Great Lakes Science Center

Wetlands Research

Background

Wetlands are vitally important to the ecological health of the Great Lakes ecosystem. The USGS Great Lakes Science Center has broad capabilities in the area of wetland research and conducts studies that produce information critical to wetland protection and restoration.

Capabilities

Center scientists conduct quantitative wetland vegetation analyses, vegetation mapping, photointerpretation, quantitative wetland fisheries, benthic macroinvertebrate, and mollusk analyses, water chemistry analyses, hydrologic data collection, laser surveying, application of GPS, GIS, remotely-operated underwater video, side-scan sonar, SCUBA, and snorkel diving.

Through ongoing collaborations, we have access to expertise in coastal sedimentology and paleoecology, radiocarbon and Pb^{210} dating, stable isotope analyses, seed-bank analyses, landscape ecology modeling, hydrologic modeling, and studies of phytoplankton, zooplankton, benthic invertebrates, herpetofauna, larval fish, shorebirds, and small mammals.

Applications

Under the International Joint Commission (IJC) Water-Levels Reference Study, research was conducted on the effects of water-level regulation on wetland plant communities of the Great Lakes, including site-specific studies on lakes Superior, Huron, Michigan, and St. Clair, plus broader studies at 18 sites on Lake Superior and 17 sites on Lake Ontario. Results demonstrated the relationship between water-level fluctuations, basin morphometry, and the diversity of wetland plant communities. Results also demonstrated for the first time that regulation of water levels on Lake Ontario since operation of the St. Lawrence Seaway began had substantially altered wetland plant community structure, reduced habitat diversity, and encouraged the spread of invasive species. Reports issued by the IJC thus recommended that the regulation plans for Lake Ontario be revised to include more variability. A new study to implement this recommendation is nearly complete.

Research on the effects of global climate change on wetlands of the Great Lakes is being conducted under the DOI Global Climate Change program, focusing on sites spanning a 450-km latitudinal gradient on Lake Michigan and sites on Lake Superior. This study integrates sedimentological and paleoecological analyses of cores taken from chronosequences of beach ridges and intervening wetlands with modern-day wetland vegetation analyses. Completed work resulted in construction of a 4,700-year history of climate-driven lake level changes in Lake Michigan, reevaluation of isostatic rebound, and conclusions that long-term, major wetland vegetation changes resulted from hydrologic changes forced by regional climate change rather than hydrarch succession.

Studies of alternative means of managing diked refuge wetlands adjacent to Great Lakes waters while restoring hydrologic connections translated into a research partnership to use this approach in restoration of Metzger Marsh in western Lake Erie. A dike constructed to replace the protective function of the long-eroded barrier beach contains a water-control structure that mimics the natural hydrologic function of an opening in the barrier beach but also incorporates a carp-control barrier. Following drawdown to simulate a low lake-level period and elicit growth of emergent vegetation from the seed bank, the control structure was opened to allow the wetland to function naturally. In collaboration with other federal and state agencies and university partners, the Center is conducting the relevant pre- and post-restoration biological and physical science studies that will allow the results of this effort to be applied to a wide number of diked wetland sites.
In cooperation with the U.S. EPA, the Center is developing bioindicator methods to detect degradation of Great Lakes wetlands at an early stage when mitigation and resolution may be successful. Studies of plant, fish, and invertebrate communities at sites ranging from relatively pristine to severely degraded were conducted in barrier beach wetlands of Lake Superior, lakeshore emergent marshes of Saginaw Bay in Lake Huron, and drowned-river-mouth wetlands of Lake Michigan. That suggested caution in use of bioindicators.

At the request of the U.S. Fish and Wildlife Service, studies supporting a peatland restoration project in the Seney National Wildlife Refuge were conducted to provide guidance for restoration activities. In cooperation with the USGS Water Resources Discipline, the Center evaluated current environmental conditions in the wetland and the impacts caused by an unsuccessful drainage project started in 1912. Results of these studies assisted the refuge manager in developing a plan for future distribution of water across the wetland that more closely approximates pre-drainage conditions, revitalizes impacted portions of the wetland, and minimizes erosion of peat and sand.