

Whitaker, J.O., Jr., W.J. Hamilton, Jr. 1998. Mammals of the Eastern United States. Comstock Publishing Associates, Ithaca, New York, USA.

Wilson, P. J., S. Grewal, I. D. Lawford, J. N. M. Heal, A. G. Granacki, D. Pennock, J. B. Theberge, M. T. Theberge, D.R. Voigt, W. Waddell, R.E. Chambers, P.C. Paquet, G. Goulet, D. Cluff, and B. N. White. 2000. DNA profiles of the eastern Cnadian wolf and the red wolf provide evidence for a common evolutionary history independent of the gray wolf. Canadian Journal of Zoology 78:2156-2166.

Wydeven, A.P., T.K. Fuller, W. Weber, and K. MacDonald. 1998. The potential for wolf recovery in the northeastern United States via dispersal from southeastern Canada. Wildlife Society Bulletin 26:776-784.

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