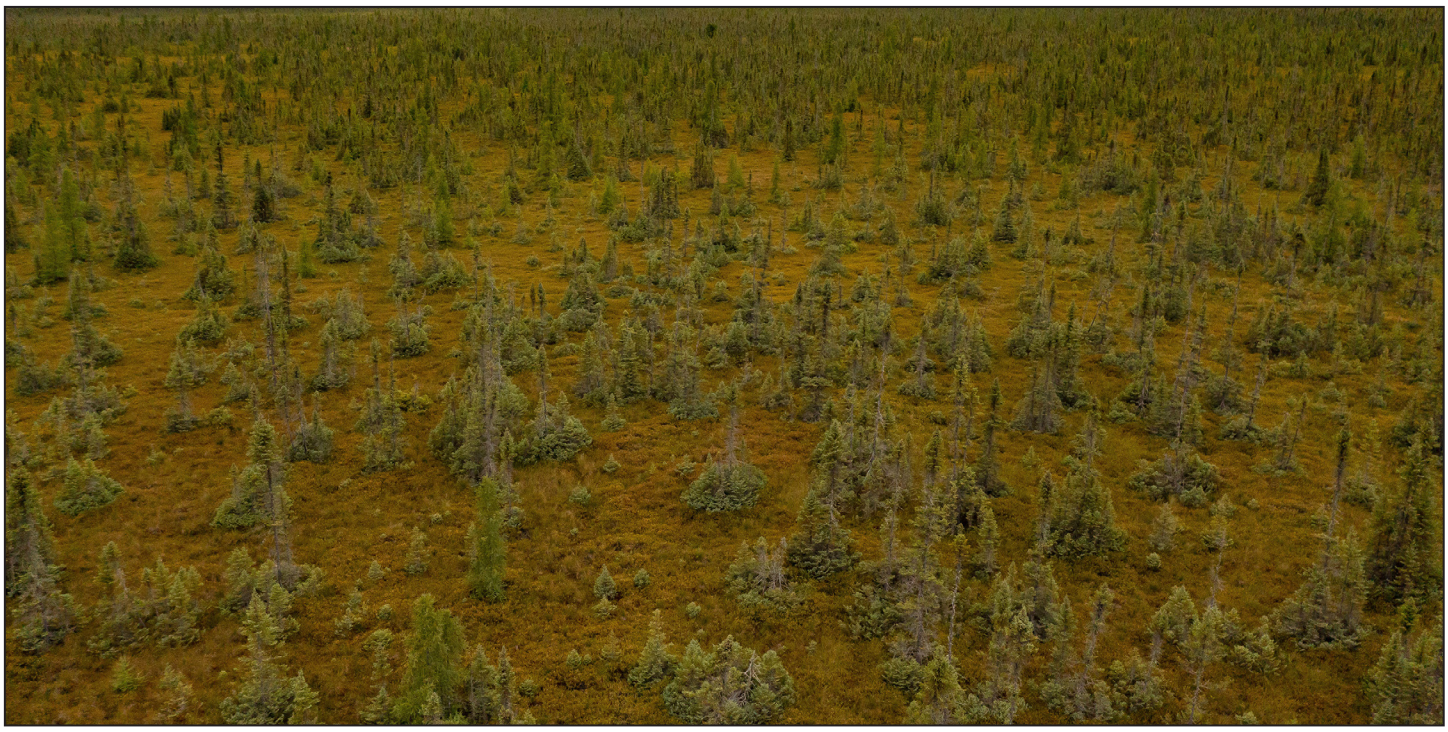
Peatlands restoration potential sparks research, conservation



CLEAN WATER LAND & LEGACY AMENDMENT

WEB PAGE: Details, including links to the Potentially Restorable Peatlands Mapping Tool, the Minnesota Climate Action Framework and BWSR staff contacts, are on BWSR's Peatlands web page.

Minnesota's peatlands, often overlooked in the past, are now gaining attention for their biodiversity and for their potential to help mitigate the effects of climate change.

The Minnesota Board of Water and Soil Resources (BWSR) is developing a Reinvest in Minnesota (RIM) easement option focused on peatlands. BWSR staff and partners recently developed a mapping tool to help identify potentially restorable peatlands.

The state is home to nearly 7 million acres of peatlands — the largest peatlands acreage of any state in the continental U.S. and second only to Alaska. A peatland is a type of wetland where high water tables saturate plant material, so that layers of decomposed vegetation build up over time, forming peat or muck soils, known as histosols. These saturated soils create anaerobic conditions that trap most greenhouse gases, except for some methane emissions.

The 24,000-acre Sax-Zim Bog southeast of Hibbing was protected and restored as part of the Lake Superior Wetland Bank. Peatlands (bogs and fens) hold some of Minnesota's largest carbon reserves, but emit large quantities of carbon when ditched and drained. Protecting existing peatlands and other wetlands, and restoring drained, farmed or pastured peatlands and wetlands will increase carbon storage. **Photo Credits:** Derek Montgomery for The Nature Conservancy

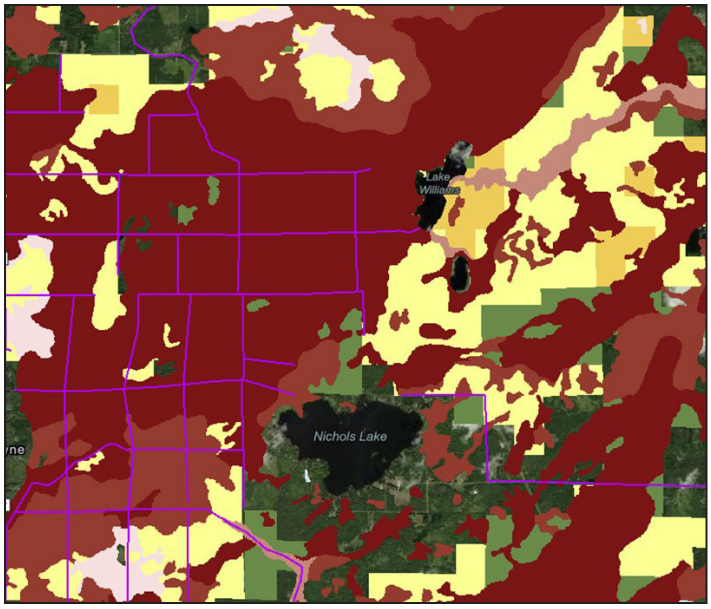
While peatlands occupy only about 3% of the Earth's land area, they store up to 30% of its terrestrial soil carbon — as much as is stored in forests worldwide. But when peatlands are drained or farmed, they release this carbon to the atmosphere as carbon dioxide, along with nitrous oxide and methane, "flipping" from carbon sinks to carbon sources. Drained peatlands can also release methyl mercury to downstream water bodies, where it can accumulate in fish tissues.

According to a recent analysis by The Nature Conservancy (TNC), about one-sixth of Minnesota's peatlands have been fully or partially drained, including approximately 478,000 acres currently used as cropland or pasture.

Minnesota's peatlands are usually classified as bogs, fed mainly by rainfall, with acidic water and sparse vegetation; or as fens, a rare wetland type fed by flowing groundwater. However, peatlands differ in their nature and extent across Minnesota.

The large peatlands that span the Continental Divide and form the headwaters of the Mississippi and Great Lakes watersheds are among the most valuable in North America, both as carbon sinks and as unique wetland habitats. They hold and filter water, reducing downstream flooding and contributing to clean water in wild rice lakes.

Native vegetation is dominated by sphagnum mosses and sedges, although some peatlands contain stands of black ash, black spruce, tamarack and other lowland conifers. Many large bogs are home to unique carnivorous plants such as sundews and pitcher plants. Birders are drawn from around the world to the Sax-Zim Bog Important Bird Area southeast of Hibbing, an internationally renowned winter habitat for Arctic and boreal bird species.



Top: *The mapping tool produced a depiction of drainage ditches, histosols (reddish brown) and a patchwork of public and private land in the Meadowlands area south of the Lake Superior Wetland Bank.* **Left:** *The tool shows RIM wetland easements, outlined in red, and other histosols on cropland in Steele County.* **Map Credits:** BWSR

Smaller drained and farmed peatlands in southern and western Minnesota are less widely recognized, but are surprisingly extensive in areas such as the Anoka Sand Plain, where peat and muck soils often form shallow basins within a sandy substrate. These lands have been extensively farmed for sod and vegetable production, and further drained for urban development. However, many small wetlands have also been restored and protected for water storage and water quality. Wet meadows are dominated by a combination of grasses, sedges and forbs.

Many peatlands have been restored through BWSR's RIM Wetlands Easement program and as part of wetland mitigation banks.

The Sax-Zim Bog, for example, was protected and restored as part of the Lake Superior Wetland Bank, one of Minnesota's largest banks at 24,000 acres. Approximately one-fifth of BWSR's existing RIM easements include restored wetlands with areas of peat or muck soils. Among wetland banking easements, 45% include histosols, covering over half of those easements' total acreage.

Mapping tool

BWSR and Minnesota IT Services (MNIT) staff worked closely with researchers from TNC and the U.S. Forest Service to develop and refine the Potentially Restorable Peatlands mapping tool. The tool provides a view of multiple layers, including the percentages of histosols in soils, agricultural land uses, identified wetlands, public ownership and tribal landholdings.

It is intended for use by field staff and local partners as a first step in identifying partially drained, cropped or pastured peatlands with potential for restoration. As with any wetland restoration, more detailed surveys of site conditions, including hydrology, vegetation and land ownership would follow.

Throughout northern Minnesota, gridded or angular lines depict the drainage ditches, many dating from the early 20th century, built to "drain the swamps" for agricultural use. Many of those farming efforts failed, and hundreds of miles of ditches were abandoned but remain in place, causing subsidence and drying out of vegetation and soil within 150 meters (about 500 feet) on either side of the ditches.

Many partners

Both peatlands research and conservation efforts are accelerating. Minnesota's Climate Action Framework recognizes the importance of protecting and restoring this resource as a key



Mosses and plants, including an orchid, **center,** *grow in and near the Sax-Zim Bog near Hibbing.* **Photo Credits:** Kristen Blann, The Nature Conservancy

strategy for reducing greenhouse gas emissions.

The 2023 Legislature also recognized the importance of the peatlands resource, appropriating up to $9 million to acquire conservation easements and restore and enhance peatlands and adjacent lands "for the purposes of climate resiliency, adaptation, carbon sequestration, and related benefits." In response, BWSR is developing a RIM easement option focused on peatlands, as a subprogram under the broader RIM Wetlands Easement program. BWSR and partner agencies are exploring opportunities for additional federal funds to restore both publicly and privately owned peatlands.

Since 2021, TNC has been conducting research to assess the benefits of peatlands restoration for climate change mitigation and to identify sites with the best restoration potential. TNC and other partners hosted a Peatlands Science Summit in March 2023, and have established several working groups to share information about policy development, restoration methods, data and greenhouse gas emissions. TNC's spatial analysis work will be incorporated into the Minnesota Pollution Control Agency's (MPCA) greenhouse gas inventory and other climate mitigation efforts.

With a 2023 Minnesota Environment & Natural Resources Trust Fund (ENRTF) grant, University of Minnesota and TNC researchers will measure carbon dioxide, methane fluxes and energy exchange with the atmosphere at two sets of disturbed (ditched), natural (undisturbed) and restored (rewetted) peatland sites in the Sax-Zim bog area and nearby properties, part of the Lake Superior Wetland Bank.

The team will use state-of-the-art equipment to measure gas flux. BWSR is a partner in this effort, which will produce valuable guidance on peatland restoration methods.

Partners' Related Work

A few more examples of partner activities include:

The Minnesota Department of Natural Resources received legislative funding to protect and restore carbon storage in state-administered peatlands, including school trust lands, and to complete a peatland restoration project on DNR lands.

The MPCA Watershed Division is currently sampling water flow and water chemistry in three legacy-ditched peatlands in the Mississippi River-Grand Rapids and the St. Louis River watersheds, looking at total phosphorus, dissolved organic carbon (to understand carbon loss) and dissolved oxygen.

The U.S. Forest Service is working to map peatlands nationwide and is looking at the implications of restoration on greenhouse gas fluxes and mercury, including the role of cleaner emissions in decreasing mercury transport from peatland watersheds even as the climate warms.

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND