Species Status Assessment

Class: Insecta
Family: Saturniidae
Scientific Name: *Hemileuca* sp.1
Common Name: Bogbean buckmoth

Species synopsis:

The bog buckmoth is a silk moth under the genus *Hemileuca*, of which there are 20 species in North America (Gradish and Tonge 2011). It is also commonly known as bogbean buckmoth or Cryan's buckmoth. *Hemileuca* sp. 1 fits in the *Hemileuca maia* species complex, where *H. maia, H. lucina,* and *H. nevadensis* are also included (Gradish and Tonge 2011). The naming of the *H. maia* complex is based on *maia* being the oldest name associated with the group (Tuskes et al. 1996). The status of the bog buckmoth has been intensively debated due to lack of genetic difference with other species within the complex and current thought is that the New York populations may be a distinctive subspecies of *H. nevadensis* (NatureServe 2013). This species stands out due to its unique use of fen habitat and its foodplant bog buckbean (*Menyanthes trifoliata*) (Tuskes et al. 1996, Gradish and Tonge 2011).

The primary foodplant, bog buckbean, is not a full reason to grant a species separation. A population in Wisconsin has been found to feed upon bog buckbean, making the distinctive foodplant restriction not as unique to the New York and Ontario populations as previously thought (Gradish and Tonge 2011). However, the larvae resemble other populations that span from New Jersey to central Wisconsin (NatureServe 2013). The ecological differences between bog buckmoth and other *Hemileuca* species are significant and are the basis for its species recognition and protection (Rubinoff and Sperling 2004).

Bog buckmoths are found on the northeastern margin of the *H. maia* complex distribution, with known populations in central New York and eastern Ontario (see Figure 1, Legge et al. 1996). In New York, this species occupies 6 wetlands, all within Oswego County. This species inhabits minerotrophic fens (Bonanno and White 2011). Population trends in New York vary by each specific locality.

I. Status

a. Current and Legal Protected Status

i. Federal ___Not listed___ **Candidate?** _No___

ii. New York ___Endangered; SGCN___

b. Natural Heritage Program Rank

i. Global ____G1Q____

ii. New York _____S1_____ **Tracked by NYNHP?** __Yes____

Other Rank:

United States and Canada National Status: N1 (20 September 1999)
COSEWIC: Endangered (27 November 2009)

Status Discussion:

Hemileuca sp. is a very rare moth, having 5-10 known populations. Out of the occurring populations, 3-5 are known to be viable. Populations in New York are all in Oswego County. This moth species is susceptible to invasive plants, which crowd out its preferred food plant (NatureServe 2013).

II. Abundance and Distribution Trends

a. North America

i. Abundance

_X__ declining ____increasing ____stable ____unknown

ii. Distribution:

_X__ declining ____increasing ____stable ____unknown

Time frame considered: _____1998-present_____

Moderate decline

b. Regional

i. Abundance

_X__ declining ____increasing ____stable _____unknown

ii. Distribution:

_X__ declining ____increasing ____stable _____unknown

Regional Unit Considered: ___Northeast_____
Time Frame Considered: ____1998-present_____

Moderate decline

c. Adjacent States and Provinces

CONNECTICUT	**Not Present __X___**	**No data _____**
MASSACHUSETTS	**Not Present __X___**	**No data _____**
NEW JERSEY	**Not Present __X___**	**No data _____**
PENNSYLVANIA	**Not Present __X____**	**No data _____**
QUEBEC	**Not Present __X____**	**No data _____**
VERMONT	**Not Present __X___**	**No data _____**
ONTARIO	**Not Present _____**	**No data _____**

i. Abundance

____ declining ____increasing __X__ stable ____unknown

ii. Distribution:

____ declining ____increasing __X__ stable ____unknown

Time frame considered: _____2009-present_____
Listing Status: _____Endangered_____

d. NEW YORK **No data _____**

i. Abundance

_X_ declining ____ increasing ____ stable _____ unknown

ii. Distribution:

_X_ declining ____ increasing ____ stable _____ unknown

Time frame considered: _Severe Decline from 1998-present_____

Severe decline

Monitoring in New York.

Since 1994, the six populations in New York have been annually monitored, however a standardized monitoring protocol was not introduced until 1998 (Pryor 1998, Serra 2003, Bonanno 2009).

Trends Discussion:

The global population is estimated to be 2,500-10,000 individuals, with populations in serious decline of 10-90% (NatureServe 2013). A survey of individuals in Ontario is estimated to have a total population of roughly 3,000 individuals (COSEWIC 2009).

The status of the six sites in New York, all in Oswego County, are as follows:

At Rainbow Shores Bog, flying adults have not been sighted since 2003, despite annual surveying. Moths were abundant at this site in 1994 and 1996, crashed in 1996 and were very sparse through 2003 (Lawlor 2003). This site appears to have been extirpated (Bonanno 2013).

The Deer Creek/Mud Creek site has shown the most extreme fluctuation pattern. Stanton (2000) considered this location to be an overflow site, which has supported a regular low-abundance population.

The Deer Creek Marsh South population was first surveyed in 1992, when 11 larvae were found. The largest number of individuals found in subsequent surveys is six (Bonanno 2007).

Selkirk Fen, South Pond Fen and Silver Lake fen support fluctuating but persistent populations (Bonanno and White 2011). In 2013, mean five-minute counts were very low: 1.0 at Selkirk, 0.3 at Deer Creek, and 0.0 at South Pond (Bonanno 2013).

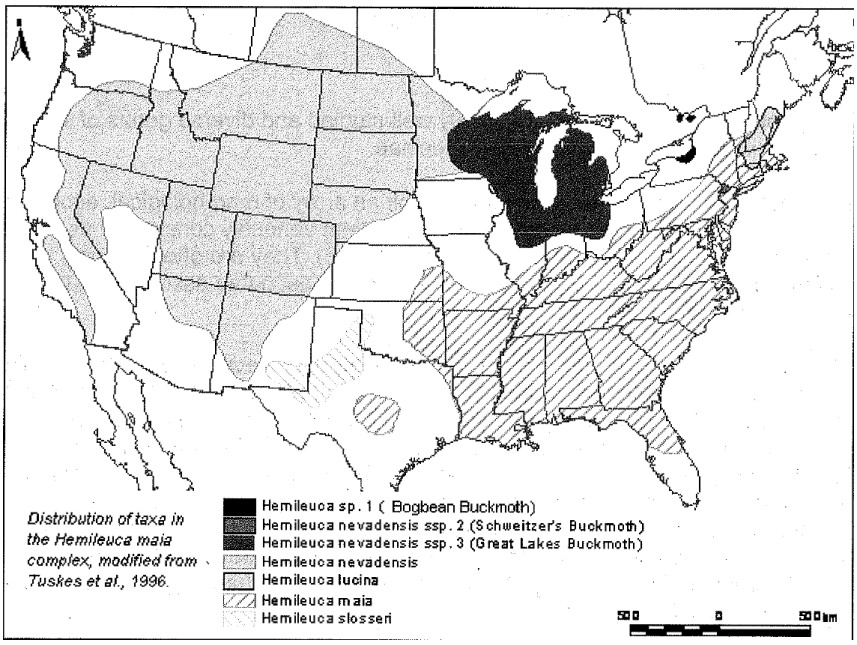

Figure 1. Distribution of *Hemileuca* sp. and the *Hemileuca maia* complex in North America (modified from Tuskes et al. 1996).

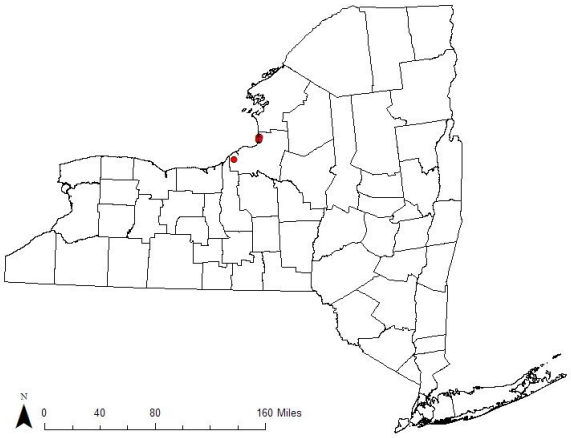

Figure 2. Known location of populations of *Hemileuca sp.* in New York State (NYNHP 2013).

Figure 3. Location of *Hemileuca* sp. populations in Oswego County (Bonanno and White 2011).

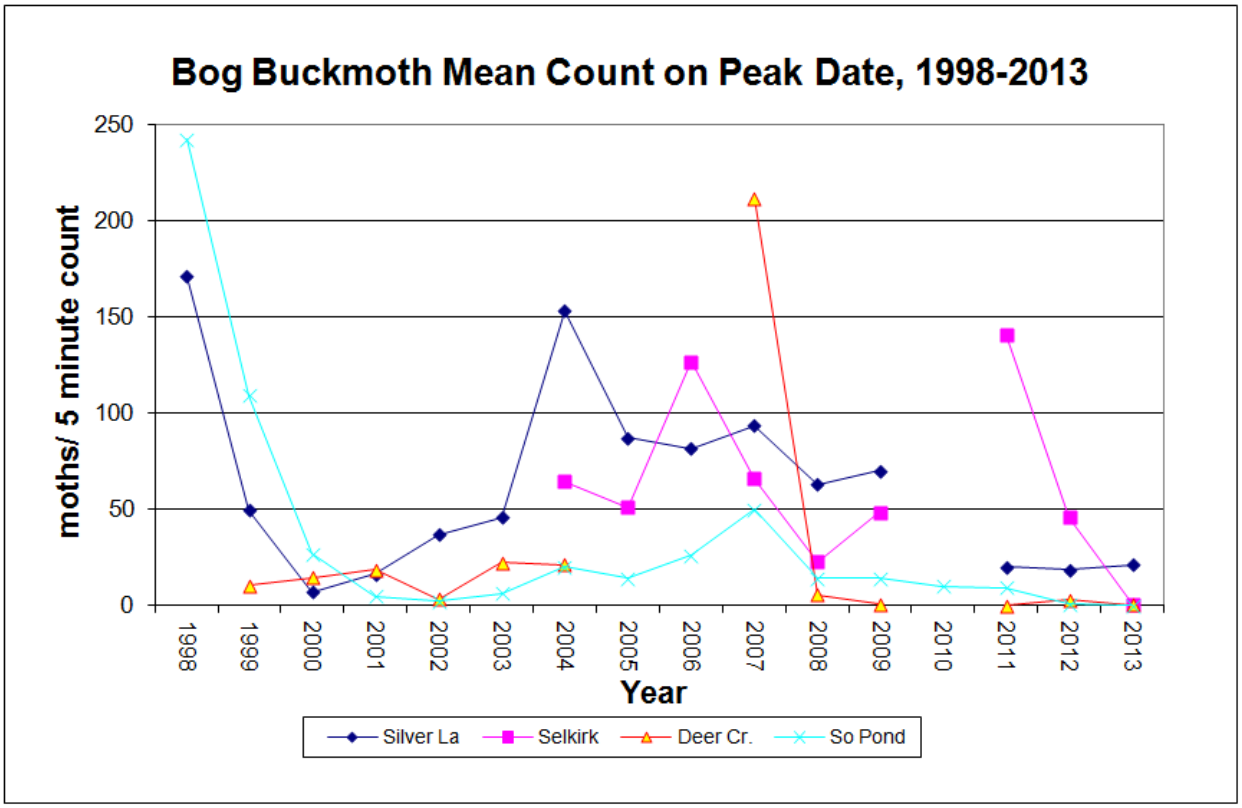

Figure 4. Bog buckmoth population trends for known populations from 1998-2013. Data are mean number of moths counted in repeated five-minute intervals on the peak date for each year. Moths are counted over a two-hour period of repeated five-minute intervals along multiple permanent 25-m transects at each site. Breaks in the line indicate no data available for intervening years (Bonanno and White 2011, Bonanno 2013).

III. New York Rarity, if known:

Historic	# of Animals	# of Locations	% of State
prior to 1970	_____	_____	_____
prior to 1980	_____	**3**	_____
prior to 1990	_____	**4**	_____

Details of historic occurrence:

This first population of *Hemileuca* sp. was discovered at Rainbow Shores Bog, Oswego County, in 1977. A population was discovered at Brennan Beach Fen, Oswego County in 1978. An additional population was found in Mud Pond Fen, Oswego County the following year in 1979. In 1987, another population was found in South Pond Fen, Oswego County (NYNHP 2013). In 1992, two additional populations were discovered at Deer Creek Marsh and Deer Creek Marsh South in Oswego County (NYNHP 2013).

Current	# of Animals	# of Locations	% of State
	_____	**3**	_____

Details of current occurrence:

There are currently three active bog buckmoth sites of the six documented localities: Silver Lake, Selkirk, and Deer Creek/Mud Creek.

New York's Contribution to Species North American Range:

Distribution (percent of NY where species occurs)

_X_ 0-5%

____ 6-10%

____ 11-25%

____ 26-50%

Abundance (within NY distribution)

___ abundant

___ common

___ fairly common

___ uncommon

____ >50%

_X_ rare

NY's Contribution to North American range

____ 0-5%

____ 6-10%

____ 11-25%

____ 26-50%

_X__ >50%

Classification of New York Range

_X_ Core

____ Peripheral

____ Disjunct

Distance to core population:

_____

IV. Primary Habitat or Community Type:

1. Open acidic peatlands

Habitat or Community Type Trend in New York:

_X_ Declining ____Stable ____ Increasing ____Unknown

Time frame of decline/increase: _____

Habitat Specialist? _X__ Yes _____ No

Indicator Species? _X__ Yes _____ No

Habitat Discussion:

The habitat for the six known localities in New York is characterized as medium fen with "…sedge – dominated floating peat mats on lake edges to low shrub-dominated backwater peat mats behind barrier dunes in the Lake Ontario basin" (Olivero 2001, Stanton 2004). The preferred host plant for *Hemileuca* sp. is bogbean (*Menyanthes trifoliata*), a shade intolerant species (Bonanno and White 2011).

V. New York Species Demographics and Life History

_X_ Breeder in New York

_X_ Summer Resident

_X_ Winter Resident

_____ Anadromous

_____ Non-breeder in New York

_____ Summer Resident

_____ Winter Resident

_____ Catadromous

_____ Migratory only

_____Unknown

Species Demographics and Life History Discussion:

Females lay their eggs after mating in the fall, with the eggs left to overwinter. Young hatch from April-June and develop into larvae in from May-July. Larvae pupate within peat and diurnal adults emerge from mid-September through mid-October, with peak flight around September 26-28 (Stanton 1998). Life expectancy averaged 3.7 days, with a maximum of 9 days for adult females and 12 days for males (Stanton 1998). Females usually mate with the first male to reach them and then oviposit eggs on the same day (Tuskes et al.1996). Females oviposit their eggs in clumps on shrubs and in rings around stems on a variety of plants (Stanton 1998). Early instar larvae have been observed feeding on the foliage of the closest plant until the preferred host plant, *M. trifoliata* emerges (Pryor 1998). Gravid females have a limited dispersal and move less than 10 m between potential oviposition sites, but up to 500m after ovipositing (Stanton 1998). Mark-recapture studies of adults in New York showed no dispersal between adjacent fens through forested habitat. Adults were found to travel up to 500m within the same fen (Stanton 2003).

VI. Threats:

Threats known to affect bog buckmoth include water level changes in fens containing known populations; natural succession of fens to woody swamps from hydraulic alteration and nutrient enrichment; encroachment invasive species (*Phragmites australis*, *Typha angustifolia*)that out compete larval food plant *M. trifoliate*; developmental changes in watersheds altering natural water supplies; mosquitoes, gypsy moth and other pest spraying (NYSDEC 2005). A direct threat to overwintering eggs is trampling and browse by deer and rabbits (Pryor 1998). Larval and egg parasitoids are thought to play a role in population regulation. Stanton (2000) had found 45% of eggs in South Pond Fen, Oswego County, to be parasitized in 1999.

Hemileuca sp. was classified as "extremely vulnerable" to predicted climate change in an assessment of vulnerability conducted by the New York Natural Heritage Program. Its abundance and/or range extent within geographical area assessed likely to decrease by 2050 (Schlesinger et al. 2011).

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

_____ No ____ Unknown

__X__ Yes

The bog buckmoth 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.

All known localities are in conservation ownership and are protected from development. The Nature Conservancy owns the South Pond Fen and Rainbow Shores Bog. NYS owns Selkirk Fen and both Deer Creek sites. An organization known as "Save the County Land Trust" owns Silver Lake Fen.

The Freshwater Wetlands Act provides protection for wetlands greater than 12.4 acres in size under Article 24 of the NYS Conservation Law. The Army Corps of Engineers has the authority to regulate smaller wetlands in New York State, and the DEC has the authority to regulate smaller wetlands that are of unusual local importance. The Protection of Waters Program provides protection for rivers, streams, lakes, and ponds under Article 15 of the NYS Conservation Law.

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

In 2011, a management plan for bog buckmoth was drafted, identifying recovery goals to maintain a long-term self-sustaining population of *Hemilecua* sp.. One objective identified is to secure and buffer known breeding sites with their hydrological and ecological processes. A second objective is to maintain viable breeding populations in each of the six NY sites (Bonanno and White 2011).

Conservation actions following IUCN taxonomy are categorized in the table below.

Conservation Actions	
Action Category	**Action**
Land/Water Protection	Site/Area Protection
Land/Water Protection	Resource/Habitat Protection
Land/Water Management	Site/Area Management
Land/Water Management	Invasive/Problematic Species Control
Land/Water Management	Habitat and Natural Process Restoration
Education and Awareness	Awareness & Communications
Law and Policy	Policies and Regulations

The Comprehensive Wildlife Conservation Strategy (NYSDEC 2005) includes recommendations for the following actions for the bog buck moth.

Fact sheet:

___ Develop a fact sheet for the bog buckmoth for paper distribution and for the website.

Human management:

___ Take appropriate action to remove invasive species or control, deter, or repair damage from human activities

Habitat monitoring:

___ Identify development and other human impacts on the population sites and whether they are negatively affecting the populations.

___ Identify invasive species contamination of all population sites and whether it is negatively impacting populations.

Human restoration:

___ With understanding of habitat requirements and threats, identify methods to maintain and improve habitat and if possible expand the species to other wetlands.

Life history research:

___ Conduct research on effects of egg/larvae parasitism on population dynamics at all sites.

___ Determine viability parameters for bog buckmoth populations.

___ Conduct research to better understand pupation habitat, immigration and emigration from population sites, and long term population dynamics.

Other action:

___ Contact experts in Ontario Canada regarding the status of the sites previously known from that province.

___ Pursue final naming of the species (subspecies) by experts supposedly working on this.

Other management plan:

___ Develop a management/recovery plan for the bog buckmoth that includes all current knowledge of the species and its habitat and recommendations for actions to recover the species to the extent that it can be down-listed or de-listed.

Population monitoring:

___ Continue monitoring of all populations. Increase effectiveness of monitoring techniques.

State land unit management plan:

___ Incorporate bog buckmoth management into management and work plans for NYS DEC lands where it occurs.

VII. References

Bonanno, S.E. 2007. Summary report: Eastern Lake Ontario bog buckmoth population monitoring program. 2007 field season and temporal trends. A report prepared for NYS DEC Endangered Species Unit, Albany, NY, 26 pp.

Bonanno, S.E. 2008. Summary Report: Eastern Lake Ontario bog buckmoth population monitoring program. 2008 field season and temporal trends. A report prepared for NYS DEC Endangered Species Unit, Albany, NY.

Bonanno, S.E. 2013. Summary Report: Eastern Lake Ontario bog buckmoth population monitoring program. 2013 field season and temporal trends. A report prepared for NYS DEC Wildlife Diversity Unit, Albany, NY.

Bonnano, S.E. and E.L. White. 2011. Draft: Bog buckmoth (*Hemileuca sp. 1*) recovery plan for New York State. New York Natural Heritage Program, Albany, NY.

COSEWIC. 2009. COSEWIC assessment and stauts report on the Bogbean Buck moth *Hemileuca* sp. in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. <www.saraegistry.gc.ca/species/speciesDetails_e.cfn?sid=1058>.

Gradish, A. and M. Tonge. 2011. Recovery strategy for the bogbean buckmoth (*Hemileuca* sp.) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi+ 19pp.

Lawlore, F. 2003. Summary report: eastern Lake Ontario bog buckmoth population monitoring program. 2003 field season and temporal trends. A report prepared for NYS DEC, Endangered Species Unit, Albany, NY. The Nature Conservancy, Pulaski, NY. 7 pp.

Legge, J.T., R. Roush, R. Desalle, A.P. Vogler, and B. May. 1996. Genetic criteria for establishing evolutionarily significant units in Cryan's buckmoth. Conservation Biology 10:85-98.

NatureServe. 2013. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. <http://www.natureserve.org/explorer>. Accessed 26 April 2013.

New York Natural Heritage Program (NYNHP). 2013. Biodiversity database. Albany, New York. Accessed 26 April 2013.

Olivero, A.M. 2001. Classification and mapping of New York's calcareous fen communities. A report prepared for The Central/Western New York Chapter of The Nature Conservancy with funding from the Biodiversity Research Institute. New York Natural Heritage Program, New York State Department of Environmental Conservation, Albany, NY. 28 pp.

Pryor, G.S. 1998. Life history of the bog buck moth (Saturniidae: *Hemileuca*) in New York State. Journal of the Lepidopterists' Society 52:125-138.

Rubinoff, D. and F.A. Sperling. 2004. Mitochondiral DNA sequence, morphology and ecology yield contrasting conservation implications for two threatened buckmoths (*Hemileuca*: Saturniidae). Biological Conservation 118:341-351.

Schlesinger, M.D., J.D. Corser, K.A. Perkins, and E.L. White. 2011. Vulnerability of at-risk species to predict climate change in New York. New York Natural Heritage Program, Albany, NY.

Serra, L. 2003. The effects of temperature and precipitation on peak flight period of the bog buckmoth, *Hemileuca* sp 1, at two localities in New York State. Unpublished report.

Stanton, E. 1998. Life history of bog buck moth (*Hemileuca* sp.) in Oswego County, New York. 37 pp.

Stanton, E. 2000. Final report: bog buck moth ecology and conservation management. A report prepared for the Nature Conservancy, Pulaski, NY.

Stanton, E. 2003. Development of a population monitoring program for the bog buck moth (Saturniidae: *Hemileuca* sp.). Report submitted to The Nature Conservancy, Central and Western New York Chapter, Pulaski, NY. 12 p.

Tuskes, P.M., J.P Tuttle, and M.M Collins. 1996. The wild silk moths of North America. A natural history of the Saturniidae of the United States and Canada. Comstock Publishing Associates, a division of Cornell University Press, Ithaca and London.

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