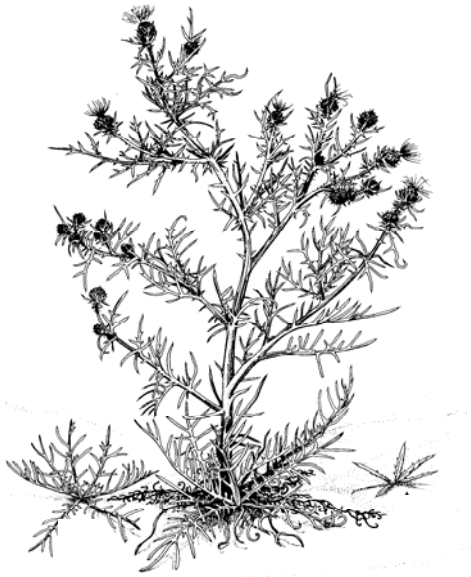
Pitcher's thistle
(Cirsium pitcheri)



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: Pitcher's thistle (*Cirsium pitcheri*)

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5-YEAR REVIEW
Pitcher's thistle (*Cirsium pitcheri*)

1.0 GENERAL INFORMATION

1.1 Reviewers

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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 via the *Federal Register* (71 FR 16176) requesting new scientific or commercial data and information that may have a bearing on the Pitcher's thistle (*Cirsium pitcheri*) classification as a threatened species.

The East Lansing Field Office (ELFO), in coordination with Midwest Regional Office Ecological Services staff, conducted this review. Information contained in this review is primarily derived from the Recovery Plan for Pitcher's Thistle (*Cirsium pitcheri*) (USFWS 2002), the Michigan Pitcher's thistle database maintained by the Michigan Natural Features Inventory (MNFI), and scientific research journals. Staff from cooperating field offices either directly supplied information or provided references to retrieve data from State or Federal natural resource agencies. A peer review was not needed and therefore not conducted according to the requirements described in the Service's 2006 Interim 5-Year Review Guidance.

1.3 Background

1.3.1 FR Notice citation announcing initiation of this review: 71 FR 16176, Thursday, March 30, 2006.

1.3.2 Listing history

Original Listing

FR notice:	53 FR 27137 - 27141
Date listed:	July 18, 1988
Entity listed:	Species
Classification:	Threatened

1.3.3 Associated rulemakings: None

1.3.4 Review History: Pitcher's thistle was included in a cursory five-year review of all species listed before January 1, 1991 (56 FR 56882). The five-year review resulted in no change to Pitcher's thistle listing classification of threatened.

1.3.5 Species' Recovery Priority Number at start of 5-year review: 8C. The "8" indicates a moderate degree of threat and high recovery potential; the "C" indicates a high degree of conflict with development and other forms of economic activity.

1.3.6 Recovery Plan or Outline:
Name of plan or outline: Recovery Plan for the Pitcher's Thistle (*Cirsium pitcheri*)
Date issued: September 20, 2002
Dates of previous revisions, if applicable: N/A

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. For threats-related recovery criteria, please note which of 5 listing factors are

addressed by that criterion. If any of the 5 listing factors is not relevant to this species, please note that here.

We will consider delisting Pitcher's thistle when the following criteria are met:

1. **The essential habitat associated with a total of 115 priority occurrences[1] representing each biogeographic region and dune type is protected and managed under a management plan, including: (a) all Federal and State owned essential habitat and occurrences, (b) all publicly and privately-owned essential habitat and occurrences having a rank of A, AB, B, or BC (Appendix 1), (c) all occurrences in southern Lower Michigan, Indiana, and Wisconsin, and (d) all complex perched dune systems.**

There are 211 known historic and extant element occurrences[2] (EO) of Pitcher's thistle (excluding Canada), but 18 are extirpated (4 in Indiana and 14 in Illinois). Of the 193 extant occurrences, 139 fit the definition of priority occurrences (PO) as defined in the recovery plan. Michigan has 118 priority occurrences (MNFI 2009). The MNFI combined several Michigan element occurrences and recorded new ones since publication of the recovery plan in 2002 (MNFI 2006). The 21 remaining priority occurrences consist of 9 in Wisconsin and 12 in Indiana.

This criterion calls for the protection of essential habitat associated with priority occurrences and management of these occurrences under a management plan. The recovery plan defines protection as "implementation of actions necessary to maintain and perpetuate essential habitat, remove threats, and enable Pitcher's thistle populations to be self-sustaining."

1a. All Federal and State owned essential habitat and occurrences:

Seventy-eight PO and associated essential habitat are located on Federal and State owned lands (MNFI 2009). Pitcher's thistle and associated habitat are included within site management plans at locations managed by the U.S. Forest Service (USFS), National Park Service (NPS), U.S. Geological Survey (USGS) at the Indiana Dunes National Lakeshore (INDU), Wisconsin Department of Natural Resources (WDNR), Indiana Department of Natural Resources (IDNR), and The Nature Conservancy (TNC). In addition, the Michigan Department of Natural Resources (MDNR) has Pitcher's thistle in 17 (includes EO and PO) of its State parks. Although no management plan exists for Pitcher's thistle in the State parks, the species benefits from non-native species control programs implemented at the parks. In total, there are 59 actively managed PO, including private landowner sites enrolled in the WDNR landowner program, sites managed by TNC (Darcy Kind, WDNR, pers. comm., 2007; MNFI 2009), and Michigan State Parks sites receiving invasive species control. Due to numerous locations containing Pitcher's thistle within Michigan, land managers have

[1] Priority occurrences are element occurrences that have the following characteristics: (1) located on Federal and State owned lands; (2) ranked A, AB, B, or C; (3) located in southern Lower Michigan, Indiana, and Wisconsin; and (d) are complex perched dune systems.

[2] Element occurrence – all Pitcher's thistles in an area within approximately one mile of each other and at least one mile from the nearest Pitcher's thistle which would be part of another occurrence.

more information on the presence or absence of the species at most sites than the status of the populations.

1b. All publicly and privately-owned essential habitat and occurrences having a rank of A, AB, B, or BC:

Michigan has 71 PO with these rankings. Of these, 38 are located on State, Federal, or land conservancy owned lands; 28 are managed, and 9 occur on unknown ownership lands. Indiana has 2 PO that are protected and managed with these rankings. Wisconsin has 6 PO with these rankings and they are found on State or County land or enrolled in the landowner program; 4 of these sites are managed. Overall, 79 PO are ranked A, AB, B, or BC[3]; 49 sites are protected and 31 are managed (Noel Pavlovic, USGS, pers. comm. 2003 and 2007d; MNFI 2009).

1c. All occurrences in southern Lower Michigan, Indiana, and Wisconsin:

Southern Lower Michigan has 16 PO. Five are located at State parks and three are proposed to receive non-native and exotic species control in 2009 (Ray Fahlsing, MDNR, pers. comm., 2009). The others are not protected or managed (MNFI 2009). Wisconsin has nine PO and a reintroduced population at the Kenosha Dunes State Natural Area, which has not been assigned an EO number (Tim Bell, Chicago State University {CSU}, pers. comm. 2008). Three Wisconsin PO are in State parks and another four are located on private properties enrolled in the WDNR landowner program. There are 12 PO in Indiana and all occur on either Federal or State lands (N. Pavlovic, pers. comm. 2008). Reintroduction sites also occur in Indiana where two restoration sites occur at Odgen Dunes on the INDU and one reintroduction site in Illinois at the Illinois Beach State Park (T. Bell, pers. comm., 2008; N. Pavlovic, pers. comm., 2007).

1d. All complex perched dune systems:

Within the U.S., nine PO are located on complex perched dunes found only in Michigan. Eight are in northern Lower Michigan and one is in the Upper Peninsula. Seven occurrences are on NPS lands and four of these are monitored (MNFI 2009).

Criterion 1 addresses Factor A (Present or threatened destruction, modification or curtailment of its habitat or range) and Factor D (inadequacy of existing regulatory mechanisms) and has been partially met. Some federally-managed as well as some state and land-conservancy managed areas have site management plans which include protection, management and periodic surveys, and monitoring for Pitcher's thistle. The MDNR does not have such a plan yet; however, the plant is considered protected under the State's Endangered Species Act, but is not actively managed at all the parks or State forests sites. If the MDNR were to develop and implement a management plan, this criterion would be very close to being be fulfilled, since the majority of occurrences are located in Michigan.

[3] Rank by habitat condition and population size and vigor. Ranks range from A–D, with A indicating the highest quality habitat and largest population size.

2. Regular field surveys to verify occurrences and record new occurrences have been established.

Regular (every five years) field surveys and monitoring occur at eight sites (Appendix 1) within the USFS Manistee National Forest (MNF), Michigan, and most recently in 2006 (Patty O'Connell, USFS, unpub. data, 2006). Annual counts (Appendix 2) occur at Whitefish Dunes State Park, Wisconsin (Carolyn Rock, WDNR, unpub. data, 2008). Plant counts occurred at P. J. Hoffmaster State Park, Michigan, in 2004 and 2006 (T. Dandridge, USFWS East Lansing Field Office, unpub. data, 2007; Appendix 3). The USGS samples permanent plots in Indiana at the following locations: Big Blowout Dunes State Park, West Beach, Miller Dunes, and Ogden Dunes where there are two restoration sites (N. Pavlovic, pers. comm., 2008). The Nature Conservancy also includes Pitcher's thistle with their site management plan for Point Betsie Preserve, Michigan, where they remove and control invasive plants and monitor rare species (Jack McGowan-Stinski, TNC, unpub. data, 2007). The MNFI discovered six new occurrences in Michigan: four in the Upper Peninsula and two in the northern Lower Peninsula (MNFI 2009). The majority of occurrences, however, are not surveyed and monitored regularly.

Criterion 2 addresses Factor A (The present or threatened destruction, modification, or curtailment of its habitat or range) and has been partially met. Many Pitcher's thistle occurrences are not surveyed on a regular basis and as a result population and habitat trends are unknown in these locations. This criterion will be met when future records indicate that the majority of occurrences have been routinely surveyed and monitored.

3. Landowner contacts have been initiated and protection has been investigated for the remaining (rank<BC) public and private occurrences.

The WDNR has met this criterion, but is partially met in Michigan. Michigan has 35 (non-Federal or State land) PO ranked "A", "AB", "B", and "BC", of which seven occur on local or county government lands, land conservancy properties, and individual landowner sites (MNFI 2009). Indiana has one "B" and one "BC" ranked occurrence, located on Federal and State-owned property, respectively. Wisconsin has four privately owned PO, with one ranked "BC". The MNFI initiated a landowner contact program in Michigan, but the contact program is no longer in operation and contacts are now sporadic (Mike Penskar, MNFI, pers. comm., 2007). A WDNR landowner contact program is active in Wisconsin (D. Kind, pers. comm. 2007).

Criterion 3 addresses Factor A (Present or threatened destruction, modification or curtailment of its habitat or range) and Factor D (Inadequacy of existing regulatory mechanisms). Of the four states within Pitcher's thistle range, Michigan and Wisconsin have more than half of their occurrences on private property.

4. Monitoring of known sites show a stable or increasing trend towards recovery and protective plans are being implemented.

Active management and monitoring occur at 40 sites managed by the NPS, USFS, USGS, WDNR, TNC, and CBG/Morton Arboretum (McGowan-Stinski, unpub. data, 2007; P. O'Connell, unpub. data, 2007; C. Rock, unpub. data, 2007; T. Bell, Morton Arboretum, pers. comm., 2008; Kathyrn McEachern, USGS, pers. comm., 2008; N. Pavlovic, pers. comm., 2007a, b, d, and 2008). These occurrences are relatively stable and protective plans are being implemented (see Appendices 2-4). Records indicate regular monitoring does not occur at many sites and is therefore difficult to assess overall trends at these sites and rangewide. The population status or trend is unknown at many unmanaged sites.

Criterion 4 has been partially met and addresses Factor A (Present or threatened destruction, modification or curtailment of its habitat or range) and Factor D (Inadequacy of existing regulatory mechanisms). As with Criterion 2, this will be met when future records indicate the majority of occurrences are actively managed, including surveying and monitoring on a regular basis.

5. Restoration of two occurrences from among historical sites where sufficient habitat remains in Illinois, Indiana, Wisconsin, and southern Lower Michigan has been completed.

Two Pitcher's thistle restoration sites are present at Odgen Dunes on INDU and have been managed by USGS since 1994 (N. Pavlovic, pers. comm. 2007d). Bell et al. (2002) initiated Pitcher's thistle reintroductions and population monitoring at the Illinois Beach State Park, Lake County, Illinois, in 1991 and the Kenosha Dunes State Natural Area, Kenosha County, Wisconsin, in 2004 (T. Bell, pers. comm., 2008). However, Bell et al. (2002) will not be able to determine the longterm viability of these populations until at least 15 years has passed since the establishment of these reintroduced populations.

The USGS annually monitors the INDU sites and they have persisted; however, numbers were low in 2006, perhaps due to the drought of 2005 (K. McEachern, pers. comm., 2008 and N. Pavlovic, pers. comm. 2008). The last transplants of Pitcher's thistle at Illinois Beach State Park occurred in 2000 (T. Bell, pers. comm., 2008). Since then, natural recruiting has increased and from 2003 to 2006 the population appeared to fluctuate at around 225 individuals (T. Bell, pers. comm. 2008). A decline in the population occurred in 2007, with only nine new recruits and a total of 170 individuals (T. Bell, pers. comm. 2008).

Criterion 5 addresses Factor A (Present or threatened destruction, modification or curtailment of its habitat or range) and has been met. As of now, restoration sites exist in Illinois, Indiana, and Wisconsin. Monitoring these populations need to continue to determine if they are viable.

6. Research necessary to protect, manage and restore Pitcher's thistle has been conducted.

The recovery plan provides the following research actions to address Criterion 6: (6-1) seedbank and seed dispersal; (6-2) use of genetics to investigate breeding system and

population viability; (6-3) Pitcher's thistle's response to trampling; (6-4) plant establishment and transplant techniques for restoration; (6-5) evaluation of the risk of flowerhead weevil and other biological control agents on seed production and methods of reducing risks; and (6-6) non-native weed invasion and degree of threat.

The following research studies, focused on recovery plan research actions, are addressing Criterion 6. Additional information is provided under section 2.3 Updated Information and Current Species Status.

- Action 6-1 – Seedbank and seed dispersal: Pitcher's thistle appears to have a small between-year seed bank (Loveless 1984, McEachern 1992, Bowles and McBride 1996, Hamze and Jolls 2000). Rowland and Maun (2001) conducted a study and concluded that the species has the ability to form a persistent seed bank but only at soil depths of ≥15 cm. However, Chen and Maun (1999) showed that the maximum depth from which Pitcher's thistle seedlings could emerge was 6 cm. Therefore, Rowland and Maun (2001) concluded that a persistent seed bank may not be a contributing factor to population growth of Pitcher's thistle. Seed dispersal to nearby suitable habitats may be a more important stability factor.

- Action 6-2 – Use of genetics to investigate breeding system and population viability: No new information on this action.

- Action 6-3 – Evaluate Pitcher's thistle response to trampling: No new information that evaluates the species response to trampling due to variation in intensity by dune visitors exists at this time; however, new information exists on response to burial, which could result from trampling as well as other means. Recurring sand burial resulting from wind and wave action is an important factor controlling the population dynamics of Pitcher's thistle. Rowland and Maun (2001) found that the greater the burial depth, the slower the rate of emergence of plants. All plants emerged and survived at burial depths of 0, 5, and 15 cm. In a controlled growth chamber experiment, Pitcher's thistle plants were subjected to three burial treatments: 0, 33, and 66 percent of the plant's height (Perumal and Maun 2006). Under the 33 and 66 percent burial treatments, Pitcher's thistle exhibited stimulation in growth, an increase in biomass, photosynthetic efficiency, and chlorophyll-*a* fluorescence. These studies indicate that the species has the ability to recover from burial in sand up to a certain threshold.

- Action 6-4 – Investigate establishment and transplant techniques for restoration: Bell et al. (2003) assessed the viability of the Illinois Beach State Park restoration by conducting a population restoration viability analysis (PRVA). According to this analysis, growth rates are similar to the natural Indiana Dunes population, from which this population originated, and several hundred transplants are needed for this population to be considered viable. The analysis also revealed that planting seedlings was more effective than planting seeds.

- Action 6-5 – Evaluate risk of flowerhead weevil and other biological control agents: In a study to determine host specificity for biological control insects in a laboratory and garden setting, Louda et al. (2005) found that Pitcher's thistle is an accepted host species to flowerhead weevil (*Rhynocyllus conicus*) in a laboratory setting. She also reported that Pitcher's thistle would be available and susceptible to oviposition during the weevil's expected activity period, which may result in a decrease in seedling establishment. In the garden, flowerhead weevil oviposited and developed completely on Pitcher's thistle, especially on the taller plants with more flower heads. The weevil is also known to use native Hill's thistles (*Cirsium hillii*) as an alternate host (Bradley, unpub. 2007).

- Action 6-6 – Study non-native weed invasion and determine the degree of threat: Research (Louda et al., unpub. 2007) focusing on the effects that non-native plants have on the germination and survival of Pitcher's thistle demonstrated that the presence of non-native invasive species such as spotted knapweed (*Centaurea maculosa*) and baby's breath (*Gypspphila paniculata*) and their proximity to Pitcher's thistle influences its growth and development by reducing seedling establishment and juvenile survival.

  The Nature Conservancy (McGowan-Stinski and T.J. Gostomski, unpub. report, 2007) conducted non-native species removal experiments, most notably for baby's breath at Point Betsie Preserve, Michigan, using a variety of methods. They found that using the spade was most efficient, but spot-burning as an alternative or in combination with the spade was also effective depending on the location of the Pitcher's thistle in the dunes. As expected, mortality can result to Pitcher's thistle if caution is not used; however, the expansion of baby's breath will result in even greater mortality.

Criterion 6 addresses Factor E (other natural or manmade factors affecting its continued existence) and has mostly been met. Invasive and non-native species are encroaching into and altering native species habitats. Control measures have been used at some sites with various levels of success.

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:

Rowland and Maun (2001) determined the effects of shade, burial by sand, simulated herbivory, and fertilizers on the survival and growth of artificially planted populations of Pitcher's thistle. Results of their study showed that significantly higher numbers of Pitcher's thistle seedlings emerged and survived in open versus shaded areas. Seedlings growing in the open sun had significantly larger total leaf area per plant, root length, length of longest leaf, number of leaves per plant, and total dry biomass of leaves, roots, and the whole plant than those growing in the shade. These results indicate that Pitcher's thistle requires full sunlight for maximum survival and growth.

In their sand burial experiments, Rowland and Maun (2001) showed that greenhouse grown plants transplanted into areas receiving 5cm of sand deposition maximized their emergence, survivorship, and below-ground biomass. Rowland and Maun's (2001) simulated herbivory experiment on a transplanted population of Pitcher's thistle showed that although plants were negatively affected the year of the herbivory, they were able to recover and compensate for lost tissue by the following growing season. However, the authors also concluded that plants subject to bouts of herbivory would require a longer juvenile period to reach reproductive stage and thus increase the period of vulnerability to herbivory and environmental stresses. They further concluded that restoring Pitcher's thistle populations can occur by planting seeds at shallow depths, transplanting greenhouse-grown plants, applying water soluble fertilizers, and protecting plants from herbivores.

Girdler and Radtke's (2006) investigation on spatial pattern in a Michigan Pitcher's thistle population found that individual plants were clustered on a scale of approximately 1 m. The size of the clusters was consistent with reports of relatively short-distance dispersal of seeds (Keddy and Keddy 1984; Loveless 1984). The overall herbivory rate was 43%, with larger individuals more likely to suffer damage than smaller individuals. Additionally, isolated individuals were more likely to suffer herbivory than those that were clustered.

Recurring sand burial resulting from wind and wave action may impact the population dynamics of Pitcher's thistle. Rowland and Maun (2001) found that the greater the burial depth, the slower the rate of plant emergence. All plants emerged and survived burial depths of 0, 5, and 15 cm. In a controlled growth chamber experiment, Perumal and Maun (2006) subjected Pitcher's thistle plants to three burial treatments: 0, 33, and 66 percent of the plant's height. Pitcher's thistle exhibited stimulation in growth, an increase in biomass, photosynthetic efficiency, and chlorophyll-*a* fluorescence under the 33 and 66 percent burial treatments. These studies indicate that the species has the ability to recover from burial in sand up to a certain threshold.

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:

Despite fluctuations among most occurrences, most regularly monitored EO are stable. The USFS MNF, Michigan, conducted surveys at eight sites in 1993, 1996, 2001, and 2006 (O'Connell and Stephens, USFS, unpub. report, 2002, O'Connell, unpub. report, 2007). Most sites had population increases in 1996, decreases in 2001, and another increase in 2006 (Appendix 2). At P.J. Hoffmaster State Park, Michigan, there was a minor increase in plant numbers in 2006; however, the number of individuals in the youngest age class (seedling) decreased noticeably from 2004 to 2006 (Appendix 4), suggesting recruitment may have decreased (T. Dandridge, USFWS, unpub. data, 2007). Population numbers at Whitefish Dunes State Park, Wisconsin, have for the most part,

steadily increased, with only a few years of slight decreases (Appendix 3). Uncommon to previous years, USGS managed sites in Indiana had low numbers, with the exception of Miller Dunes, which has declined for several years (N. Pavlovic, pers. comm., 2008). Pitcher's thistle populations and distributions commonly fluctuate from year to year, especially among the various age-classes. Habitat at these sites remain suitable and essentially unchanged in abundance.

2.3.1.3 Genetics, genetic variation, or trends in genetic variation (e.g., loss of genetic variation, genetic drift, inbreeding, etc.): No new information.

2.3.1.4 Taxonomic classification or changes in nomenclature: There are 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.):

Of the 193 extant occurrences in the U.S., 169 EO (including PO) occur in Michigan (9 are historic) (MNFI 2009). Among the remaining 24 extant EO outside of Michigan, 10, including 1 reintroduced population, occur in Wisconsin; 13, including 2 reintroduced populations are in Indiana; and 1 reintroduced population occurs in Illinois. Aside from the reintroduced populations and new occurrences in Michigan (4 in the Upper Peninsula and 2 in the northern Lower Peninsula), spatial distribution of Pitcher's thistle has not changed since 2002.

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

Besides the increase in non-native and invasive species such as spotted knapweed, baby's breath, and Lombardy popular, no new information exists that indicates any significant changes in habitat since the 1991 Five-Year Review and the 2002 recovery plan.

2.3.1.7 Other: N/A

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

The recovery plan provides a detailed analysis of the five factors.

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

The recovery plan reports that around ten percent of Pitcher's thistle populations have been lost, modified or curtailed through habitat destruction, overuse and

repeated disturbance. Some populations have also been lost or negatively impacted through the alteration of local dune geomorphic processes, which prevents the creation and maintenance of Pitcher's thistle habitat. In addition, shoreline stabilization projects such as sea walls, rip rap, and planting of beach grass, northern white cedar, and some exotic species also alters dune building processes and may decrease habitat available to Pitcher's thistle.

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

No past or current demand exists for Pitcher's thistle plants for commercial, residential or educational purposes. Occasionally, permitted research activities lend to collection of Pitcher's thistle.

2.3.2.3 Disease or predation:

The introduction of non-native species for biological control may pose a substantial risk. In laboratory and garden host specificity tests, Louda et al. (2005) found that the flowerhead weevil (*Rhinocyllus conicus*) fed, oviposited, and developed completely on Pitcher's thistle as well as its target species. See "Other Natural or Manmade Factors" for additional discussion.

2.3.2.4 Inadequacy of existing regulatory mechanisms:

Government units below State level generally do not provide adequate protection for rare plants. However, a few townships passed zoning ordinances designed to protect some natural resources and other townships with outdated zoning ordinances.

At the State level, specifically in Michigan, the MDEQ (now the Michigan Department of Natural Resources and Environment) continue to permit home development in Critical Dune Areas. Although these permits include conditions to avoid immediate loss of existing plants, fragmentation or potential alteration in dune-sustaining processes are not addressed. If direct impacts to the species are not expected, State-level endangered species permits are not required and the State has no authority to require protection of the plants from indirect effects. In Wisconsin, State agencies do not have authority to protect listed species from impacts on private lands unless the activity otherwise requires a Federal permit or funding.

The Federal ESA provides little protection for listed plants on private property except where Federal agency action occurs.

2.3.2.5 Other natural or manmade factors affecting its continued existence:

Non-native species: Common bull thistle

The proximity of the common bull thistle (*Cirsium vulgare*) may present a potential threat of introgressive hybridization with Pitcher's thistle (Dobberpuhl and Gibson 1987). Several microlepidoptera (moths) that feed on native *Cirsium* spp. are also the adopted host of common bull thistle (Louda 2000). Having common bull thistle in the vicinity of Pitcher's thistle could increase populations of the moths and lead to increased feeding damage on Pitcher's thistle flowerheads (Louda and McEachern 1995).

Spotted knapweed, Lombardy poplar, baby's breath

Louda et al. (unpub. data 2007) conducted seed planting experiments at two sites within the linear and perched dunes of the Sleeping Bear Dunes National Lakeshore, Michigan. She conducted this experiment to examine spatio-temporal variation in the influence of non-native versus native plant neighbors across the key demographic stages of regeneration (seedling emergence and survivorship) of Pitcher's thistle. This study found that in the drier soils of the linear dunes, seedling establishment was very low and recruitment was lowest near (<3cm) a spotted knapweed (*Centaurea maculosa*) neighbor and highest in an open area cleared of knapweed and knapweed-influenced soil (>20 cm). In perched dunes, with higher soil moisture, seedling establishment was much higher, and proximity (<3 cm) to another plant, either native or non-native, increased thistle germination. However, for the subsequent juvenile stage, Louda et al. (unpub. data 2007) found proximity to a neighbor plant, especially spotted knapweed, reduced juvenile survival at both sites. Thus, depending on spatial variation and local environment, spotted knapweed was either a competitor or facilitator for seedling establishment, but competition increased in importance, relative to soil moisture for subsequent stages. Louda et al. (unpub. data 2007) concluded weed management in the dunes should consider potential positive effects of native as well as non-native neighbors on Pitcher's thistle. If done strategically in areas with open vegetation and high soil moisture, a net positive effect on Pitcher's thistle regeneration might exist.

On the USFS MNF, the most prevalent invasive species are Lombardy poplar (*Populus nigra*) and spotted knapweed (O'Connell and Stephens, unpub. report, 2002; O'Connell, unpub. report, 2007). Effects of Lombardy poplar on Pitcher's thistle habitat on the MNF sites are unknown at this time, although Pitcher's thistle numbers were reduced at sites containing poplar compared to sites without poplar. Additional monitoring could determine if this invasive tree competes with Pitcher's thistle. The USFS has attempted experimental removal of Lombardy poplar. Cutting down trees with chainsaws and pruning the new-growth has resulted in aggressive growth and spread of sprouts. Herbicide may represent a more effective control method, but the USFS does not permit herbicide use (O'Connell and Stephens, unpub. report, 2002; O'Connell, unpub. report, 2007).

Spotted knapweed's presence on the MNF has not yet reached the point of invasiveness and does not yet appear to be competing with native plants for dune habitat (O'Connell, unpub. report, 2007). In other locations, this is not the

case and various control measures were implemented. Hand-pulling spotted knapweed has not been an effective means of control. In other locations, such as the Pointe Betsie Preserve, where spotted knapweed and baby's breath are invasive and compete with other native species, TNC (McGowan-Stinski, unpub. report, 2003) conducted a study and determined that invasive species, specifically baby's breath, were best controlled using a variety of methods, such as hand or spade removal, and spot-burning/prescribed burning in combination with the spade method for reducing dense patches. The effectiveness of the control methods was dependent upon the densities of baby's breath and Pitcher's thistle and the slope of the work area.

Flowerhead weevil

The flowerhead weevil was released in Walworth and Waukesha Counties in southeast Wisconsin in 1975, 1978 and 1980 to control musk thistles (*Carduus nutans*), its preferred host (Bradley 2007; Sauer and Bradley, in press). This weevil develops on multiple native *Cirsium* species in the United States (Goeden and Ricker 1986a, 1986b, 1987a, 1987b; Turner et al. 1987; Louda et al. 1997). Laboratory tests in the summer of 1999 demonstrated that the weevil oviposited on Pitcher's thistle, and that it fed and developed on Pitcher's thistle under common garden test plot conditions in Alberta, Canada (Louda et al. 2003). In a garden environment, taller plants of Pitcher's thistle with more flowerheads were significantly more vulnerable to the weevil (Louda et al. 2005). Thus, if the weevil spreads to the Pitcher's thistle range, and the Pitcher's thistle shows a comparable reduction in seed production, the flowerhead weevil may pose a serious threat to Pitcher's thistle seed production and regeneration (Louda et al. 1997, Louda 2000, Louda et al. 2005). Other insects introduced for the biological control of non-native thistle species may also threaten native thistles, including close relatives of Pitcher's thistle (Louda and O'Brien 2002).

During the summer of 2007, the Chicago Botanic Garden found a flowerhead weevil infestation on Pitcher's thistle in a garden plot (Jeremy Fant, CBG, pers. comm. 2007 and N. Pavlovic, pers. comm., 2007). The weevil was also located on musk thistles at the Illinois Beach State Park, which houses the first Pitcher's thistle reintroduction site (J. Fant, pers. comm., 2007.). Currently, it has been detected as far west as Lafayette County, Wisconsin; east to Racine and Kenosha Counties, Wisconsin, as far south as the CBG in Cook County, Illinois; and north to Washington County, Wisconsin (K. Bradley 2007).

Bradley (2007) estimated the weevil has moved at a rate of 3.14 km per year and has spread west and south from the original release sites. Based on the observed movement patterns and rate of movement, Bradley (2007) advised that the weevil will likely not reach Pitcher's thistle populations in some northeastern Wisconsin counties (Sheboygan, Door and Manitowoc) in the next 40 to 60 years if management activities prevent the spread of musk thistles northwards along Lake Michigan. However, Pitcher's thistle populations in northeastern Illinois and northern Indiana face the greatest risk of attack, since the weevil already occurs on the beaches in northeastern Illinois (Bradley 2007), but no

detection has occurred in Indiana (N. Pavlovic, pers. comm., 2007c). If the preferred host, musk thistle occurs on the coastal dunes of these states, it would pose a threat to the three Pitcher's thistle reintroduction sites. Musk thistles are present at INDU more than a mile from the nearest Pitcher's thistle site (N. Pavlovic, pers. comm., 2007c), but no one knows the distribution of the species between INDU and the closest source population of flowerhead weevil (Bradley 2007). If the weevil continues to spread northward, some Michigan populations may decrease as a result of seed reduction and regeneration (Louda et al. 1997, Louda 2000, Louda et al. 2005).

Climate Change

Climate change models predict that 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; Reznicek, pers. comm. 2004; Kling et al. 2003). Although AMEC (2006) and Kling et al. (2003) predict increased precipitation, the warmer temperatures will likely lead to increased evaporation and transpiration that does not compensate for precipitation, contributing to significant reductions in Great Lakes, river, and stream water levels.

Great Lakes and inland lake levels are expected to decline and occur more frequently in the future climate as temperatures increase and winter ice coverage decreases (AMEC 2006; Kling et al. 2003). As the Great Lakes recede, more dune formation will take place and Pitcher's thistle may follow this retreat in the basin (M. Penskar, pers. comm., 2009). On the other hand, some scientists expect global warming to 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 (Malcolm et al. 2002; AMEC 2006; M. Penskar, pers. comm., 2009).

2.4 Synthesis -

The Pitcher's thistle population is relatively stable, although fluctuations in population numbers at any site have and are occurring. These fluctuations are likely normal and are common for this species. Since the 1991 Five Year Review and publication of the recovery plan, Michigan has six new sites and INDU and Kenosha Dunes State Natural Area in Wisconsin have reintroduced populations. Reports of lost reintroduced sites do not exist. Because this species has a limited distribution, which in itself is not threat, actual threats from development and certain recreational activities may be amplified (M. DeCapita, USFWS, pers. comm., 2007). State and Federal (U.S. Army Corps of Engineers) laws and regulations provide reasonable protection, although development and recreational activities still continue on the dunes and in the lakeshore environment. The MDEQ requires permits that include conditions to avoid immediate loss of existing plants for development in Critical Dune Areas. In many cases, MDEQ permitted removal and transplanting of Pitcher's thistle to accommodate development activities.

Non-native and invasive species such as spotted knapweed, baby's breath, and Lombardy poplar occur at many sites regardless of management, and will require a continuous management regime. These species not only stabilize and disrupt the shifting mosaic of suitable Pitcher's thistle habitat, but researchers have concluded that non-native and invasive species also negatively influence the growth and development of Pitcher's thistle and other native species. Land managers and other stakeholders have used control and removal efforts to eradicate these non-native species with some success, depending upon location and densities of native and non-native species. The Nature Conservancy (McGowan-Stinski, unpub. report, 2003) found that using a variety of eradication methods together provides for more habitat restoration success than by any single method alone. Removal of non-natives also allowed for the return of sand movement and expansion of Pitcher's thistle (McGowan-Stinski, unpub. report, 2007).

The flowerhead weevil was purposely introduced as a biological control agent to eradicate musk thistles and has now slowly expanding its range south and westward from the original release site. Musk thistle (the native host of the weevil) occurs at the INDU over a mile away from the nearest Pitcher's thistle site (N. Pavlovic, pers. comm., 2007c). The flowerhead weevil will likely spread into Michigan without control efforts if the species and its host plant continue to be available.

For most occurrences, management agencies note the presence or absence of the species in certain locations, but we need additional systematic, comparable and quantitative information about habitat conditions and population trends, as well as expert qualitative observations of habitat or site conditions. The recovery plan briefly mentions threats by non-native invasive weeds and lacks detail on invasive species control. Management plans addressing this issue as well as other threats on Federal and State lands with essential habitat for Pitcher's thistle are needed. The recovery of Pitcher's thistle is highly feasible; however, the development and implementation of management plans, as stated in the recovery plan, is the mechanism for delisting, as most of the actions listed in the recovery criteria have already been initiated.

Scientists predict impacts to Great Lakes coastal dune plants, including Pitcher's thistle, as a result of climate change. Climate Change may increase drought frequency and McEachern et al. (1989) believes drought may account for the poor success of Pitcher's thistle populations at INDU and other southern locations. The warmer climate may cause a decrease in Great Lakes levels and as they recede dune formation will occur and may increase Pitcher's thistle habitat. However, invasive species, which are already a problem on the dunes, are expected to expand their range and thus increase competition. Impacts to this species and habitat are expected, but scientists are uncertain exactly how they will react to a changing climate.

Progress has been made in protecting some Pitcher's thistle occurrences from human-caused disturbances and invasive species encroachment. However, many occurrences lack routine management and are threatened by invasive species, including previously recognized threats such as flowerhead weevil, and possibly new threats. These threats may affect the existence of the Pitcher's thistle to the extent that it may become endangered in the foreseeable future throughout all or a significant portion of its range. Therefore, this species continues to meet the definition of threatened. The listing classification of the Pitcher's thistle should remain as threatened under the Endangered Species Act.

3.0 RESULTS

3.1 Recommended Classification:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist (*Indicate reasons for delisting per 50 CFR 424.11):*
____ *Extinction*
____ *Recovery*
____ *Original data for classification in error*
_X_ No change is needed

3.2 New Recovery Priority Number: No change is needed

3.3 Listing and Reclassification Priority Number: N/A

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- Plan and implement regular surveys and monitor occurrences at all Pitcher's thistle locations. Document habitat conditions and populations trends during these surveys.
- Conduct more research on the effects of non-native plants on Pitcher's thistle.
- Develop and implement management plans for all Federal and State lands.
- Reinitiate the landowner contact program in Michigan to protect occurrences on private land.
- Work with stakeholders to incorporate Pitcher's thistle into more management plans.
- Monitor approach of using biocontrol insects to eradicate non-native plants.

5.0 BIBLIOGRAPHY

AMEC Earth & Environmental. 2006. Coastal Zone and Climate Change on the Great Lakes – Final Report. Natural Resources Canada, Final Report, Climate Change Action Fund, 601 Booth Street, Ottawa, Ontario. July 2006. 162 pp.

Bell, T. J., Bowles, M. L., and A. K. McEachern. 2003. Projecting the success of plant population restoration with viability analysis. Pages 313-348 *in* C. A. Brigham and M. W. Schwartz (eds.). Population viability in plants. Springer-Verlag, Berlin.

Bell, T., M. Bowles, J. McBride, K. Havens, P. Vitt, and K. McEachern. 2002. Endangered Species Bulletin. Volume XXVII. No. 3: 14 – 15.

Bowles, M. L. and J. L. McBride. 1996. Pitcher's thistle (*Cirsium pitcheri*) reintroduction. Pages 423-431 in Falk, D.A., C.I. Millar, M. Olwell, editors. Restoring Diversity: Strategies for Reintroduction of Endangered Plants. Island Press, Washington, D.C.

Bradley, K. L. 2007. Quantifying the spatial distribution, abundance, and host use of the invasive insect, *Rhinocyllus conicus*, across Wisconsin and the greater Chicago area. Report to the Bureau of Endangered Resources, Wisconsin Department. of Natural Resources. Unpublished report. 32 pp.

Chen, H. and M. A. Maun. 1999. Effects of sand burial depth on seed germination and seedling emergence of *Cirsium pitcheri*. Plant Ecology 140:53-60.

Dobberpuhl, J. M. and T. C. Gibson. 1987. Status surveys and habitat assessment of plant species. I. *Cirsium pitcheri* (Torr.) T. and G. Wisconsin Department of Natural Resources, Project E-1, Study 808, Madison, Wisconsin. 17 pp.

Girdler, E. B. and T. A. Radtke. 2006. Conservation implications of individual scale spatial pattern in the threatened dune thistle, *Cirsium pitcheri*. American Midland Naturalist 156: 213-228.

Goeden, R. D. and D. W. Ricker. 1986a. Phytophagous insect faunas of the two most common native *Cirsium* thistles, *C. ochrocentrum* and *C. vulgare*, in southern Califiornia. Annals of the Entomological Society of America 79:953-962.

Goeden, R. D. and D. W. Ricker. 1986b. Phytophagous insect faunas of two introduced *Cirsium* thistles, *C. ochrocentrum* and *C. vulgare*, in southern California. Annals of the Entomological Society of America 79:945-952.

Goeden, R. D. and D. W. Ricker. 1987a. Phytophagous insect faunas of native *Cirsium* thistles, *C. mohavense, C. neomexicanum*, and *C. nidulum*, in the Mojave Desert of southern California. Annals of the Entomological Society of America 80:161-175.

Goeden, R. D. and D. W. Ricker. 1987b. Phytophagous insect faunas of native thistles, *Cirsium brevistylum*, *C. congdonii, C. occidentale*, and *C. tioganum*, in the Mojave Desert of southern California. Annals of the Entomological Society of America 80:152-160.

Hamzé, S. I. and C. L. Jolls. 2000. Germination ecology of a Federally threatened endemic thistle of the Great Lakes, *Cirsium pitcheri*. American Midland Naturalist 143:141-153.

Keddy, C .J. and P. A. Keddy. 1984. Reproductive biology and habitat of *Cirsium pitcheri*. Michigan Botanist 23:57-67.

Kling, G. W., K. Hayhoe, R. L. Lindroth, J. J. Magnuson, M. Wander, M. Wilson, D. J. Wuebbles, and D. Zak. 2003. Confronting Climate Change in the Great Lakes Region, Impacts on Our Communities and Ecosystems – Executive Summary. A Report of The Union of Concern Scientists and The Ecological Society of America. Updated 2005. 92 pp. Retrieved September 4, 2009 from www.ucsusa.org/assets/documents/global_warming/gl-exec-summary-update-05-doc.pdf.

Lake Michigan Development Commission. 1987. Indiana Boating: Creating a wave of economic growth. Pamphlet. 12 pp.

Loope, W. L., C. L. Siterlet and A. P. McKenna. 1995. Distribution and experimental management of *Gypsophila paniculata* (baby's breath) within Sleeping Bear Dunes National Lakeshore. Phase I: Initial Assessment and plot establishment, Summer 1995. Unpublished report. 87 pp.

Louda, S. M. 2000. Negative ecological effects of the musk thistle biocontrol agent, *Rhinocyllus conicus* Frol. Pages 215-243 in Follett, P.A. and J.J. Duan, editors. Nontarget effects of biological control. Kluwer Academic Publishers, Dordrecht.

Louda, S. M. and A. K. McEachern. 1995. Insect damage to inflorescences of the threatened dune thistle, *Cirsium pitcheri*. Bulletin of the Ecological Society of America 76:125.

Louda, S. M. and C. W. O'Brien. 2002. Unexpected ecological impacts of redistributing the exotic weevil, *Larinus planus* (F.), for the biological control of Canada thistle. Conservation Biology 16:717-727.

Louda, S. M., A. E. Arnett, T. A. Rand, and F. L. Russell. 2003. Invasiveness of some biological control insects and adequacy of their ecological risk assessment and regulation. Conservation Biology 17 (1), 73–82.

Louda, S. M., D. Kendall, J. Connor, and D. Simberloff. 1997. Ecological effects of an insect introduced for the biological control of weeds. Science 277: 1088-1090.

Louda, S. M., T. A. Rand, K. Bradley, and K. Crider. Unpublished, 2007. The effect of spotted knapweed, *Centaurea maculosa*, on germination and survival of the rare, threatened Pitcher's thistle, *Cirsium pitcheri*, depends on environmental context.

Louda, S. M., T. A. Rand, A. E. Arnett, A. S. McClay, K. Shea, and A. K. McEachern. 2005. Evaluation of ecological risk to populations of a threatened plant from an invasive biocontrol insect. Ecological Applications 15(1): 234-249.

Loveless, M. D. 1984. Population biology and genetic organization in *Cirsium pitcheri*, an endemic thistle. Ph.D. Dissertation, University of Kansas, Lawrence, Kansas. 109 pp. + appendices.

Loveless, M. D. and J. L. Hamrick. 1988. Genetic organization and evolutionary history in two North American species of *Cirsium*. Evolution 42(2):254-265.

Malcolm, J.R., A. Markham, R.P. Neilson, and M. Garaci. 2002. Estimated migration rates under scenarios of global climate change. J. Biogeography. 29:835-849.

McEachern, A. K. 1992. Disturbance dynamics of Pitcher's Thistle (*Cirsium pitcheri*) populations in Great Lakes Sand Dune Landscapes. Ph.D. Dissertation, University of Wisconsin-Madison. 216 pp.

McEachern, A. K., J. A. Magnuson and N. B. Pavlovic. 1989. Preliminary results of a study to monitor *Cirsium pitcheri* in Great Lakes National Lakeshores. National Park Service Report, Science Division, Indiana Dunes National Lakeshore, Porter, Indiana. 96 pp.

Michigan Department of Environmental Quality (MDEQ), Office of the Geological Survey. 2004. Sand Dune Mining Annual Report (Fiscal Year 2003-2004). Lansing, Michigan. Retrieved September 4, 2007 from www.deq.state.mi.us/documents/deq-ogs-land-sanddune-Report2000.pdf

Michigan Department of Environmental Quality (MDEQ), Office of the Geological Survey. 2005. Dune production statistics. Lansing, Michigan. Retrieved August 14, 2009 from www.michigan.gov/documents/deq/ogs-sdm-SandProd2000_263333_7.pdf

Michigan Natural Features Inventory (MNFI). 2009. Element occurrence records, *Cirsium pitcheri*. Computer database. Michigan Natural Features Inventory, Lansing, Michigan.

O'Connell, P. 2007. Unpublished Report. 2006 Pitcher's Thistle Monitoring Report. Cadillac-Manistee Ranger District Huron-Manistee National Forests. 15 pp. + Appendices.

O'Connell, P. and S. Stephens. 2002. Unpublished Report. Pitcher's Thistle Monitoring Report. Cadillac-Manistee Ranger District, Huron-Manistee National Forests. 14 pp. + Appendices.

Perumal, V. J. and M. A. Maun. 2006. Ecophysiological response of dune species to experimental burial under field and controlled conditions. Plant Ecology 184: 89-104.

Rowland, J. and M. A. Maun. 2001. Restoration ecology of an endangered plant species: establishment of new populations of *Cirsium pitcheri*. Restoration Ecology 9(1): 60-70.

Sauer, S. and K. L. Bradley. In press. First record for the biological control agent *Rhinocyllus conicus* (Coleoptera: Curculionidae) in a threatened native thistle, *Cirsium hillii*, in Wisconsin. Entomological News.

Turner, C. E., R. W. Pemberton and S. S. Rosenthal. 1987. Host utilization of the native *Cirsium* thistles (Asteraceae) by the introduced weevil *Rhinocyllus conicus* (Coleoptera: Curculionidae) in California. Environmental Entomology 16:111-115.

U. S. Fish and Wildlife Service. 2002. Pitcher's Thistle (*Cirsium pitcheri*) Recovery Plan. Fort Snelling, Minnesota. vii + 92 pp.

Additional contributing materials:

Bell, Tim. 2008. Pitcher's thistle end of year reporting. Email message; August 29, 2008. On file at USFWS, East Lansing Field Office, East Lansing, Michigan.

Fahlsing, Ray. 2009. Pitcher's thistle/invasive species control/management at State parks. Email message; July 7, 2009. On file at USFWS, East Lansing Field Office, East Lansing, Michigan.

Fant, Jeremie. 2007. DNR report – please do not distribute with Ms. Bradley's permission. Email message; December 19, 2007. On file at USFWS, East Lansing Field Office, East Lansing, Michigan.

Kind, Darcy. 2007. Pitcher's thistle landowner contact program. Email message; January 22, 2007. On file at USFWS, East Lansing Field Office, East Lansing, Michigan.

McEachern, Kathryn. 2008. Pitcher's thistle end of year reporting. Email message; September 3, 2008. On file at USFWS, East Lansing Field Office, East Lansing, Michigan.

Pavlovic, Noel. 2003. INDU thistles. Email message; August 26, 2003. On file at USFWS, East Lansing Field Office, East Lansing, Michigan.

Pavlovic, Noel. 2007a. Pitcher's thistle. Email message; January 19, 2007. On file at USFWS, East Lansing Field Office, East Lansing, Michigan.

Pavlovic, Noel. 2007b. Pitcher's thistle. Email message; February 5, 2007. On file at USFWS, East Lansing Field Office, East Lansing, Michigan.

Pavlovic, Noel. 2007c. Rhinocyllus conicus. Email message; August 3, 2007. On file at USFWS, East Lansing Field Office, East Lansing, Michigan.

Pavlovic, Noel. 2007d. Restoration sites. Email message; December 18, 2007. On file at USFWS, East Lansing Field Office, East Lansing, Michigan.

Pavlovic, Noel. 2008. Pitcher's thistle end of year reporting. Email message; August 25, 2008. On file at USFWS, East Lansing Field Office, East Lansing, Michigan.

Penskar, Mike. 2009. Pitcher's thistle and climate change. Email message; August 26, 2009. On file at USFWS, East Lansing Field Office, East Lansing, Michigan.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Pitcher's thistle

Current Classification: Threatened

Recommendation resulting from the 5-Year Review:

____ Downlist to Threatened
____ Uplist to Endangered
____ Delist
__X__ No change needed

Appropriate Listing/Reclassification Priority Number, if applicable:

Review Conducted By: Tameka Dandridge

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve _____ Date 12/24/09

REGIONAL OFFICE APPROVAL:

Lead Assistant Regional Director, Ecological Services, Fish and Wildlife Service

Approve Lynn M. Lewis Date 2/5/10

6.0 APPENDICES

Appendix 1. The NatureServe Element Global Ranking Criteria for *Cirsium pitcheri*

Rank Specification	Habitat	Population and Vigor
A	Extensive, dynamic dune systems of more than 250 acres in size and greater than two miles in length, with a broad foredune. Dune processes have not been altered in any unnatural way, nor are threatened by any immediate unnatural event (development, offshore construction, etc.). Dune stabilization by plants is minimal and temporary and is part of a dynamic ecosystem.	A population consisting of more than 5000 individuals. Existing plants occupy both juvenile and adult cohorts, indicating successful population maintenance.
B	Dune system 100-250 acres in size and 2-4 miles in length. Dune habitat is dynamic and open, without sign of alterations in natural dune system processes. Stabilization by plants is minimal; OR, habitats of more than 250 acres in size that show moderate signs of stabilization and other hindrances of dune dynamics.	A population of 500-5000 individuals occupying both juvenile and adult cohorts. Population structure is such as to maintain or enhance existing populations.
C	Dune systems 50-100 acres in size and 0.5-2 linear miles of dune system habitat. Habitat of this size may begin to show problems associated with maintenance of appropriate *C. pitcheri* habitat. Fracturing of habitat due to development pressure, etc. may be noticeable, particularly in the smaller sizes.	A population of 100-500 individuals.
D	Dune systems of less than 50 acres in size and less than 0.5 miles in length. In such systems, dune processes have likely ceased to function adequately in maintaining the dynamic nature of the habitat. Off-shore and shoreline structures, fracturing of the landscape by development, fence and retaining wall construction, etc., may have added additional degradation to the site. Excessive stabilization by *Andropogon scoparius*, *Ammophila breviligulata* and shrubs may have occurred in available habitat. Little likelihood of future recovery exists.	A population of less than 100 individuals; OR, populations larger than 100 individuals in which maintenance as indicated through inappropriate age structure, is doubtful or of serious concern.

NatureServe. 2001. Natural Heritage Central Databases. Arlington, VA. USA. This information is provided by NatureServe (www.natureserve.org) and its natural heritage member programs, a leading source of information about rare and endangered species, and threatened ecosystems.

Appendix 2. Pitcher's thistle monitoring results, Manistee National Forest, Manistee County, Michigan (1993–2006).

Site 1 (North LMRA)	**1993**	**1996**	**2001**	**2006**
Seedlings	1	1	0	57
1-4 Leaves	27	53	10	18
5-12 Leaves	17	97	36	59
13-25+ Leaves	1	15	3	23
Total Juvenile Plants (1-25+ Leaves)	45	165	50	100
Total Juvenile and Seedling Plants	46	166	50	157
Adult Plants	1	7	5	13
Total Plants	**47**	**173**	**54**	**170**

Site 2 (South LMRA)	**1993**	**1996**	**2001**	**2006**
Seedlings	0	0	0	20
1-4 Leaves	7	48	7	2
5-12 Leaves	20	37	21	18
13-25+ Leaves	10	11	4	12
Total Juvenile Plants (1-25+ Leaves)	37	96	32	32
Total Juvenile and Seedling Plants	37	96	32	52
Adult Plants	7	3	3	2
Total Plants	**44**	**99**	**35**	**54**

Site 3 (North Wilderness)	**1993**	**1996**	**2001**	**2006**
Seedlings	0	0	0	0
1-4 Leaves	0	0	0	0
5-12 Leaves	1	1	0	3
13-25+ Leaves	1	1	0	0
Total Juvenile Plants (1-25+ Leaves)	2	2	0	3
Total Juvenile and Seedling Plants	2	2	0	3
Adult Plants	0	0	0	0
Total Plants	**2**	**2**	**0**	**3**

Site 4 (Wilderness Shoreline)	**1993**	**1996**	**2001**	**2006**
Seedlings	0	6	2	21
1-4 Leaves	3	22	7	16
5-12 Leaves	11	21	36	89
13-25+ Leaves	9	3	26	59
Total Juvenile Plants (1-25+ Leaves)	23	46	69	164
Total Juvenile and Seedling Plants	23	52	71	185
Adult Plants	3	0	8	15
Total Plants	**26**	**52**	**79**	**200**

Site 5 (RNA)	1993	1996	2001	2006
Seedlings	0	10	44	3
1-4 Leaves	11	34	14	14
5-12 Leaves	18	68	74	31
13-25+ Leaves	10	5	41	38
Total Juvenile Plants (1-25+ Leaves)	39	107	129	83
Total Juvenile and Seedling Plants	39	117	173	86
Adult Plants	4	3	7	3
Total Plants	**43**	**120**	**180**	**89**

Site 6 (South Blowout)	1993	1996	2001	2006
Seedlings	1	132	13	10
1-4 Leaves	64	83	7	64
5-12 Leaves	58	11	62	185
13-25+ Leaves	25	6	17	56
Total Juvenile Plants (1-25+ Leaves)	147	100	86	305
Total Juvenile and Seedling Plants	148	232	99	315
Adult Plants	14	2	4	13
Total Plants	**162**	**234**	**103**	**328**

Site 7 (North Blowout)	1993	1996	2001	2006
Seedlings	6	22	0	11
1-4 Leaves	97	90	8	21
5-12 Leaves	91	148	44	82
13-25+ Leaves	19	8	8	30
Total Juvenile Plants (1-25+ Leaves)	207	246	60	133
Total Juvenile and Seedling Plants	213	268	60	144
Adult Plants	21	2	8	3
Total Plants	**234**	**270**	**68**	**147**

Site 8 (Cooper Creek)	1993	1996	2001	2006
Seedlings	6	17	0	10
1-4 Leaves	50	110	9	19
5-12 Leaves	107	287	52	43
13-25+ Leaves	21	31	7	11
Total Juvenile Plants (1-25+ Leaves)	178	428	68	73
Total Juvenile and Seedling Plants	184	445	68	83
Adult Plants	9	6	9	3
Total Plants	**193**	**451**	**77**	**86**

Total for All Eight Monitoring Sites	**1993**	**1996**	**2001**	**2006**
Seedlings	14	188	59	132
1-4 Leaves	259	440	62	154
5-12 Leaves	323	670	325	510
13-25+ Leaves	96	80	106	229
Total Juvenile Plants (1-25+ Leaves)	678	1190	493	893
Total Juvenile Plants and Seedlings	692	1378	552	1025
Adult Plants	59	23	44	52
Total Plants	**751**	**1401**	**596**	**1077**

Appendix 3. Annual Pitcher's thistle monitoring results, Whitefish Dunes State Park, Sturgeon Bay, Wisconsin (1989-2008).

Year	Total number	Water level	Beach	Comment
1989	206			Only south end & Old Baldy counted
1990	680			
1991	984			
1992	1024			
1993	966			
1994	1490			
1995	1358			
1996				Missing Data
1997		high	closed	Missing Data
1998		high	open in August	Missing Data
1999	2235		open	Nursery count only
2000	1998		open	Nursery count only, bad weather may not have counted all plants.
2001	6603		open	No Old Baldy Count
2002	9284	low	open	
2003	6738	low	open	
2004	9760	low	open	
2005	10722			
2006	12352			
2007	9641			
2008	12164			

Total plants per ageclass for years 2001 – 2008.

Ageclass	***2001***	***2002***	***2003***	***2004***	***2005***	***2006***	***2007***	***2008***
Seedlings	1507	3152	1009	2918	1827	1452	1530	2053
More than 4 leaves & < 12"	2757	2694	1215	2747	8011*	9750*	6599*	8228*
More than 4 leaves & > 12"	1563	2299	3399	2957				
Adults	776	1139	1115	1138	842	1180	1512	1883
Total	6603	9284	6738	9760	10722	12382	9641	12164

*Population numbers were combined for juveniles with more than 4 leaves.

Appendix 4. 2004 and 2006 Pitcher's thistle count results, P.J. Hoffmaster State Park, Muskegon County, Michigan. The state park has 9 major blowouts or dunes; site number 3.5 is the smallest and newest.

2004

Age class

Site No.	Seedling: 4 leaves or less	Small juvenile: >4 leaves & <12 inches	Large juvenile: >4 leaves & <12 inches	Adults: in flower or standing dead	Total
1	315	256	120	43	734
2	4	52	31	11	98
3	45	120	99	32	296
3.5	160	229	104	51	544
4	13	50	51	22	136
5	372	354	350	223	1299
6	75	202	143	91	511
7	36	25	7	5	73
8	222	244	147	84	697
Total	**1242**	**1532**	**1052**	**562**	**4388**

2006

Age class

Site No.	Seedling: 4 leaves or less	Small juvenile: >4 leaves & <12 inches	Large juvenile: >4 leaves & <12 inches	Adults: in flower or standing dead	Total
1	45	142	107	46	340
2	8	34	41	21	104
3	19	85	103	35	242
3.5	51	249	125	70	495
4	1	34	74	13	122
5	189	638	344	234	1405
6	39	134	83	31	287
7	1	26	25	17	69
8	196	545	606	143	1490
Total	**549**	**1887**	**1508**	**610**	**4554**