



Pitcher's Thistle: Threatened Dune-Dweller



Photo by N. Pavlovic

Pitcher's thistle, a hardy flowering plant native to the western Great Lakes, relies on ever-changing dune sandscapes for survival. Recent declines in native populations of the thistle are due to human and non-human activity. Both have put the plant at risk of local extinction.

Pitcher's Thistle, its Range, and Habitat

Pitcher's thistle is a silvery green, federally threatened plant that spends five to eight years as a juvenile before flowering once, producing seed, and then dying. The adult thistle, reaching three feet in height, produces seed after it sprouts many "heads," each containing from 100 to 150 small cream-colored flowers (Pavlovic, McEachern, & Korte, 2015). In order to survive dry conditions, seedlings grow their roots first, before producing leaves. The roots of a mature plant can reach up to six feet in length. The plant grows on open, wind-blown sand dunes from southern Lake Michigan to the south and east shores of Lake Superior. It is also observed

along the western and southeast shores of Lake Huron (Pavlovic et al., 2015). This rare thistle prefers habitats with lots of exposed sand, and can be found growing on beaches, foredunes, secondary dunes, blowouts, sand spits, and large perched dunes within portions of its range. At Indiana Dunes National Lakeshore, human activity including the construction of harbors and industrial sites has disrupted wave action and sediment deposition, or littoral drift, causing shoreline erosion and loss of sand to replenish the dunes. This, in combination with storm erosion, prevents Pitcher's thistle from growing on Indiana's beach and foredunes. It does grow here in other dune habitats, however, and tends to grow on northwest facing dunes

where storm winds erode the sand and carve depressions, or blowouts. These blowouts provide the exposed sand that Pitcher's thistle needs.

Populations in the Landscape and Threats to their Persistence

Researchers monitor this threatened thistle throughout its entire Indiana range, from Miller Dunes in the west to Keiser Blowout in the east – a distance of over 15 miles along the shoreline. Despite the fact that Pitcher's thistle is biologically well adapted to tolerate the stress of life in this hot, sandy environment, close monitoring has revealed the long-term decline of the plant

(Havens et al., 2010). This population decline is likely the result of multiple factors. Disturbances associated with both residential and commercial shoreline development in Indiana have reduced and isolated dune habitat (Harrison, 1988). This isolation prevents pollination between local Pitcher's thistle populations, causing a decline in genetic diversity and making it difficult for the species to adapt and survive. To a much lesser degree, the natural succession of plant communities can further exacerbate population isolation. For example, competition with jack pine and oak trees has decreased the available thistle habitat in Miller Dunes.

Recreational use also has an impact. Human foot traffic can cause erosion in the dunes. Though this can provide additional exposed sand needed



Figure 1. American goldfinch (*Carduelis tristis*) feeding on the seeds of Pitcher's thistle (*Cirsium pitcheri*). Photo by M. Korte

by the Pitcher's thistle, it also greatly increases the risk that people walking in the dunes will trample the plant's tiny, fragile seedlings. Trampled seedlings are often killed, but if they are somehow able to survive, they (along with some insect damaged plants) are likely to develop into multiple stemmed plants, which often produce fewer seeds than single stemmed plants (McEachern, 1992).

New Threats to Pitchers Thistle

Pitcher's thistle was listed as threatened due to human activity, but now that researchers are studying dune dynamics and plant predation, new threats are being discovered. After blooming, the adult Pitcher's thistle closes its flower's cluster heads very tightly to protect seed production. Despite this protection, American



Figure 2. Maturing thistle (*Cirsium pitcheri*) seed head damaged by goldfinches trying to access the seeds inside (left) Photo by N. Pavlovic; empty husks of seeds eaten by goldfinches (center) Photo by K. McEachern, N. Pavlovic; thistle seed heads bagged to deter goldfinches (right) Photo by K. McEachern, N. Pavlovic.



Figure 3. Intact Pitcher's thistle (*Cirsium pitcheri*) seed head (left) Photo by N. Pavlovic, K. McEachern and M. Korte; damaged seed head (center) Photo by M. Korte; Thistle seed head with two adult Rhinocyllus weevils embedded (right) Photo by N. Pavlovic

goldfinches are able to tear into the heads for a meal and to obtain the seed hairs, or pappus, for building their nests. In fact, goldfinches appear to have increased their seed feeding in Indiana Dunes, eating as much as 90 percent of the seed from an individual plant (Pavlovic et al., 2015). To study the impacts of goldfinch predation, researchers put several layers of bridal veil netting over the thistle flower heads after bloom to block the goldfinch's ability to penetrate the developing seed head. In 2014, seed predation by goldfinches was reduced to one percent on netted flower heads (Pavlovic et al., 2015). Bagging heads is time consuming, so other means for reducing goldfinch feeding have been sought. Research has shown that larger Pitcher's thistle populations have proportionally less goldfinch seed predation compared to small populations. This suggests that a good strategy for mitigating native

goldfinch seed predation is to increase the size of local thistle populations (Pavlovic et al., 2015).

As scientists and managers attempt to protect the Pitcher's



Figure 4. Larinus (*Larinus planus*) weevils on Pitcher's thistle (*Cirsium pitcheri*) seed heads. Photo by M. Korte

thistle from goldfinches, they are discovering additional threats. Through bridal veil netting, researchers discovered the presence of two nonnative weevils. Both of these insects lay their eggs in the plant's flower head and their larvae destroy the seeds. They were discovered in the Indiana Dunes in 2012 and 2013. In 2014, weevils damaged 31 percent of the observed Pitcher's thistle, making them an important threat.

Luckily, most weevil-damaged heads are still able to mature at least some seed. As researchers continue monitoring the distribution of weevils, they are testing the effects of certain insecticidal clays that, when painted on the thistle, could deter harmful insects. At Miller and Ogden Dunes, another insect pest, the sluggish weevil (*Cleonus piger*), was found feeding on Pitcher's thistle roots in 2013. This was the first

report of the species feeding on Pitcher's thistle (Pavlovic et al., 2015). Weevils are present throughout the thistle's range from southern to northern Lake Michigan and are of increasing concern.

The Future for Pitcher's Thistle in the Indiana Dunes

No adult thistles have been observed in the Miller Dunes section of Indiana Dunes National Lakeshore for two years (Pavlovic et al., 2015), and researchers project they will become locally extinct in this location in the near future (Havens et al., 2012). Efforts continue to protect this threatened plant. A special "sandbox" has been built to grow Pitcher's thistle to produce seed to be used to



Figure 5. U.S.G.S. Ecologist Noel Pavlovic, PhD, counts Pitcher's Thistle seedlings as part of a climate change investigation. *Photo by W. Smith*

increase local populations. As scientists monitor sites in the Indiana Dunes, they hope to develop new ways to limit weevil population growth across the Pitcher's thistle range. Scientists are also investigating yet another human-induced threat: climate change. Researchers and park

managers planted thistles at varying aspects and distances from the lakeshore to determine the plant's response to lake-moderated climate. Park managers will continue to protect Pitcher's thistle using the best science available.

Citations

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