Pitcher's Thistle
(Cirsium pitcheri)

Status Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
Michigan Ecological Services Field Office
East Lansing, MI

STATUS REVIEW
Pitcher's Thistle (*Cirsium pitcheri*)

GENERAL INFORMATION

Species: Pitcher's thistle (*Cirsium pitcheri*)

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Cooperating Regional Office(s): N/A

Date of listing publication: July 18th, 1988

FR citation(s): 53 FR 27137 - 27141

Classification: Threatened species

Methodology used to complete the review:

In accordance with section 4(c)(2) of the Endangered Species Act of 1973, as amended (Act), the purpose of a status review is to assess each threatened species or endangered species to determine whether its status has changed and if it should be classified differently or removed from the Lists of Threatened and Endangered Wildlife and Plants. The U.S. Fish and Wildlife Service (Service) evaluated the biology and status of the Pitcher's thistle to inform this status review.

This 5-year review was conducted by the Service's Michigan Ecological Services Field Office. Data for this review were solicited from interested parties through a *Federal Register* notice announcing this review on January 13, 2022. We also contacted the Michigan Natural Features Inventory, Michigan Department of Natural Resources, Wisconsin Department of Natural Resources, Chicago Botanical Garden, Door County Land Trust, Chicago State University, University of Wisconsin, Lawrence University, The Nature Conservancy, Huron Pines, federal agencies, and other conservation partners to request any data or information we should consider in our review. Additionally, we conducted a literature search and a review of information in our files.

The information below summarizes substantive new information since our previous 5-year review in 2018.

FR Notice citation announcing the species is under active review: January 13, 2023 (88 FR 2368)

Review History:

U.S. Fish and Wildlife Service. 2011. Pitcher's thistle (*Cirsium pitcheri*) 5-Year Review: Summary and Evaluation. East Lansing Field Office, East Lansing, MI. 29 pp. Finalized – February 05, 2010.

U.S. Fish and Wildlife Service. 2018. Pitcher's thistle (*Cirsium pitcheri*) 5-Year Review: Summary and Evaluation. East Lansing Field Office, East Lansing, MI. 8 pp. Finalized – September 26, 2018.

REVIEW ANALYSIS

Recovery Criteria
Recovery Plan or Outline: Pitcher's Thistle (*Cirsium pitcheri*) Recovery Plan (09/20/2002)

We are working with the U.S. Geological Survey, Great Lakes Science Center, on a Pitcher's Thistle Synthesis that includes an integration of population, genetic and landscape conditions of Pitcher's thistle (PITH) populations, climate change vulnerability, and testing a new approach for assessing extinction risk (expected completion December 2023). This synthesis may indicate a need to revise the delisting criteria. There are six delisting criteria for PITH. Criterion 1 requires the essential habitat associated with a total of 115 priority occurrences of PITH that represent each biogeographic region and dune type is protected and managed under a management plan for each management unit. Criterion 2 requires regular field surveys to verify occurrences and record new occurrences of PITH that have been established. Criterion 3 requires the contact with landowners to be initiated and investigate the protection for the remaining (rank<BC) public and private occurrences of PITH. Criterion 4 requires known sites be monitored and they show a stable or increasing trend toward recovery, and that protective plans are being implemented. Criterion 5 requires restoration of two PITH occurrences from historical sites where sufficient habitat remains in Illinois, Indiana, Wisconsin, and southern Lower Michigan. Lastly, Criterion 6 requires necessary research be conducted to protect, manage and restore PITH. Progress has been made toward all 6 criteria with additional information provided below; data continues to be analyzed to determine our level of recovery and help to inform the Species Status Assessment (SSA).

Updated Information and Current Species Status

Biology and Habitat:

Population demographics:
NatureServe (2023) notes there "are an estimated 50,000 plants in Canada, 10,000 to 20,000 in Wisconsin, 500-1000 in Indiana, and possibly over 1,000,000 individuals in Michigan (Slaughter and Cuthrell 2017)" and that over "the last 10 years this species has remained stable in Michigan, stable to slightly increased in Canada, declined >50% in Indiana, and stable to declined <25% in Wisconsin."

In Canada, many populations appear robust, including many that have increased in size since 2000 when it was assessed as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2010). Fieldwork, which includes annual surveys and monitoring, since 2000 has significantly increased the size of the total known Canadian population of PITH from approximately 10 sites to currently 45 sites.

Several studies have examined the PITH's ability to disperse to other locations, and subsequently, the likelihood of its extinction. One Canadian study found that many PITH populations have a high probability of either extinction or undergoing a 50% decline at some point in the future, mainly due to steady declines experienced by small populations (Nantel et al. 2018). However, it was also stated that multi-population stochastic projections and the projected growth of many large individual populations indicate that PITH is likely to persist in Canada over the next 100 years, assuming past conditions continue in the future (Nantel et al. 2018). Danielson (2019) examined the population of PITH at the Grand Sable Dunes within Pictured Rocks National Lakeshore and found its population during 2011–2018 suggested a slight decline. Continued observations on the species are needed to further ascertain if this population decrease is of concern.

Along with dispersal capabilities, other variables, including research on flowerheads and seeds, have helped to inform likelihood of PITH persistence on the landscape. Previous research (Gijsman et al. 2020) has shown differences in the number and weight of PITH seeds among the PITH flower head positions and study sites. Researchers furthered this work by examining the effects of seed attributes (flower head position, seed weight, and site of origin) on the proportion and timing of PITH seed germination under temperature treatments that simulate projected climate warming in the Great Lakes (20/10, 25/10, and 30/10°C day/night) (Gijsman & Vitt 2021). The researchers were able to determine that PITH seed germination proportions were highest at 20°C and decreased successively at 25°C and 30°C. Seeds from terminal capitula also had higher germination proportions and took longer to germinate than those from secondary capitula.

In addition to temperatures, recruitment time lags in seedling recruitment from reintroductions can also be a driver of intergenerational persistence. Previous research has shown that PITH population dynamics fluctuate widely across wind-driven successional gradients (Bell et al. 2003), and while there is limited data available to determine the causes of within-species variation, the large variation in recruitment intervals captured in the research of Albrecht et al. (2019) states that local processes (e.g., competition, herbivory, and disturbance) are just as important as traits and other factors on recruitment. In turn, this may be one reason why founder size and propagule stage were less powerful predictors of recruitment than reproductive adult abundance, which better reflects the suitability of a reintroduction location to support population growth (Albrecht et al. 2019).

Genetics:

Sefton (2020) used eight microsatellite loci to investigate the population structure, genetic variation, and isolation by distance trends in PITH across 21 Lower Peninsula, Upper Peninsula, and island sites in Michigan. The genetic diversity of PITH investigated in Sefton (2020)

research was fairly low across sites, and similar to the levels of genetic diversity found by Gauthier et al. (2010) in Ontario and Fant et al. (2014) in Indiana, Michigan, and Wisconsin. These low levels of genetic diversity consistently found in studies of PITH are indicative of widespread isolation, resulting in loss of genetic variation. Failure to find consistent evidence of recent genetic bottlenecks at any of the sample sites except one suggests that the low levels of genetic variation observed are likely due to small population size rather than bottleneck events.

Taxonomic and nomenclature:
There are no changes in taxonomic classification or nomenclature.

Range and distribution:

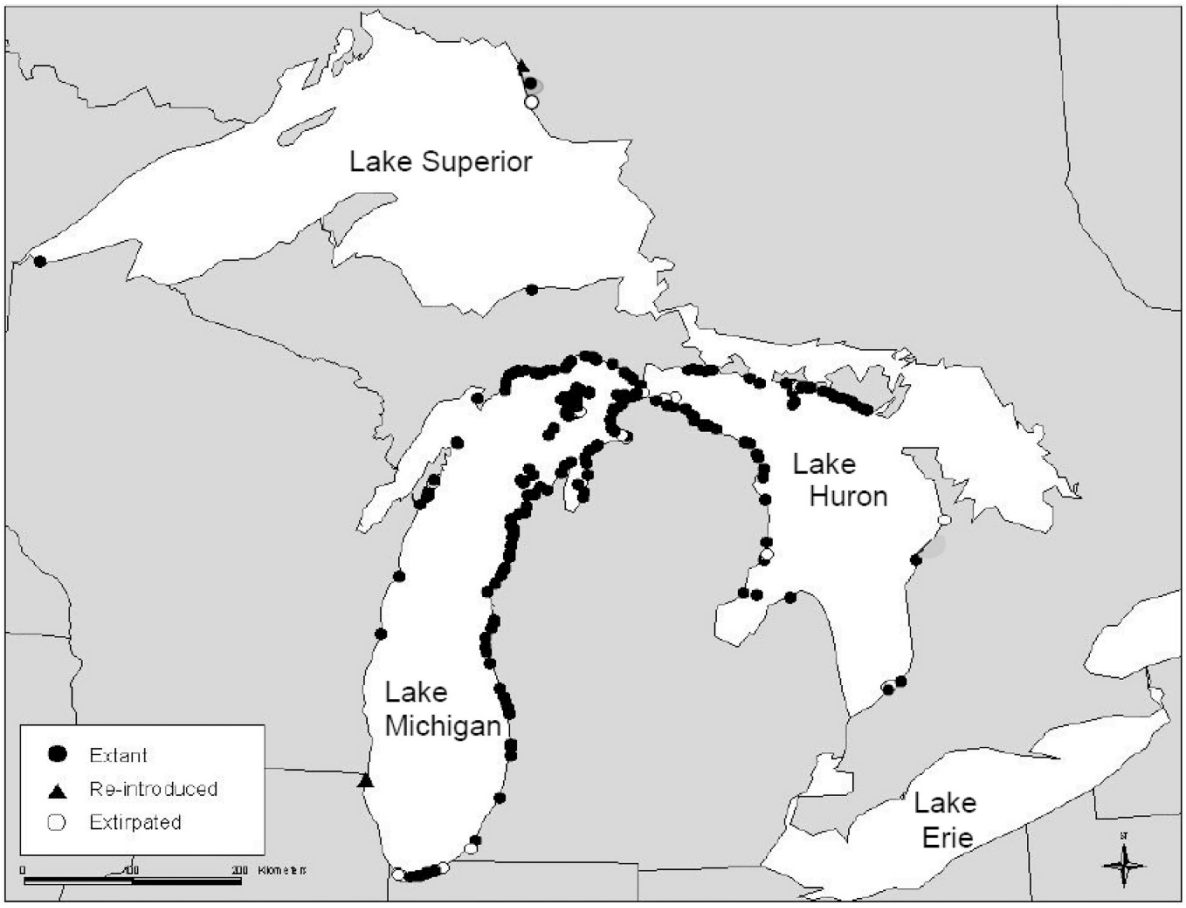

Figure 1. Map of PITH global occurrences (sources: Parks Canada Agency 2011, Nantel et al. 2018).

There is a total of 222 known occurrences of PITH in the United States (Figure 1). In Michigan, there are 182 extant occurrences, in Indiana there are 24 extant occurrences, in Illinois there are 5 known occurrences, and in Wisconsin there are 11 extant occurrences (personal comm. Pavlovic 2023). At the time of the previous 5-year review in 2018, several of the EOs that were found to be decreasing were located in southern Lower Michigan (Slaughter and Cuthrell 2017), and it was stated that inbreeding depression and other factors could leave EOs in southern Michigan

prone to extirpation, resulting in fragmentation and isolation of remaining colony sites in other parts of the southern Great Lakes (Gauthier et al. 2010, Slaughter and Cuthrell 2017).

There are 45 populations of PITH now known in Canada. Three populations at Pukaskwa National Park were surveyed annually between 1982 and 2015, and an additional 33 populations on Lake Huron were monitored annually between 2000 and 2017, with methods standardized in 2004 (Nantel et al. 2018). Monitoring at each location consisted in recording the total number of plants by life stage (i.e., seedling, rosette, or mature/flowering). Overall, habitat size increased from 2000 to 2010, stayed relatively constant until 2015, and has decreased since then (Nantel et al. 2018).

Habitat:
Rivera et al. (2021) determined that increasing temperature and decreasing soil moisture significantly predicted the presence of PITH across Beaver Island. However, while these factors predicted PITH presence at a site, they did not correlate with the growth of individuals. Further, their results indicated that PITH can disperse to and establish in wet and more densely vegetated dune habitats (e.g., wet swales), and that established individuals are just as likely to be successful in these sites as in their more "typical" (e.g., open, dry, sandy areas) habitats.

Additional information (Pollinators):
PITH may act as an important resource for pollinators on the landscape. In one study, PITH received 18.2% of all 600 recorded visits, 61.1% more than the next most visited plant, and they also received visits from 22 of the 59 different insect species in the network, twice as many as the next most visited plant species (Jolls et al. 2019). Further, Vitt et al. (2020) investigated the role of plant species in a plant–pollinator network across the entire flowering season and across dune and adjacent woodland habitats in Wisconsin, USA. The researchers found that both native and exotic species play important structural roles in plant– pollinator networks, however, simulations showed that losing of the PITH on the landscape would result in a disproportionate loss of pollinator species (Vitt et al. 2020).

The pollinator type may also be critical to the success of a PITH population. Marshall (2018) quantified insect visitors to flowers and their effectiveness in pollination of PITH within established populations in Indiana Dunes National Lakeshore and Indiana Dunes State Park to determine if subsequent seedling presence was a surrogate for seed viability. The study found a total of 14 insect families were observed visiting PITH plants during 2012 and 2013 (Marshall 2018). Of the observed families, only Apidae (bees) counts were significantly correlated with subsequent year seedling counts, indicating that Apidae species may be disproportionally valuable to PITH compared to other species.

Threats Analysis (threats, conservation measures, and regulatory mechanisms):

As discussed in more detail below, two primary threats are most frequently noted for PITH populations, invasive plants and recreational use (primarily beach use and foot traffic in dunes, but also in some locations from off-road vehicle users). Additionally, shoreline stabilization projects, high-water levels, and climate change interactions may alter local dune geomorphic

processes affecting the creation and maintenance of PITH habitat. Significant attention is also focused on resolving the potential impact from an invasive weevil that feeds on PITH seed heads.

Conservation Measures:

Great Lakes Restoration Initiative

Under the Great Lakes Restoration Initiative (GLRI) Action Plan III, federal agencies and their partners are continuing to work to maintain, restore, and enhance the habitats of native fish and wildlife species to increase the resiliency and overall health of these species. The GLRI has provided critical funding for PITH conservation efforts beginning in 2010. Since the last five-year review, GLRI supported PITH related projects that allowed the National Park Service and U.S. Forest Service to control invasive plants impacting PITH habitat and assess the invasive weevil threat. Additionally, GLRI has allowed land managers to collaborate with the Chicago Botanical Gardens and the U.S. Geological Survey's Great Lakes Science Center. With this funding, a PITH range-wide status and viability assessment was conducted, which included surveys at two sites in Door County, Wisconsin and one site in northern Michigan at Wilderness State Park, Indiana, and the Upper Peninsula of Michigan. In addition to the range assessment, a threat assessment was incorporated in surveys to determine the threat posed by biocontrol insects and climate change. This threat assessment included including the documentation of changes in successional dynamics particularly at the southern edge of the species range, fluctuations in overall population size in response to lake level dynamics, and decline in pollination services rendered by native bees, including several species of *Bombus*. The effects of each of these are in the process of being modeled, using integral projection models (IPM) across the range of PITH to prioritize management actions and sites that are critical for species recovery and to provide data needed for the Species Status Assessment. To better capture the PITH geospatial data, the USGS Great Lakes Science Center is collating a GIS database of all the known and extirpated element occurrences of PITH in the US, evaluating each occurrence regarding demographic, biological (invasive plants and insects, and goldfinch seed predation), habitat, metapopulation and landscape condition in relation to occurrence viability (ongoing), and lastly, synthesizing threats for an overall assessment of viability for each occurrence and regional evaluation of viability. The data and information from these efforts are helping to inform the overall status of the species and assist with the future Species Status Assessment.

Threats

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

Development

At the time of the 2002 Recovery Plan, about 39% of the extant occurrences in the U.S. were in public ownership and an additional 20% occurred on a mix of public and private ownership. The public ownership includes populations at three National Park Service units, two National Forests, two National Wildlife Refuge units, several State Parks, and other types of protected State or local public lands. In addition, several PITH occurrences are on privately held land conservation lands (e.g., Door County Land Trust, Land Conservancy of West Michigan, Little Traverse Conservancy, Michigan Nature Association, The Nature Conservancy, etc.). In Canada, of the 30

total extant populations assessed in 2010, 4 small populations were noted in National or Provincial parks (COSEWIC 2010). As part of the Species Status Assessment, we will update and access the land ownership of the PITH occurrences as part of evaluating potential threats.

Private lands supporting PITH are subject to both pressures for new development and shore protection for existing structures. Between 1992 – 2001, over 21% of all newly developed land within the Great Lakes watershed occurred within 10 km of the Great Lakes shoreline (an area which makes up 0.27% of the watershed) (Wolter et al. 2006). Much of this loss of shoreline habitat is due to urban or suburban sprawl, including second home development (Wolter et al. 2006). The strongest predictors of the distribution of second homes in the Upper Great Lakes were the presence of natural areas and the presence of water (Shellito 2006). When Great lakes water levels are high the demand for adding shoreline protection measures can increase significantly. The State of Michigan reported a nearly ten-fold increase in approved permits Great Lakes shoreline protection from Fiscal Year (FY) 2019 to FY2020's total (i.e., 2,238 shoreline protection permits approved in FY2020). Several PITH populations are also affected by sand mining (Slaughter and Cuthrell 2017). The loss and development of shoreline habitat makes it more difficult for shoreline ecosystems to shift in space with water level fluctuations as they once could.

Recreational Activities

The shorelines of the Great Lakes are a very popular area for many recreational activities. Potential human impacts to PITH from these activities include trampling by foot and destruction from off-road recreational vehicle use (including direct impact to individuals, habitat alteration, and introduction of invasive species; e.g., Slaughter and Cuthrell 2017).

Great Lakes Water Levels

Since forming at the end of the Ice Age, the Great Lakes' water levels have continually fluctuated. The Wisconsin Department of Natural Resources (2023) notes that the "annual change in water levels is from 11 to 20 inches. In addition to annual changes, long-term lake levels fluctuate on a 10-year to 30-year cycle. On Lake Michigan, the difference between the record low and high-water levels is greater than 6 feet". According to the U.S. Army Corps of Engineers (2023), water level fluctuations are the result of "natural climate variability occurring from season-to-season, year-to-year, and from decade-to-decade. The record of measured lake levels (more than 140 years) is inadequate to confidently predict lake levels that will occur in the next 20, 50 or 100 years". Sandy beaches, ridges and banks advance and retreat as water levels rise and fall, storms re-occur, and sand supplies change. These fluctuations affect the extent of shoreline erosion and the littoral processes that play a key role in creating and maintaining PITH habitat.

High water levels and associated flooding events on the shorelines of the Great Lakes in 2020 inundated some shoreline populations and caused temporary loss of habitat. These populations may rebound when water levels lower. We intend to more fully evaluate the risks related to climate change, including fluctuating Great Lakes water levels, on PITH populations by conducting a Species Status Assessment after the USGS synthesis is completed.

Climate change

As defined by the Intergovernmental Panel on Climate Change (IPCC), "climate" refers to average weather, typically measured in terms of the mean and variability of temperature, precipitation, or other relevant properties over time; thus "climate change" refers to a change in such a measure which persists for an extended period, typically decades or longer, due to natural conditions (e.g., solar cycles) or human–caused changes in the composition of the atmosphere or in land use (IPCC 2013). Climate change has impacted, and will continue to impact, the physical, chemical, and biological properties of the Great Lakes and the adjoining coastal ecosystems (Schmitt et al. 2022). Anticipated changes that may affect PITH include increased periods of wave action that can accelerate erosion, changing storm and precipitation patterns, declines in soil moisture, and changing water levels that could alter highs and lows as well as the pace of change (Byun et al. 2019, Wuebbles et al. 2019, Schmitt et al. 2022). In the Great Lakes region, precipitation is expected to increase in winter and spring then decline 5–15% in the summer (Wuebbles et al. 2019). Heavy rainfall and severe storms are expected to increase in intensity and frequency throughout the Midwest region (Wuebbles et al. 2019). Methods of projecting water levels in the Great Lakes are constantly improving, and recent projections predict modest drops in lake level, with a great deal of uncertainty and an appreciable probability of small rises (Wuebbles et al. 2019). There has also been major variability in lake level in recent years, and it is expected that increased variability will continue, resulting in more fluctuations and extreme high- and low-water level conditions (Magee et al. 2021). Projected changes in water level, increases in storm surges, and decreases in ice cover are also expected to increase coastal erosion along some types of Great Lakes coasts (Wuebbles et al. 2019).

B. Overutilization for commercial, recreational, scientific, or educational purposes:
No new information since last 5-year review.

C. Disease or predation:

As discussed in the last 5-year review, several seed weevil species are of concern to PITH populations: *Larinus carlinae* and *Rhinocyllus conicus*. Gijsman (2020) determined that seed predation and infestation by *L. planus* produced 60% fewer mature seeds and 40% fewer unfilled seeds, which could cause the population to decline at a faster rate. To further understand weevil preferences, Warneke et al. (2020) performed a set of choice and nonchoice trials under laboratory conditions in order to test whether the three adult weevil species (*Larinus carlinae, Larinus minutus, and Larinus obtusus*) are more flexible in their host preferences than previously known. It was found that all three weevil species spent more time feeding on their intended/known hosts but also fed on the nontarget species, and in some cases the differences were not significant. All three weevil species always oviposited on their known hosts, with no ovipositions on the other test species. Based on the results, it is thought that neither *L. minutus* nor *L. obtusus* is likely to be a major threat to PITH. However, based on the broader literature *on L. minutus* and *L. obtusus*, as well as the feeding activity observed in the laboratory, particularly on PITH florets, a threat may exist (Warneke et al. 2020).

E. Inadequacy of existing regulatory mechanisms:

State and Federal Regulatory Programs

State and Federal agencies help protect PITH populations through their permitting programs. For example, the Michigan Department of Environment, Great Lakes, and Energy (EGLE) and the U.S. Army Corps of Engineers in Michigan implement section 404 of the U.S. Clean Water Act. These agencies work with applicant to minimize or avoid the potential for adverse effects to PITH.

In Michigan, the USFWS' online planning tools help alert project planners to the potential presence of PITH and encourage beneficial conservation measures to ensure the actions are not likely to adversely affect PITH. In 2022, approximately 522 user-generated species list in Michigan included PITH as a species that may be present at a proposed project location.

Under state law in Michigan, the Natural Resources and Environmental Protection Act (Act 451 of 1994; Part 353), "Sand Dunes Protection and Management" allows for the designation of Critical Dune Areas (CDAs). The CDAs include both public lands and private properties where developmental and other activities are regulated and a permit is required. According to the Michigan Department of Environment, Great Lakes, and Energy, the law "balances the benefits of protecting, preserving, restoring and enhancing the diversity, quality, functions, and value of the critical dunes with the benefits of economic development, multiple uses, and public access…In 1989, approximately 74,000 acres of dunes along 265 miles of coastline were identified as needing protection from developmental pressures and designated as Critical Dunes" (EGLE 2023). As part of a future SSA, we anticipate further assessing shoreline stabilization in terms of cumulative effects to shoreline processes and relationship to climate projections or other factors.

Biocontrol Agents

The use of biocontrol agents has been promoted as a relatively safe, efficient, and environmentally friendly alternative to chemical or mechanical control of invasive plant species. However, these agents may not be effective or may have unacceptable nontarget effects on desirable plant species. Researchers found that two recent meta-analyses concluded that biocontrol of weeds is effective (Clewley et al. 2012) and that nontarget impacts are rare and minimal (Suckling and Sforza 2014); however, they found that these conclusions were overstated and that most studies were either data deficient or were not designed to effectively assess biocontrol agent impact on fitness components of targeted weeds and on nontargeted plant species (Havens et al. 2019). With the current data available, researchers concluded that given the uncertain efficacy and the demonstrable risks of biocontrol, its use should be less frequent, better regulated, and better monitored.

E. Other natural or manmade factors affecting its continued existence:

Invasive plants species continue to pose a threat to the habitat of the PITH. In a review of 77 sites, spotted knapweed (*Centaurea stoebe*) was noted as primary threat and was reported as "nearly ubiquitous" (Slaughter and Cuthrell 2017). An emerging threat to suitable PITH habitat is the non-native, invasive oriental bittersweet (*Celastrus orbiculatus*). The species can quickly alter suitable habitat for PITH by forming a dense blanket and smothering native dune vegetation (Leicht-Young and Pavlovic 2012).

Synthesis

We received several reports regarding PITH since the last five-year review with updated information on species' status and current threats. Much of the new information, however, remains incomplete. As identified in the 2018 five-year review, the primary threats are still invasive plants and recreational use of the dunes, but there is continued concern regarding the potential impact of seed-eating weevils. Surveys have been done in portions of the range, indicating increased abundance and potential stability in parts of the range (i.e., Upper Peninsula of Michigan) and decreases in abundance or even extirpation of previously known populations in other areas of the range (i.e., southern Michigan).

While the PITH population in Michigan may be larger than previously understood, surveys are needed to confirm the status of several important populations. Until we confirm PITH population status and better understand the potential future impacts of invasive species on its long-term viability, our understanding of the status of this species remains similar to that of our last five-year review. A thorough examination of the species' long-term viability as part of a species status assessment is needed before changes in species status should be contemplated.

After reviewing the best available scientific information, we conclude that a change in status is not indicated at this time based on the available data. However, the species has made significant progress toward achieving the recovery criteria, with a few remaining high priority recovery actions that are planned to occur in coming years. Prior to the next 5-year review, we intend to conduct a full status assessment within the SSA framework.

Recommendations for future actions

- Continue to plan and implement regular surveys, monitor occurrences, and document habitat conditions and population trends at PITH locations. (Recovery Plan Action 2, 4 & 6))
- Monitor an approach of using biocontrol insects to manage non-native plant species.
- Seek funding opportunities to support research that addresses the following knowledge gaps that assess the threat of invasive weevils, including *Larinus carlinae*. (Recovery Plan Action 4.41))
- Complete PITH Species Status Assessment by 2024.
    - Investigate whether possible extirpation of populations in southern Michigan is significant in terms of representation.

RESULTS

U.S. FISH AND WILDLIFE SERVICE
STATUS REVIEW of Pitcher's Thistle *Cirsium pitcheri*

Current Classification: Threatened

Status Recommendation resulting from Status Review:

____ Downlist to Threatened
____Uplist to Endangered
____ Delist (Indicate reasons for delisting per 50 CFR 424.11):
____The species is extinct
____The species does not meet the definition of an endangered or threatened species
____The listed entity does not meet the statutory definition of a species
__X_No change needed

Lead Field Supervisor, Fish and Wildlife Service

Approve SCOTT HICKS Digitally signed by SCOTT HICKS Date: 2023.05.02 15:56:27 -04'00' Date _____

The lead Field Office must ensure that other offices within the range of the species have been provided adequate opportunity to review and comment prior to the review's completion. The lead field office should document this coordination in the agency record.

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