

Houghton's Goldenrod
(*Solidago houghtonii* A. Gray, Asteraceae)



**5-Year Review:
Summary and Evaluation**

**U.S. Fish and Wildlife Service, Midwest Region
East Lansing Field Office
East Lansing, Michigan**

5-YEAR REVIEW

Species reviewed: Houghton's goldenrod (*Solidago houghtonii*)

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5-YEAR REVIEW
Houghton's goldenrod (*Solidago houghtonii*)

1.0 GENERAL INFORMATION

1.1 Reviewers

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Mary Parkin, Regional Recovery Coordinator, 617-417-3331

1.2 Methodology used to complete the review

The U.S. Fish and Wildlife Service (Service) conducts status reviews of species on the List of Endangered and Threatened Wildlife and Plants (50 CFR 17.11 and 17.12) as required by section 4(c)(2)(A) of the Endangered Species Act of 1973, as amended (Act) (16 U.S.C. 1531 *et seq.*). The Service provided notice of this status review for the Houghton's goldenrod (*Solidago houghtonii*) via the *Federal Register* (72 FR 56787) and requested new scientific or commercial data and information that may have a bearing on the Houghton's goldenrod's classification as threatened.

The East Lansing Field Office (ELFO), in coordination with Midwest Regional Office Ecological Services staff, conducted this review. The New York Field Office (NYFO) also reviewed this document. We reviewed past and recent literature, public comments, the final listing rule (53 FR 27134), the Houghton's Goldenrod (*Solidago houghtonii*) Recovery Plan (USFWS 1997), and the Michigan Natural Features Inventory (MNFI) database to prepare this 5-year review. The Service's 2006 Interim 5-Year Review Guidance does not require peer review if a 5-year review results in a recommendation to leave the status unchanged due to a lack of new information, or all new information considered for the review has undergone prior peer review.

1.3 Background

1.3.1 *Federal Register* notice citation announcing initiation of this review:
72 FR 56787, Thursday, October 4, 2007

1.3.2 Listing history:

Federal Register notice: 53 FR 27134 – 27147
Date listed: July 18, 1988
Entity listed: Species
Classification: Threatened

1.3.3 Associated rulemakings: None

1.3.4 Review History: The Service initiated a cursory 5-year review of all species listed before January 1, 1991, which included Houghton's goldenrod (56 FR 56882). This review resulted in no change to Houghton's goldenrod's listing classification of threatened.

1.3.5 Species' Recovery Priority Number at start of 5-year review: 8C, indicating that: (1) it faces a moderate degree of threat, (2) has a high recovery potential, and (3) it is in conflict with construction or other development project(s) or other forms of economic activity.

1.3.6 Recovery Plan:

Name of plan: Houghton's Goldenrod (*Solidago houghtonii*) Recovery Plan

Date issued: September 17, 1997

Dates of previous revisions, if applicable: None

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review a vertebrate? No

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria? Yes

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat? Yes

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria (and is there no new information to consider regarding existing or new threats)? Yes

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information.

The Houghton's Goldenrod Recovery Plan (USFWS 1997) contains one delisting criteria:

- 1. *Solidago houghtonii* will be considered for delisting when 30 distinct, self-sustaining occurrences are protected.** Protection as defined in the recovery plan, consists of all actions necessary to conserve known occurrences, maintain ecosystem processes for the perpetuation of essential habitat, and enable each occurrence to be naturally self-sustaining.

Currently, there are 92 element occurrence records (EORs) for this species throughout its range (USFWS 1997; COSEWIC 2005; MNFI 2010). Michigan has 74 EORs, New York has one EOR, and 17 EORs occur in Canada (Figures 1 and 2). Upon issuance of the recovery plan in 1997, there were 59 EORs in the U.S. (58 in Michigan and one in New York). This status review will provide brief information on Canadian occurrences, but focus on recovery and protection only within the U.S.

Only a few Houghton's goldenrod EORs are protected. The USFS monitors five EORs under its jurisdiction. Bergen Swamp Preservation Society monitors its only occurrence. Michigan engages in invasive species removal and control projects for its eight element occurrences within the State Parks when funding permits.

As stated in the Committee on the Status of Endangered Wildlife (COSEWIC 2005), Canada lists Houghton's goldenrod as a species of special concern instead of its previous classification of threatened because "(1) the risks are limited, (2) about two-thirds of the total population is protected due to the presence of nearly one-half of the total population in Cabot Head Provincial Nature Reserve, and (3) a sizeable number occurs in relatively inaccessible locations."

The recovery criteria to delist Houghton's goldenrod have not been met. Protection is secured for 14 occurrences. More long-term protection is needed as well as comprehensive systematic surveys, monitoring, mapping, and working with private landowners.

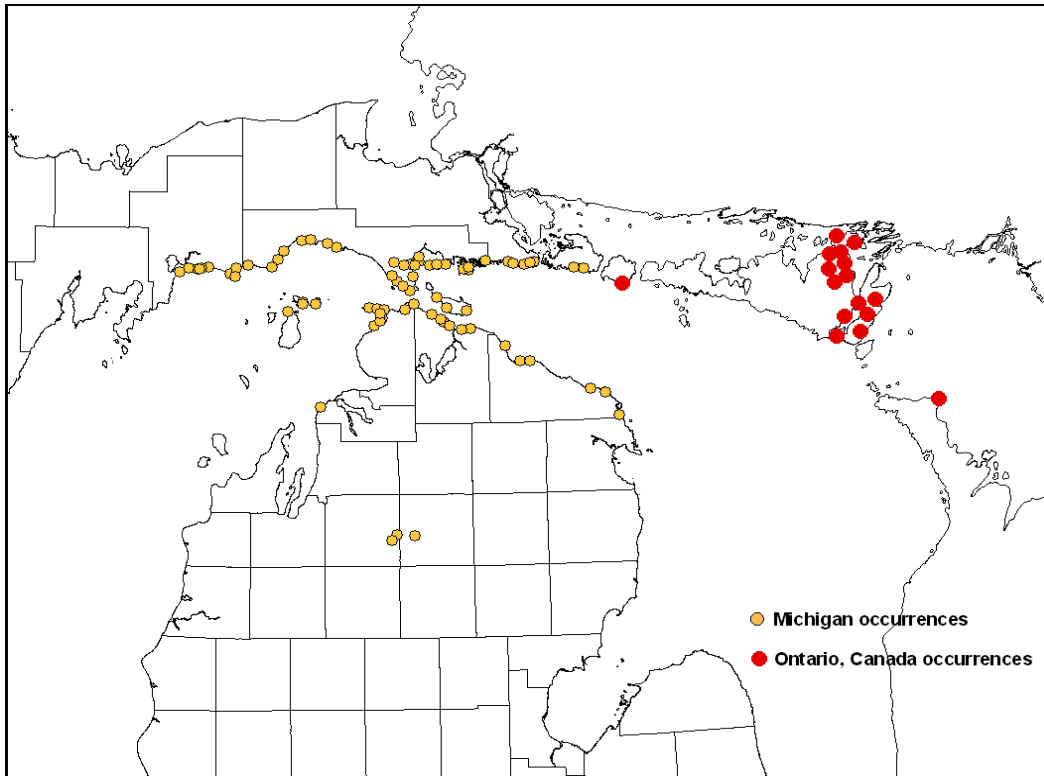


Figure 1. Houghton's goldenrod occurrences in Michigan and Ontario, Canada.

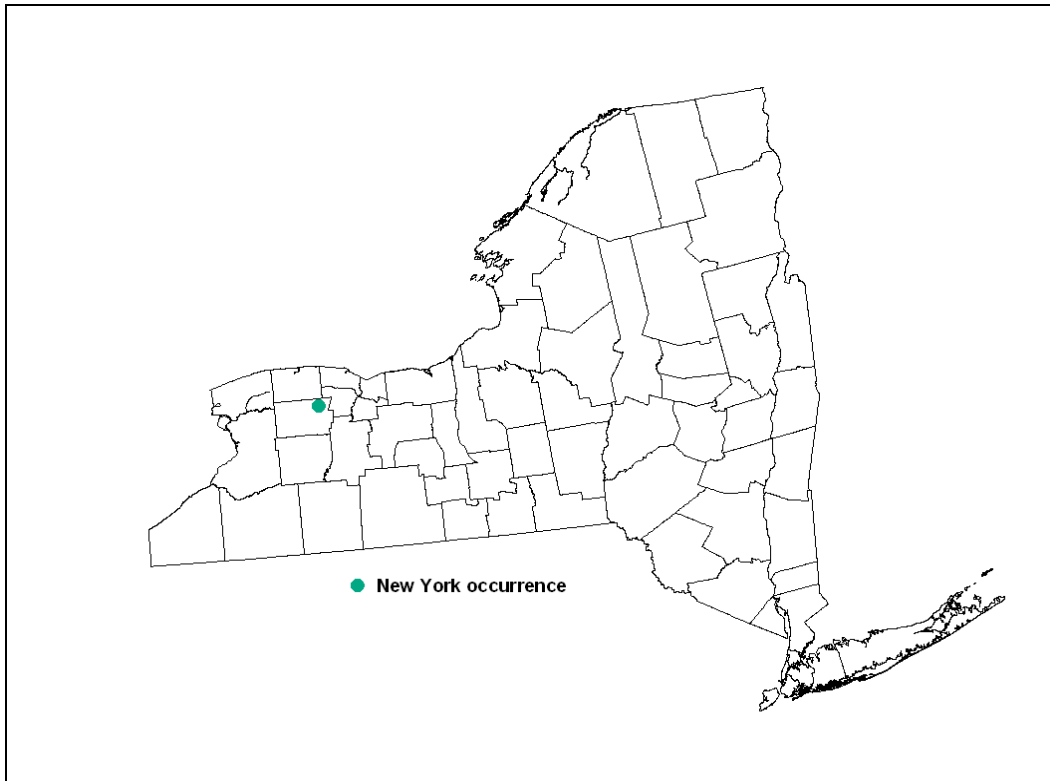


Figure 2. Houghton's goldenrod occurrence in New York.

2.3 Updated Information and Current Species Status

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history: No new information.

2.3.1.2 Abundance, population trends (e.g. increasing, decreasing, stable), demographic features (e.g., age structure, sex ratio, family size, birth rate, age at mortality, mortality rate, etc.), or demographic trends:

At the time of Houghton's goldenrod status review in 1991, there were 39 EORs documented in the United States, within eight Michigan counties. The recovery plan (USFWS 1997) lists 59 EORs in the U.S. (58 in Michigan including one extirpated EOR, and one in New York). Currently, 74 EORs are present in Michigan (MNFI 2010) and one in New York. At the time of the final listing rule, studies were underway to confirm the New York occurrence (53 FR 27134). Since then, this occurrence has been confirmed, thus extending the spatial distribution of Houghton's goldenrod.

Summary of Tables 1 and 3:

- A total of seventy-five Houghton's goldenrod EORs have been documented in the U.S. These include one extirpated and two historical occurrences.
- The recovery plan (RP ranks) lists 21 EORs with ranks of A, AB or B (Table 1).
- Currently 32 EORs are ranked A, AB or B (Table 3). Of these, seven were not included in the recovery plan (Table 1).
- Four EORs have improved in their ranks and one EOR's rank was downgraded since issuance of the recovery plan (Table 1).
- Forty-two EORs are located partially or fully on State, Federal or land conservancy properties. Of these, 25 are ranked A, AB or B (Table 3).
- The New York occurrence was not ranked in the recovery plan and is now ranked AB.

Michigan continues to be the population center for Houghton's goldenrod. Since the first status review in 1991 and issuance of the recovery plan in 1997, MNFI has recorded new occurrences and combined some existing occurrences of Houghton's goldenrod (Mike Penskar, Michigan Natural Features Inventory, pers. comm. 2007; MNFI 2010), so some of the EORs known in 1997 do not directly correspond to current sites. When EORs are combined, MNFI assigns a new rank to reflect the current condition of the newly combined EOR (Penskar, pers. comm. 2011).

Barbara Drake (Bergen Swamp Preservation Society, pers. comm. 2010) advised that the Bergen Swamp population is vibrant, but in a location with limited access. According to the New York Natural Heritage Program (NYNHP) in 1992, this population consisted of hundreds of plants within a marl fen (USFWS

1997). In 2008, during a census of the Houghton's goldenrod population at Bergen Swamp, the NYNHP conducted its first precise stem count of Houghton's goldenrod and counted 771 plants (Young 2008).

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.):

The recovery plan (USFWS 1997) recommends biosystematics research on Houghton's goldenrod throughout its range and discusses several hypotheses surrounding the phylogenetic origin of the species. Morton (1979) thought *S. houghtonii* arose as a result of hybridization between *S. ohioensis* and *S. ptarmicoides*. According to Semple and Ringius (1992), *S. riddellii* and *S. ptarmicoides* are the putative parents of *S. houghtonii*.

Upon the Service's listing of Houghton's goldenrod as a threatened species, Pringle (1987) provided the Service with unpublished data and research on the origin of Houghton's goldenrod. Based upon his data, Pringle (1987) proposed that *S. houghtonii* is composed of four taxonomic entities likely derived from separate hybridization events involving different species and corresponding to distinct geographic locations. According to Pringle (1987), the taxonomic entities listed below freely interbreed within their own groups and produce fertile, relatively uniform progeny.

- 1) "True" *S. houghtonii*, the nomenclatural type primarily located in northern Michigan within the Straits of Mackinac region and possibly in Ontario on Cockburn Island, is the result of hybridization between *S. ptarmicoides* ($2n = 18$) and *S. riddellii* ($2n = 18$).
- 2) The octoploid disjunct population in Camp Grayling, Crawford County, Michigan resulted from hybridization between *S. ptarmicoides* ($2n = 18$) and *S. uliginosa* ($2n=36$).
- 3) Plants that occur around the Manitoulin Island region to the east side of the Bruce Peninsula in Ontario, Canada resulted from hybridization between *S. ohioensis* ($2n = 18$) and *S. ptarmicoides* ($2n = 18$).
- 4) The Bergen Swamp population in New York derived from hybridization between *S. ptarmicoides* ($2n = 18$) and *S. uliginosa* ($2n = 18$).

Laureto (2010) and Laureto and Barkman (2011) continued and supplemented Pringle's work using modern molecular and genealogical technology. Laureto (2010) conducted genetic analyses on the above four entities to determine (a) if *S. houghtonii* is of hybrid origin, (b) its parentage, and (c) if it originated in a single hybridization event or if it is of polytypic¹ origin.

¹ A species of polytypic origin arises through multiple hybridization events that happened at different times.

Using phylogenetic and nuclear DNA analyses, Laureto (2010) discovered that Riddell's goldenrod (*S. riddellii*), prairie goldenrod (*S. ptarmicoides*), and Ohio goldenrod (*S. ohioensis*) are paternal sources of *S. houghtonii*. Three parental genome donors are expected since Houghton's goldenrod is a sexually reproducing hexaploid species (Laureto 2010). The morphology of *S. houghtonii* also supports these three species as paternal sources (Laureto 2010). Maternally inherited chloroplast (cpDNA) (Corriveau and Coleman 1988) data indicates maternal parentage by giant goldenrod (*S. gigantea*) or that one of the parental taxa of *S. houghtonii* captured the cpDNA of *S. gigantea* (Laureto 2010; Laureto and Barkman 2011).

According to Laureto (2010) analyses, the contribution of multiple donors to *S. houghtonii*'s nuclear genome and its morphology is suggestive of a hybrid origin. The presence of *S. gigantea* cpDNA within the genome of *S. houghtonii* provides evidence of a single origin (Laureto and Barkman 2011).

Although the New York population is now considered to be *S. houghtonii*, it was previously thought to be a separate species or of independent origin, due in part to its morphology (Morton 1979; Mitchell and Sheviak 1981). Pringle (1987) also considered this population a separate entity based on variation in chromosome number and morphology. Laureto and Barkman (2011) confirmed that the New York plants are also *S. houghtonii* as they share the same chloroplast and most of the nuclear DNA with Michigan and Canada populations. Morphological differences may have arisen in response to its different environmental conditions (Laureto 2010).

Laureto (2010) also investigated the population genetic structure of *S. houghtonii* and suggested the origin of *S. houghtonii* may be in northern Michigan. There is a high level of genetic diversity but unequal distribution of genetic variation among the 23 sampled populations representing Pringle's (1987) four entities (Laureto 2010). *Solidago houghtonii* exhibited high differentiation in chloroplast types and limited gene flow between populations (Laureto 2010).

Overall, *S. houghtonii* populations are highly differentiated and isolated by distance and contain relatively high levels of genetic diversity (Laureto 2010). Laureto (2010) commented that the morphological distinction among populations of this rare species could be due to restricted gene flow, resulting from geographic distance between populations. *Solidago houghtonii* may be able to maintain its high level of genetic diversity because it is able to reproduce clonally, which increases generation time (Laureto 2010). Michigan's Upper Peninsula population has the highest genetic diversity and largest percentage of polymorphic populations while the Lower Peninsula has the lowest (Laureto 2010). The low genetic diversity of Michigan's Lower Peninsula could be due to this region's more extensive habitat fragmentation; therefore, protecting the habitat from further fragmentation will preserve the present level of genetic variation within this species, especially for those populations with higher genetic diversity (Laureto 2010).

2.3.1.4 Taxonomic classification or changes in nomenclature:

No changes in taxonomic classification or nomenclature.

2.3.1.5 Spatial distribution, trends in spatial distribution (e.g. increasingly fragmented, increased numbers of corridors, etc.), or historic range (e.g. corrections to the historical range, change in distribution of the species' within its historic range, etc.):

At the time of Houghton's goldenrod last status review, there were 39 EORs within eight Michigan counties (Cheboygan, Chippewa, Crawford, Delta, Emmet, Mackinac, Presque Isle, Schoolcraft), primarily on the northern shores of Lakes Michigan and Huron (53 FR 27134). Upon issuance of the recovery plan in 1997, there were 59 total EORs. The Bergen Swamp population in Genesee County, New York was undergoing further study because it was not thought to represent this taxon (53 FR 27134), but the USFWS (1997) later considered the Bergen Swamp occurrence to be *S. houghtonii*. The confirmation of the New York Bergen Swamp element occurrence has provided one additional EOR for Houghton's goldenrod and increased its spatial distribution. The spatial distribution in Michigan remains unchanged.

2.3.1.6 Habitat or ecosystem conditions (e.g., amount, distribution, and suitability of the habitat or ecosystem):

In addition to fragmentation, almost all occurrences are threatened by the increase in invasive plant species, such as baby's breath (*Gypsophila paniculata*), *Phragmites australis*, purple loosestrife (*Lythrum salicaria*) and false brome (*Brachypodium sylvaticum*). If not removed or controlled, these invasive species may threaten the Houghton's goldenrod habitat by out-competing native species, shading the habitat or altering the hydrology.

2.3.1.7 Other: N/A

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Present or threatened destruction, modification or curtailment of its habitat or range:

As discussed in the recovery plan, Houghton's goldenrod is particularly vulnerable to extirpation because of the restriction of most occurrences to narrow shoreline habitats of the Great Lakes. Like most of its associated endemics, its greatest threat is habitat loss and destruction. Residential development, dune stabilization projects, recreational vehicle use, and excessive human foot traffic along portions of the shoreline of Lakes Michigan and Huron destabilize dune and beach flats, prevent or inhibit dune formation, and further

fragments populations of Houghton's goldenrod.

Disjunct populations, located in calcareous fens and dependent upon calcium-rich groundwater flowing through them, face additional threats. Modifications or contamination of the groundwater could cause these sites to become unsuitable for Houghton's goldenrod and could lead to extirpation of this species. As such, this species could be also be threatened by off-site activities.

2.3.2.2 Overutilization for commercial, recreational, scientific, or educational purposes:

No past or current demand exists for Houghton's goldenrod plants for commercial, residential or educational purposes. Occasionally, permitted research activities collect Houghton's goldenrod.

2.3.2.3 Disease or predation: None

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Government units below the State level generally do not provide adequate protection for rare plants. At the State level, the Michigan Department of Environmental Quality continues to permit home development in Critical Dune Areas. Although permits may include conditions to avoid immediate loss of existing plants, these permits do not address fragmentation or potential alteration of dune-sustaining processes. The State of Michigan has no authority to require protection of plants from indirect effects and does not require State-level endangered species permits if direct impacts to the species are not expected.

The State of New York lists Houghton's goldenrod as an endangered species and affords it protection pursuant to the New York Environmental Conservation Law (NYSDEC 2010). Under this law, it is a violation to pick, pluck, sever, remove, damage by the application of herbicides, or carry away, without the consent of the landowner, any state protected plant (NYSDEC 2010). The New York State Department of Environmental Conservation (2010) does not require state issued permits to collect or destroy listed plants.

Section 9(a)(2)(B) of the Federal Act provides protection to federally listed plants only on Federal land, where Federal agency action occurs or in the case of endangered plants, where a knowing violation of any state law or regulation occurs. Because of Houghton's goldenrod's association with the shoreline and wetlands, consideration of effects to this species may occasionally trigger section 7 consultations with the U.S. Army Corps of Engineers (USACE) for actions requiring permits, pursuant to section 404 of the Clean Water Act. For example, a driveway construction project on private property in Michigan required a USACE permit to discharge fill material into wetlands and a section 7 consultation with the Service to relocate Houghton's goldenrod plants (USFWS 2005).

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Since the 1991 status review and 1997 recovery plan, threats to Houghton's goldenrod caused by ORVs, recreational activities, and development have occurred. Plants have been trampled, driven upon, and some development activities have altered its habitat and fragmented populations. In addition, the spread and encroachment of non-native invasive species threaten to stabilize the dunes by decreasing the movement of sand, which allows for increased vegetation cover build-up and speeds up the succession process. The disruption of the geomorphic processes that maintain dune systems leads to a decrease in habitat for native species.

Invasive species control efforts are underway in three of the four Michigan State Parks with Houghton's goldenrod. New York has had limited success with control efforts at Bergen Swamp. Common reed grass (*Phragmites australis*) is the non-native invasive species most likely to affect Houghton's goldenrod at Bergen Swamp (Drake, pers. comm. 2010), although encroachment by false brome (*Brachypodium sylvaticum*) may pose a threat to Houghton's goldenrod also (Steve Young, NYNHP, pers. comm., 2010).

Climate Change

Climate change models predict the climate of the Great Lakes region will grow warmer and drier over the next century, with precipitation increasing in winter and decreasing in summer (AMEC 2006; Anton Reznicek, University of Michigan, pers. comm. 2004; Kling *et al.* 2003). Average temperatures in the Great Lakes region could increase by 3 to 7°C in winter and 3 to 11°C in summer by the year 2100. While average annual precipitation could increase by 10–20 percent, significant changes in the seasonal precipitation cycle are likely, with winter and spring rain increasing and summer rain decreasing by up to 50 percent (Kling *et al.* 2003). A warmer, drier summer will affect surface and groundwater levels, as well as soil moisture, which is projected to decrease by 30 percent in summer (Kling *et al.* 2003).

Earlier models had indicated that increased precipitation, higher air temperatures, and reduced ice cover would increase evaporation in the Great Lakes, resulting in lake level drops of 1.5 feet to as much as 8 feet (Sousounis and Glick 2000; AMEC 2006; Kling *et al.* 2003). However, more recent models show a more variable response in lake levels. A majority of the model simulations run by Angel and Kunkel (2010) resulted in reductions in lake levels, yet also showed a high degree of uncertainty in possible future lake levels, depending on future emissions. Furthermore, Hayhoe *et al.* (2010) suggest that the competing effects of shifting precipitation and warmer temperatures will result in little change in Great Lake levels until the end of the century, when net decreases in lake levels are expected under higher emission scenarios. If Great Lakes levels recede, more dune formation may occur,

potentially increasing habitat for shoreline occurrences of Houghton's goldenrod (Penskar, pers. comm. 2009).

Increased water temperatures will also result in decreased ice cover that when combined with an expected intensity of winter storms, will leave coastal areas more vulnerable to the effects of winter storms and flooding (Fang and Stefan 2000; AMEC 2006), altering Houghton's goldenrod habitat. A warmer climate could also bring about a northward shift and an even greater increase in invasive species that may be more problematic in the dunes and lakeshore systems, thus increasing competition with native plant species (Malcolm *et al.* 2002; AMEC 2006; Penskar, pers. comm. 2009).

2.4 Synthesis

Although the MNFI has documented new occurrences of Houghton's goldenrod, these occurrences are not systematically monitored. More than half of occurrences are found on partially or fully owned State, Federal or land conservancy properties; however, only a few are managed. As a result, comparable and quantitative information about current and past habitat conditions and population trends of most occurrences are lacking.

Genetics research to determine the taxonomic relationships among populations in Michigan, New York, and Canada has revealed that Houghton's goldenrod originated in a single hybridization event. In addition, this species exhibits high genetic variability, within and among occurrences, especially in the Upper Peninsula, but has restricted gene flow. The lower genetic diversity of Michigan's Lower Peninsula populations is possibly a result of habitat fragmentation. Preventing further fragmentation and linking existing occurrences will preserve the present level of genetic diversity in this species.

Climate change represents a new, unknown threat for Houghton's goldenrod. Regional warming as well as increasing periods of drought may have a significant effect on habitat suitability. Climate change may also result in lowering Great Lakes level, potentially increasing the amount of available habitat for many coastal dune plant species but also potentially allowing invasive species to expand their range and increase competition with Houghton's goldenrod.

Previously recognized threats to Houghton's goldenrod have not significantly diminished, and climate change represents a new, unknown threat; however, no new information is available to suggest this species' status has changed since listing. Houghton's goldenrod continues to meet the definition of a threatened species. The listing classification of the Houghton's goldenrod should remain as threatened under the Act.

3.0 RESULTS

3.1 Recommended Classification

_____	Downlist to Threatened
_____	Uplist to Endangered
_____	Delist
<u> X </u>	No change is needed

3.2 New Recovery Priority Number

No change

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Report survey results and habitat and population conditions to the Michigan Natural Features Inventory and the East Lansing Field Office and update element occurrence records. *Recovery plan action number: N/A*
- Plan and implement regular surveys and monitoring of occurrences, including better documentation of habitat conditions and populations trends. *Recovery plan action numbers: 22, 4*
- Reassess ranks of known occurrences. *Recovery plan action number: 24*
- Provide education and outreach to stakeholders and the public. *Recovery plan action number: 142*
- Monitor approach of non-native species and control as appropriate. *Recovery action plan number: N/A*

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**U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Houghton's goldenrod**

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

<u> </u>	Downlist to Threatened
<u> </u>	Uplist to Endangered
<u> </u>	Delist
<u> X </u>	No change needed

Appropriate Recovery Priority Number: 8C

Review Conducted By: Tameka N. Dandridge

FIELD OFFICE APPROVAL:

Lead Field Supervisor, U. S. Fish and Wildlife Service

Approve: Scott Hicks
Scott Hicks

Date: 8-22-2011

REGIONAL OFFICE APPROVAL:

Assistant Regional Director, Ecological Services, U. S. Fish and Wildlife Service, Midwest Region

Approve: Lynn M Lewis

Date: 8/26/11

^{participating}
Cooperating Regional Director, U. S. Fish and Wildlife Service, Northeast Region

Signature: Theresa Clark

Date: 9/12/11

Table 1. U.S. range of element occurrence records for Houghton's goldenrod.

EOR#	County	Site	Current rank	RP rank	Property type	Ownership
1	Emmet	Trail's End/Cecil Bay	BC	BC	Private	Private
2	Emmet	Waugoshance Point	B	B	SP	State of Michigan
3+	Cheboygan	Grass Bay	A	A	Pres	Private nature preserve
4	Cheboygan	Point Nipigon	BC	C	Private	Private
5	Presque Isle	Hammond Bay E	B	B	SF	State/private
6	Presque Isle	Hammond Bay-Mast Pt	A	A	RP	Private
7	Mackinac	Limekiln Pt	BC	BC?	Private	Private
8	Chippewa	Drummon Is/Seamans Pt	C	C	SF	State/private
9	Mackinac	W Mile Ck-Naubinway E	CD	CD	unknown	Private
10	Mackinac	Black River Rd	B	C	SF	State/private
11	Emmet	Temperance Is	B	not in RP	SP	State of Michigan
12*	Mackinac	Rabbit Back Peak	C	CD	NF	Federal
15	Chippewa	St. Vital Bay	B	B	SP	State of Michigan
17*	Mackinac	Pointe Aux Chenes	A	AB	NF	Federal
19	Mackinac	Sand Bay	H	unknown	unknown	Private
20	Emmet	Big Stone Bay	C	C?	SP	State of Michigan
21	Emmet	Sturgeon Bay	A	A	SP	State of Michigan
22*	Cheboygan	Cheboygan State Park	B	B	SP	State of Michigan
23	Schoolcraft	Manistique Beach W	H	unknown	unknown	Unknown
24	Cheboygan	Pries Landing	C	C	unknown	Private
26	Crawford/ Kalkaska	Howes Lk/Portage Ck	A	A	SF	State of Michigan
27	Mackinac	Seiners Pt	C	unknown	SF	State of Michigan
28	Schoolcraft	Manistique Shore E	BC	BC?	unknown	Private
29	Presque Isle	Evergreen Beach	BC	BC?	unknown	Private
30	Mackinac	Pointe Labarbe	A	A	unknown	Unknown
31+	Chippewa/ Mackinac	Albany Bay	BC	B	Pres	Private nature preserve
32	Chippewa	Albany Ck Mouth	AB	AB	unknown	State/private
33	Chippewa	Strawberry Is	D	CD	unknown	Unknown
34	Chippewa	Seymour Bay	B?	B?	unknown	Private
35	Chippewa	Rice Pt	B?	B?	SF	State/private
36	Cheboygan	Stoney Pt Rd	C	C	Pres	Local
38	Schoolcraft	Goudreau's Harbor	BC	C	unknown	Private
39+	Mackinac	Bois Blanc Is	B	B	SF	State/private nature preserve
41	Mackinac	Lower Millecoquins River Mouth	B	B	unknown	Private
42	Mackinac	Big Knob Campground	A	A	SF	State of Michigan

EOR#	County	Site	Current rank	RP rank	Property type	Ownership
43	Presque Isle	Ferron Pt	E	unknown	unknown	Private
44	Schoolcraft	Rocky Pt	BC	BC?	unknown	Private
45	Charlevoix	Garden Is	BC	BC	Pres	State of Michigan
46	Emmet	Sturgeon Bay Pt - Lakeview Beach	AB	AB	SP	State/private
47	Mackinac	St. Martin Pt	BC	BC?	NF	Federal
48	Mackinac	Gros Cap	B	C	NF	Federal
49	Mackinac	Horseshoe Bay	B	B	Pres	State of Michigan
50	Cheboygan	Point Nipigon	C	C	unknown	Private
51	Charlevoix	Hog Is-Baltimore Bay	C	CD	Pres	State of Michigan
52	Mackinac	Summerby Fen	C	C	NF	Federal
53	Mackinac	West Epoufette	B	BC	SF	State of Michigan
54*	Mackinac	Horseshoe Bay N	C	C	NF	Federal
55+	Presque Isle	Thompson's Harbor	AB	AB	SP	State of Michigan
56	Mackinac	Charles Rd	D	CD	NF	Federal
57	Cheboygan	Mackinaw City	X	D	unknown	Private
58	Mackinac	Marquette Is-Voight Bay	C	C?	unknown	State/private
59	Mackinac	Bush Bay	C	C	unknown	Private
61	Mackinac	W Moran Bay	C	BC	unknown	Private
62*	Charlevoix	Fishermans Is State Pk	AB	AB	SP	State of Michigan
63	Charlevoix	Donnegal Bay-Beaver Is	C	C	unknown	Private
64	Kalkaska	Bluestem Prairie	D	D	Mil	State of Michigan
65	Crawford	Cantonement Rd	B	C	Mil	State of Michigan
66	Charlevoix	Jensen Harbor	C	not in RP	Pres	State of Michigan
67	Schoolcraft	Dry Creek	C	not in RP	unknown	Private
68	Schoolcraft	Section 10 Dunes	C	not in RP	unknown	Private
69	Schoolcraft	Michibay Rd Twp Pk	C	not in RP	unknown	Local
71	Mackinac	Fox-Grants Pt	C	not in RP	SF	State of Michigan
73	Mackinac	Cozy Pt	C	not in RP	unknown	Unknown
74	Emmet	Cross Village Shores	C	not in RP	unknown	Private
75*	Mackinac	Brevort Lake Rd	C	not in RP	NF	Federal
76*	Mackinac	Horseshoe Bay	AB	not in RP	NF	Federal
77	Mackinac	Peck Bay	B	not in RP	unknown	Private nature preserve
78	Mackinac	Belonga Rd E	C	not in RP	NF	Federal
79	Mackinac	St. Martin Is	B	not in RP	unknown	Private
80	Mackinac	Big St. Martin Is	B	not in RP	unknown	Private
81	Presque Isle	Presque Isle Harbor	CD	not in RP	unknown	Private
82	Emmet	Sturgeon Bay	A	not in RP	SP	State of Michigan
83	Mackinac	Voight Bay E	B?	not in RP	unknown	Private
84	Chippewa	Big Shoal Cove	C	not in RP	unknown	Private

EOR#	County	Site	Current rank	RP rank	Property type	Ownership
1*	Genessee Co, NY	Bergen Swamp	AB	not in RP	Pres	Private nature preserve

* protected

+ possibly protected: some management may occur

E – extant (viability not assessed)

X – extirpated

State – State of Michigan

SF – state forest

SP – state park

Pres – preserve (nature preserve, environmental area, or research area)

NF – national forest

Mil – Camp Grayling Military Reservation

Current rank – updated rank since issue of recovery plan

RP rank – rank indicated in the recovery plan

Table 2. The NatureServe Element Global Ranking Criteria for Houghton’s goldenrod.

Rank Specification	Habitat	Population and Vigor
A	Large, undisturbed habitats (beach flats, rocky and cobbly shores, dunes, interdunal wetlands or alvar) with sufficient buffer to protect the integrity of the habitat; OR, habitats of similar size that have recovered from past disturbance. Species composition shows little departure from original structure and composition (except in seral or disturbance-dependent communities).	A population consisting of 1,000 or more individuals. Populations are stable or growing in size, large in number of individuals, show good reproduction, and exist in a natural, sustainable habitat.
B	Moderate-sized habitats (beach flats, rocky and cobbly shores, dunes, interdunal wetlands or alvar) with sufficient buffer to protect the integrity of the habitat; OR, habitats of similar or larger sizes that are still recovering from early or recent light disturbance but eventually will reach an A-rank. Presence of exotic species (if only localized and/or a minor component of flora) and recoverable departure from original structure and composition for the site (except in seral and disturbance-dependent communities).	A population consisting of 100–999 individuals. Populations are stable and are of moderate size.
C	Small-sized habitats (beach flats, rocky and cobbly shores, dunes, interdunal wetlands or alvar) with sufficient buffer to protect the integrity of the habitat; OR, larger habitat areas lacking sufficient buffer for habitat protection. Habitats are in the early stages of recovery from disturbance; OR, the structure and composition of the habitat has been altered such that the original vegetation of the site will never rejuvenate, yet with management and time, partial restoration of the habitat is possible.	A population consisting of 10–99 individuals. Populations are small. All populations larger than 99 individuals that continually decline in number over a period of several years are of this rank.
D	Beach flats, rocky and cobbly shores, dunes, interdunal wetlands or alvar habitats that are severely disturbed, their structure and composition having been greatly altered. Recovery of habitats of this rank to original conditions, despite management and time, essentially will not take place. Small habitats that lack sufficient buffer to protect the existing quality of the site are of this rank, for long-term survival is not likely.	A population consisting of 1–9 individuals. Populations of this size are very small, with a high likelihood of dying out or being destroyed. Populations smaller than 100 individuals that continually decline in number over a period of several years are of this rank.

From (USFWS 1997).

Table 3. Summary of Houghton's goldenrod occurrences in Michigan and New York.

Current element occurrence rank	A	AB	B	BC	C	CD	D	E	H	X	Total
Ownership category:											
Federal	1	1	1	1	5	0	1	0	0	0	10
State	5	3	11	1	7	0	1	0	0	0	28
Local	0	0	0	0	2	0	0	0	0	0	2
Private	1	0	5	7	9	2	0	1	1	1	27
Private nature preserve	1	1	1	1	0	0	0	0	0	0	4
Unknown ownership	1	0	0	0	1	0	1	0	1	0	4
Occurrences summarized by rank	9	5	18	10	24	2	3	1	2	1	75

Federal includes federal holdings and those shared with neighboring private landowners.

State includes state holdings and those shared with neighboring private landowners.

Private consists of only private properties, excluding private nature preserves.

E = extant (viability not assessed)

H = historical

X = extirpated