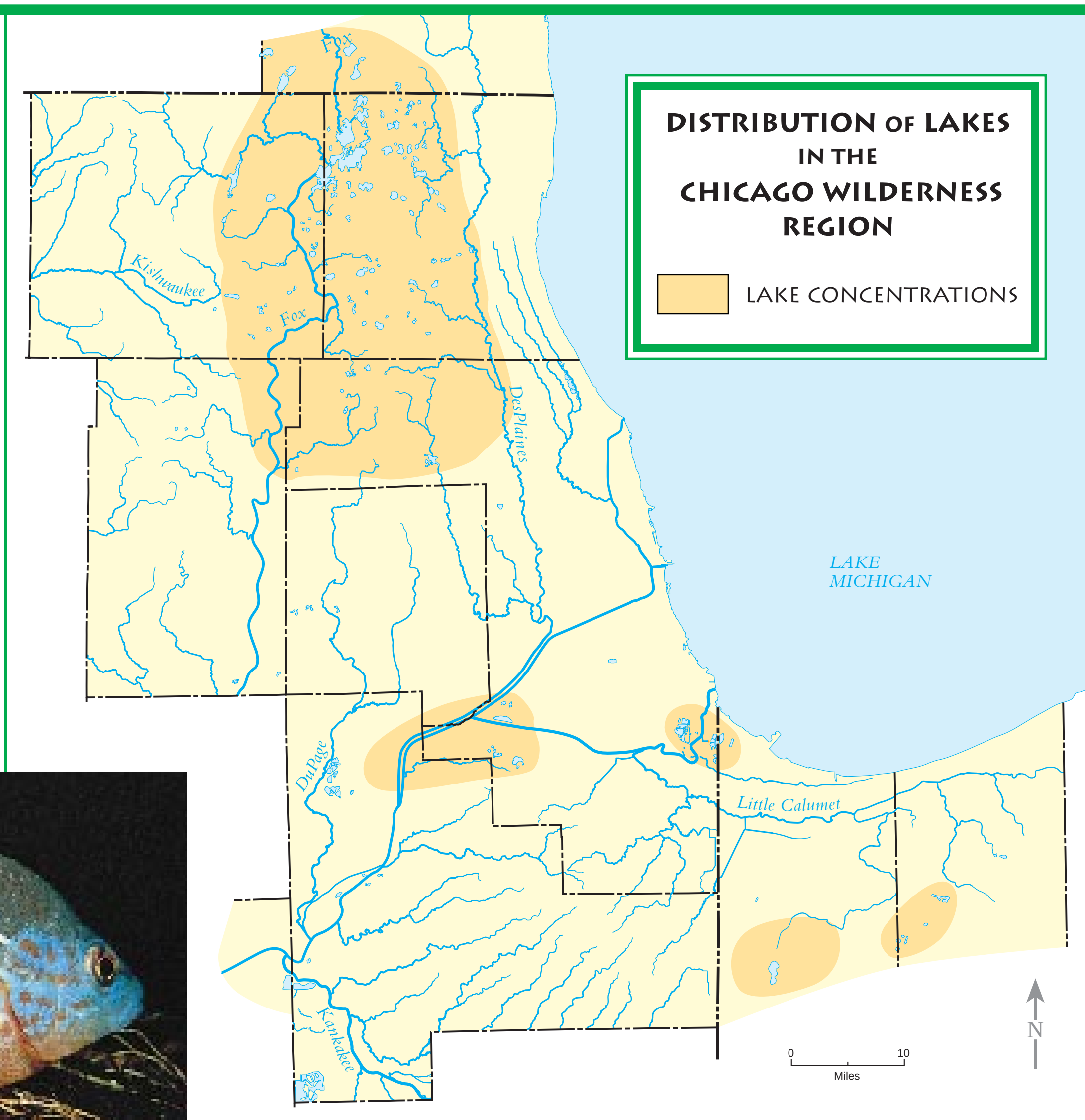
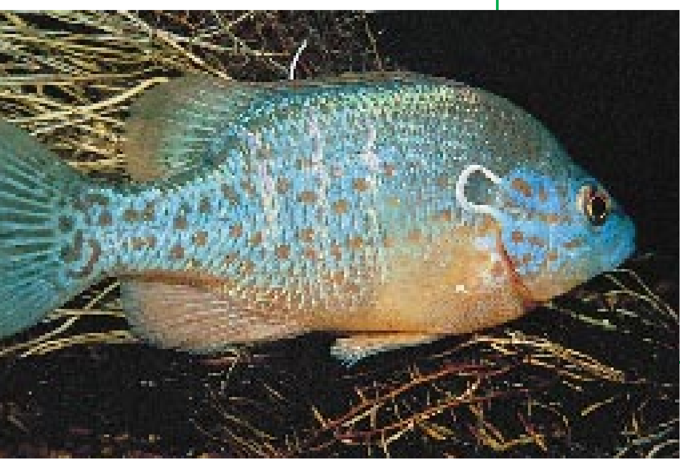
STILL WATERS
Lakes and Ponds



Lakes in our region are concentrated on the moraines and in low spots on the Chicago Lake Plain. Draining and filling have eliminated all but a few of the lake-plain lakes.



*The longear sunfish (*Lepomis megalotis*) brightens the waters of both lakes and rivers in this region.*

Lakes are one of the signs of the youth of our landscape. In areas to the south and west, where the glaciers departed less recently, the various depressions left by the ice have drained away or been filled by erosion from the surrounding uplands.

Glacial lakes are common to the north in Wisconsin and Michigan, but in the states of Illinois and Indiana, they are almost entirely confined to the small portion of each state that lies on the Valparaiso Moraine or on the younger lands between the moraine and Lake Michigan.

Lakes are permanently, not just seasonally, wet. They are too deep for rooted plants to grow except in shallow, near-shore areas. The distinction between a lake and a pond is a matter of size. Lakes are bodies of water large enough to have at least one wind-swept beach. When winds are high, they blow across the water and create waves large enough to wash away any plants attempting to colonize the beach.

Our inland lakes are generally of moderate depth. One, in Lake County (IL), reaches a depth of 50 feet and has been named Deep Lake. Thirty to 35 feet is more usual.

Lakes and ponds can be divided into categories based on abundance of nutrients and how these nutrients are cycled through them. Oligotrophic lakes contain limited nutrients and maintain an approximate balance between production of organic material by photosynthesis and decomposition. The process of decay releases nutrients back to the water. The open waters of Lake Michigan are oligotrophic.

In eutrophic lakes and ponds (the name means "well fed"), nutrients are abundant and more are taken up during production than are released by decay. Such lakes usually receive a continuing supply of nutrients through run-off from surrounding lands. Sediments rich in organic matter build up on the bottom, and the lake gradually fills. In the deeper waters, the bacteria of decay may absorb all the available oxygen, creating stagnant conditions where few animals can live. Stagnation is most frequent during late summer when the supply of oxygen brought to the deep waters by the spring overturn—see graphic on this page—has been exhausted. Many inland lakes are usually eutrophic.

In dystrophic lakes, production and reduction are wildly out of balance. Bogs are good examples of dystrophic waters. Thick layers of peat build up in the lake basin because very little decay is taking place.

One of the common effects of settlement has been a large increase in the amounts of nutrients flowing into our lakes and ponds. These come from fertilizers, from sewage treatment plants, or leaking septic systems. They push lakes in the direction of dystrophy by greatly increasing the amount of production. Algae blooms fertilized by these nutrients can also be foul smelling.

Lakes are ecologically complex communities with several distinctive kinds of organisms living in them. On the bottom are mussels, tube worms, and fresh water sponges.

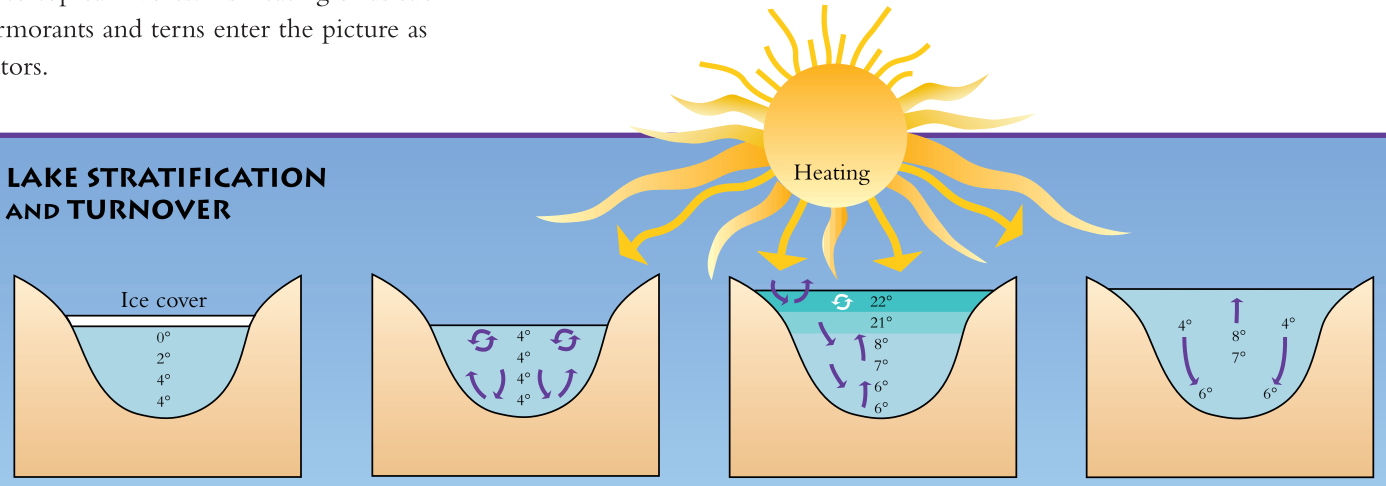
Swimming organisms include crustaceans and other invertebrates as well as fish. Healthy lake communities have animals at different trophic—that is, feeding—levels, from herbivores to top carnivores. Fish-eating birds such as cormorants and terns enter the picture as predators.

*The cup-like leaves and yellow flowers of American lotus (*Nelumbo lutea*) cover the shallow water in Nippersink Lake in Lake County, IL.*

Several endangered and threatened species live in the lakes of the Chicago region, most of them in the lakes of the Fox River watershed. They include several small fish belonging to the genus *Notropis* that carry the common name "shiners." Shiners are seldom more than six inches long and often much smaller. They feed on insects and small crustaceans.

The plight of the shiners is usually a product of environmental changes in their home lakes. The Illinois Endangered Species Board has recommended that glacial lakes be protected from further development and from pollution and herbicides, that introduction of sport fish be prohibited, and that native submerged and emergent vegetation be protected and enhanced.

LAKE STRATIFICATION AND TURNOVER



WINTER

Heating and cooling separate lake waters into layers. In winter the cold air chills water near the surface. The warmest water is in the depths.

SPRING *(turnover)*

Spring sunshine heats the surface layers until all the water is the same temperature. Mixing by wind and currents brings oxygen-rich water to the depths.

SUMMER *(layering)*

In summer, the warm water is at the surface. A sharply defined *thermocline* divides the warm surface water from the deep cold water.

FALL *(turnover)*

Fall cooling produces uniform temperatures again and another turnover. The turnovers are the principal sources of oxygen in the deep waters of lakes.

MOVING WATERS
Streams and Rivers

The North Branch of the Chicago River is a peaceful stream on a sunny summer day. The creation of preserves along the rivers is helping return life to the waters.

The rivers of the Chicago region have been subjected to the same kinds of humiliations as other rivers in major industrial, population, and agricultural centers. They have been used at times as open sewers. They have been dumping grounds for industrial wastes and been muddied with run-off from plowed fields. The Chicago in Illinois and the Grand Calumet in Indiana got the worst of this treatment, although no river escaped without some damage.

Over the last 25 years, since the passage of the Clean Water Act and other legislation, conditions have improved somewhat. Fish that have not been seen in a century have returned to the Chicago; herons can be seen in the marshes along the Grand Cal. According to the Biological Stream Characterization of the Illinois Department of Natural Resources, some Chicago region streams qualify as "Unique Aquatic Resources," Class A, or "Highly Valued Aquatic Resources," Class B. The lower Kankakee as it flows through Will County is a river whose biodiversity makes it of global significance.

The use of rivers by living things is largely controlled by physical and chemical factors. Physical factors include the size of the river and the amount of water flowing through it, the consistency of the flow, the speed of the current, and the nature of the bottom. Chemical factors in our region are mostly about the extent of pollution.

Biologists have divided the rivers of the Chicago region into four size categories. The smallest of these is the headwater stream, a tiny creek that may flow only intermittently. Headwater streams have few species of fish, and most of those are shiners and other minnows.

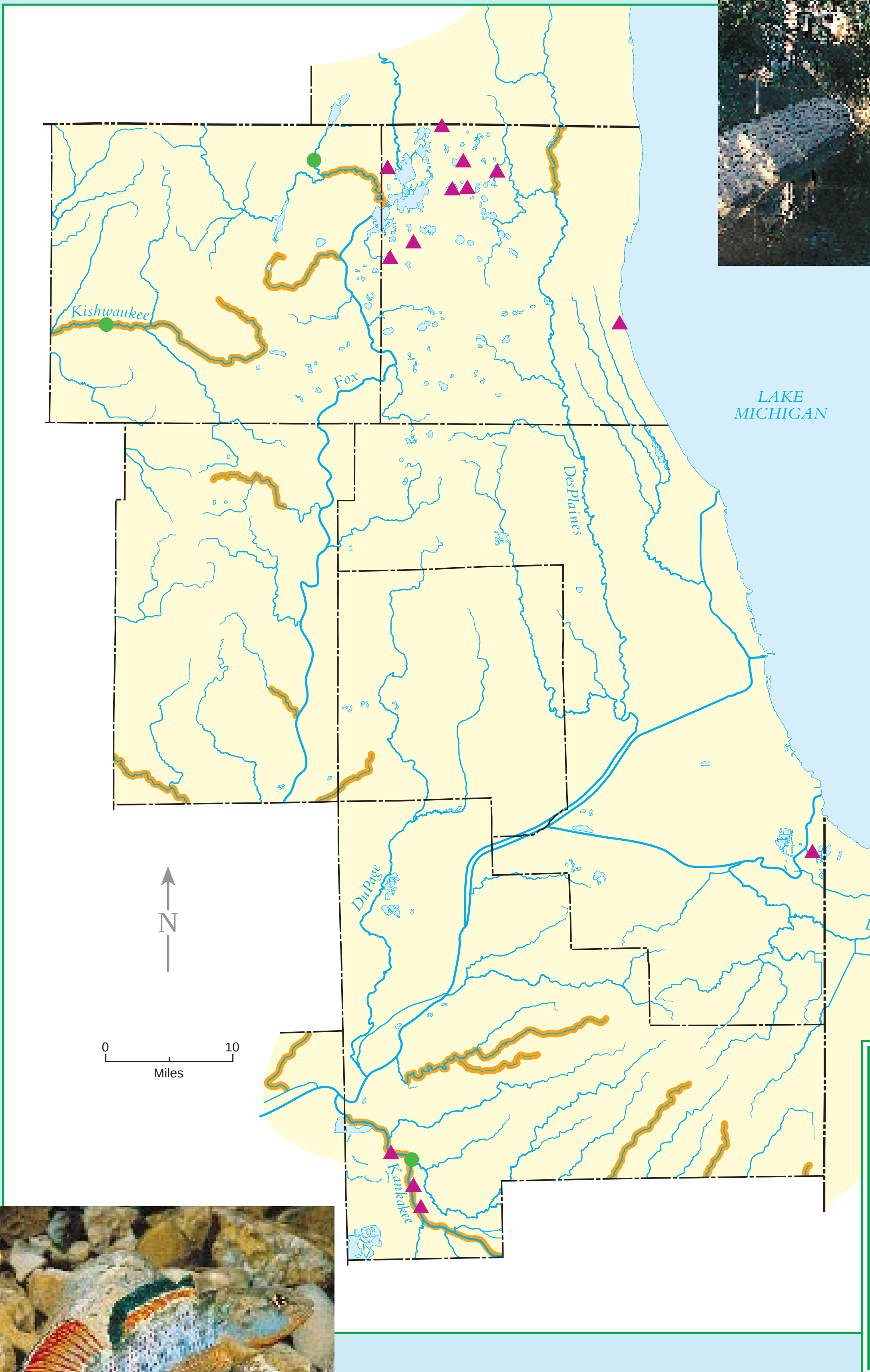
Low order streams are small- to medium-sized creeks whose bottoms have been shaped by the water to produce riffles and pools, alternating sections of fast shallow water and slow deep water. Life in these streams often sorts itself into ripple and pool species. The creek heelsplitter (*Lasmigona compressa*), an endangered mussel known in recent years from the Kishwaukeee and tributaries of the Kankakee, is a quiet water species. Among fish, the threatened river redhorse (*Moxostoma carinatum*) is a riffle species, while the threatened Iowa darter (*Etheostoma exile*) is a fish of quiet pools.

Many miles of streams in the Chicago region have been channelized, that is, dredged into straight, steep-sided ditches of uniform depth. Channelized streams have neither riffles nor pools. Dams on our rivers, by preventng upstream movement, also contribute to the decline in biodiversity.

Mid-order streams are our most complex river habitat. Water flows through both deep and shallow pools. In the riffles, smallmouth bass (*Micropterus dolomieui*) are top predators, while largemouth bass (*Micropterus salmoides*) live in the pools. Floodplains begin to develop along streams of this size.

Our largest rivers have broad floodplains. Floodplains are low lands adjoining the river channel that are regularly flooded during periods—such as early spring—of heavy flow. The flooding exerts a heavy influence on vegetation along the banks.

Our presence in the watersheds has dramatically changed the pattern of flow in our rivers. If the surrounding watershed is largely natural land, heavy rains or snow melt tend to be absorbed by the soil and released gradually. We have turned much of our watersheds into impervious surfaces—pavement and roofs. Water is carried rapidly to the river by storm sewers and produces frequent flooding.



The irregular shore and varied depth of a natural creek (above) contrasts sharply with the sterile ditch created by channelizing (top).

Rainbow darter (Etheostoma caeruleum) is one of the endangered species that still lives in our river systems.

A continental divide runs through the heart of Chicago Wilderness. The Chicago, Grand Calumet, and Little Calumet Rivers flow into Lake Michigan. The Des Plaines and Kankakee Rivers join to create the Illinois River which flows to the Mississippi. The Fox also joins the Illinois. The Kishwaukee flows to the Mississippi via the Rock River. A century ago, the flow of the Chicago was reversed. It now flows through the Sanitary and Ship Canal into the Des Plaines and the Illinois. Rare and endangered fish and mussels still live in the best of our rivers.

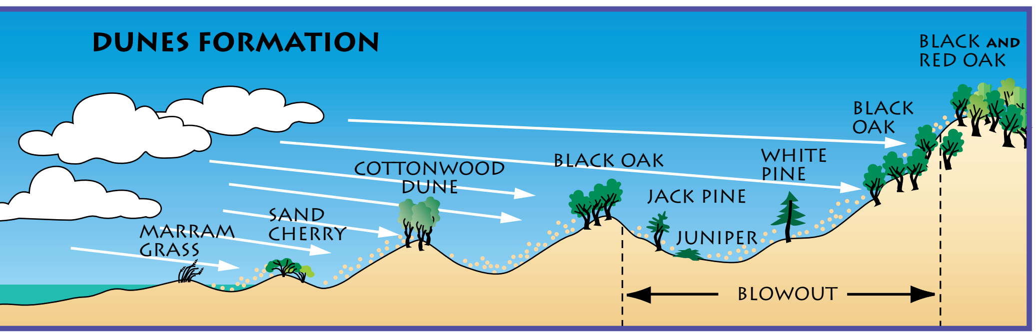
THE DUNES

*Fowler's toad (*Bufo woodhousii fowleri*) is a duneland specialist not found elsewhere in our region.*

Henry Chandler Cowles

The University of Chicago's Professor Cowles was one of the founders of the science of ecology. His studies of plant life at the Indiana Dunes developed the idea of ecological succession and connected the history of the land to the life it supports.

Henry Chandler Cowles is said to have developed his interest in the Indiana Dunes after passing through the area on a train during his first trip to Chicago. The landscape that Cowles glimpsed is one of the most diverse in North America. Open dunes, marshes, prairies, upland forests and swamps, oak savannas, and relict populations of jack pines all grow within a few miles of the Lake Michigan shore. Botanical surveys tell us that more species of plants grow in the Indiana Dunes National Lakeshore than in Great Smoky Mountains National Park.



The beach at the Indiana Dunes is a windswept desert where only a few hardy annuals can live. South from the beach, the land is progressively older and more extensively modified by the plant communities that cover it. The vegetation separates into narrow bands of very different communities. These differences help give the dunes their great biodiversity.

The basis of this diversity is the shape of the land. As part of the lake plain, the dunes show the history of the various stages and levels of Lake Michigan. Long beach ridges parallel the present shoreline. Between them are low swales now occupied by lakes, marshes, and other wetlands.

The most spectacular sights are the dunes themselves, mountains of sand rising nearly a hundred feet above the swales. These dunes sit atop glacial drift. They have formed through the millenia from sand blown by the prevailing westerly winds, sand taken from the endless supply carried by near-shore currents in Lake Michigan.

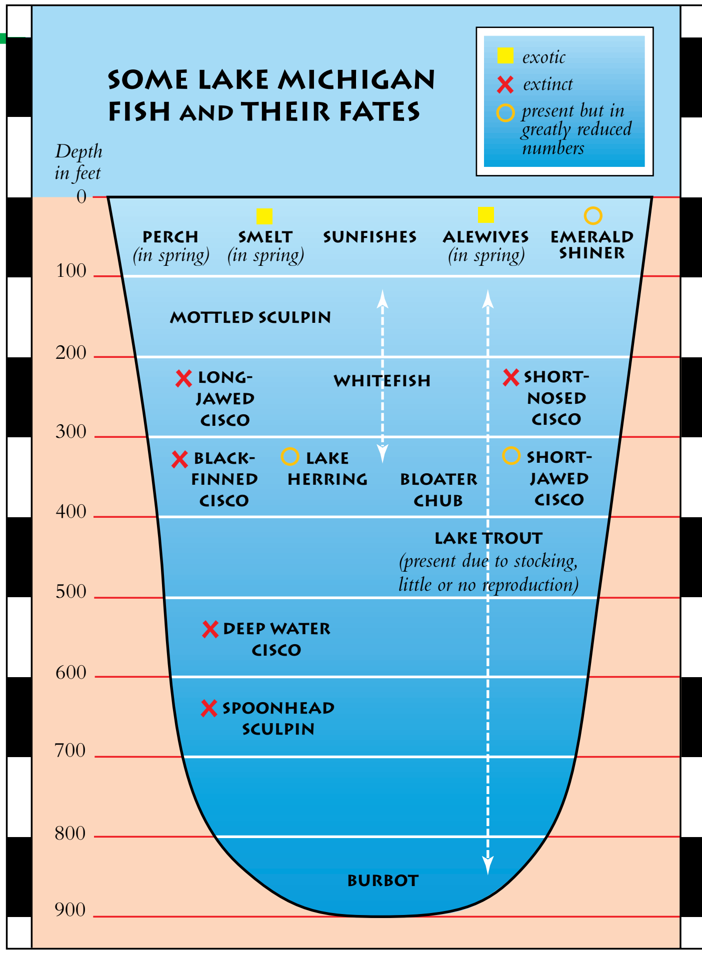
Illinois has its dune lands too. At Illinois Beach State Park marram grass (*Ammophila breviglata*) grows on low foredunes immediately behind the beach, and sand savannas dominated by black oak (*Quercus velutina*) are a major community type. But there are no high dunes at Illinois Beach, because the prevailing winds blow toward the lake. Illinois Beach is also a much younger landscape. It was formed in the past 3,000 years, while parts of the dunelands of Indiana go back to the earliest periods of Lake Michigan's development.

The story that Cowles pieced together from his researches at the Indiana Dunes was of changes wrought largely by plants on the landscape in which they grew. Adding organic matter to the soil, changing the microclimate by casting shade or shielding land from the winds, the marram grass of the foredunes would eventually create conditions that would favor the growth of other plants, and these plants would replace the marram grass.

The process was called ecological succession, and it became a major concept in the then young science of ecology. Succession was thought to lead ultimately to a natural community called the regional climax, a single, stable, long-lived community that would cover the entire landscape.

Cowles made ecological change intelligible, although today, we think of the idea of a climax community as too directional. No landscape ever reaches the regional climax. Instead, a variety of forces act to maintain diversity. The winter storm that blows down trees and opens new opportunities for marram grass is not a setback on the road to the regional climax but a predictably recurring event that sustains biodiversity.

LAKE MICHIGAN



This diagram reveals some of the massive changes in the life of Lake Michigan that have accompanied settlement and the often heedless harvesting of the lake's living resources.

The Great Lakes are among the wonders of the world. The five inland seas hold one-sixth of the world's surface fresh water. Lake Michigan is the third largest of the lakes, with a surface area of 22,300 square miles.

The lake has played a major role in the history of the Chicago region. It has been a highway for traders, travelers, and immigrants.

The natural riches of the lake were major resources. Commercial fishing in the lake was a big business, and for much of its history, it was totally unregulated. Over-fishing pushed some species to the brink of extinction. By the late 1930s, lake trout (*Salvelinus namaycush*) numbers had been seriously reduced. The arrival of sea lampreys (*Petromyzon marinus*) in the forties finished off the species. Lampreys, an Atlantic species that entered the Upper Great Lakes via the Welland Canal, are parasites on fish, and heavy infestations can be lethal. By the time another kind of newcomer, the alewife (*Alosa pseudoharengus*), arrived, the lake had no top predator to help control the numbers of this very prolific exotic species. Alewife populations boomed and then crashed in massive die-offs that littered beaches in the late sixties.

Zebra mussels (inset) are the latest exotic species to upset the ecological balance of the Great Lakes. These tiny molluscs now occupy practically every square inch of suitable habitat in Lake Michigan.

In the early seventies, various species of salmon, including the coho (*Oncorhynchus kisutch*), were introduced to control the alewives. They succeeded at that and, as a sort of side effect, created a multi-billion dollar sport fishing industry.

Meanwhile, lake trout stocking continued, but the species showed few signs of being able to reproduce naturally. New exotic species arrived, the most troublesome being the zebra mussel (*Dreissena polymorpha*), a mollusc that now infests practically every suitable bit of lake bottom. Traditionally abundant species such as the yellow perch (*Perca flavescens*) have been declining alarmingly.

Not long ago, it was the water quality of Lake Michigan that was declining. A concerted international effort has produced major improvements—although problems with persistent toxic chemicals remain. However, the biological quality of the lake is very much in question. Aquatic biologists have the heavy task of trying to maintain a system in the face of the constant arrival of new exotic species and the loss of coastal habitat.