ST. CLAIR RIVER DELTA WETLANDS, MICHIGAN AND ONTARIO

The St. Clair River has formed a massive birdfoot-shaped delta where it enters Lake St. Clair. This delta is the largest river delta in the Great Lakes, covering about 7.5 mi^2 (19.5 km^2). Almost one-third of it is in Michigan and two-thirds are in Ontario. At one time much of the delta may have been wetlands, but much of it has been drained for agriculture and urbanization, especially on the American side. These changes were documented in a mapping project that recorded wetland losses from 1873 to 1975.

Botanists have mapped zones of twelve different wetland habitats along deltaic distributary channels, storm deposits, and bays. Five of these broad zones reflect the depth to the water table and the sediment type of the bottom. Bulrush marshes form in abandoned channels and open water having sandy sediments. Cattails grow in broad zones in lower parts of the delta along river banks and in the bottoms of shallow ponds and bays. Here the water depth is greater than 6 in. (15 cm) and the bottom is peaty and clayey. Sedge marsh forms in a narrow zone along river channels, at the base of ancient lake shorelines, and along unstable shorelines that may be flooded and eroded. Dogwood meadow has water-tolerant shrubs, such as red-osier and gray dogwood, and cottonwood; the water table here is normally 1.5 to 3 ft (0.5 to 1 m) below the surface. Red ash and swamp white oak grow in wetland forests about 3 to 9 ft (1 to 2.7 m) above mean lake level.

Borings penetrating the delta reveal the past history of the area. Organic-rich deposits, remnants of an earlier wetland complex, are sandwiched between a glacial lake clay from a lake that covered the area about 13,000 years ago and the sand and silt of the modern delta.

Today, the Canadian Government and the Walpole Island First Nation, composed of Ojibway, Ottawa, and Potawatomi Indian tribes, administer most of the remaining Canadian wetlands. One part is designated as a Canadian National Wildlife Area. Most of the remaining wild areas in Michigan are owned and protected by private hunting clubs. Together, the St. Clair and Long Point wetlands are the most important staging area in Ontario for waterfowl. Mallards, black ducks, Canada geese, and tundra swans prefer the delta islands, while canvasback and redhead ducks prefer the open waters of the shallow lakes.

POINT MOUILLEE MARSHES, NEAR ROCKWOOD, MICHIGAN

The word "mouillee" is of French derivation meaning wet, which aptly describes the most notable wetlands along the Michigan shore of Lake Erie. The Point Mouillee marshes, which once encompassed over 4.5 mi^2 (11.7 km^2), are on an eroded delta behind a barrier beach and lagoon complex. Cattails have dominated the vegetation through recorded history.

Although some fibrous peat and organic-rich clayey and silty materials have accumulated in the marshes, the area is being severely eroded by inundation from Lake Erie. The wetlands receive the brunt of storm damage, and the wind transforms the water into oscillating waves called seiches that scour the accumulated plant material. The U.S. Army Corps of Engineers built an artificial barrier at Point Mouillee in 1983 to replace the destroyed natural barrier beach. Material dredged from the nearby Detroit River has been piled behind rocky banana-shaped barriers. Bulrushes and common reeds from the surrounding wetlands have reinvaded the new ground. Black willow, white ash, and eastern cottonwood shrubs have invaded higher areas.

Today, the Point Mouillee marshes are managed by the Michigan Department of Natural Resources. Smartweed, pigweed, and burreed provide important food sources for waterfowl. As a result, the Point Mouillee marshes have become a major stopover for migratory waterfowl. In addition, fishermen line the road built over large culverts that allow water exchange between the wetland and protected coves.

POINT PELEE, ONTARIO

Reaching into Lake Erie is a massive sand spit called Point Pelee that is lined with wetlands. Its triangular, south-pointing shape is caused by two factors. At its core is a clayey glacial till moraine that was deposited by a retreating glacier. Along its margins, shifting sand swept from the north by intersecting longshore currents has deflected Point Pelee to the south.

The spit hosts several different types of wetland plant communities. Six large ponds having submerged aquatic vegetation are surrounded by a cattail marsh over 4 mi^2 (10 km^2) in size. Intertwined cattail rhizomes form massive floating mats. Shrub willow, red-osier dogwood, and buttonbush grow along the drier edges. On higher, drier land are forested lowland wetlands that once were home to disease-prone elms, but now host massive silver maples, green ash, and peachleaf willows.

Borings through the wetlands reveal their past history. Clay at the base was formed as lake-bottom sediment in a glacial lake ancestral to Lake Erie. The clay is overlain by a boulder-clay till from a moraine deposited by a retreating glacier. Localized peat deposits as thick as 9 ft (2.7 m) provide evidence that wetlands have flourished here for a long time. Although the extensive marsh is now a closed system that does not usually receive water from Lake Erie, beach ridges occasionally are breached during storms. These storm waves erode both ancient peat deposits and modern wetlands.

The history of people in the wetlands is well documented. Native Americans traversed the extensive marshes to avoid the longer route around the spit where the open lake currents could be dangerous. In 1799, the southern part of the spit was designated a naval reserve by the British, and trees were cut for timber, ship building, and ship repair. For the next 100 years, the wetlands attracted fur trappers, hunters, and fishermen.

In 1918, the Canadian Government recognized the importance of the wetlands as habitat for a unique collection of plants and animals that normally flourish farther to the south and as the intersection of two major migratory bird flyways. Hence, Point Pelee became part of the Canadian National Park system. The spring migration of colorful songbirds and the fall migration of hawks, falcons, eagles, and monarch butterflies attract thousands of people to the wetlands of Point Pelee.

LONG POINT WETLAND COMPLEX, ONTARIO

Pirates, gamblers, and other unsavory characters brought Long Point to the attention of travelers in the first half of the 19th century. Long Point is a sand spit that juts 20 mi (32 km) eastward into Lake Erie. This spit may have formed 4,000 to 5,000 years ago. Underlying the spit is a glacial moraine that traverses Lake Erie to Presque Isle in Pennsylvania.

The most varied of its wetland communities are in protected swales between beach ridges on the outer parts of the spit. The youngest wetlands are waterlily-filled ponds to the east. Noted plant associations include sedges, rushes, and bulrushes and tamarack-white cedar sloughs. However, both deep and shallow ponds and marshes have extensive stands of sedges, cattails, wild rice, buttonbush shrubs, and tamarack trees. To the west, the older, forested wetlands contain red oak, sugar maple, and white birch. Oscillating waves generated by the wind and long term water-level variations of Lake Erie have caused deep scouring of peat and muck in the marshes. Each fall accumulated plant remains used to be set afire by the native inhabitants to drive out wild game and clear the land for new growth, but burning is prohibited now in most places.

The earliest known occupation of the peninsula was about 750 A.D.; this date was determined from the remains of snapping turtles and a fish resembling cod, called ling or burbot, discarded by migrating Native Americans. Iroquois and other Indians, early explorers, such as Champlain in 1616, and the Europeans settlers, who followed in 1790, all hunted beavers in the wetlands. Walsingham Swamp, now known as the Big Creek National Wildlife Area, was a famous place for trappers and hunters to portage canoes. Adding to the perils of pirates who preyed upon travelers, dangerous sand bars and currents caused hundreds of shipwrecks off the point.

Members of hunting clubs have protected the wetlands since 1866. Now the Long Point wetland complex is managed by the Ontario Ministry of Natural Resources, the Canadian Wildlife Service, and a private company. Thousands of acres (hectares) of protected wetlands have made Long Point one of the most important areas in Ontario for flocks of migratory waterfowl, including tundra swans, Canada geese, hawks, and redhead and canvasback ducks, as well as monarch butterflies.

PRESQUE ISLE-ERIE CITY WETLAND COMPLEX, ERIE, PENNSYLVANIA

The wetlands of Presque Isle Bay are on a peninsula that protected the shipbuilding activities of Commodore Oliver H. Perry. Perry's troops then proceeded to defeat the British fleet in Lake Erie during the War of 1812. Presque Isle is formed from an elongated peninsula of sand called a spit. The spit stretches out like an arm, the arm of the Great Spirit protecting his people according to Erie Indian legend. Wetlands occur in low-lying areas between dunes or beach ridges, protected from the prevailing winds and waves. In 1902, Otto Jennings observed that the relative age of a swale wetland could be determined by its vegetation. Cottonwood seeds germinated in clean fresh sand within one or two years after swale ponds formed. In four years, bulrushes, stoneworts, and cattails colonized the ponds. Cranberries were so valued in one wetland named Cranberry Marsh, that the Cranberry Act of 1841 was enacted to protect the plants between July 1 and the first Tuesday of October. Despite legislation, most of the cranberries disappeared as the marsh aged. In 50 years, the cottonwoods were tall, and bayberry and willow shrubs were present. As vegetation filled the ponds, alders, maples, and elms became established.

Subsurface borings provide evidence of ancient wetlands on the spit. Underlying the marshes is partly decomposed organic material underlain by silt and sand that were deposited when a deep glacial lake, a precursor to Lake Erie, flooded the area about 12,800 years ago. Beneath the glacial lake sediments is a clayey glacial till that was deposited directly by a retreating glacier about 14,000 years ago. The moraine ridge built by this glacier extended from Erie, Pennsylvania, to Long Point, Ontario. This moraine forms the backbone of the Presque Isle spit.

In 1819, help from the Army Corps of Engineers was enlisted to stabilize the spit from lakeshore erosion. By the late 1940's, serious attempts were made to maintain the area for recreation and protect Erie Harbor. Engineers have been trying to stabilize Presque Isle's beaches ever since. Administered by the Pennsylvania Department of Environmental Resources, the Presque Isle-Erie City wetland complex provides a sanctuary for animals and rare, endangered plant species. The wetlands of the region are refuge for over 300 species of birds, including ducks, geese, and other waterfowl annually migrating along the vast American flyways.

TIFFT FARM WETLAND, BUFFALO, NEW YORK

There is a new saying that if you want to build a wetland habitat, find a place where a wetland used to be. The Tifft Farm wetland was an ancient wetland, a dairy farm, a docking facility, a dump, and now it is a wetland again. Originally, much of the land from Buffalo south to Lackawanna was a cattail marsh that formed on the delta of the Buffalo River where it emptied into Lake Erie. Its sedimentary history is revealed in soil borings. Landfill composed of dredged material, garbage, and industrial waste overlies silty clay that, in turn, overlies well- decomposed organic muck that formed in the cattail marsh. Beneath the organic layer is clay that was deposited in glacial Lake Warren, a higher, more extensive lake than present day Lake Erie.

Ducks and muskrats were hunted in the marsh by Seneca Indians and other tribes, a practice continued by Europeans. According to legend, the city of Buffalo got its name because the French explorer La Salle found "mysterious wild bulls," which may have been buffalo, grazing on the marshy ground in 1687. In 1858, George Washington Tifft bought 600 acres (240 hectares) to develop a dairy farm and stock yards. As the Industrial Age became established, the Lehigh Valley Railroad Co. installed a rail network and canal system for transporting grain, coal and coke, and steel. By 1900, an extensive area was dredged from the former Tifft Farm, and 83 ships from 12 shipping lines could be docked and stored there. The Panama Canal Act of 1912 broke the monopoly that allowed companies to own both rail and shipping lines, and the land fell into disuse. Municipal and industrial wastes, including foundry sand, steel slag, and harbor dredge materials were dumped on the property.

When the Buffalo Sewer Authority chose the wetland as the site for a new sewer facility and dump for refuse from the Squaw Island Disposal Site in 1972, hunters, fishermen, hikers, canoers, and birdwatchers protested. Green space for outdoor activities still existed, tucked between railroad lines and highways. A coalition of citizens, educators, environmental associations, sportsmen groups, and public officials devised a master-plan compromise to create hilly mounds from refuse that would overlook the more natural habitats. These diverse habitats now include open water ponds having submerged plants; a 75-acre (30-hectare) marsh having emergent plants such as cattails, arrowhead, and bulrushes; wet grassy meadows; thick, bushy, wet areas called shrub-carrs that are populated by willows and three species of dogwood; and forested wetlands dominated by American elm, black willow, and cottonwood. This area, now called the Tifft Farm Nature Preserve and administered by the Buffalo Museum of Science, is an important stop for migrating waterfowl and songbirds.

THE BLACK SWAMP, NORTHWESTERN OHIO

The Black Swamp once covered an area one-half the size of the original Florida Everglades. It extended southwestward from Toledo, Ohio, to Fort Wayne, Indiana. Now part of the great American corn belt, the Black Swamp used to be forested wetland supporting majestic stands of American elm, swamp white oak, pin oak, and shagbark hickory. Early traders, settlers, missionaries, and soldiers wrote of bears, flocks of wild turkeys, and the dreaded "swamp ague" spread by malaria-bearing mosquitoes. During the Indian Wars between 1791 and 1815, Shawnee, Delaware, Miami, and Potawatomi Indians lived around the edges of the swamp, and Ottawa and Wyandot Indians lived along the well-drained, natural levee banks of the larger streams that flowed sluggishly through the swamp. General William Henry Harrison may have fought Tecumseh's warriors through the swamp. Later Harrison's troops cut the first road through the swamp on their way to fight the British, who had taken Detroit during the War of 1812. The soldiers under Harrison's command, many of whom were farmers, recognized the richness of the organic soil for agriculture. Many remained after the war to farm, but first they had to clear and drain the wetland. The draining of the Black Swamp was the earliest large drainage program undertaken in the United States. When the farmers discovered that the underlying clay from glacial Lake Maumee made excellent drainage tiles, numerous tile factories were built to produce the tiles to drain the fields. By 1890, most of the Black Swamp had been drained. The forests fed a lumber industry that furnished timber for ships, log cabins, furniture, gunstocks, drainage planking, railroad ties, fuel for steamships, and charcoal to smelt iron ore.

Today, vestiges of the Black Swamp have been protected in Pearson Metropark in Toledo, Ottawa National Wildlife Refuge along southwestern Lake Erie, and other smaller areas in Wood County. Because the flat land used to be lake bottom, the heavy clay soils drain poorly and water stands for days in fields following rainstorms. If the land were allowed to go fallow and the drainage ditches were allowed to fill in, it is quite possible many plant communities of the original Black Swamp would grow again.

LOCATION MAP

EXPLANATION

- Ancestral wetlands—Characterized by organic soils and clayey lake sediments at depth. Extent determined by outward limit of lake clays and ancient beach ridges, as well as wet or poorly drained soils at the surface
- Modern wetlands—Characterized by vegetation, soils, and hydrology. Vegetation adapted to high water table or high soil moisture and low oxygen; soils are mottled or gleyed sediments or organic-rich muck and peat; water level is at or near the surface
- Watershed boundary of modern Lakes Erie and St. Clair. Note that both watersheds extend beyond the northern limit of the map
- Extent of clayey sediments reworked or deposited by lakes in the Lake Erie basin
- Sandy beach ridges of ancestral lake shorelines
- × Older wetlands buried by Lake Erie

DISCUSSION

Glaciation and deglaciation, waxing and waning of lakes, southward tilting of the underlying continent, and the activities of people all played major roles in the wetlands of the Lake Erie area. To some people, the word "wetland" conjures up images of alligators, mosquitoes, and snakes. Coal scientists think of places where the ground shakes as they walk over peat. Biologists and soil scientists determine wetlands by their vegetation, soils, and hydrology. Wetland scientists look for certain features: plant roots that have been modified for high moisture and low oxygen content, soils that show evidence of high moisture, and a water table that is at or near the surface. By their very nature, wetlands are transitory and ever changing.

Many of these characteristics define the wetlands that surround Lakes Erie and St. Clair today. However, many lakes preceded these modern lakes, and many clues must be used to decide how to define the wetlands of these ancestral lakes. First, one must understand the evolution of lakes in the Lake Erie basin. At least 15 different lakes occupied the area during the past 14,000 years. The most expansive or the longest lived of these ancestral lakes were Lakes Maumee, Whittlesey, and Warren. Because of variations in the continental glaciers during the Pleistocene Ice Age, the lakes dramatically expanded and retreated in response to changing water supplies from melting glaciers. The location and altitude of lake outlets also changed dramatically. Most of the ancestral lakes drained through rivers leading southwest and, later, northwest. Early Lake Erie came into existence when drainage was established northeast through the Buffalo and Niagara Rivers about 12,600 years ago. Modern Lake Erie came into existence about 4,000 to 5,000 years ago after a very low, dry stage when the lake had essentially become a river. Ages have been determined by measuring the concentration of carbon-14 remaining in organic material in sediments after radioactive decay.

An important clue to the location of former glacial lakes is the presence of lake-bottom deposits, particularly clay. When glacial meltwater streams flowed into the glacial lakes, their velocity decreased. Suspended sediments carried by the streams spread out and were laid down as lake-bottom mud, along with older clayey glacial debris (till) eroded from the shore during high lake levels. This silt and clay settled into flat-lying layers, many of which contain fossils of algae and shells.

Through time, wetland communities formed around the lakes. The plants responded to the underlying clay and poor drainage, the flat lay of the land, and changes in lake levels. When lake levels fell, extensive wetlands became established on the newly exposed lake-bottom sediments. When rising water levels expanded the lakes, these wetlands were drowned and the plants migrated toward higher ground.

The lack of good drainage on the older lake plains was very important for the formation and maintenance of the different kinds of wetlands. Where water stood at the surface all year, marsh plants were dominant. Where the shallow water table fluctuated up and down with the changing seasons, swamp forest trees grew. In places where plant material accumulated and ground water carried calcium, fen plants appeared. Acid bogs only formed where limestone was not available to supply calcium. Some of these plant communities deposited peat, while others left behind a sediment soil that was rich in organic matter. In some places, conditions were so stable that swamp trees grew quite large. In other places, storms from Lake Erie or shifting water levels never allowed the long-lived establishment of stable plant communities.

Lake St. Clair, north of Lake Erie, is also a remnant of the earlier lakes. Its history of shifting lake levels and its physical setting are similar to western Lake Erie, so similar wetlands fringe both lakes. But Lake St. Clair also has extensive wetlands that formed in the north where the St. Clair River deposited a large, low- lying delta into the glacial lake.

In more modern times, two powerful forces are continuing to shape the wetland plant communities of Lakes Erie and St. Clair. The first is a result of deglaciation. The thick ice that covered the northern part of the continent was so heavy, it depressed the land beneath. When the glaciers melted, the land rose and now is tilting southward. This means that wetlands north of Lake Erie in Ontario, Canada, are slowly being drained as they are uplifted, and wetlands southwest of the lake in Ohio are gradually being flooded. This process is being accelerated in the southern wetlands by storm surges that invade the wetlands and scour away the sediment and peat.

The second major force changing the wetlands is the activity of people. We have drained wetlands for crops and homesites, filled them for roads, and excavated wetlands for harbors. Native Americans modified the forested wetlands by cutting trees. Their pathways and trails allowed new plants to invade the existing wetland plant communities. Acres of bottomland became corn fields. When the European settlers came, they cleared more land and drained ancient wetlands, such as the Black Swamp of northwestern Ohio. Most recently, city dwellers have continued to drain the wetlands and pave the land with impervious surfaces.

Recent changes in land-use concepts have resulted from our scientific understanding that wetlands serve vital functions for the maintenance and health of the land, the water, and all living creatures. Therefore, a variety of agencies, both large and small, are attempting to protect the remaining wetlands. Prime examples of such protection include areas of Long Point, Point Pelee, and the St. Clair delta in Ontario; St. Clair and Mouillee Marsh in Michigan; remnants of the Black Swamp, such as the Ottawa National Wildlife Refuge and Toledo's Pearson Metropark in Ohio; Presque Isle in Pennsylvania; and Tifft Farm Nature Preserve in New York. These examples illustrate a diversity of wetland types and a common geological history.

SPECIAL NOTES

Federal, State, Provincial, Tribal, and local regulatory agencies with jurisdiction over wetlands may define, describe, and map wetlands differently. Furthermore, this map scale is too general to adapt for local detailed use. Persons intending to engage in activities involving modifications within or adjacent to wetland and open-water areas should seek the advice of appropriate agencies concerning specific regulations and restrictions.

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Modern wetlands from National Wetlands Inventory (NWI) maps of the U.S. Fish and Wildlife Service, scale 1:100,000, supplemented by U.S. Geological Survey 7.5′ topographic maps, scale 1:24,000, and Wetland Map Series of Environment Canada, scale 1:50,000.

Ancestral wetlands hydric soils from survey maps of the U.S. Department of Agriculture, Soil Conservation Service, scale primarily 1:190,080, and from the Geographic Information System (GIS) in New York, scale 1:500,000; former wetlands in Ontario from Wetland Map Series of Environment Canada, scale 1:50,000. Clay distribution and beach ridges from state geologic maps of various scales

SELECTED REFERENCES

WETLANDS OF MODERN AND ANCESTRAL LAKES ERIE AND ST. CLAIR, MICHIGAN, OHIO, INDIANA, PENNSYLVANIA, AND NEW YORK, U.S.A., AND ONTARIO, CANADA

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