Species Status Assessment

Common Name: Karner blue butterfly **Date Updated:** May 2025

Scientific Name: *Plebejus melissa samuelis* **Updated By:** Kathy O'Brien

Class: Insecta

Family: Lycaenidae

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

In New York, the Karner blue butterfly (*Plebejus melissa samuelis*) is considered a subspecies of the Melissa blue (*Plebejus melissa*) because no published works have revised the taxonomy to elevate this subspecies to species status. Some experts suspect this will prove to be a full species; the number of species in this genus is not well understood (New York Natural Heritage Program 2011).

The Karner blue is currently found in Wisconsin, Michigan, Ohio, New York, and New Hampshire. The populations in Ohio and New Hampshire have been reintroduced from other states after they had been extirpated. It is still considered extirpated from Illinois, Iowa, Ontario, Pennsylvania, Massachusetts, Maine, Minnesota and, most recently, Indiana. It is hoped that habitat restoration in western Wisconsin may enable the species to recolonize close Minnesota sites.

Currently, the only known occupied sites in New York are clustered in Albany, Schenectady, Saratoga, and Warren Counties and represent remnants of two or three once large metapopulations. Historically there were also specimens, or at least reports from Clayton, Tonawanda, Rome, Sullivan County, and Brooklyn (Shapiro 1974). With the suppression of natural wildfires, the habitat for Karner blue has become overgrown except where human activities allowed open areas to persist. These areas include airport lands, roadsides, and powerline rights-of-way. (New York Natural Heritage Program 2011). Since the 1980s direct restoration and management of early successional habitat with lupine in the sand belt from Albany to Warren County has increased Karner blue numbers and made progress toward recovery.

I. Status

a. Current legal protected Status

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

ii. **New York:** Endangered

b. Natural Heritage Program

i. **Global:** G1G2

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

Other Ranks:

-New York State: High Priority Species of Greatest Conservation Need

-IUCN Red List: None

-Northeast Regional SGCN: RSGCN, Very High Conservation Concern

-COSEWIC: Extirpated (May 2019 determination)

Status Discussion:

The federally and state-listed Karner blue butterfly is completely management-dependent in New York, as is the case in most or all of the remaining portion of the range. Although about 50 subpopulations exist in NY, these cluster into four metapopulations, or recovery units. Of the 50 subpopulations, the vast majority have fewer than 100 butterflies present. This species does not persist well if the total July brood for the metapopulation is fewer than 1,000 adults (New York Natural Heritage Program 2011). The Federal Recovery Plan for the Karner blue prescribes a minimum viable meta-population size of at least 3,000 adults in either brood within four of five consecutive years (USFWS 2003). The Plan defines a viable subpopulation as supporting at least 500 adult animals within at least 12.4 acres. To maintain meta-population levels above the minimum recovery thresholds Fuller (2008) determined that a minimum viable meta-population should contain between 7,641 and 12,960 adult butterflies.

More than 10,000 individuals historically occurred at the 300-acre Saratoga Airport during July, but this population has significantly declined to probably less than 1,000. The Albany Pine Bush Recovery Unit has approximately 2200 acres of restored habitat (Gifford pers. Com 2025). Estimated second brood sizes (which are generally larger than first brood) have substantially surpassed the minimum recovery thresholds for at least four of the past ten years. The Albany Pine Bush Recovery Unit had an estimated summer brood of 10,500 in 2023 (Gifford Pers comm). Captive rearing of New York Karners at the New Hampshire facility has been used successfully in the Albany recovery unit since 2007 to accelerate the colonization of restored habitat while at the same time allowing the repatriation of the species to New Hampshire. Acquisition of the land base and restoration of habitat is expected to expand both the Saratoga Sandplains and Albany Recovery Units in the near future. Sites in New York that are not actively managed generally contain fewer than 100 adults.

Since the Federal Listing, this species has apparently been fairly stable in New York, but some small subpopulations have declined or increased slightly. At most sites, the current population sizes are not known (New York Natural Heritage Program 2011).

The Albany area population had declined by over 90% from what it apparently was in the 1970s and the population was probably even higher originally. The site currently supports >5,000 adult butterflies (APBPC unpublished data). The Tonawanda, Brooklyn, and Sullivan County populations are extirpated, as are the Rome and Watertown populations. The Warren County populations are now small remnant colonies (New York Natural Heritage Program 2011). However, the Saratoga Sandplains have seen dramatic increases as a result of management efforts.

According to the U. S. Fish and Wildlife Service (USFWS) (2003), over the past 100 years the Karner blue has declined by 99%, with 90% of that decline occurring in the prior 15 years. As noted above, restoration efforts have increased in two recovery units but only where habitat restoration and just as importantly, maintenance, is occurring regularly.

II. Abundance and Distribution Trends

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
North America	Yes	Increasing	Increasing		E	Yes
Northeastern US	Yes	Increasing	Declining		E	Yes
New York	Yes	Increasing	Declining		E	Yes
Connecticut	No	N/A	N/A			(blank)
Massachusetts	No	N/A	N/A			(blank)
New Jersey	No	N/A	N/A			(blank)
Pennsylvania	No	N/A	N/A			(blank)

Region	Present?	Abundance	Distribution	Time Frame	Listing status	SGCN?
Vermont	No	N/A	N/A			(blank)
Ontario	No	Extirpated	Extirpated		Extirpated	(blank)
Quebec	No	N/A	N/A			(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):*

Regular monitoring by Distance sampling methods and by presence/absence surveys are done by NYSDEC, the Albany Pine Bush Preserve Commission and NYS Parks. National Grid, Saratoga County and the City of Albany perform presence/absence surveys for Karner blue and frosted elfin as part of permit requirements for other activities.

Three methods are used to monitor Karner blue butterflies in New York. Some sites have been dropped from monitoring because of lack of staff or because of the length of time passed since butterflies were last seen.

1) Pollard-Yates: Index counts using modified Pollard-Yates (PY) methods are now done at fewer sites than in past years both because of a shift to Distance sampling and a shift to searches.
2) Distance: Distance sampling is the most commonly used method for population estimates. Sites are surveyed in the Albany Pine Bush, Saratoga West, and Saratoga Sandplains.
3) Presence/Absence Searches: Once numbers have dropped so low that regular transect monitoring is not picking up the butterflies, as has happened at many sites, monitors search the entire site for them. This is true for all of the Queensbury Sandplains and Saratoga West sites and many sites in of Albany.

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

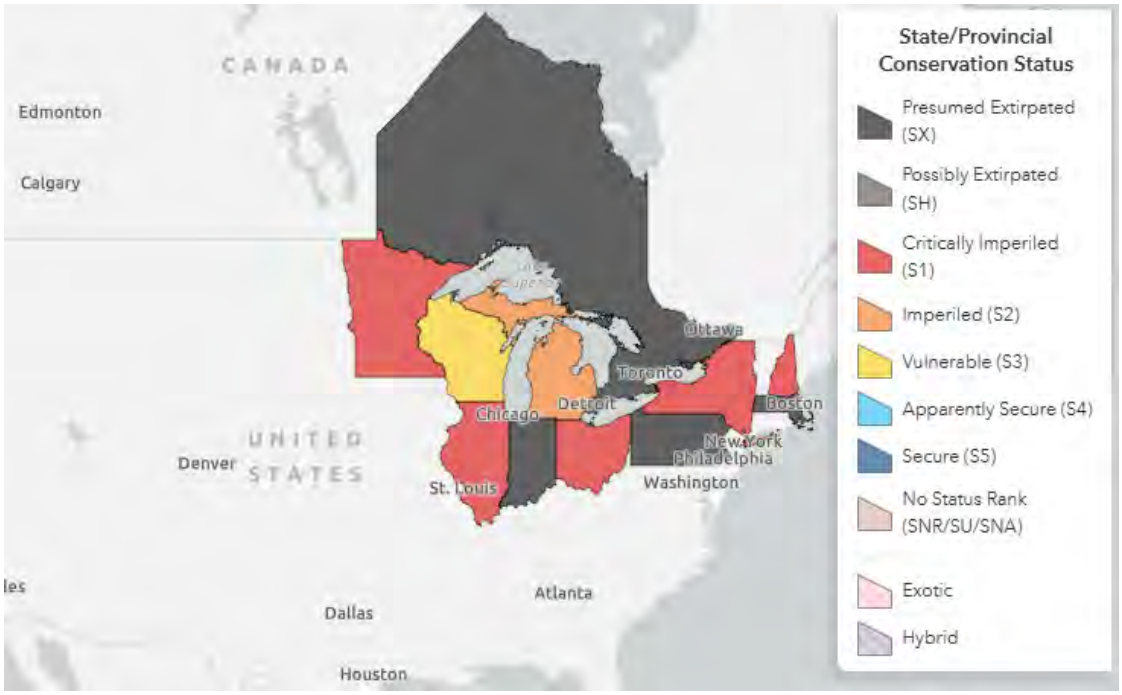

Figure 1. Conservation status of Karner blue butterfly in North America (NatureServe 2024).

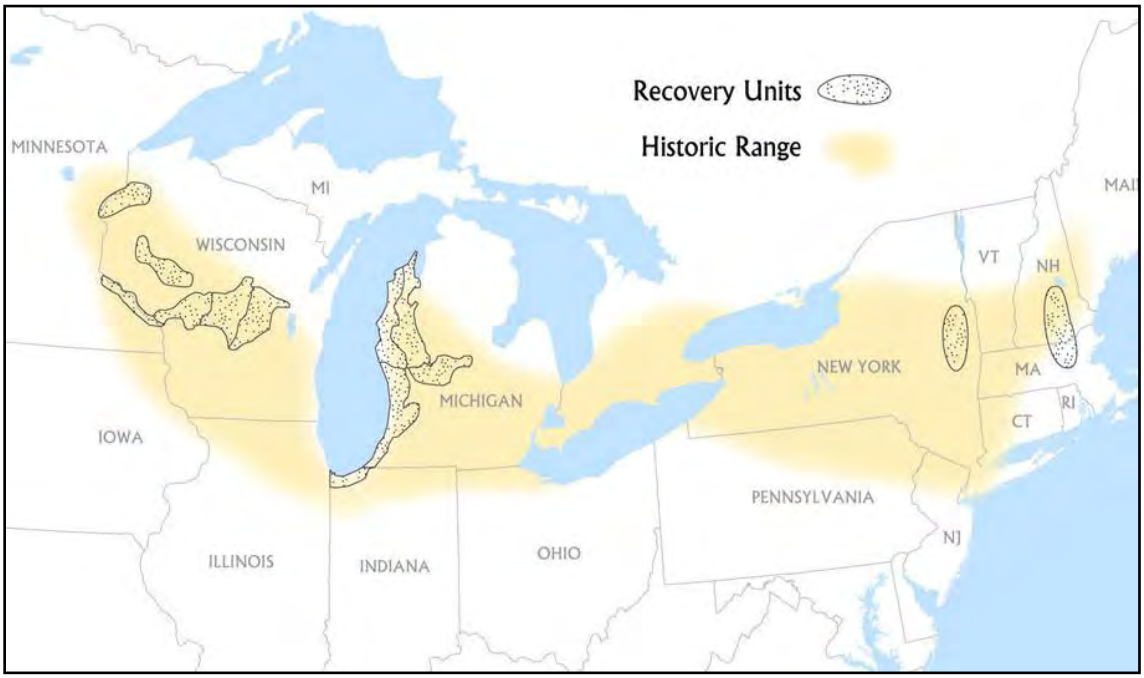

Figure 2. Historic range of Karner blue butterfly, and Federal Recovery Units (Zimmerman and O'Brien 2012)

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

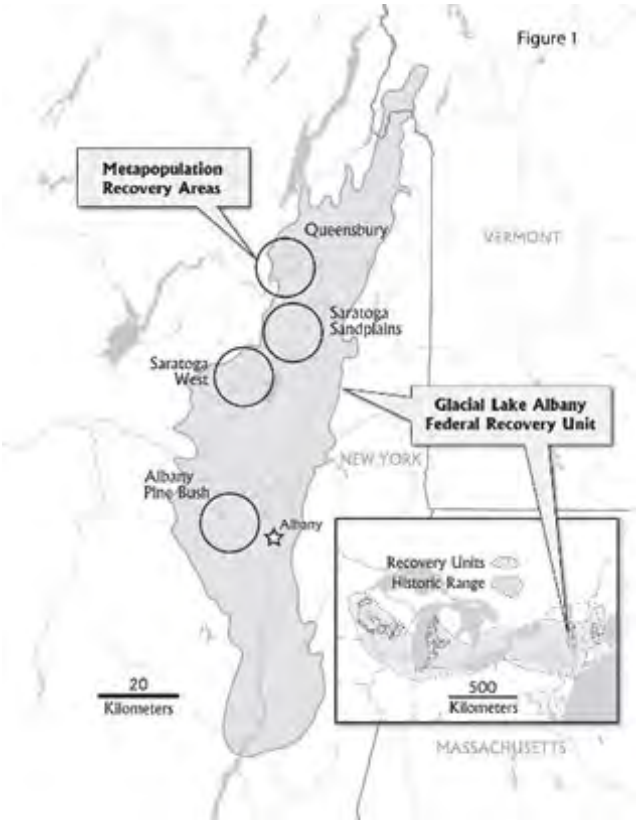

Figure 3. Present range of extant Karner blue populations in New York

Details of historic and current occurrence:

Karner blues were found historically in pine barrens in at least 6 New York counties prior to1974 (Shapiro 1974). It is known from only three counties as of 2025.

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	~900 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. Pine barrens

Habitat or Community Type Trend in New York Early successional habitat

Habitat Specialist?	Indicator Species?	Pollinator Species?	Habitat/ Community Trend	Time frame of Decline/Increase
Yes	Yes	Yes	Increasing	

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

Habitat Discussion:

Karner blue butterflies can be found in extensive pine barrens, oak savannas or openings in oak woodlands, and unnatural openings such as airports and rights-of-way that contain lupine (*Lupinus perennis*), the sole larval food source. The original communities for some remnant populations in Saratoga and Warren Counties are unclear since there is little to suggest former pine barrens in these areas. Some recent populations have occurred in sandy old fields (New York Natural Heritage Program 2011). In the early 1990s the largest single Karner blue population was at the Saratoga County Airport where a large area of lupine was maintained on 300 acres by the mowing annually of the entire airport in the fall. Since accelerated land acquisition, habitat restoration and fire management began in the Albany Pine Bush Preserve this area now supports what is likely the largest population with an estimated 14,500 second brood Karner blues (Gifford 2024)

V. Species Demographic, and Life History:

Breeder in NY?	Non-breeder in NY?	Migratory Only?	Summer Resident?	Winter Resident?	Anadromous/ Catadromous?
Yes	Yes	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):*

Karner blue butterfly larvae feed only on the native lupine *(Lupinus perennis*). The adults take nectar from many kinds of low growing flowers, native or otherwise. The Karner blue is unlikely to be seen more than a few yards from patches of lupine, although wandering individuals do occur up to a mile or more away from main breeding areas (New York Natural Heritage Program 2011).

The exact phenology varies from year to year and colony to colony. Those in the most open habitats tend to be about a week ahead of those in more wooded places. There are always two annual broods. The eggs overwinter and hatch, but not all at once, around the middle of April. The larvae mature mostly in late May and pupate. Adults emerge in late May to early June and are active for two to three weeks. The eggs from these adults hatch in a few days and the larvae are mostly mature in early July. Second brood adults fly for about three weeks and peak numbers usually occur for about a week in the second half of July. The eggs laid by these adults hatch the following spring (New York Natural Heritage Program 2011). Occasionally, an egg laid by a second brood female may hatch during the second brood and emerge as an adult in August as essentially a “third” brood. Adults may live an average of four to five days, although individuals have been known to live 18 days (Bidwell 1995).

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

Threats to Karner blue butterfly include habitat loss, degradation, and fragmentation, fire suppression, inappropriate management of lupine (*Lupinus perennis*), mosquito spraying and the use of other insecticides, and browsing of lupine by herbivores, primarily deer. There is also a concern that a reduction in winter snowpack and other changes in temperature and precipitation regimes threaten this species.

The greatest threat to the Karner blue butterfly is residential and commercial development which reduces potential habitat and and/or fragments the landscape, preventing subpopulations from interacting (Zimmerman and O'Brien 2012). The second greatest threat is the suppression of natural processes that create and maintain lupine and habitat for Karner blue butterfly. This leads to habitat degradation as trees or other shading vegetation gradually close in. While lupine may continue to persist for a time as non-flowering plants or become dormant, such heavily shaded plants appear of little utility to the butterflies (O'Brien, unpublished report).

Even where habitat is maintained in an open condition, incompatible management and other activities can destroy the ability of lupine or Karner blues to survive. Lupine patches along roadsides and on private land in the recovery unit that are subject to mowing during the growing season may crush larvae or deprive them of food. Additionally, these areas are often used as opportunistic dumping grounds for yard waste or other debris which buries lupine and encourages the spread of invasive plants (Zimmerman and O'Brien 2012).

While fire suppression is a threat to the persistence of Karner blues on the landscape, unplanned wildland fire is also a minor threat that may be caused by careless backyard burning by homeowners, cigarettes dropped along trails or roadsides, repair activities along railroads and right-of-ways (which are often near or through Karner blue butterfly habitat), and arson.

When wildfire does occur, the impacts can involve not only direct burning of vegetation and butterflies but also crushing vegetation and butterflies by the fire suppression personnel, and firefighting equipment (Zimmerman and O'Brien 2012).

Pesticide use is a direct threat to Karner blues. Herbicides applied on powerline right-of-ways and in private backyards are dangerous to the host plant. Insecticides, including those used to control mosquitos, also impact Karner blues (Williams, pers. comm. 2010). Although presently discontinued, the Town of Wilton routinely used aerial spraying to control mosquitoes in the past. The potential exists for this threat to resurface on a larger scale again if demand increases for sprays to kill mosquitoes, eastern equine encephalitis, ticks, and other threats to human health.

Hand or truck spraying by landowners is much more difficult to control and may pose a threat to small subpopulations. Individual landowners may contract for aerial spraying of their own property without permits from the Town of Wilton, meaning spraying may take place without the knowledge of authorities working to protect the species (Zimmerman and O'Brien 2012).

Karner blue butterfly larvae are also susceptible to *Bacillus thuringienesis* (Bt), which is often used to control spongy moths. Currently, NYSDEC prohibits aerial spraying within 100 feet of a Karner blue butterfly subpopulation.

Non-native or invasive species encroachment is another threat that can either stand alone or in conjunction with the threat of development, fire suppression and/or canopy closure. Relative to other

biota, Lepidoptera respond quickly to environmental changes, so the impact of non-native species may be rapid and severe, especially for oligophagous species like Karner blue butterfly.

Non-native vegetation may affect frosted elfin populations more dramatically than normal succession of open habitat. This may be because some non-native species can alter soil characteristics and change them from the xeric, nutrient-poor conditions that are characteristic of lupine and wild indigo habitat (e.g. black locust) (Malcolm et al. 2008). This suggests that other factors which correlate with non-native shrub cover, such as management regime and site history, are also important (Albanese et al. 2007).

Invasive terrestrial plant species that pose a threat to Karner blue habitat include oriental bittersweet (*Celastrus orbiculatus)*, spotted knapweed (*Centaurea stoebe)*, Japanese knotweed (*Polygonum cuspidatum*), European swallowwort (*Cynanchum rossicum*), garlic mustard (*Alliaria petiolata*), and invasive grasses. Black locust (*Robinia pseudoacacia*) is an especially problematic species in the Albany Pine Bush Recovery Unit; it also occurs in the Saratoga Sandplains but at a much lower density (O'Brien unpublished 2009).

In 2007, a species of exotic thrips (*Odontothrips loti*) was discovered at some sites in the Saratoga Sandplains Recovery Unit. Shortly after, it was found in the adjacent newly restored habitat. It has since been found at several other sites. This thrips feeds in the developing flower bud and can deform the flower and stem, resulting in reduced seed production. It may also cause leaves to be stunted and yellow. This thrips is apparently very easily spread by contamination of clothing and boots, and this may be one of the mechanisms that can account for its spread to individual sites in all three of the northern Recovery Units. At this time, it is not known to what degree of threat it poses (Zimmerman and O'Brien 2012).

Other invertebrate herbivores that feed on lupine may pose a threat to Karner blue butterflies if they out-compete larvae for food, cause lupine to senesce early, or interfere with flowering and seed production. In some years, heavy aphid (Aphididae) infestations become evident on many lupine plants. The introduced helical bagworm (*Apterona crenulla*) affects many lupine plants in the Albany Pine Bush. Mildew (*Erysiphe polygoni*) appears on lupine leaves in early summer. There may be other diseases that attack lupine that are, as yet, unknown. The degree to which any of these infestations affect the quality of lupine as larval food is unknown, as are their long-term effects on lupine survival (Zimmerman and O'Brien 2012).

Although secondary to most other threats in some areas (Bried, pers. comm. 2010), overgrazing of host plants can also impact Karner blue populations. Lupine flowers and leaves are often eaten by deer (*Odocoileus virginianus*), woodchucks (*Marmota monax*), and rabbits (*Sylvilagus floridanus*). Feeding deer may pull young plants out of the ground resulting in a loss of plants and flowers that reduces the ability of lupine to spread and maintain a continual recruitment of new plants. Isolated patches of lupine may die out entirely. Browse on lupine and other flowers also causes deprivation of nectar sources during the adult flight (O'Brien unpublished 2009).

ATV use negatively impacts populations where host plants are crushed and/or uprooted. This problem is most prevalent along powerline right-of-ways, where bans from ATV use are not always enforced. In more controlled areas, use by ATVs can be discouraged by installing blockades and fences at trail heads, as has been done in the Albany Pine Bush (Bried, pers. comm. 2010).

Impacts of climate change on Karner blue include changes in vegetative communities reducing habitat availability, and high heat events that affect food availability and larval and adult survival. Extreme weather events such as heavy rainstorms and high winds can also affect Karner blues by limiting their mobility as well as by physically battering them. Populations at sites which are relatively uniform in

character may be more vulnerable to a single weather event than those at sites which have a diversity of microhabitat (Zimmerman and O'Brien 2012).

Droughts or conditions of low precipitation reduce lupine availability and quality. There is a clear link between lupine quality and Karner blue larval survival where a diet of poor-quality lupine reduces larval survival considerably.

The emergence of wild lupine is linked to ambient temperature and high temperatures or drought can decrease lupine growth and may accelerate the senescence, or seasonal aging, of wild lupine which reduces its nutritional quality (Grundel et al.1998). In addition to larval mortality, increases in adult mortality are expected. Karner blues exhibit heat stress at 35-36ºC and reduce foraging activity (LeDee unpublished report 2010). Pupal mortality also appears significant when ambient temperatures exceed 35^0C (N. Gifford unpublished data).

Low temperatures can delay larval development and limit adult activity. There is also a concern that a reduction in the depth or duration of winter snowpack and other changes to the precipitation and temperature regime threaten this species, as over-wintering eggs exposed to low temperatures are less likely to survive. Such threats could be of particular concern in New York, which has a warmer climate and is farther south than most of the current range for this butterfly.

Threat Level 1	Threat Level 2	Threat Level 3	Spatial Extent	Severity	Immediacy	Trend	Certainty
1. Residential and Commercial	1.1 Housing & Urban Areas	1.1.2 Low-density housing areas	Large	Serious	Near-term	Intensifying	Moderate
1. Residential and Commercial	1.2 Commercial & Industrial Areas	1.2.1 Commercial & industrial areas	Large	Serious	Near-term	Intensifying	Moderate
6. Human Intrusions & Disturbance	6.1 Recreational Activities	6.1.1 Motor vehicles (off-road ATVs)	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
7. Natural System Modifications	7.1 Fire & Fire Suppression	7.1.2 Suppression in the fire regime	Pervasive	Serious	Near-term	Intensifying	High
7. Natural System Modifications	7.3 Other Ecosystem Modifications	7.3.2 Vegetation succession	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
8. Invasive & Other Problematic Species	8.1 Invasive Non-Native Plants & Animals	8.1.2 Terrestrial plants	Large	Unknown	Near-term	Unknown	Moderate
9. Pollution	9.3 Agricultural & Forestry Effluents	9.3.3 Herbicides & pesticides	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
11. Climate Change	11.1 Habitat Shifting & Alteration	11.1.2 Phenological mismatch	Unknown	Unknown	Near-term	Unknown	Moderate
11. Climate Change	11.3 Changes in Temperature Regimes	11.3.1 Heat waves	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
11. Climate Change	11.3 Changes in Temperature Regimes	11.3.3 Gradual temperature change	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
11. Climate Change	11.4 Changes in Precipitation & Hydrological Regimes	11.4.2 Droughts	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.
11. Climate Change	11.4 Changes in Precipitation & Hydrological Regimes	11.4.3 Gradual change in precipitation regime	Choose an item.	Choose an item.	Choose an item.	Choose an item.	Choose an item.

Table 1. Threats to Karner blue butterfly

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

Yes: X **No: _____** **Unknown: _____**

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

The majority of the Karner blues in NYS exist in lands preserved and managed by the DEC and the Albany Pine Bush Preserve Commission where management to maintain the species' habitat occurs within parameters of federal and state permits. A large area of habitat exists on lands owned by Saratoga County, some of which is managed for early successional habitat and others that incidentally support lupine. Measures to protect Karner blues and their habitat are laid out in a federal Biological Opinion and state permits. There are scattered small patches of habitat on private land in Albany, Saratoga and Warren Counties where small numbers of Karner blues may persist. This is especially true of powerline rights-of-way (ROWs) and roadsides. Most of these sites continue to exist because the vegetation management for the ROWs keep encroaching vegetation clear. A federal Habitat Conservation Plan (HCP) and state permits lay out the conditions for protection of the habitat in the ROWs of the largest energy company in the Karner blue range while the regular maintenance of the energy lines continues. However, damage from ATVs, dumping and deer browse and mowing at the wrong time of year results in reduction of lupine over time and both lupine and Karner blue have disappeared from many of these ROWs.

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

To persist in the state there needs to be not only land with lupine on it but also appropriate management and connectivity with other occupied sites. Because of targeted land purchases and management, the vast majority of current Karner blue butterflies in NYS exist in preserved and managed lands owned by public conservation entities. Other lupine sites have very small Karner blue populations that are extremely vulnerable to being wiped out by succession, development, ATVs, dumping of yard waste and other incompatible uses. While small, these sites represent potential connections between the larger populations and variation in the collective gene pool. Many of these small sites are on powerline and gas ROWs or along roadside ROWs. Continued contact with the ROW owners and other landowners may also help to retain some of these connections.

The Albany Pine Bush Preserve Commission (APBPC) uses logging, managed fire, mowing, soil disturbance, herbicide treatment and direct planting of habitat plant species to create and maintain 2200 acres of early successional lupine habitat. The APBC's funding is from state sources and from various grants. Similar management occurs on wildlife management lands in Saratoga County with the use of controlled burns planned but not yet implemented

A small area of lupine habitat is managed for Karner blue by NYS Office of Parks and Recreation (OPR) in Saratoga County. The APBPC and DEC are working with OPR on restoration and management of early successional lupine habitat on additional properties that would create a much needed third population for recovery of the species.

DEC manages approximately 129 acres in Saratoga County as early successional lupine habitat. Management to date has been tree/stump removal, ground scarification, herbicide and mowing. It is essential that a fire management program is implemented on these acres to reduce succession

and the accumulation of a duff layer that can retard the recruitment of early successional vegetation, including lupine.

Near the DEC land, Saratoga County owns approximately 194 acres of land managed to benefit Karner blue including 183 acres dedicated as part of a mitigation agreement for Karner blue. A large area of habitat (almost 300 acres) exists on the Saratoga County Airport where Karners persist, but this is not ideal since there is little overstory diversity and the entire site is mowed annually.

The former range of the Karner blue in New York extended west in small areas supporting lupine, most recently near Rome and Batavia. Management to restore Karne blue populations in these areas would not only increase Karner blue numbers but locations with a slightly cooler and wetter climate may help to buffer the species from the effects of lower snowfall in the eastern range.

Action Category	Action	Description
A.1 Direct Habitat Management	A.1.1.1.1	Early successional habitat management, invasive species control
A.1 Direct Habitat Management	A.1.1.2.1	Planting
A.1 Direct Habitat Management	A.1.2.2.1	Implement and maintain prescribed fire management
B.3 Outreach	B.3.1	Promote understanding of the value of early successional habitats and acceptance by the public for fire management
B.4 Law Enforcement and Prosecution	B.4.2	Enforce and prosecute unauthorized habitat damage and killing of the species
C.8 Research and Monitoring	C.8.1.1	Monitor Karner blue population trends
C.8 Research and Monitoring	C.8.1.5	Promote understanding of challenges for Karner blue and its habitat as temperature and precipitation changes will impact life stages; research impacts of these changes on Karner blue and its habitat
C.9 Education and Training	C.9.2	Promote use of prescribed fire in management by DEC and other landowners; provide training in planning and implementation of fire as a management tool where appropriate

Table 2. Recommended conservation actions for Karner blue butterfly

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Originally prepared by	Jenny Murtaugh
Date first prepared	December 5, 2012
First revision	February 18, 2014 (Samantha Hoff)
Last revision	Kathleen O'Brien 2025