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Welcome teachers to this exciting study known as “River Citizen”! This program aims to teach students about the Chicago River and its watershed* through independent discovery and on the scientific method. The program is designed to allow students to establish a personal connection to the Chicago River and its watershed, and in turn have the desire to take individual action to help. Students will learn to appreciate nature and the environment as a whole and at the end of the program will become a designated “River Citizen”.

The program is designed so that students are the investigators while the teachers are the facilitators. The students are referred to as the “Chicago River Study Team”. The teacher is referred to as the “Team Leader” to emphasize the teachers role in the team process. The students should really feel like this is THEIR project. It is up to them to analyze the facts, form hypotheses, collect data, analyze data, make decisions and take action.

The program, which is divided into six stages, is a scientific investigation guided by the scientific method. At each stage, students work individually and in teams to further their understanding of the history, ecology and hydrology of the Chicago River and its watershed. Along the way, students come to appreciate the Chicago River and its watershed and build a personal connection to them. This connection serves to further inspire their work. At each stage there are specific objectives that the students must meet. It is suggested that the included lessons and activities be completed to fulfill the objectives. However, if the teacher has a favorite activity that would help students meet the stated objectives or would like to add in extra things, he/she should feel free to do so. An assessment piece follows each lesson. As part of the program, classrooms will track their collective positive impact on the Chicago River and its watershed by listing all the activities the students (and teacher) have done to improve the health of the river and watershed.

The teacher manual contains all the background information, resources and lessons needed to complete the program. References used in producing sections in the curriculum are cited after that section. Students are required to have a notebook dedicated to River Citizen. Student pages found in this manual, called Investigator pages, can be photocopied and taped into the students, notebooks. Every new section and lesson (called “Explorations”) will be introduced to the students by the River Citizen Videotape. Teachers should play the introductions at the beginning of each section and each exploration for the students.

Have a wonderful experience!!

*A watershed is the area of land that surrounds a body of water which drains into that body of water.*
SECTION ONE: What is nature and is it a part of my daily life?

Overview and Purpose

In our modern world it is often easy to forget about our connection to and dependence on nature. With skyscrapers and subdivisions surrounding us it is easy to believe that nature exists somewhere far away, like the rainforest or the ocean. Natural areas in metropolitan regions, such as in Chicago, are often more in peril than these faraway areas. Nature is right around the corner, and we are part of it! This section aims to introduce students to the natural wonders of the Chicago Region and the Chicago River as one of the most special of natural areas.

Objectives:

- Students will begin to develop an interest in the natural world around them.
- Students will understand that nature is prolific right in their own backyard and not something only in distant places.
- Students will be able to describe the basic characteristics of Chicagoland ecosystems (prairie, woodland, forest and wetland).

Background Information

The Chicago area certainly does contain nature! It is home to some of the rarest ecosystems on the planet.

Overall Landscape

Before European Settlement, the overall landscape of the Chicago River Watershed was a mosaic of prairie, savanna, woodlands, forests and wetlands.

It is important to realize that though these are distinct ecosystems, there were no clear boundaries between them. A person could not stand with one foot in a prairie and another in woodland. They all blended together and often shared species types as well as having distinct ones. At the present time, these ecosystems exist only in fragments scattered throughout the Chicago River watershed. Many people of the Chicago area work very hard to try and conserve these areas that are left and in some instances even recreate them.
**Prairies**

Tallgrass prairies are dominated by tall grasses and various flowers. There are no trees in the prairie. Tallgrass prairie proliferated in the Chicago River watershed after the last Ice Age. Several things helped to shape the tallgrass prairie. One, the drier climate in this area favored the more “drought tolerant” prairie grasses and flowers over trees. Two, wildfires set by lightening or native peoples, helped sustain prairie. Fire does not impact prairie plants negatively because their root systems are very deep and the portion of the plant responsible for growth (meristem) is underground and therefore protected from fire. In contrast, though the roots of trees and shrubs are deep, the meristem is usually above ground and therefore exposed to and harmed by fire.

Tallgrass prairies are incredibly biodiverse, especially when it comes to plants and insects. They were once home to the American Bison that roamed the midwestern and western United States. Early European settlers were very impressed by the miles of waving grass and flowers that they saw upon crossing the prairie. Unfortunately, the tallgrass prairie is virtually non-existent in Illinois at this time, with mere remnants scattered here and there.

Fire suppression, agriculture, and land development led to the demise of the prairie. When Europeans began suppressing fire, trees and shrubs were free to colonize and dominate. The rich soil of the prairie was discovered to be perfect for agriculture and after the invention of John Deere’s plow, prairies were readily converted to farms. Finally, general development of land for towns and cities destroyed the prairie as it had so many other ecosystems.

Efforts are underway to revitalize existing prairies by removing invasive species, planting native plant species, and returning fire. Many re-creations of prairies have also taken place, such as the Curtis Prairie in Wisconsin, The Schulenberg Prairie at the Morton Arboretum and the Midewin National Tallgrass Prairie.

**Oak Savanna**

The Oak savanna is a very unique ecosystem. It consists of scattered groves of trees intermingled with both prairie species and special savanna specific grass and flower species. Before European settlement, oak savannas were scattered throughout the tallgrass prairie as this ecosystem could also withstand wildfires. Oaks have the ability to re-sprout from their roots after a fire, allowing the continued growth of some individual trees. In addition, once oaks mature, their thick bark that they develop protects them from fire.

There are different types of oak savannas based on moisture level. Dry savannas are typical on sandy soils, where black oak is the dominant species. Mesic savannas develop on moderately wet soils and bur oak is the dominant tree type. Wet savannas have swamp white oak as the dominant tree species. Oak savannas are incredibly rare at this time. There are very few remnants left in the Chicago area. Efforts are being made to revitalize and recreate oak savannas in various places.
Woodlands and Forests

Though we may often use woodland and forest interchangeably, they are in fact different. These ecosystems vary in tree density, dominant tree type, and moisture level. For example, woodlands are more “open”, with a light scattering of trees that allows much sun to reach the ground. As a result, the understory is rich in grasses, flowers and shrubs. Because of the periodic fires that move through, woodlands are dominated by fire tolerant oaks and hickories, as fire sensitive trees can not proliferate. Open woodlands are incredibly diverse communities.

In the Chicago River watershed, dense forests are only found where there are no wildfires. These forests are usually found along the rivers, lakeshores or ravines that are protected from fire. Different types of forests dominate according to moisture levels. Along river floodplains, silver maple/ash/elm forests are usually found. In areas that are high in moisture yet drier than floodplains black maple/red oak forests are found.

As with all ecosystems in this highly developed area, woodlands and forests have undergone their fair share of damage. Many have been cut down for wood and land development. Invasive shrub species are a major problem for woodlands and forests because they choke out tree seedlings and understory plants. Floodplain forests have been greatly damaged by irregular flooding patterns and high rates of erosion.

Wetlands

The Chicago River watershed was once home to numerous wetlands. Wetlands are characterized by the amount of water they hold, soil chemistry and dominant plant type. Wetlands can vary in moisture from having merely saturated soil, to having miles of deep water. Some wetlands are ephemeral, existing in the wet spring and drying up in the hot summer.

Lakes and rivers are large wetlands with deep water where algae are the dominant plant type. Marshes are not as deep as lakes or rivers, and have plants that are both floating and submerged. Sedge meadows are wetlands that have rich peat soils and are dominated by clumps of grass-like plants called sedges, which are interspersed with patches of water. Fens are wetlands that are fed by calcium/magnesium rich groundwater causing an alkaline soil pH where various grasses, sedges and alkaline-loving plants can grow. Bogs are unique wetlands with very cold, acidic water that have sphagnum peat soil and various unique species of plants (including carnivorous types). Wetlands are home to great varieties of species that need wet soil or standing water to survive. Wetlands are some of the most devastated ecosystems in the Chicago River watershed, and throughout the world. They have taken much abuse from pollution and have been drained for development. Great effort is being made to revitalize damaged wetlands and to create new ones. In many cases, federal law requires that a new wetland be created anytime an existing one is destroyed for development. Two of the most well known wetlands in the Chicago region are Lake Michigan and the Chicago River. The Chicago River as been overlooked for many years as an important natural area. Providing habitat for many organisms that can even exist in urbanized areas has deemed it one of the most important natural areas in our region.
References

1) Curtis, John. The Vegetation of Wisconsin. 1959, University of Wisconsin Press
3) Swink, Floyd. Gerald Wilhelm. Plants of the Chicago Region. 1994, Indiana Academy of Sciences

The Program

Play the introduction to River Citizen and to Section 1 on the River Citizen Videotape. Tell the students that as scientists, they need to gather much background information on the subject that they are investigating before they can proceed with any data collection. Explain that the first task of the Chicago River Study Team is to explore their ideas about nature. Proceed with one or several of the following activities.

Suggested Activities

- Draw a collective class mural entitled “Nature”. Each student should add something to the mural which represents their vision of nature. When completed, discuss with the class.
- Pairs of students create a collage from magazine pictures depicting things that they consider being part of nature. Have students present the collages and discuss as a class.
- Students write a poem illustrating what nature is.
- Students write a song illustrating what nature is.
- Do any of the above, but focus on nature in this area.
- Show some pictures or slides of natural areas in the Chicago area. Ask the students “Where do you think these pictures were taken? What state or even what country? (Pictures available through Friends)
Exploration 1: Ecosystems of the Chicago River Watershed

Overview

Now that students have had a chance to explore their own knowledge and beliefs about nature it is time that they learn a bit about the ecosystems that once blanketed the Chicago River watershed. In this lesson, students read about the various ecosystems in the region, draw pictures of them and then watch a short video illustrating them.

State Standards

13.B.3d: Analyze the interaction of resource acquisition, technological development and ecosystem impact.

17.B.3b: Explain how changes in components of an ecosystem affect the system overall.

Materials:

- River Citizen Video
- “This is Chicago Wilderness” Video (available free from Chicago Wilderness- www.chicagowilderness.org “publications and products”)
- Atlas of Biodiversity (available free from Chicago Wilderness-www.chicagowilderness.org “publications and products”)
- Pens, crayons, markers
- Copies of “Investigator Page-Ecosystem Descriptions” (1 per student)
- Student data notebooks

Procedure

- Tell the Team: “As you know, we are charged with investigating the Chicago River and the land around it to figure out what problems may need fixing. To begin with, we, like all scientists, are in need of some background information. Today we will be familiarizing ourselves with all the ecosystems that once thrived, and still manage to hold on, in this area.” (At this point make sure students know what an ecosystem is: Living organisms and all their interactions with the physical environment within a given area). “Later in our study we will be to investigating some of these ecosystems first hand, but before then we must familiarize ourselves with their major characteristics so we know what we are looking at when we get into the field.”
- Play the introduction to Exploration 1 on the River Citizen videotape.
- Pass out the “Investigator Page-Ecosystem Descriptions” located on page 7 and have the students read them. Note: these descriptions are modified versions of the descriptions provided in the teacher manual.
• After students have read the descriptions, pass out the Atlas of Biodiversity. Using what they have read and the pictures from the atlas, have them sketch each ecosystem in their notebooks, being sure to label important features. Have them add particular species that they see in the atlas to their sketches if they wish.

• Then show the film “This is Chicago Wilderness” so that students get more of a visual picture of what each ecosystem looks like.

Reflection and Assessment

The following rubric can be used to assess the student ecosystem drawings:

<table>
<thead>
<tr>
<th>A work</th>
<th>B work</th>
<th>C work</th>
<th>D work</th>
</tr>
</thead>
<tbody>
<tr>
<td>A sketch is provided for each ecosystem.(3 points)</td>
<td>A sketch is provided for each ecosystem.(3 points)</td>
<td>A sketch is provided for each ecosystem.(3 points)</td>
<td>1 ecosystem has no sketch illustrating it.(2.5 points)</td>
</tr>
<tr>
<td>Ecosystem sketches are very detailed.(3 points)</td>
<td>Ecosystem sketches are rather detailed.(2 points)</td>
<td>Ecosystem sketches are somewhat detailed.(1.5 points)</td>
<td>Ecosystem sketches lack detail.(1.25 point)</td>
</tr>
<tr>
<td>Many features of the ecosystem have been noted and are labeled in all the sketches.(4 points)</td>
<td>A fair amount of features of the ecosystem have been noted and are labeled in all the sketches.(3 points)</td>
<td>A few features of the ecosystem have been noted and labeled in all the sketches.(2.5 points)</td>
<td>A few features of the ecosystem have been noted and labeled in some of the sketches.(2.25 points)</td>
</tr>
</tbody>
</table>
ECOSYSTEM DESCRIPTIONS:

**PRAIRIE**

If you were a pioneer child who had just come to the Chicago Area, your parents would warn you not to wander out into the tallgrass prairie. The truth is, if you had, you may very well have gotten lost in the grasses waving high above your head for miles and miles. What kind of place has such tall grasses?

Tallgrass prairies extended all across the Midwest. Only grasses and certain flowers are found in the prairie and there are hardly any trees. You might wonder why. The answer to that lies in a fascinating truth—it was because of fire! Huge fires burned across the prairie every year and could be seen for miles away. These fires were natural: set by lightening strikes or sometimes Native Americans. Prairie grasses and flowers can survive fire because the part of them from which they grow (meristem) is underground and protected from the flames. Shrubs and trees that happen to start growing in the prairie are killed because their center of growth is not underground and not safe from the flames.

Tallgrass prairies have many different species of plants and animals. Prairies were once home to the American Bison that roamed all over the midwestern and western United States. Early European settlers were very impressed by the miles of waving grass and flowers they saw when crossing the prairie.

Unfortunately, the tallgrass prairie has virtually disappeared from Illinois; only a few are scattered here and there. The prairies disappeared because European settlers stopped the wildfires, built farms and developed land for houses and businesses. When Europeans began putting out fires, trees and shrubs were free to grow. The rich soil of the prairie was discovered to be perfect for agriculture and after the invention of John Deere’s plow, prairies were readily converted to farms. Finally, general development of land for towns and cities destroyed the prairies.

Various people and organizations in the Chicago area are working to help protect the prairies that still exist. In some areas, people are actually planting new prairies from scratch on old farmland, or even in their backyards! Included in maintaining a prairie is returning fire. Professionals light fires in prairies now a days because wildfires are always put out to protect towns and cities. This setting of prairies on fire purposely is called “prescribed burning” and can only be done by trained professionals. Do not try this at home!!
OAK SAVANNA

We can now imagine the beautiful prairie with its tall waving grasses and rainbow of flowers: but what about trees? There have to be some, right? The Chicago area has a very rare type of place called an oak savanna. Oak savannas are so special and scarce that they are now considered to be more endangered than the rainforest! These places are small groupings of big oak trees with grasses and flowers underneath them. When there were miles of prairie, savannas were scattered here and there, amongst the prairie, like little parks. Early European settlers thought that these areas were very beautiful; nice and shady after traveling across the prairie with the sun beating down. Nowadays, you can see savannas hidden in the forest preserves in some very special areas.

You might wonder: how did these oak trees survive if there were wildfires in the prairie? Well, it just so happens that oak trees, the grandfathers of the prairie, are tough enough to survive fires. First of all, if they are burned from the fire, they can sprout again from the roots, which most trees cannot do. If they are able to keep re-sprouting after each fire, they end up growing to be big trees with thick, tough bark that protects them from future fires. If you look at an old oak tree that has been cut down, and examine the rings in the wood, you will often see black marks on some of these rings. These are scars from fires that the old oaks weathered.

There are very few oak savannas left in the Chicago area. People are working hard to conserve and restore oak savannas.

WOODLANDS AND FORESTS

What the blazes is the difference between woodlands and forests? We heard about Little Red Riding Hood and the Three Bears walking through a woodland when our grandfathers told us the stories but our grandmothers said that the Three Bears and Little Red Riding Hood were walking in a forest when she told us these stories. We’re talking about the same type of place, right? WRONG! The Chicago Area contains both woodlands and forests, and the difference between these has to do with how many trees there are.

Woodlands have a light scattering of trees that allows much sunlight to touch the ground. As a result, a lot of other plants can grow on the ground because trees aren’t taking all of the light. Believe it or not, fires are a natural part of woodlands as well. Oaks and hickory trees tend to be the bosses in woodlands, because, as we know, oaks can handle fire and hickory trees can as well.

Forests have many trees that are closer together. Because of this, light doesn’t reach the ground and fewer plants grow on the ground. A forest is darker and cooler than a woodland. Dense forests are rare in the Chicago area because they can only be found where there is no fire. So what would stop fire? Rivers, ravines and the lakeshore! Upon reaching these wet areas, fire dies out. This allows many different types of trees to grow, including maples, ash and willows.

As with all ecosystems in this highly developed area, woodlands and forests have undergone their fair share of damage. Many have been cut down for wood and land development. Again, there is hope because of efforts to conserve and restore these areas.
WETLANDS

What is a wetland? It's just like what it sounds like "WET" "LAND". A wetland must have enough wet soil during the year to support plant species that need to keep their roots very wet. Some wetlands have areas of standing water, like lakes, ponds and rivers. Others just have soil that is wet all year. Still others are ephemeral, having wet soil in the spring and drying up in the summer.

There are many types of wetlands. For example, lakes and rivers are large wetlands with deep water and the dominant plant type being algae. Marshes are not as deep as lakes or rivers, and have plants that both float and grow on the bottom. Sedge meadows are wetlands where mostly clumps of grass-like plants called sedges grow. Fens are wetlands that are fed by calcium/magnesium rich groundwater causing the pH to be basic (the opposite of acidic). Only basic-loving plants can grow there. Bogs are unique wetlands with very cold, acidic (the opposite of basic) water that have sphagnum peat soil and various unique species of plants (including carnivorous types).

The Chicago area was once home to all of these types of wetlands. Now, wetlands are some of the most destroyed ecosystems in the Chicago area and throughout the world. They have taken much abuse from pollution and draining for development. Wetlands are so important because they support a great variety of species. They also "filter" out pollution from the water, and act as a sponge to soak up rainwater, which prevents flooding. A lot of effort is being made to restore damaged wetlands and to create new ones. Federal law often requires that a new wetland be created anytime an existing one is destroyed for development.

Two of the most well known wetlands in the Chicago region are Lake Michigan and the Chicago River. The Chicago River has been overlooked for many years as an important natural area. Providing habitat for many organisms that can even exist in urbanized areas has made it one of the most important natural areas in our region.