Efforts to manage Big Rice Lake have not improved Manoomin functionality

Manoomin continues to be affected by hydrologic conditions and other threats

Historically, Big Rice Lake was one of the best-producing Manoomin (wild rice) lakes in northeastern Minnesota, and Manoomin on this lake provided cultural, ecological, and educational services to the Anishinaabe people. Over the last two decades, natural resource managers actively managed Big Rice Lake to improve conditions of Manoomin and its associated habitat. However, their actions – including water management, vegetation control, and beaver control – have been largely ineffective in recent years and Manoomin abundance continues to remain low. Manoomin and its habitat at Big Rice Lake have declined across all cultural and ecological metrics, and ginoozhegoons (pickerelweed) continues to outcompete Manoomin in parts of the lake. This case study highlights the difficulties in restoring degraded Manoomin and its associated habitat, and the importance of protecting it.

Threats to Manoomin at Big Rice Lake

Hydrologic changes, impacts from competing vegetation, and perhaps climate change have threatened Manoomin at Big Rice Lake. Manoomin is very sensitive to changes in water levels. Low or stable water conditions over long periods can encourage the proliferation of other vegetation, such as ginoozhegoons (pickerelweed), which can outcompete Manoomin for space and resources. Ginoozhegoons has expanded considerably on Big Rice Lake, especially on the eastern half of the lake. In addition to the artificial controls on water levels, climate change could change precipitation patterns, which may increase both the likelihood of drought and the frequency of heavy rain events that can cause high water levels and flooding in Big Rice Lake.

"Big Rice Lake is culturally and historically important to local Ojibwe Bands who have utilized the lake for centuries and continue to exercise treaty rights there today. State residents also have strong ties to Big Rice Lake for wild rice harvesting, waterfowl hunting, and fur trapping."

MN DNR, 2013.

Credit: 1854 Treaty Authority.

About Big Rice Lake

Big Rice Lake, located in St. Louis County in northeastern Minnesota, is approximately 1,870 acres. The area was traditionally used for ricing, sugar bush, and hunting activities; and archaeological evidence indicates human use on sites surrounding the lake for hundreds – perhaps thousands – of years.

The lake is an important feeding and resting area for migrating waterfowl. In years of good Manoomin production, mallards, goldeneyes, wood ducks, blue winged teal, and ring-necked ducks use the lake. In 1992, Big Rice Lake became a Designated Wildlife Lake because of its "outstanding value to wildlife." Currently, the lake supports a bald eagle nesting territory, as well as muskrats, minks, beaver, otter, great blue herons, and trumpeter swans.

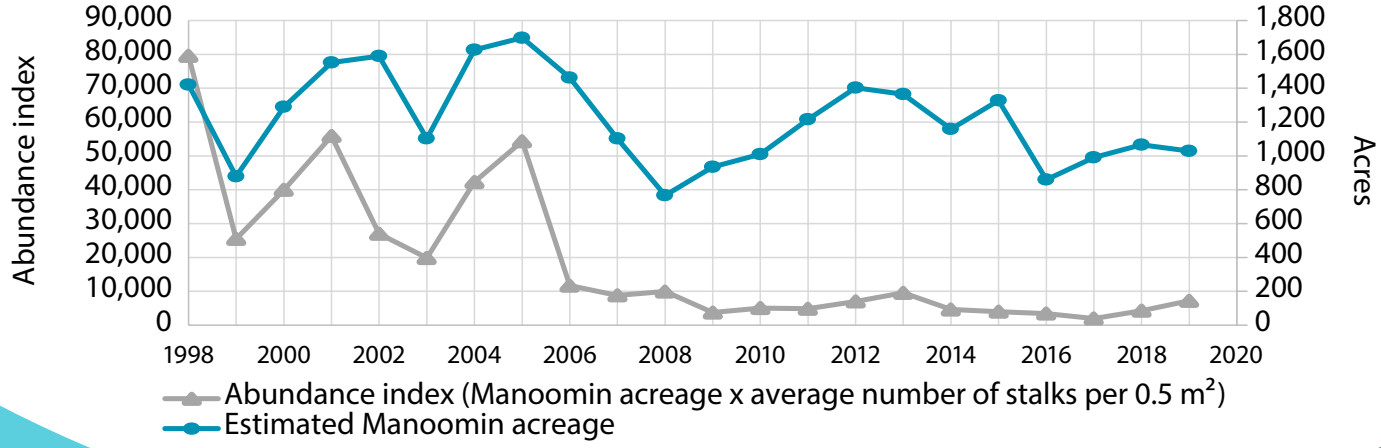
Actions taken to improve the abundance of Manoomin at Big Rice Lake

Natural resource managers have taken several actions to increase Manoomin at Big Rice Lake. In 1995, federal and state agencies built a rock weir at the outlet of the lake to increase the water flow out of the lake and reduce rapid water-level changes that can negatively impact Manoomin growth (MN DNR, 2013). Initially, the installation of the rock weir seemed to improve Manoomin coverage at Big Rice Lake; however, despite adjustments to the weir and varied beaver management, the more stable water level appears to have favored ginoozhegoons over Manoomin.

Since 2006, a cooperative effort of several federal, state, and tribal partners has taken additional management activities to further support Manoomin (Vogt, 2020). In addition to allowing water levels to vary naturally, natural resource managers are cutting ginoozhegoons. Natural resource managers use an airboat with chains to disturb the substrate of Big Rice Lake to encourage the germination of Manoomin seed in several test plots (Vogt, 2020). These efforts control about 100 acres of ginoozhegoons each year, but Manoomin regrowth in cut areas has been minimal (Vogt, 2020). Over the years, partners have also trapped beavers and removed beaver dams to control water levels.

Natural rock rapids at the outlet of Big Rice Lake in 1992.
Credit: MN DNR, 2019.

Rock weir at the outlet of Big Rice Lake in 2016.
Credit: MN DNR, 2019.



Manoomin abundance index and acres on Big Rice Lake.

Approach to characterizing Manoomin at Big Rice Lake

Twelve metrics characterize the cultural and ecological functions of Big Rice Lake's Manoomin and its associated habitat. These metrics describe how Manoomin at Big Rice Lake contributes to maintaining connections with the Anishinaabe culture, how ecological functionality is supported and resilient to changing conditions, and how continued learning and sharing of Anishinaabe values are promoted.

Cultural Metrics

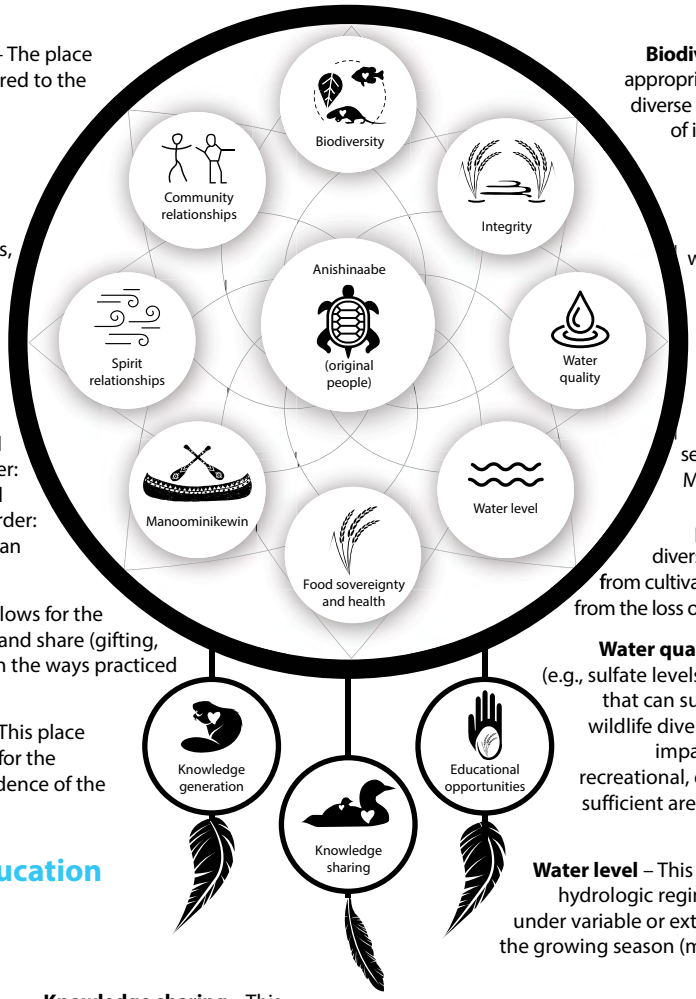
Anishinaabe (original people) – The place provides Manoomin, which is sacred to the Anishinaabe and central to the foundations of their culture, sovereignty, and treaty rights.

Community relationships – Manoomin at this place contributes to bonding, traditions, and strengthening family and community connections.

Spirit relationships – Manoomin at this place enables the Anishinaabe to maintain connections and balance with spirit beings (or relatives) from all other orders of creation (first order: rock, water, fire and wind; second order: other plant beings; third order: animal beings; fourth order: human beings).

Manoominikewin – This place allows for the Anishinaabe to harvest, prepare, and share (gifting, healing, and eating) Manoomin in the ways practiced by their ancestors for centuries.

Food sovereignty and health – This place provides the capacity to provide for the sustenance, health, and independence of the Anishinaabe.



Ecological Metrics

Biodiversity – Healthy Manoomin and appropriate habitat at this place supports diverse biological communities (e.g., free of invasive species) that indicate the capacity of the place to support abundant associated plant and animal species (e.g., other native aquatic vegetation, fish, waterfowl, muskrat), providing for spiritual and subsistence needs.

Integrity – Physical habitat and hydrology, and water and sediment chemistry support stands of Manoomin that exhibit natural annual variability; viable seed bank ensures that sustainable Manoomin populations will persist even after occasional poor production years. Natural genetic diversity is maintained without impact from cultivated strains, or reduced gene flow from the loss of nearby Manoomin populations.

Water quality – This place has clean water (e.g., sulfate levels below 10 ppm) and sediments that can support robust stand density and wildlife diversity; is free of contamination or impacts from industrial, agricultural, recreational, or residential influence; and is of sufficient areal extent to sustain a Manoomin population.

Water level – This place has a natural or managed hydrologic regime that can maximize resilience under variable or extreme climatic conditions across the growing season (maintaining optimal depth range and flow).

Cultural and Ecological Education Metrics

Knowledge generation – This place allows for continued learning and generation of the Anishinaabe practices, values, beliefs, and language through experience.

Knowledge sharing – This place allows for the continued sharing and transmittal of the Anishinaabe practices, values, beliefs, and language among family members and community.

Educational opportunities – This place provides opportunities for language, land stewardship, and other educational programs, such as educational rice camps.

Cultural and ecological characterization at Big Rice Lake

Big Rice Lake's Manoomin and its associated habitat were characterized over three time periods. Each metric was ranked using the following five-point descriptive scale: No use, Very bad, Not very good, Pretty good, Doing great

1900 to 1994: Before rock weir construction

Based on the combined ranking of the cultural and ecological metrics, Big Rice Lake was characterized as "pretty good." During this period, Big Rice Lake was dominated by Manoomin with variable production across years, which provided high-quality waterfowl and wildlife habitats, and the opportunity for harvesting. The lake was culturally and historically important to Ojibwe Bands who used the lake during this period and exercised their treaty rights.

1995 to 2005: After rock weir construction

Immediately after the installation of the rock weir in 1995, Manoomin coverage at Big Rice Lake improved in some years. However, over time the more stable water level favored ginoozhegoons over Manoomin, and Manoomin began to decline, although it remained at the "pretty good" ranking score based on the combined ranking of cultural and ecological metrics.

Credit: 1854 Treaty Authority.

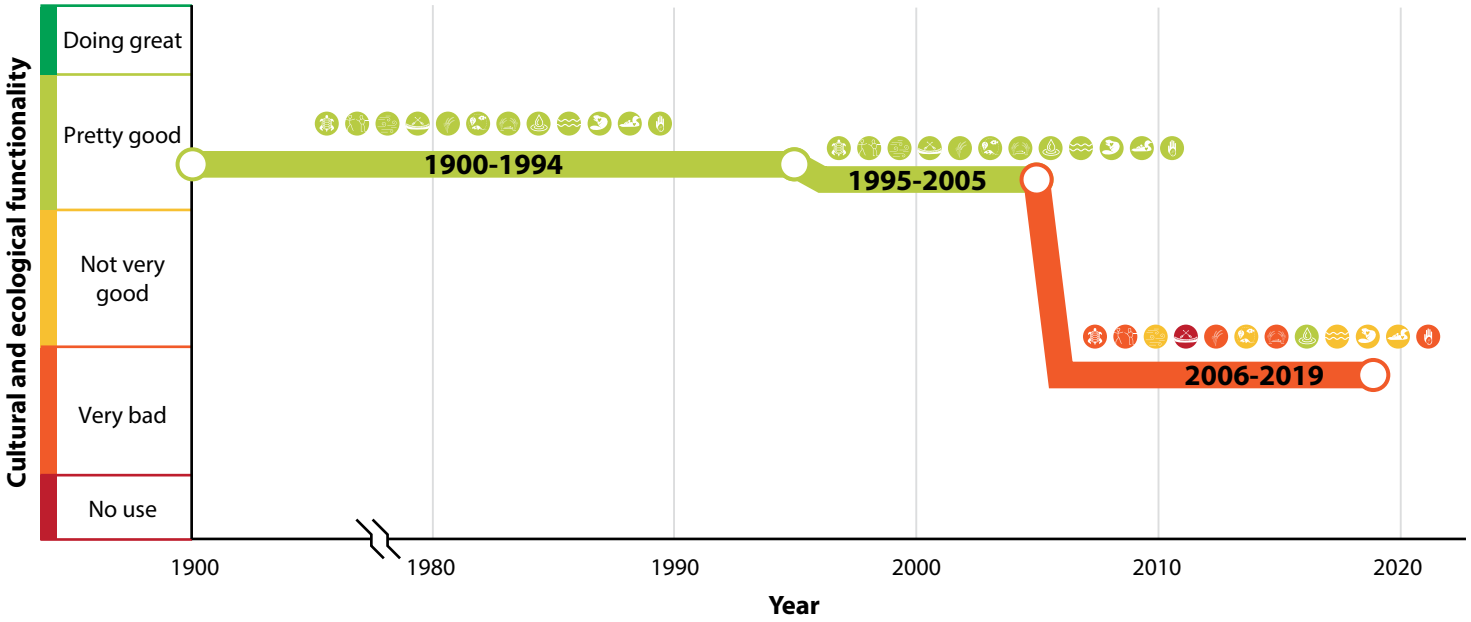
2006 to 2019: With active management of Manoomin

By 2006, Big Rice Lake ranked as "very bad" based on the combined ranking of cultural and ecological metrics. Hydrologic changes, competition from ginoozhegoons, and perhaps other unknown factors led to the dramatic decline of Manoomin. From 2006 to 2019, natural resource managers took active management steps to recover Manoomin at Big Rice Lake; however, it remained sparse in coverage, with only a few small, moderate-to-good density stands found on the lake. As a result, community members were unable to harvest, prepare, and share Manoomin in ways practiced by their ancestors. This also limited sharing, transmittal, and generation of Anishinaabe practices. The decline in Manoomin has also negatively affected migratory waterfowl that use the lake.

Credit: 1854 Treaty Authority.

Cultural and ecological characterization of Big Rice Lake

Cultural and ecological services provided by Manoomin and its associated habitat at Big Rice Lake decreased over time, both in total and for individual metrics.



Additional restoration needed

Since the 1990s, natural resource managers have tried to improve the conditions of Manoomin and its associated habitat at Big Rice Lake; however, recent actions have not been successful and conditions continue to be diminished.

Restoration funds have recently been awarded to undertake further actions at the lake (Helmberger, 2019). If these actions were to improve functionality, we could use a Habitat Equivalency Analysis (HEA) to demonstrate the additional equivalent units of restoration that would be needed to counter-balance the severity and timespan of degradation. For example, if actions were implemented over the next 20 years (2020 to 2040) to improve habitat functionality by 2.5%, we would need over 400,000 acres of similar Manoomin restoration to counter-balance the lost habitat functionality that has occurred over time (from 1995 to 2019). This is equivalent in size to over 200 Big Rice Lakes. The table to the right provides the HEA results, assuming several hypothetical scenarios of improvements in habitat functionality; it is important to note that we do not know what actions are needed to create these percent improvements. The main purpose of these scenarios is to highlight that if only minimal restoration is achieved at Big Rice Lake (which may be anticipated, given the long history of attempting restoration, with minimal response), then significant equivalent amounts of this restoration would be needed to balance the prolonged period of degradation at this lake.

Hypothetical percentage of improvement in habitat functionality from 2020 to 2040	**Acres needed to counter-balance historical losses given hypothetical improvement** *(Acres rounded to the nearest hundred)*	**Number of Big Rice Lakes needed to counter-balance historical losses given hypothetical improvement**
2.5%	426,100	228
5.0%	213,100	114
10.0%	106,500	57
20.0%	53,300	29

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About this effort

This case study is part of the Lake Superior Manoomin Cultural and Ecosystem Characterization Study. The project was initiated by a team of Lake Superior Basin Anishinaabe communities, and federal and state agencies, with technical support from Abt Associates. This project aims to describe the importance of Manoomin to help foster community stewardship and education; and to inform Manoomin stewardship, protection, and policy in the Lake Superior region and throughout the Great Lakes. Funding for this project was received via Great Lakes Restoration Initiative. For more information on the Initiative and Action Plan go to https://www.glri.us/.

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