

## ES 600: InterTribal Lake Winnebago Wild Rice Revitalization Project 2022



**Brothertown Indian Nation**  
**Eeyamquittoowauconnuck**



**Nelson Institute for  
Environmental Studies**  
UNIVERSITY OF WISCONSIN-MADISON

*About the Project:* Lake Winnebago, Wisconsin's largest inland lake, connects major rivers to Lake Michigan. Historically this watershed supports diverse wetlands, wildlife, and fisheries. The waterways and connecting lakes have been altered by dams and other development. Wild rice persists and continues to offer habitat for fish, wildlife, and waterfowl. The Wisconsin InterTribal Lake Winnebago Connectivity Project for Wild Rice convenes Tribes, InterTribal, state and federal agencies, non-profits, and university employees in partnership for sustaining fisheries, traditions, and healthy food and water for communities.

In winter and spring of 2022, Brothertown and Nelson Institute for Environmental Studies undergraduates worked together on projects for research, community education, and policy. The goal of the student projects is to integrate Traditional Ecological Knowledge and Western science through community engagement.

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Literature Review by Nat Xu, 04/28/2022

Lake Winnebago Connectivity Project:  
Wild Rice Literature Review (*Zizania aquatica* and *Zizania palustris*)

In this literature review I will be summarizing essential information about the botanical features, harvesting and habitat, protection projects, and ecological threats to Wild Rice (*Zizania aquatica* and *Zizania palustris*) in Wisconsin and the Lake Winnebago Watershed. This information was compiled specifically with the Lake Poygan and Eeyamquittowauconnuck Brothertown Nation's Wild Rice Revitalization project in mind and holds space for indigenous leadership and scholarship throughout its production.

## About the Species and Harvesting

Who is Wild Rice?

***Manoomin***, or ***mayomunsh*** in Mohegan, Wild Rice, is an Indigenous cultural touchstone, food resource, and keystone wetland plant species found primarily in the Great Lakes region <sup>(29)</sup>. Wild rice significantly influences wetland productivity, pollutant fate, and intricate relationships with various other plant and animal species including but not limited to sturgeons (namewag), mallards (ininishib), and muskrats (wazhashk) (in Ojibwe Language)<sup>(42,43)</sup>. Although Wild Rice is not actually a rice, but a grass, it is the only grain native to North America <sup>(1, 29)</sup>. It is not related to white rice (*Oryza*) and differs highly from the paddy wild rice grown/cultivated in parts of Minnesota and California who have undergone frequent hybridization and selective breeding for maximum harvest.

There are four species of natural wild rice but only two grow in the Midwest: *Zizania aquatica* (southern) and *Zizania palustris* (northern). Northern wild rice is adapted to colder climates. Southern wild rice is rarer and disappearing more rapidly. Both kinds of rice have been important to indigenous tribes and are not frequently distinguished when seeking protection, although some accounts say the northern rice has a longer grain and is better for cooking and more desirable/easier to harvest <sup>(35, 36)</sup>. Wild rice has a highly specialized role in the region's wetlands because it is virtually the only native annual aquatic macrophyte in the Great Lakes region. It is a highly nutritious grain with significant benefits to cardiovascular health. While comparable to other grains, wild rice has a higher protein efficiency <sup>(29)</sup> and is essential for maintaining the culturally interdependent diet of many tribes <sup>(13)</sup>.



*Freshly Harvested Wild Rice* <sup>(24)</sup>

Language Names

Wild Rice is known by many names:

***Manoomin***- Anishinaabemowin/ Anishinaabe (Chippewa or Ojibwa), derived from “Manitou,” meaning Great Spirit, and “meenum,” meaning delicacy. It is the “food that grows on water,” whose presence fulfilled the prophecies foretold in the story of the Anishinaabe’s migration stories from the east <sup>(24, 52)</sup>.

***Mayom, mayomunsh*** (plural)- Mohegan Language<sup>(50)</sup>.

***Psij*** - Dakota/Lakota Language <sup>(26, 52)</sup>.

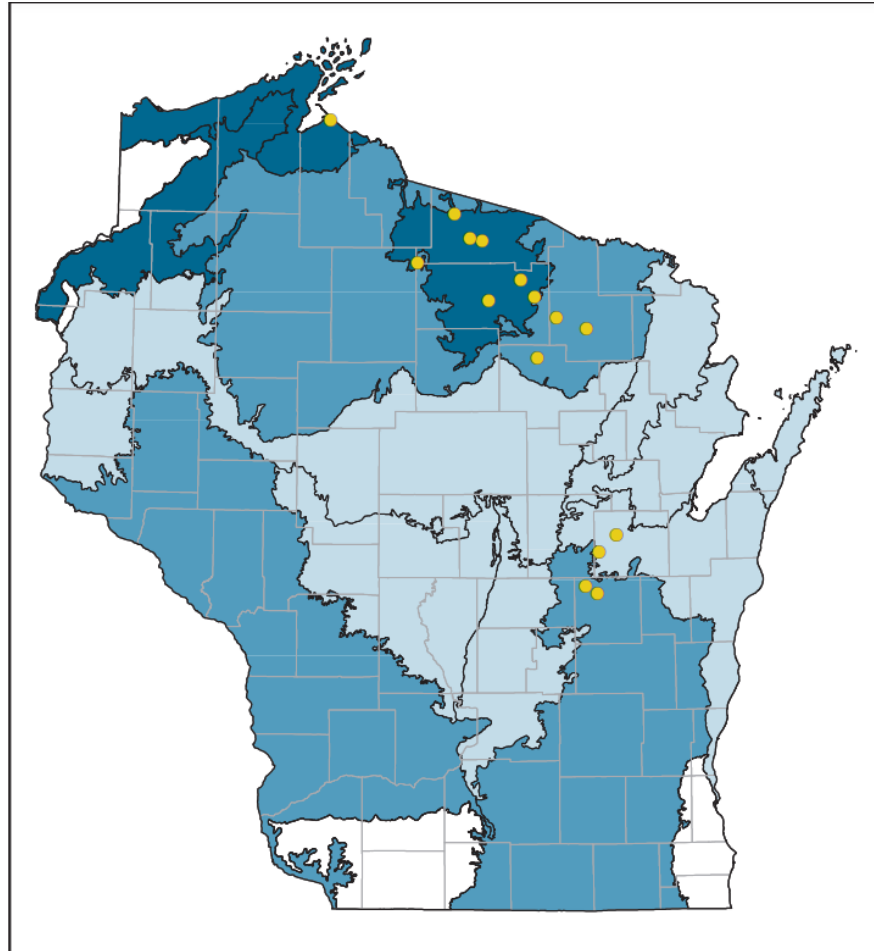
***Sij*** -Hoocąk, Ho-Chunk Language <sup>(52)</sup>.

***Thínhgañye***-Chiwere/Siouan, Missouriia, Otoe, and Iowa peoples Language <sup>(52)</sup>.

Menomonee

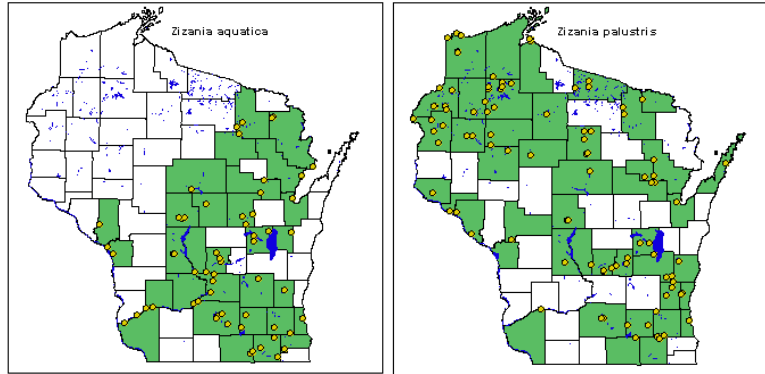
Oneida

## Maps and Range

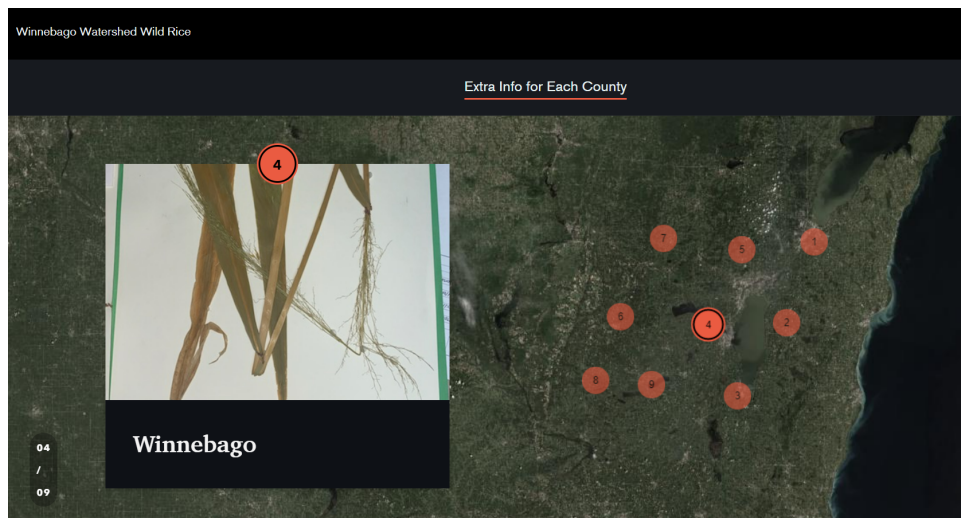


*Wild Rice Marshland WI Historical and Present Stands (31)*

According to the map above, there are four occurrence reports of Wild Rice in the Lake Winnebago watershed, with a large portion falling into the extensive abundance range<sup>(31)</sup>. The mouth of the Wolf River into Lake Poygan and out to Lake Winnebago west has historically been and continues to be a transition zone between the northern and southern species of Wild Rice<sup>(38)</sup>. Though there is a significant range overlap between the species, “southern wild rice” (*Zizania aquatica*) is more prevalent to the south and east, while “northern wild rice” (*Zizania palustris*) is more commonly distributed to the north and west. Two varieties of northern wild rice are recognized *Zizania palustris* var. *palustris* and *Zizania palustris* var. *interior*<sup>(31)</sup>. This area has been utilized by Indigenous Peoples for harvesting for thousands of years including by the Menomonee and Ho-Chunk Tribes<sup>(35, 39)</sup>, and continues to be a vital avenue for cultural recognition and practice for Anishinaabe and New York tribes’ (Brothertown and Stockbridge Munsee) members and descendants<sup>(40)</sup>.



*Distribution Maps of Z. aquatica and Z. palustris Species* <sup>(44)</sup>



*Interactive Storymap of Herbarium Specimens from each County in the Winnebago Watershed* <sup>(41)</sup>

[View Online](#)

History, Habitat,  
and Harvesting

Historical Presence of Wild Rice on Lake Poygan:

It was said back in the day, Wild Rice grew so abundantly on Lake Poygan and Winnebago that a canoe couldn't pass without becoming full of rice<sup>(37)</sup>. According to Menomonee's oral history, there was no Wild Rice in Lake Winnebago and its vicinity until they arrived and were supplied by the creator for their needs. It came so abundantly that they even named Lake Poygan after it, "Powa-he'-canne" or threshing or striking Wild Rice<sup>(49)</sup>. Numerous lakes, rivers, or towns are named Rice or Manoomin, or bear-related names such as "Poygan," derived from the Menominee word for gathering rice. It is believed that no other plant has contributed to more geographic names in all of North America<sup>(24)</sup>.

"A government interpreter for over forty years among the Menomonee, said, in 1899, that the Indian agent who removed the tribe in 1852 from the vicinity of Lake Winnebago to their present reservation, desired them to gather wild rice and sow it in their new home. At each council, he sought to induce them, but they unanimously refused. Nio'pet, the very intelligent chief of the tribe, says that when they came to their present home, wild rice grew only in scattered stalks in Shawano lake. In about ten years it was plentiful and has been their annual harvest field since. He also says that it has nearly died out in the vicinity of Lake Winnebago, where previously they gathered it in great quantities. Then the old chief asked "Why?" and smiled satisfiedly as though he knew"<sup>(49)</sup>.

The acreage of the Wild Rice beds in Lake Poygan remained fairly constant until 1880-81 when the dam at Menasha raised the normal water level 3-31/2 feet and unprecedented floods reduced the acreage, and with weather conditions that year hungry carp brought the wild rice to almost total extinction.

"In the winter when the water level was low, much of the rice beds had frozen solid. The spring floods poured into the lake before the rice beds had thawed out, lifting them up to the increased water level and literally tearing them up by the roots. This produced a floating rice bog. The winds and water tore some of that bog loose, which was then blown to and fro, muskrat houses and all, and dashed to pieces by wind and water"<sup>(48)</sup>.

Habitat

Wild rice grows best in gently flowing waters with a mucky or organic bottom and in areas with relatively stable water levels during the growing season. Wild rice prefers a water depth between six inches and three feet. Often, these areas are near the inlet or outlet of a lake<sup>(25)</sup>. *Zizania palustris*, aka northern Wild Rice, is an emergent annual aquatic grass that grows in shallow depths in lakes and rivers<sup>(30)</sup>. It grows best in shallow, slow-moving waters and is highly sensitive to environmental changes such as fluctuations in water depth and temperature<sup>(1)</sup>. Periods of prolonged high water levels prevent seed germination, and spring flooding uproots young plants during their "floating leaf stage". Increased winter temperatures shrink the wild rice dormancy period, causing lower spring germination rates and seed production. Very dark or turbid water caused by sedimentation limits sunlight penetration and may hinder early plant development. Wild rice can tolerate water level fluctuations as long as they are not too great.

Shallower sites can allow strong competition from perennial emergent plant species, while deeper sites can stress wild rice plants and limit seed production. Although wild rice may occur in a variety of lake bottoms, the most consistently productive stands are those with soft, organic sediment. Nitrogen and phosphorus are limiting nutrients for wild rice<sup>(22)</sup>.

### Harvesting

Across all management jurisdictions wild rice harvest takes place using the same methods - a boat, typically two people, and hand-held flails. Traditionally, Ojibwe people harvested wild rice, and continue to harvest it today, in pairs, with one person pushing or paddling a canoe and the other knocking rice into it with sticks (bawa'iganaakoog). When the wild rice is ripe, the grains fall easily into a canoe, and the grains that fall into the water lodge themselves into the mud, then grow into the following year's stands of rice.

Freshly harvested manoomin is called "green" rice. When processed in the traditional way, it is parched (roasted) over a fire, then threshed by being stepped or danced on. This motion, called jigging, loosens and removes the fibrous outer covering of the grain. Finally, to separate the hulls from the grain, wild rice is "winnowed" or "fanned"—tossed up in the air with birch bark trays (nooshkaachinaaganan) so that the hulls are blown away and only the edible grain is left behind.

The work that goes into preparing wild rice for eating and storage was traditionally carried out collectively. Women marked the areas designated for particular families by binding a number of heads together. This ensured that everyone in the community got the rice they needed, and it also made harvesting easier.

Taking care of the natural world that sustains us forms a central part of the Ojibwe people's way of seeing the world. Traditional wild rice harvesting practices reflect this, protecting wild rice beds for the long-term wellbeing of the ecosystem as well as the community. Designated elders would, and on reservations still do, carefully monitor lakes to prevent premature or excessive harvests, "opening" and "closing" lakes to ricing as necessary, and leaving some mature grains unharvested for re-seeding.

Differences exist in the size restrictions for the boat and the harvesting flails or 'Knockers' <sup>(51)</sup>. Flails or knocking sticks are shorter in Minnesota (maximum of 30 inches) while Wisconsin harvesters have a longer reach at 38 inches <sup>(13)</sup>.

### Calendar

Wild Rice grows to the water surface usually by mid-June. This is called the "floating leaf" stage because the buoyant leaves lay flat on the water. During this stage, the plant is able to exchange gases and literally "breathe" underwater. It is at this time that manoomin is extremely susceptible to water level fluctuations. Plants can be uprooted, washed away due to increased water levels, or drowned. By mid-July, manoomin undergoes a physiological change from breathing underwater to growing upright and exchanging gases with the air <sup>(4)</sup>.

The August, or Rice Making Moon (manoominike giizis), signaled the harvest season, which was a time for celebrations of thanksgiving <sup>(42)</sup>.

Companion Species	<p><u>Wildlife Interactions</u></p> <p>Many wildlife and fish species utilize manoomin for food, and as nursery and migratory habitats <sup>(1)</sup>. Bitterns and herons and tons of birds utilize the rice. They also provide nesting areas for muskrats, nursery areas for fish species, and there are frogs and other small fish that use those areas as well <sup>(3,6)</sup>. There may be no food more important to waterfowl, being readily and heavily consumed by mallards, blue-winged teal, ring-necked ducks, wood ducks, and other species <sup>(42)</sup>.</p> <p><u>Companion Plants:</u></p> <ul style="list-style-type: none"> <li>Water plantain</li> <li>Northern manna grass</li> <li>American lotus lily</li> <li>American burreed</li> </ul>
Revitalization/ Restoration Projects	



Rights of Nature  
and Legal  
Standings

Manoomin, meaning “the good berry”, is the traditional name for the sacred wild rice that has been a cultural and dietary staple among the Menominee and Anishinaabeg (Ojibwe/Chippewa, Odawa/Ottawa, Potawatomi, & Cree) tribes throughout the Great Lakes Region for centuries and is part of the Anishinaabeg migration story - to the place where the food grows on the water”<sup>(1,26, 45)</sup>. The tribes who migrated to the land now called Wisconsin, including the Brothertown and Stockbridge Munsee, encountered Wild Rice and other Peoples, including the Menomonee, called “the people of the rice” by other tribes for their relationship with the plant, although they called themselves Mamaceqtaw or “the people of the seasons” for their seasonal migration<sup>(46)</sup>. These tribes all have intricate cultural relationships, practices, and dishes/preparations for wild rice and continue to advocate for its protection through Rights of Nature Legislation and State Level Protections.

August 2021 White Earth Band of Ojibwe vs the DNR:

On August 5, an action was filed in the Tribal Court of the White Earth Band of Ojibwe in Minnesota, by Manoomin (wild rice), the White Earth Band of Ojibwe, and several tribal members, to stop the State of Minnesota and Department of Natural Resources from allowing the Enbridge corporation to use five billion gallons of water for the construction of the oil pipeline known as “Line 3.” The rights of manoomin law is the first tribal law to recognize legal rights of a plant or animal species. Plaintiffs assert that the diversion of 5 billion gallons of water for an oil pipeline will interfere with both the rights of manoomin, as well as the rights of tribal members to use Treaty lands to hunt, fish, and gather wild rice. In December 2018, the business committee of the White Earth Band of Ojibwe adopted a “rights of manoomin” tribal law, which recognized wild rice as having the right to exist, flourish, regenerate, and evolve, as well as inherent rights to restoration, recovery, and preservation. (8)

In particular, the Band Parties allege that the DNR’s conduct violates the First, Fourth, Fifth, and Fourteenth Amendments to the United States Constitution, the American Indian Religious Freedom Act (AIRFA), and treaties between the United States of America and the Chippewa and other tribes, among other claims. In their lawsuit in the Tribal Court, the Band Parties seek declaratory and injunctive relief. The DNR moved to dismiss the Band Parties’ tribal lawsuit, arguing that the Tribal Court lacks subject-matter jurisdiction due to the non-member status of the DNR and its officers, the DNR’s sovereign immunity, and the fact that the contested actions did not take place on reservation land. Chief Judge DeGroat of the Tribal Court denied the DNR’s motion to dismiss, holding that the DNR’s arguments regarding sovereign immunity and subject-matter jurisdiction “must give way” to the Band’s “vital” interests. (7)

Wisconsin and Minnesota Wild Rice Protections: ?

Michigan's Lack of Protections:

The destruction of rice in the state underscores a major issue: Although wild rice is protected in Minnesota and Wisconsin, only one threatened variety of rice (*Zizania aquatica aquatica*) is protected in Michigan, Barton said. The rest is vulnerable. Currently, the rice removal on Tawas Lake is on hold pending an analysis to determine whether it is the threatened variety, according to City Manager Ron Leslie. “The wild rice was checked a number of years ago and found not to be the threatened (variety), but we need to retest,” he said. If the city gets the go-ahead, 70 acres will be cut, and additional cutting will continue for up to five years.

EPA Regulations	<p>Several federal environmental laws authorize EPA to treat eligible federally recognized Indian tribes as a state (TAS) for the purpose of implementing and managing certain environmental programs and functions, and for grant funding. WQS not only set water quality goals for a tribe’s water bodies but also serve as the regulatory basis for establishing water quality-based treatment controls and strategies. To administer a WQS program under the CWA, a tribe must apply to EPA for authorization to be treated in a similar manner as a state (TAS) (refer to the second tab above <sup>(9)</sup>).</p> <p>Wild rice is important to the Fond du Lac Band of Lake Superior Chippewa for mental, physical, and spiritual health reasons. For that reason, the Band has undertaken a Health Impact Assessment (HIA) to characterize the impacts of potential wild rice loss if the Minnesota Pollution Control Agency changes its water quality standards for sulfates<sup>(10)</sup>.</p>
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Other Sites:  
Protection Projects  
and Case Studies

Wild Rice Camps:

The camps are created in partnership with organizations such as the Native Wild Rice Coalition, Great Lakes Indian Fish and Wildlife Commission (GLIFWC), and Great Lakes Restoration Initiative.

Camp volunteers have the opportunity to learn from Tribal knowledge keepers about their ancient ricing traditions and the symbiotic relationship they share with the manoomin. Cultural revitalization, restoration practices, and environmental ethics are also taught during the camps. While attending wild rice camps, researchers have focused their studies on fungal smut infections among manoomin, germination and viability, water chemistry, seed variation, and population genetics. (1)

The Nottawaseppi Huron Band of Potawatomi

The HBP Environmental Department oversees the restoration, management, and inventory of Wild Rice production on the Pine Creek Indian Reservation. Hosts Wild Rice Wednesday and Wild Rice Camp in the fall. Wild Rice Wednesday consists of a meal for the entire NHBP Community and an opportunity to learn the history of Wild Rice. Wild Rice Camp is open to the Community and is a two-day camp that teaches participants how to manage and oversee the production of Wild Rice (2)

The tribe was concerned about the impacts of runoff on our waterways, drinking water aquifers, and wild rice,” Essentially, story maps use geography as an anchor for information. They tell the story of place, issue, trend, or pattern placed into a geographic context. Interactive maps are combined with photos, text, illustrations, video, and/or audio in ways that meant to be intuitive for the user. Some of the current Band’s founding members escaped during the trek, while others returned after completing the forced march. After achieving recognition, NHBP was able to receive federal assistance to begin rebuilding its government and recovering a nearly lost language and culture. That was a turning point that lead to expansion of the tribe and its resources. “It was the spark that ignited a fire for the tribe,” says Kerney. In 2010, all the tribal concerns about water quality were shown to be justified when the largest inland oil spill in U.S. history occurred in the Kalamazoo River area, when approximately a million gallons of oil were spilled. “The tribe was pulled into the Natural Resource Damage Assessment and Recovery (NRDAR) process, in a way we could not have anticipated. This has brought the upper Kalamazoo River into our focus for wild rice restoration, and further recovery of ecosystem services. We anticipate future involvement in Restoration Projects and the potential; establishment of long-term water monitoring stations in the watershed. In addition to the wild rice, some other notable species at Pine Creek Reservation are the threatened Eastern Box Turtle, sandhill cranes, and the American Columbo, *Frasera caroliniensis*, a rare native plant. Diverse turtle and frog species also abound, as well as deer, turkey, and fish.(5)

Lac Vieux Desert Band of Lake Superior Chippewa Indians

Roger LaBine, chair of the conservation and cultural committees for the in the western Upper Peninsula, is spreading the word about wild rice’s cultural significance through programs called rice camps. They teach traditional harvesting and tell the “migration story” of how rice brought native Americans to the Great Lakes region. The story begins on the East Coast, where LaBine said his ancestors were given seven prophecies, the third of which directed them to migrate westward to where the sunsets. Members of LaBine’s band settled around Lac Vieux Desert, a lake southeast of Lake Gogebic on the Michigan-Wisconsin border, and continued to harvest wild rice from the lake until a hydroelectric dam, operated by the Wisconsin Valley Improvement Company, raised the water and flooded out the rice, he said. A court battle followed, and the band in 2002 was granted a 10-year test period to restore wild rice in the lake at lowered water levels. “In 2002, we had 15 acres,” LaBine said. “In 2011, we had 107 acres,

and although we went down a little bit in 2012, we still have two established rice beds now on Lac Vieux Desert.” Melanie Manion, natural resources management supervisor of Ottawa County Parks and Recreation, worked with Barton, the Match-E-Be-Nash-She-Wish Band of Pottawatomi Indians (also known as the Gun Lake tribe) and others to survey the southwestern Lower Peninsula county for wild rice. They concentrated on the Grand and Pigeon rivers and their bayous, looking for the threatened variety of native wild rice. (3)

Bay Mills Indian Community:

Efforts to re-establish wild rice within lands managed by the BMIC have produced mixed results. Seeding efforts in Waishkey Bay began in the mid-1990s and have continued inconsistently with low success. While there have been no seeding efforts in the past 5 years, some wild rice continues to grow. Disruption of biological conditions as a result of introduced species may have a substantial effect on the likelihood of wild rice rehabilitation. Common carp (*Cyprinus carpio*) is an invasive species that has been described as an ecosystem engineer due to its ability to impact biotic and abiotic factors within a waterbody. Common carp are present throughout the Great Lakes, including Waishkey Bay (6)

## Wild Rice Threats

Invasive Species-  
Plants Out of Place

Invasives impacting Wild Rice habitats and growth stages include fungal disease, rice worms, purple loosestrife, cattails, carp, and migratory waterfowl. (1) Once common in the state's rivers and lakes, sizable beds of the tall grass have dwindled to less than a dozen, the result of invasive species, higher water levels from dams, and lakefront property owners seeking to clear the way for water recreation. Temperature increases have also reduced ice cover, which protects plants from invasive species such as carp, hydrilla, and water hyacinth. Species of water lily, water lily, and pickerelweed, though mostly native, also pose competition with wild rice<sup>(3)</sup>.

**Non-Native Plants**

Narrow-leaf cattail, *Typha angustifolia*, and the hybrid *Typha glauca*<sup>(1, 38)</sup>: can tolerate depths of up to 1.5 m. It occupies the same niche as wild rice with the advantage of being a perennial and thus able to usurp the annual wild rice, particularly when water levels increase from year to year. This invasive species has had devastating effects on the wild rice stands in Rainy Lake<sup>(29)</sup>. However, total, extractable, and pore water results for sediment nutrients showed that cattails were depleting many macro and micronutrients in the former wild rice areas which may have long-term implications. Of particular significance were the lower nitrogen levels in the sediment where cattails grew. Boom bay cattail control, main concern<sup>(38)</sup>.

Eurasian milfoil (*Myriophyllum spicatum* L.)<sup>(4, 29, 30)</sup>: Hardier than wild rice stands and in warmer temperatures can outcompete. Shorter and warmer winters prevent seeds from germinating the next year because seeds need at least 3 months under freezing or near-freezing water conditions to successfully germinate in the spring<sup>(29)</sup>. Eurasian watermilfoil also occurs in areas of wild rice, however, water depths preferred by milfoil are typically deeper and competition between the two is not well understood<sup>(13)</sup>.

Non-native Phragmites: For these populations, the major threat to the rice is the invasive common reed called Phragmites, which can take over the habitat where wild rice grows, she said. The Ottawa County Invasive Phragmites Group will begin treating Phragmites with pesticides in the fall. Manion will then collaborate with the Gun Lake band, the Little River Band of Ottawa Indians, and others in the summer of 2014 to identify waterways suitable for wild rice stands<sup>(3)</sup> Have been controlled in lake Pygan

Purple Loosestrife: In addition to funds spent on control efforts, economic losses to agriculture can exceed millions of dollars annually when purple loosestrife invades irrigation systems. Also, the loss of entire crops of wild rice can occur when this species invades shallow lakes and bays dominated by wild rice, which results in great economic loss to local agricultural communities<sup>(32)</sup>. Populations are fairly Low in Poygan, beetles have aided in knocking back the population. More of a threat in wet meadows than most rice marshes<sup>(38)</sup>.

Curly Leaf Pondweed:

Water hyacinth: Benefits from climate warming and reduced ice cover<sup>(1)</sup>.

Hydrilla<sup>(1)</sup>

Flowering Rush: Concern in shallow waters, Partridge lake on wolf river has a higher population<sup>(38)</sup>.

**Diseases and Pests**

Brown Spot Disease: Appears to be increasing as a warming climate creates the warm, humid air that favors fungal diseases <sup>(36)</sup>

Fungal Disease: Fungal disease, together with intense rain events, markedly reduced the 2010 wild rice harvest to the lowest level observed in 25 years <sup>(36)</sup>

Rice Worms: Warm summers and mild winters may also be resulting in higher populations of insects, especially “rice worms” which are a type of moth larvae. Rice worms can reduce the seed production in manoomin <sup>(36)</sup>

**Eastern and Oneida Indian Nation Aquatic Invasive Species Efforts:**

Invasive Species Initiative (Giant Hogweed and Water Chestnut) In recent years, the Oneida Indian Nation (close relation to Brothertown’s migration journey) has identified invasive species within its jurisdiction. Two specific examples of aquatic invasive species identified on Nation lands are Giant hogweed (*Heracleum mantegazzianum*) and water chestnut (*Trapa natans*). Aquatic invasive plants adversely impact the ecology of Nation lands because they out-compete native plants, spread rapidly, and restrict recreational activities such as boating and swimming. During the summer of 2018, the Nation’s Youth Work Learn Program, under the supervision of the Nation’s Environmental Manager, participated in a project to control water chestnut present at the Nation’s marinas on Oneida Lake <sup>(6)</sup>.

<p>Climate Change</p>	<p><u>Water Level Changes/ Flooding:</u></p> <p>The greatest climate change threats to manoomin are higher humidity levels and fluctuations in water depths beyond the plant's critical thresholds. Water depth is critical for all growth stages of manoomin and has significantly increased throughout the region. Flood events have the possibility to wash away young plants and change the sensitive habitat to be more compatible with invasive species. In the early stages of growth, water depth is critical; the plants can be drowned or uprooted by wave action reproductive failure may result from very hot, dry weather or excessive rain during pollination, while harvest may be curtailed by early fall frosts. (35)</p> <p><u>Warming Waters:</u></p> <p>The Midwest is expected to experience higher warm-season temperatures than any other region in the country. Frost-free seasons are predicted to increase by at least 10 days this century. As a result, water surface temperatures of the Great Lakes are projected to rise 7°F by 2050 <sup>(1)</sup>.</p> <p>Traditional manoomin territories have been greatly diminished due to land development, recreational use of habitats, and decreased water quality from agricultural &amp; industrial run-off, and increases in invasive species. Today's biggest threat to remaining wild rice stands is our rapidly changing climate and weather patterns. Due to drastic precipitation and temperature changes, manoomin has been deemed the most vulnerable species throughout the Anishinaabeg territories <sup>(1)</sup>.</p> <p>Climate change poses many threats to the natural resources upon which tribes rely. As a changing climate affects entire ecosystems, various beings/species (in Ojibwe culture, the word 'beings' refers to those which are both animate (such as a fish) and inanimate (such as a rock), and implies equal importance to all) utilized by tribes may experience declines, range shift out of Ceded Territory areas where the Ojibwe exercise their treaty rights or become extinct. With the loss of beings/species, many of the cultural connections to the natural world are changing or are being lost <sup>(27)</sup>. Stands of wild rice growing in unmanaged habitats are sensitive to environmental perturbations which greatly affect annual productivity <sup>(28)</sup>. Less ice cover also increases the use of recreational vehicles within manoomin habitats during critical growth stages, causing damage to plants already under environmental stresses.</p>
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## Manoomin (Northern Wild Rice)

*Zizania palustris*

Highly - Extremely Vulnerable  
(Confidence Level: Moderate)

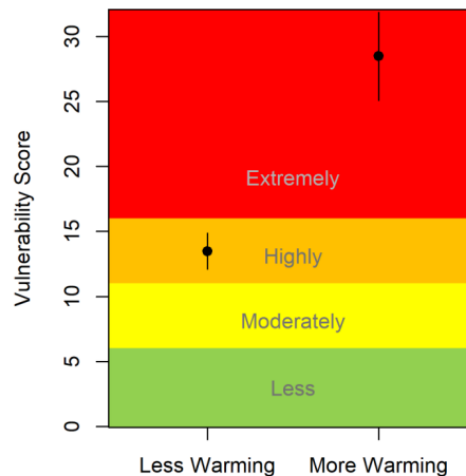


Figure 24. Climate change vulnerability scores for manoomin on a scale of 0 (lowest vulnerability) to 32 (highest vulnerability). Dots indicate average score; lines indicate possible range of scores for each warming scenario.

*Climate Change Vulnerability Assessment by GLIFWC* <sup>(27)</sup>

### References and Further Reading

1. College of Menominee Nation Sustainable Development Institute, & Northeast Indigenous Climate Resilience Network. (2022). *Manoomin: Climate Change Impacts & Conservation*. Retrieved April 2022, from <http://www.nicrn.org/manoomin-climate-change-impacts--conservation.html>
2. Nottawaseppi Huron Band of the Potawatomi. (2020, November 21). *Wild Rice Program*. Retrieved April 2022, from <https://nhbp-nsn.gov/environmental/wild-rice-program>
3. Great Lakes Echo. (2013, August 8). *Wild Rice Mounts a Comeback for Culture and Ecology: Great lakes echo*. Great Lakes Echo | Environmental news of the Great Lakes region. Retrieved April 27, 2022, from <https://greatlakesecho.org/2013/08/08/wild-rice-mounts-a-comeback-for-culture-and-ecology/>
4. *Ojibwe lifeway: Wild rice harvesting ("Dagwaagin"-fall)*. GWOW - Wild Rice (Manoomin). (n.d.). Retrieved April 2022, from <http://www.g-wow.org/en-us/wildrice/default.aspx>
5. Balstar, L. (2018, May 4). *Nottawaseppi Huron Band of the Potawatomi Tribal Ecosystem Restoration Aided by Environmental Monitoring*. Environmental Monitor. Retrieved

- April 2022, from <https://www.fondriest.com/news/nottawaseppi-huron-band-potawatomi-tribal-ecosystem-restoration-aided-environmental-monitoring.htm>.
6. Great Lakes Indian Fish and Wildlife Commission. (2019). *Tribal Great Lakes Restoration Culturally Inspired Restoration*. GLIFWC. Retrieved April 2022, from <http://glifwc.org/publications/pdf/2019BIAGLRI.pdf>
  7. *Minnesota Department of Natural Resources (DNR) v. White Earth Band of Ojibwe (Band)*. National Indian Law Library (NIL). (2021). Retrieved April 2022, from [https://narf.org/nill/bulletins/federal/documents/minnesota\\_v\\_whiteearth.html](https://narf.org/nill/bulletins/federal/documents/minnesota_v_whiteearth.html)
  8. Margil, M. (2022, February 7). *Press release: First "rights of nature" enforcement case filed in Tribal Court to Enforce Treaty Guarantees*. Center for Democratic and Environmental Rights. Retrieved April 2022, from <https://www.centerforenvironmentalrights.org/news/press-release-first-rights-of-nature-enforcement-case-filed-in-tribal-court-to-enforce-treaty-guarantees>
  9. Environmental Protection Agency. (2020, October 14). *Expanding the narrative of Tribal Health: The effects of wild rice water quality rule changes*. EPA. Retrieved April 2022, from [https://cfpub.epa.gov/si/si\\_public\\_record\\_Report.cfm?dirEntryId=349834&Lab=CCTE](https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=349834&Lab=CCTE)
  10. Fisheries, N. O. A. A. (2022, February 24). *Efforts to restore native wild rice in the st. louis river estuary*. NOAA. Retrieved April 2022, from <https://www.fisheries.noaa.gov/feature-story/efforts-restore-native-wild-rice-st-louis-river-estuary>
  11. Fletcher, A., Christin. (2015). *The Value of Nature's Benefits in the St. Louis River Watershed*. GLIFWC. Retrieved April 2022, from <https://glifwc.org/Events/Earth%20Economics%20St%20Louis%20River%20Project%20Factsheets.pdf>
  12. Diller, S. N., McNaught, A. S., Swanson, B. J., Dannenhoffer, J. M., & Ogren, S. (2018). Genetic structure and morphometric variation among fragmented Michigan wild rice populations. *Wetlands*, 38(4), 793–805. <https://doi.org/10.1007/s13157-018-1029-2>
  13. Drewes, A. L., & Silbernagel, J. (2008). *Sustaining a ricing culture: An integrated landscape approach to understanding harvest, distribution and management of wild rice (Zizania palustris) across the Upper Great Lakes Region* (thesis). *ProQuest Dissertations and Theses*. Retrieved April 2022, from <https://ezproxy.library.wisc.edu/login?url=https://www.proquest.com/dissertations->

[theses/sustaining-ricing-culture-integrated-landscape/docview/304447850/se-2?accountid=465](https://theses.sustaining-ricing-culture-integrated-landscape/docview/304447850/se-2?accountid=465).

14. Pastor, J. (2016, October 4). *Effets of sulfate and sulfide on the life cycle ...* - wiley. ESA Journals. Retrieved April 2022, from <https://esajournals.onlinelibrary.wiley.com/doi/10.1002/eap.1452>
15. LaDuke, W. (2020, October 12). *Ricekeepers*. Orion Magazine. Retrieved April 2022, from <https://orionmagazine.org/article/ricekeepers/>
16. LaDuke, W. (2019, February 21). *The Rights of Wild Rice*. In These Times. Retrieved April 2022, from <https://inthesetimes.com/article/the-rights-of-wild-rice-winona-laduke-white-earth-rights-of-nature>
17. Drewes, A. D., & Silbernagel, J. (2012). *Uncovering the spatial dynamics of Wild Rice Lakes, harvesters and management across Great Lakes Landscapes for shared regional conservation*. Ecological Modelling, 229, 97–107. <https://doi.org/10.1016/j.ecolmodel.2011.09.015>
18. Mitchell, P., Rico, C., & Pochedley, E. (n.d.). *The Rights of Manoomin*. Arcgis StoryMaps. Retrieved April 27, 2022, from <https://www.arcgis.com/apps/Cascade/index.html?appid=bd1b940a4d404990989e3cbc6163d0b8>
19. Virgillio, S. (n.d.). *Lower Green Bay/Fox River Area of Concern*. EPA. Retrieved April 2022, from <https://www.epa.gov/great-lakes-aocs/lower-green-bayfox-river-aoc>
20. NOAA Office of Coastal Management. (2019, May 29). *Lake Superior Manoomin Cultural and Ecosystem Characterization Study*. Great Lakes Wildlife Initiative. Retrieved April 2022, from <https://nrd.kbic-nsn.gov/sites/default/files/manoomindraft1-s.pdf>
21. *Manoomin Research & Restoration*. Little Traverse Bay Bands of Odawa Indians. (n.d.). Retrieved April 27, 2022, from <https://ltbbodawa-nsn.gov/departments/natural-resources-department/environmental-services/manoomin-research-restoration/>
22. Minnesota Department of Natural Resources. (2008). *Natural Wild Rice in Minnesota - A Wild Rice Study*. Retrieved April 2022, from [https://files.dnr.state.mn.us/fish\\_wildlife/wildlife/wildrice/natural-wild-rice-in-minnesota.pdf](https://files.dnr.state.mn.us/fish_wildlife/wildlife/wildrice/natural-wild-rice-in-minnesota.pdf)
23. *DNR Wild Rice Advisory Committee Meeting Minutes*. Personal Communication. (2019, July 30). Retrieved April 2022, from <https://p.widencdn.net/d4oehw/MeetingMinute0719>

24. Great Lakes Indian Fish & Wildlife Commission (GLIFWC). (n.d.). *Wild Rice*. Odanah, WI; GLIFWC. Retrieved April 2022, from [http://glifwc.org/publications/pdf/Wildrice\\_Brochure.pdf](http://glifwc.org/publications/pdf/Wildrice_Brochure.pdf).
25. Wisconsin Department of Natural Resources. (n.d.). *Wild Rice harvesting*. Wild rice harvesting || Wisconsin DNR. Retrieved April 2022, from <https://dnr.wisconsin.gov/topic/wildlifehabitat/rice.html>
26. Olivia Mōhala Takeko Aiona and Tyler Tran. (2021, February 2). *Importance of and threats to manoomin*. ArcGIS StoryMaps. Retrieved April 2022, from <https://storymaps.arcgis.com/stories/07f1a45881a14d198bd0d0bea9b3dd51e>
27. Great Lakes Indian Fish and Wildlife Commission. (2018, April). *Climate Change Vulnerability Assessment - Integrating Scientific and Traditional Ecological Knowledge*. GLIFWC. Retrieved April 2022, from [https://glifwc.org/ClimateChange/GLIFWC\\_Climate\\_Change\\_Vulnerability\\_Assessment\\_Version1\\_April2018.pdf](https://glifwc.org/ClimateChange/GLIFWC_Climate_Change_Vulnerability_Assessment_Version1_April2018.pdf)
28. Weichel, B. J., & Archibold, O. W. (1989). *An evaluation of habitat potential for wild rice (Zizania palustris L.) in northern Saskatchewan*. Applied Geography, 9(3), 161–175. [https://doi.org/10.1016/0143-6228\(89\)90037-4](https://doi.org/10.1016/0143-6228(89)90037-4)
29. Lee, P. (n.d.). *Controlling Exotic Cattails Invading Wild Rice Stands: Rainy Lake*. Rainy Lake of the Woods Watershed. Retrieved April 2022, from <https://www.rainylakeofthewoods.org/index.php/2018/02/02/controlling-exotic-cattails-invading-wild-rice-stands-rainy-lake/>
30. Kristi E. Dysievick, Peter F. Lee and John Kabatay. (2016, April). *Recovery of a wild rice stand following mechanical removal of Narrowleaf cattail*. International Joint Commission. Retrieved April 2022, from [https://ijc.org/sites/default/files/2018-12/IWI\\_Effect\\_Water\\_Management\\_Regime\\_Cattail\\_Invasion\\_Wild\\_Rice\\_Production\\_2014.pdf](https://ijc.org/sites/default/files/2018-12/IWI_Effect_Water_Management_Regime_Cattail_Invasion_Wild_Rice_Production_2014.pdf)
31. Wisconsin Department of Natural Resources. (2021, June 16). *Wild Rice Marsh*. Wild Rice Marsh - Wisconsin DNR. Retrieved April 27, 2022, from <https://dnr.wi.gov/topic/EndangeredResources/Communities.asp?mode=detail&Code=CPHER057WI>
32. Johnson, R. (n.d.). *2.16 Purple loosestrife*. Aquatics.org. Retrieved April 2022, from <http://aquatics.org/bmpchapters/2.16%20Purple%20Loosestrife.pdf>

33. Sea Grant Wisconsin. (n.d.). *Literature Background*. Manoomin Education and Outreach Project. Retrieved April 2022, from <https://seagrant.wisc.edu/manoomin/literature-background/>
34. *Aquatic Invasive Species Prevention: Fox-Wolf Watershed Alliance*. Fox-Wolf Watershed Alliance. (2021, December 22). Retrieved April 2022, from <https://fwwa.org/aquatic-invasive-species/species-profiles-and-pathways/>
35. Personal Communication, 02/20/2022, Bill Cwackembush, ES 600 Lake Poygan Fieldwork, Snow Snake and Sturgeon Celebration
36. Personal Communication, 04/14/2022, Courtney Cotrell, Brothertown Nation: Tribal Historic Preservation Officer, *Intertribal Partnership for Wild Rice Restoration Meeting*, ES 600 Capstone
37. Personal Communication, 04/21/2022, Jessica Ryan, Brothertown Vice-Chair, *Tribal University Partnerships For Wild Rice Revitalization In Wisconsin Waters*
38. Personal Communication, 04/26/2022, Ted Johnson, *Intertribal Partnership for Wild Rice Restoration Meeting*, ES 600 Capstone
39. Loew, P., DeMain, P., & Leary, J. P. (2013). Brothertown Indian Nation. In *Indian Nations of Wisconsin: Histories of Endurance and Renewal* (pp. 149–158). Essay, Wisconsin Historical Society Press.
40. Tribal Adaptation Menu Team. 2019. *Dibaginjigaadeg Anishinaabe Ezhitwaad: A Tribal Climate Adaptation Menu*. Great Lakes Indian Fish and Wildlife Commission, Odanah, Wisconsin. 54 p.
41. Gould, K. (2022, March 31). Winnebago Watershed Wild Rice. ArcGIS Storymap. Retrieved April 2022, from <https://storymaps.arcgis.com/stories/6e5817a820044bf7b9414c4316d308b2>
42. Ojibwe People's Dictionary Project. *The Ojibwe People's Dictionary*. (2021). Retrieved April 2022, from <https://ojibwe.lib.umn.edu/>
43. Lee, S. W. (2022, April). *WI Intertribal Lake Winnebago Connectivity Project: Wild Rice Revitalization Biodiversity*. Biodiversity Report Final Draft. Retrieved April 2022, from [https://docs.google.com/document/d/1kRxP-5OG4XMN8xL9eWawwTsHe1pi7nLL4Z7\\_EyqRfOk/edit?usp=sharing](https://docs.google.com/document/d/1kRxP-5OG4XMN8xL9eWawwTsHe1pi7nLL4Z7_EyqRfOk/edit?usp=sharing)
44. UW Green Bay Herbarium- Cofrin Center for Biodiversity. (2006). *Zizania aquatica and*

- Zizania palustris*. Wetland plants of Wisconsin: Wild Rice. Retrieved April 2022, from [https://www.uwgb.edu/biodiversity-old/herbarium/wetland\\_plants/zizaqu01.htm](https://www.uwgb.edu/biodiversity-old/herbarium/wetland_plants/zizaqu01.htm)
45. Benton-Banai, E. (2015). *The Mishomis Book: The voice of the Ojibway*. Manitoba Education and Advanced Learning, Alternate Formats Library.
46. Personal Communication, 04/23/2022, Dennis Kenote, *Menomonee Veteran and Elder*, ES 600 Capstone Fieldwork Trip to Brothertown and Menomonee Nations
47. Fleener, J. (2021, August 26). *2021 Wisconsin Wild Rice Harvest Forecast Shows Varied Outlook*. Wisconsin DNR. Retrieved April 2022, from <https://dnr.wisconsin.gov/newsroom/release/48986>
48. Velte, C. H. (1976). Wild Rice and High Waters. In *Historic Lake Poygan* (pp. 10–31). essay, Velte. Retrieved April 2022, from <https://digicoll.library.wisc.edu/cgi-bin/WI/WI-idx?type=turn&entity=WI.WFLakePoygan.p0021&id=WI.WFLakePoygan&isize=text>.
49. Jenks, A. E. (1901). *The Wild Rice Gatherers of the Upper Lakes: A Study in American Primitive Economics*. US Library of Congress Archives. U.S. General Printing Office. Retrieved April 2022, from <https://ia601909.us.archive.org/3/items/wildricegatherer00jenk/wildricegatherer00jenk.pdf>.
50. Beaumont. (n.d.). Freelang Mohegan-English-Mohegan Online Dictionary. Translation Mohegan-English-Mohegan - FREELANG online dictionary. Retrieved April 2022, from <https://www.freelang.net/online/mohegan.php?lg=gb>
51. Milgroom, J. (n.d.). *Wild rice and the Ojibwe*. MNopedia. Retrieved April 2022, from <https://www.mnopedia.org/thing/wild-rice-and-ojibwe>
52. Rood, D. S. (2015). *Rice, wild, Zizania aquatica*. Comparative Siouan Dictionary. Retrieved April 2022, from <https://csd.clld.org/parameters/435#5/44.528/-96.218>