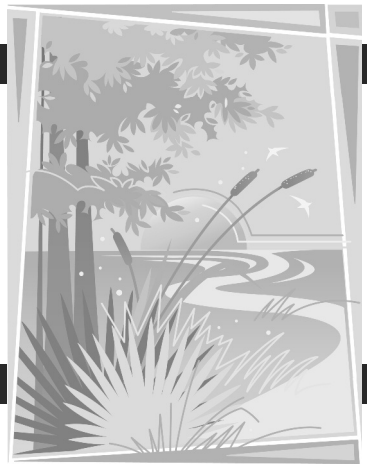
Rivers and Streams
Teacher's Guide



Rivers and streams contain water in motion. Running water is beneficial to supporting aquatic organisms because the constant movement aerates the water, providing oxygen necessary for survival. The movement of water also keeps nutrients available and flushes wastes further downstream. Running water also can cause some loss of life, such as experienced during a flood, with organisms moved downstream, into flood plains and away from flowing water or unable to survive the increased flow and dying.

Illinois has 106,900 miles of rivers and streams within its borders (see Figure 1). It is estimated that the surface area of Illinois' interior rivers and streams is 325,000 acres.

Definition

Rivers and streams are deep water habitats contained within a channel. If water flows through the channel throughout the year, the river or stream is called a perennial stream. An intermittent stream has water flowing only part of the year. The smaller streams that feed into larger rivers and streams are called tributaries. The land adjacent to a river or stream that is periodically flooded is called the flood plain.

Young or immature streams are short and flow swiftly, thus the rate of erosion is great. The channels of these streams are usually straight, with a v-shaped bottom. Older or mature streams have wide, flat-bottomed, or u-shaped channels. The water flows slower, and the rate of erosion is less. It is a natural process for bodies of water to evolve. Water is dynamic, not static.

The rate water flows within a channel is called velocity. Many factors can influence the velocity of water. The gradient (pitch) of the channel, volume of water flowing and amount of area the stream drains (watershed) influence the flow of water. Recent precipitation, or lack of precipitation, will contribute to the stream's velocity. Stream flow also is affected by the composition or type of material in the stream bed (sand, silt, mud, gravel, bedrock).

Every river and stream has a watershed or drainage basin. This is the total land area that provides water to the river or stream. Along with the surface water runoff, these bodies of water receive sedimentation and other materials from the watershed. Many rivers flood regularly, increasing productivity and enriching flood plains with sediment and nutrients. Changes to the Mississippi and Illinois rivers, such as levees and locks and dams, have diminished the natural flooding cycles and reduced productivity of these systems. So, while flooding may be a problem for humans, it is an important and natural process for rivers.

Length of Major Illinois Rivers
(includes only Illinois portion of rivers found in multiple states)

581 miles	Mississippi
332 miles	Illinois
292 miles	Kaskaskia
237 miles	Little Wabash
230 miles	Wabash
220 miles	Embarras
206 miles	Sangamon
166 miles	Big Muddy
163 miles	Rock
163 miles	Spoon
156 miles	Des Plaines
133 miles	Ohio
115 miles	Fox
93 miles	Cache

Source: Illinois Environmental Protection Agency, 1995.

The vegetation growing adjacent to flowing water is called riparian vegetation. This zone of vegetation provides shade to the water body, slows the rate of erosion and decreases the amount of silt flowing into the water. Characteristic plants growing in riparian zones in Illinois include willows, cottonwood, sycamore, box elder, sedges, bulrushes, cattails, buttonbush and touch-me-not.

Meanders (curves) form in older, slower-flowing streams as their channel migrates along the path of least resistance. During floods, the additional volume and velocity of water often will cut off the meander, forming a chute. As the flood subsides and the water loses velocity, sediment drops out of the water column. Sediments may form a sandbar, creating a natural dike between the chute and the old meander. Thus, an oxbow lake is formed where the meander used to be. The sediment that is left behind during these natural stream migrations is called alluvium.

With the constant flow of water, temperatures in rivers and streams vary. Stream velocity, the amount of water directly exposed to sunlight and volume of water can alter water temperature.

As water flows over structures in the channel, aeration occurs. The amount of oxygen in water is called dissolved oxygen, or "DO." The addition of oxygen to the water body is important in providing the oxygen needed for many aquatic organisms. In some instances you can determine the general quantity of dissolved oxygen in the water by the presence or absence of certain organisms. Pike and trout require medium to high levels of dissolved oxygen, while carp and catfish survive in waters having low dissolved oxygen. Waters with high dissolved oxygen support a large variety of aquatic creatures including mayfly nymphs, stonefly nymphs, caddisfly larvae and beetle larvae. As dissolved oxygen levels drop, these species disappear and are replaced with aquatic worms, fly larvae and outbreaks of algae populations.

Life in a Stream

Aquatic organisms are often categorized by where they live in the water column: benthic; pelagic; and surface. Benthic organisms live on the stream substrate and feed on plant and animal materials that collect on the bottom. Crayfish, mussels and stonefly and mayfly larvae are examples of benthic organisms. Pelagic organisms live within the water column. These organisms may float or swim and include fishes, frogs, turtles, water lilies and a variety of insects. The final category is the surface-dwelling organisms, such as water striders, duckweeds and adult dragonflies and damselflies.

The place organisms live within a stream or river is primarily determined by how well they can deal with water currents. Some organisms that live in swift water have adaptations that allow them to anchor to the substrate (stonefly and mayfly nymphs). Others seek out more protected areas in the water, such as behind large rocks or in pools (water striders, fishes). Life in swift water provides abundant food supplies flowing downstream and highly oxygenated water.

Historical Perspective

Illinois has been part of the central lowland of the North American continent for at least the last 300 million years. The Ice Age had major impacts on Illinois and its rivers. Glaciers blocked and buried some rivers and created new ones. Ancient rivers, such as the Teays, Cumberland, Paw Paw and Ticona, no longer exist. The Missouri River once flowed in much of what is now the Mississippi River bed but was blocked and filled during the Kansas (second) glacier and diverted to a new channel. The Teays River was diverted south of the glacier and became the Ohio River. The Ohio River was where the Cache River is now.

The French fur traders or "courerur de bois" were the first known Europeans to set foot from Illinois' water to her soil. Like Native Americans and other European explorers of their time, these robust frontiersmen traveled Illinois by canoe for three reasons. First, it was the best and most efficient way to find, establish and operate trade routes. Second, water provided them with immediate access to their primary means of income—beaver pelts. Last, rivers helped protect them from the uncertainties of the wilderness.

Illinois' recorded history began on June 20, 1673, with French explorers Louis Jolliet and Father Jacques Marquette. On that date they paddled their supply-laden canoes past the rugged hills of present-day Galena in search of a trade route to the Orient. Meanwhile, fur traders, frontiersmen and other French explorers went about the business of settling what was to become the "Prairie State." Forts, such as Creve Coeur, St. Louis, Kaskaskia and de Chartres, were built by the French to protect their hard-won discoveries. Villages sprung up and more settlers moved in along the banks of such rivers as the Illinois, Rock, Vermilion, Mackinaw, Kaskaskia and Sangamon. Eventually, the fur trading boom died and Illinois' prairies fell to the moldboard plow (device used to turn over soil). Today, places such as Ottawa, Joliet, Peoria and La Salle still bustle with the sounds of a different kind of commerce. Our lives, however, remain inextricably tied to Illinois' water.

Ecological Importance

Many of the river backwaters, deep glacial lakes and wet prairies historically found in Illinois have been drained or seriously disturbed. More than 106,900 miles of streams exist in Illinois. Only 200 acres of Illinois streams are recognized as high-quality, natural communities. Degradation of Illinois streams has occurred through many means including dredging, damming, pollution, siltation or presence of exotic plants and animals.

Many rivers rely on flooding to increase productivity and enrich flood plains with sediment and nutrients. Changes to the Illinois and Mississippi rivers such as levees, locks and dams have diminished the natural flooding cycle and reduced productivity of these systems.

Economic Importance

Water is the cornerstone of much of our recreation—from boating, canoeing and fishing to skiing, scuba diving and swimming. Fishing, hunting and trapping of aquatic life provide recreational opportunities, supplement the table with food and may provide fur for clothing. Many rivers, streams and lakes attract tourists and support area businesses.

River corridors continue to be used for shipping produce and manufactured goods downstream. Rivers and streams dammed to create a reservoir may provide recreational opportunities, generate electricity, supply homes and agricultural lands with water and store flood waters. Damming of rivers and streams does, however, result in the loss of almost all the habitat features and amenities which depend upon and are produced by flowing water.

Soils can be eroded and moved downstream by wind, rain or glaciers. Though erosion is a natural process, many human practices accelerate the erosion process. Soil particles can be picked up by wind or water when trees are cleared or prairie grasses or other terrestrial herbaceous vegetation is removed, either by people or when cattle over graze the site. Soil particles in water can kill bottom-dwelling organisms, clog the gills of fishes and mussels and destroy spawning habitat. Herbicides, pesticides and other chemicals attached to soil particles can kill or severely injure populations of aquatic organisms.

Removal of sediment is a costly process. Navigational channels must be periodically dredged to maintain an area for barges transporting products and travel. Destruction of vegetation in a watershed may result in erosion and the filling of a lake or reservoir with sediment. As a result, the water body may have diminished appeal for recreation. A decreased capacity for water storage provides less water for human, agricultural or industrial use or for flood storage.

Management Practices

Management of streams and rivers requires protecting habitat essential to the aquatic organisms. Activities within the watershed greatly affect the quality of water. Controlling erosion includes minimizing the amount of soil that is exposed to air and water. Projects and activities should be designed to minimize the amount of soil disturbed. Conservation farm practices may include covering the soil, leaving a crop residue or revegetating the area.

Protection of aquatic resources may require zoning to prevent construction along the banks of the water body. Water pollution is categorized as nonpoint (from a land practice such as agriculture or construction), municipal (wastewater and storm runoff), industrial (chemical discharge from industry) and dredging (removal which also stirs up sediment). Water quality can be improved by minimizing the amount of activity leading to any and all of these types of pollution.

Aquatic resources also may be managed by enhancing the resource. In streams, wing dams may be built from the bank. Water flowing across the wing dam cuts a deep pool for fishes on the downstream side of the dam. Other structures are placed in the bank to provide overhanging structures for shade and spawning structures (catfish and smallmouth bass).

Issues

Illinois' agricultural landscape impacts aquatic habitats. The chemicals used to increase crop production and decrease crop pests run off into lakes and streams. Contaminants that enter the water column eventually enter fish flesh. Often these contaminants make fishes unfit to eat. Bottom feeders and large predatory game fishes often concentrate large quantities of contaminants in their flesh due to their food habits and longevity.

Invasive species, such as the zebra mussel, cause serious threats to native aquatic life. A review of the *Illinois Aquatic Exotic Fact Sheets* will provide additional information on some of the most common and detrimental exotic species in Illinois waters.

Success Stories

Des Plaines River

The Des Plaines River historically supported an abundance of wildlife and fish species. These species were used by Native Americans and European settlers. By the early 1900s, however, the lands along the river were covered with homes and factories. Sewage and sedimentation polluted the river. There are even stories about a carpet producer whose workers released factory wastes directly into the river making it green one day, blue another and red still another. The number of species and individual organisms living in and along the river declined. Advances in water treatment, state and federal regulations and flood plain protection have led to improved water quality. Some organisms have returned to the area. Even organisms that require good water quality may be found in the Des Plaines River. The river will never return to presettlement conditions but great advances have been made.

Vermilion (Wabash) River Tributaries

The Middle Fork of the Vermilion River is the only National Scenic River in Illinois. Good water quality and instream habitat support a diverse fish community. The Little Vermilion River is considered to be an "A" stream, a unique aquatic resource. It supports some fish and mussel species that are considered threatened and endangered in Illinois.

Skokie River

The Chicago Botanic Garden in Glencoe, is the site of a project to restore a section of the Skokie River. Beginning around 1900, this river was altered for agricultural purposes, relocated with a straightened channel and subjected to vast amounts of stormwater runoff due to the loss of wetlands upstream. Banks were covered with non-native grasses. Due to these disturbances, the river's banks rapidly

eroded. The channel widened and down cut, exposing sewer and utility pipes. Water depths became extremely shallow resulting in stress to aquatic species from such factors as increased temperature and decreased oxygen. Riffles, meanders and deep pools were lacking. The goals of the project are to stabilize eroding stream banks, restore the riparian zone with native plants and restore a balanced, functional stream channel. Public education about the project and the plight of the river are also parts of the plan.

Fox River

When faced with the need to improve public safety at a 1960s-era dam on the Fox River at Yorkville, the State of Illinois agreed to modify the Glen D. Palmer (Yorkville) Dam to provide a safer, fish-friendly structure that provides the paddling community with a unique recreational opportunity. Modifying the dam included replacing treacherous hydraulic "rollers" downstream of the dam with four concrete steps. To facilitate the movement of fish up river, a Denil fish ladder was installed. A 3-foot wide concrete channel with aluminum plates angled upstream, the ladder creates a series of chambers where fish can rest as they move upstream. The watercraft and fish bypass channel opened in the fall of 2010. To demonstrate the ability of fish to pass upstream, fish were collected upstream of the dam, marked with an external tag, then released downstream of the dam. In July 2011, a tagged flathead catfish and a smallmouth bass were collected upstream of the dam, clearly demonstrating that fish can move upstream beyond a previously impassable barrier.

Illinois River Dredging/Island Creation Project

Peoria Lake is a wide section of the Illinois River starting just below the I-74 bridge in downtown Peoria and continuing several miles upstream. Sedimentation has caused the lake's depth to be reduced from a maximum of about eight feet to as low as one to two feet in many areas. The loss of depth has negatively affected wildlife habitat, particularly that of native fishes. In order to combat the problem, the U.S. Army Corps of Engineers has undertaken the creation of a project to dredge 55 acres of sediment from the river bottom and use the silt to create a 21-acre island. The goals are to restore some of the deep-water habitat for fishes and increase the water depth for boaters. The manmade island will be a repository for material, primarily silt, dredged from the river. The project's first phase entails filling 200-foot long containers that are 45 feet in diameter with dredged sediment. These geotextile containers resemble large sausage casings. Filled containers, lined three deep, will be placed in a boomerang shape, outlining the future island. Sediment will be pumped into the interior outlined by the containers. Eventually, three of these islands will be constructed.

Mud to Parks

The Mud to Parks Program works to take river mud washed into the water and return this soil to the land. Removing the sediment that was once Illinois topsoil and reusing it for parks and wildlife is a win-win solution for our environment. Sedimentation is the biggest problem facing Illinois' river systems. In the Illinois River alone, more than 6.6 million tons of sediment washes into the river basin annually. Eroded soil settles out in rivers, wetlands, detention basins and water supply lakes, decreasing water storage capacity, reducing navigability, destroying wildlife habitat and impacting other recreational resources. Most river backwaters have lost more than 70 percent of their capacity and are now less than two feet deep. Mud to Parks attempts to find beneficial uses for this sediment. The program is not limited to parks. Recovered sediment has been used as final cover for a landfill, in strip mine reclamation and to cover an old industrial site.

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DNR-EDU-19-0093 • 12/18 • IOCI 19-0410

ILLINOIS RIVERS | Figure 1