American Indian Center Native Sciences Curriculum Design Principles:

Effective science Learning Environments include the following design principles:

1. use local, place-based instruction and hands-on experiences (see Schroeder et al, 2007 for a relevant meta-analysis),

2. are inextricably linked with community participation and practices (Cajete, 1997),

3. are premised on the idea that nature is not an externality, apart from humans, but rather that humans are a part of nature,

4. are motivated and organized around a big idea, in our case the idea that everything is related and has a role to play in the universe (systems level or ecosystems thinking),

5. place science in an inter-disciplinary or holistic context and invites the learner to view phenomena from multiple perspectives,

6. include community values, needs, language and experiences

7. explore phenomena from a seasonal/cyclical perspective

8. explore and address the relationships and tensions between Native science and Western science (e.g. Cajete, 1997)

9. place science in social policy and community contexts that highlight the need for participation and leadership (e.g. Aikenhead, 2006).
UNIT 1: LEARNING FOUNDATIONS
Circular Perspectives

**Unit:** Seeing & Representing Places  
**Topic:** Who Does Science?  
**Lesson Length:** 45 minutes - 1 hour (depending on class size)

**Lesson Overview**

This lesson should be the precursor to the “What is Science” lesson. The major goal is to get students to start thinking about who does science and how different people have different perspectives on what science is.

This activity can also be used as an ongoing anchoring practice to bring youth into space where they can freely see and talk about multiple perspectives of phenomena.

Circular Perspectives is most effective when used as an introduction or icebreaker activity to begin another lesson as well being an introduction to thinking about scientific perspectives leading into the neighborhood walk lesson.
Lesson Objectives

- Students will understand the concept of different scientific interpretations and perspectives.
- Students will come away with the idea that the science in textbooks is just one interpretation of the world around us.
- Students will participate in a talking circle structure and know how a talking circle is used.
- Students can recognize that there are different types of science that happens.

Materials and Equipment Needed

- Chairs set in a circle
- An object to make observations about (used a rock that was painted different colors)
Lesson Activities

Circle Discussion
Find a rock or any object that has distinctly different colors on all sides.

Put chairs in a circle around the rock or object and have youth enter the circle.

Sharing Observations
Ask youth to describe the colors that they see. Do this moving counter clock wise around the circle.

Once everyone describes the object, call on two youth, each on opposite sides of the circle, to describe the colors again. Ask each youth if they believe the others’ description.

The teacher then asks two more students that are sitting on the same side as the other two but are closer to one another if they believe their classmates descriptions.

They will most likely answer yes (if not pick another person that is closer to the first student) so point out that this makes sense because these students are closer in perspective to the first students.

Discussion Around Perspective Taking
The teacher then explains that the rock symbolizes a natural phenomenon and the students represent those who tell the stories and are the scientists that write about these scientific interpretations. Also tie in that the science textbook (which was on your lap and now is standing up in an empty seat in the circle) is one perspective on science.

Also ask the class if they know the author of the book. You can use the same questions that were used with questioning student perspectives.

Sharing Stories
Students can then begin to share things with the group that they have done with their family or stories that they have heard from their family about activities that could be scientific.

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**Discussion Points**

The single item can be replaced with multiple items. If time permits a great way to create multiple layers of conversation is creating topography of items.

- Place different sized items (boxes) to create different elevations and cover them with the sheet.

- Now take items that hold different means and mix them up. For example, place out traditional items (hand drum or pipe), contemporary items (mp3 players), and or environmental objects (plastic water bottles). This is a way to be strategic and have the items drive the conversation rather than the teacher. This will allow youth to take control of the conversation while the teacher has control of the set up of the learning environment.

**Anchoring Questions**

Let youth move the conversation forward. Some guiding questions could include:

- What science do we learn in school?
- Do you do science?
- Does your family do scientific activities?

The big idea for youth to leave with is that Native Science is different way of understanding the world than non-native people but these ways are just as valid other scientific pedagogies.
Remaking Relatives
Remaking Relatives

**Unit:** Living in Relationships  
**Topic:** Adopt a Plant  
**Lesson Length:** 45 minutes - 1 hour (depending on class size)

**Lesson Overview**

In this activity, students will explore the AIC garden (or local forest preserve or school garden) and adopt at least two plants so that they can learn about each plant’s unique characteristics.

Youth will learn what medicinal or edible qualities each of the plants possess as part of Native Science.

Also, they will learn about the ecosystem of the garden as well as study the relationships (e.g. humans, animals, plants, etc.) that allow the garden to flourish.

Finally, youth will map out the garden and share with the group the location and information they know about their adopted plants.

*Stinging Nettle.*
BIG IDEAS

“Systems Theory” is a scientific perspective that examines natural and man-made phenomena holistically. This involves the utilization of multiple scientific perspectives and methods to find a comprehensive solution or answer to a particular query. For Indigenous peoples, this approach more often than not fits in with cultural perspectives of all life and phenomena being intricately connected. A common term for this is “We are all related.” This perspective reinforces the idea that for every action there are multiple reactions and implications, and that one must think about what they do.

Lesson Objectives

At the end of the unit, youth should be able to:

- Identify/define the individual characteristics of their adopted plant in AIC garden
- Relate to plants as living entities possessing a spirit
- Define the physical resources for healthy plant life
- Define plants as medicine and source of food
- Understand how plants and people have similar needs
- Understand the relationship between AIC garden plants and the insects, birds and animals that frequent the garden
- Recognize the relationship their plant has with the surrounding plants, soil, and any organisms living on or around the plant
- Understand the objectives for this unit and how the objectives fit in with Living in Relationships.
Lesson Goals
This unit will promote youths’ understanding of:

- How plants function as part of the garden ecosystem.
- The multiple uses of plants, both as a source of food and medicine.
- The cultural significance of a variety of plants to Native people.
- Their relationships to living elements in the ecosystem they find themselves a part of.

Materials & Equipment Needed

- Clipboard
- Writing/drawing materials
- Poster boards and markers for student drawings of plants and garden
- Plant and tree identification guides
- Tape measure or ruler
- Three lengths of string: 12”- 18”- 24”

Woodland Sunflower (above)/Mixed Prairie (below)
Lesson Activities

Circle Discussion
Discuss the Big Idea of living in relationships.

Garden Tour
In small groups, youth and teachers will become familiar with the garden map and walk through garden.

Establishing a Relationship
Assisted by teachers and staff members youth will explore the AIC garden and determine which 2 plants they will begin making a relationship with.

Teachers will explain the multiple methods Native peoples have used to establish relationships with plants over time, including offering tobacco and engaging in sustained observation.

Sustaining Observations Over Time
Assist youth to use their journals for drawing pictures of garden plants over time. Youth should also be supported to take notes on: the individual characteristics of plants, changes in plants over time, and surrounding plants, soil, and organisms living on or around the plant.

Encourage youth to utilize their 5 senses when interacting plants. Youth should keep track of how the plant smells and looks at different times, how it feels, how it tastes (if the plant can be eaten), and the sound it makes as the wind or animals moves through it.

Conclusion:
Return to large group and share observations.
NAVIGATING WORLDS

“Ethnobotany” is the study of the relationship between plants and humans. In a Native paradigm, ethnobotany represents a system of relationships and is not isolated in the same way as an academic understanding of the world (Alcoze, 1999:1). In an academic sense, ethnobotany is often compartmentalized as a body of knowledge that one can choose to study or not, while as ethnobotany within a Native context is understood in terms of a sustaining system of relationships (Alcoze, 1999:1). Native Peoples have learned over centuries of observation and experimentation, and trial and error, with various plants and their uses how to maintain and be maintained by healthy plants populations. This involves understanding the nature of plants, their needs, their behaviors, and their ecosystems. Thus a single plant is not viewed in an isolated context but viewed in terms of its relationship to its environment, its chemical constituents that affect how it is used, the various organisms that utilize it, its growing needs and soil conditions, light and atmospheric conditions, its place and significance within a cultural paradigm or world view.
Discussion Points

Teachers should discuss the history and cultural significance of garden plants with youth. Learning the name of the plant in their tribes’ language, along with related terms should be encouraged. The traditional uses and significance of plants is often found in their tribe’s language.

Begin a conversation about the various chemical compounds that plants produce. It is these compounds that can be used as medicine, nutrients, or in some cases, toxins. Assist youth as they learn about what compounds are unique or significant to their plant and their effects on people and other animals (and other plants in some cases).

Guiding Questions

Anchoring Questions

Revisit the following questions each week:

- How do we recognize or relatives?
- How do you make and remake (relationships) relatives?
- How are we living in relationships?
- How does everything play a role?

Youth should also be encouraged to ask new questions about their plants and the ecosystems they find them in. New questions should be generated from observations made in the garden.
Helpful Hints

• **Teacher Background Knowledge**
  Teachers will need to know the plants in the garden or develop this information before the lesson. If the garden is large, it might be good to give each teacher a section to learn more about. If teachers are using a local forest preserve, the same logic applies to knowing what plants are present in the preserve.

• **Time and Schedule**
  Time can vary depending on the schedule of your program. Usually a unit will take anywhere from 30 min. to 1 hour or 1.5 hours. The lesson itself should cover a period of 2 to 12 months. Again this is dependent on your programs schedule. The longer the lesson goes, the more observations can be made, especially tracking changes over time.

• **Teacher Preparation**
  Teachers should make sure that all of the students’ clipboards, pencils, pens, and markers are ready. Teachers should also have a list of the plants in the garden. Prior to the lesson, teachers should walk in the garden to see what plants are revealing themselves that day. Plants react to the temperature and light around them, so some species may be visible and others may be hidden or blending into the other plants.

• **Goals**
  Students should be told the following goals at the beginning of the lesson to put them in the mode of recognizing systems and relationships in the urban ecosystem. These goals will also act as guiding questions throughout the unit/lesson. This lesson will also go over a period of about 8 weeks. Students will have time to develop their understanding of the goals and should provide enough time to see if the goals have been met at the end of the lesson.

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**Extension Activity**

Youth can explore their own home environments and neighborhoods looking for plants that they may have found in the AIC garden. Students should look for these plants on field trips and walks throughout the week. Students will conduct soil tests of AIC garden to determine the quality and health of the garden soil.
Systems and Relationships

Ethnobotany itself is a discipline that combines anthropology, botany, agronomy, economics, policy, nutrition, history, and horticulture. Traditional Native perspectives of the world are often systemic relationships between organism and environments. This paradigm of the world as a system of relationships is a guiding perspective for this lesson. This perspective is not a new idea but has been practiced by many Native and Traditional peoples through time and has since been published and tested since the 1920s. Two important influences on the theoretical background of this unit come from Gregory Cajete’s Native Science and Laws of Interdependency and Ludwig von Bertalanffy’s General Systems Theory (GST).

General systems theory was originally proposed by biologist Ludwig von Bertalanffy in 1928 (Walonick, 1993:1). The following excerpt summarizes core idea behind GST.

“Growing as it does, out of the reductionist-vitalist arguments in biology, Von Bertalanffy’s greatest emphasis was on the meaning of life, on the differences between organisms and purely physical-chemical processes. In theoretical biology, he proposed a general model of an “open system” to describe the contradiction between the thermodynamics of living organisms and the second law of thermodynamics. As he put it “an open system that imports free energy or negative entropy from the outside can legitimately proceed toward states of increasing heterogeneity and order. From this he elaborated in another paper, “we must conceive living systems as systems of elements in mutual dynamic interaction, and discover the laws that govern the pattern of parts and processes.” The concepts of organization, non-summative wholeness, control, self-regulation, equipinality, and self-organization, he said, are as valid in the social and behavioral sciences as they are in the biological (http://www.n4bz.org/gst/gst1.htm, 2009).”
Up until the early twentieth century, the “scientific method” had developed under two related assumptions; a system could be broken down into its individual components so that each component could be analyzed as an independent entity, and the components could be added in a linear fashion to describe the totality of the system (Walonick, 1993:1). Von Bertalanffy conversely, proposed that both assumptions were wrong and that a system is characterized by the interactions of its components and the nonlinearity of those interactions (Walonick, 1993:1). This theory was created as a critique of reductionist and vitalistic perspectives of science that (despite their differences) viewed phenomena and patterns as isolated and separate. GTS proposes that a system is a complex of interacting elements that are open to, and interrelate with their environments. Systems can gain and lose qualitatively new properties through emergence and are perpetually evolving. Systems Theory examines the relationships between the part-to-whole and whole-to-part, and making connections between the various elements so that they fit together in a whole. Thus the part which may be hard to understand on its own becomes clearer when viewed in relation to other parts within the system.

General Systems Theory did receive critiques but it became an integral part in the theoretical mindsets within anthropology, economics, political science, education, sociology, biology, computer programming, and psychology. Systems are universal and regardless of differences in discipline or philosophies, one will always find interrelated and interconnecting systems of phenomena and patterns. What General Systems Theory purposed was not a specific theory to examine a specific phenomenon or pattern, but instead it is a blanket theory that helps put research into a holistic perspective. It is this over-arching view that explains why it is found in (and adapted itself to) various disciplines in the sciences and humanities. It attempts to link the sciences and provide a common ground for various theories and methodologies.

Following a similar train of thought, Gregory Cajete developed a paradigm known as Native Science and the Laws of Interdependency. This paradigm was developed on the basis of Native traditional ecological knowledge and its relationships to culture and society. In an interview with Earthzine, Cajete provided an outline for
“From my perspective, native science really is a body of knowledge that has been accumulated by a group of people, Indigenous people, through generations, that deals very specifically and is very much founded on how that group of people has developed an intimate relationship with the plants, the animals, the places in which they have lived. It is also how the communities have integrated that knowledge within themselves, how that knowledge has been expressed in their language, their art, their music, their dance and their practical technologies for living in places in which they have evolved. Interdependence is a principle that expresses itself in the context of native science. Expressions can be seen in the life of an indigenous group of people, the ways in which a group of people calibrates their agricultural cycle around key times of observation of the sun with regard to the equinoxes and solstices, how they understand when plants and animals are best to be harvested, when to go hunting, how to serve plants in certain kinds of condition for medicine and how to use those same plants, say for creation of shelter or as food. So there are many kinds of ways in which native science expresses itself in traditional native cultures. You almost have to be very specific in focusing on a particular group of people to be able to understand how the natural world is integrated in their life style and the expressions of cultures of those people (Racette, 2009:1).”

Cajete’s theory demonstrates and emphasizes the relationship between all organisms on the planet the ecosystems they inhabit. More often than not, this relationship is expressed through culture. The idea of systems is not just a theory, but a common concept for many Native Peoples. Cajete explains this further.

“If you understand natural systems, to say that everything is related almost goes without saying. I will use an example that I remember David Suzuki presenting in his talks where he uses the example of argon as an element that is contained in the air. They are kind of like tracer atoms. The air that we breathe and that is finite we share with each other right now and eventually we will be breathing those same argon atoms again. The idea is that air is shared by all living, breathing entities and through that physical process we become
related to each other. It is using those kinds of ways to describe the fact that physically, socially, even spiritually there is this interconnection and interrelatedness that human beings share with each other and that is referred to by saying we are all related. Mitakuye oasin is the Lakota way of expressing that idea and that reality. There are words in other Indigenous languages that describe the same thing, that we are all related. We use a term in my language, because corn is kind of our sacramental plant, a staple of our traditional diet, we say we are all kernels on the same corn cob (Racette, 2009:2).”

This theoretical background is important for this lesson because it sets up the way teachers and students will approach this unit. Understanding that the world we live in is connected on a multitude of levels should help students as they walk through the garden or forest preserve recognize how plant and animal health and success relates to human and ecosystem health, and vice versa. All life impacts each other in various ways, both positive and negative. Whether students and teachers know it or not, they are connected in some way to the plants that they will be “adopting.” As students are doing this lesson, they should think about is, “How, and in what way(s), are you related to the plant that you have adopted?

Recognizing our Relatives
All life on the earth lives in some type of relationship with and to other life and natural (and unnatural) processes. It is unavoidable as everything a human, plant, other animals, climatic or geologic processes do, they have an effect on other life forms, geologic landscapes, and water (and vice versa).

When we walk through a garden, a park, or even a typical sidewalk in the city, we encounter a myriad of organisms, landscapes, organic and inorganic materials. While it may not seem like we are related to all of this, we in fact are. Viewing the world as a series of systems interacting with each other, everything around us on some level is a relative. It really depends on how you look at it and at what level.
For example, a squirrel, pigeon, falcon, dog, deer, and humans are relatives. All of the animals mentioned have backbones (species level), live in the same ecosystem and utilize similar food and home structures (habitat level), are all made up of matter (atomic level) and also have special significance in cosmology and world view (cultural level). Similarly, humans, squirrels, oak trees, goosefoot, and raspberries live in relationship to each other. The oak trees provide food and homes (and building material) for humans and squirrels, while the oaks benefit from squirrels and humans harvesting its acorns and dropping a few in the process. Humans also by setting controlled burns in oak savanna helps keep out competing species of plants, and makes the soil good for raspberries and goosefoot; both of which are used by humans and squirrels as food and medicine.

Relatedness among various species within an ecosystem can be based on a variety of factors; it just depends on what level of relationship you are looking for.

**Observational Practices & Living in Relationships**
In order to understand a single plant, it takes various levels of observation. There is the observation of the plant itself including its structure, texture, color, leaf structure, root system, and reproductive cycle. But a single plant does not live alone, but in a community of similar plants, other plants, fungi, bacteria, animals, and insects. By understanding how the single plant lives in this community, you understand the plant as a single part in a larger system. This knowledge is important in terms of utilizing plants for food, medicine, and industrial uses. How a plant lives can influence its uses. If the plant lives in soils that are filled with heavy metals would probably not be good for food, but may be good for industrial use such as cordage or matting. And with a deeper understanding of the plant, a person may be able to extract the heavy metals and turn these into medicine (which is often done with plants that contain high amounts of alkaloids).

People who work with plants, whether for medicine, food, or industry often spend a lot of time with the plants they work with. They develop an understanding of what the plant needs to grow and when the plant is in trouble. The plant also takes its place within the cultural mindset of a people. Think about what corn, beans, and squash mean to agricultural tribes, cedar trees to tribes of the Northwest, sugar maples and goosefoot of the Midwest, or tobacco for all tribes. By
observing and interacting with plants over time, an intimate relationship develops between the two. It should also be mentioned that this process does not just exist between humans and plants, but with all animals.

If one looks at mouthparts of various pollinating insects, they would notice that the mouthparts are not all the same. Insects and plants have lived on the earth for millions of years and over time, they have co-evolved and have developed a dependence on each other. Through time certain species of birds and mammals have also developed a similar relationship. As one gets food from the nectar of the flower, the other is able to pass on genetic material in the form of pollen. Animals that eat seeds have a similar relationship to plants, trees, and shrubs that produce seeds. In the process of eating, seed and fruit eaters will scatter seeds either by dropping excess or through their feces. But in order for fruit and seeds to exist, the flowers in the spring need to be pollinated. Thus if you remove a pollinator from this relationship, it affects the relationships of other animals. And if you remove a specific plant or type of plant, the pollinators then lose their food source, and sets off a whole chain of events. A good example to think about is the recent decline in honey bees and the effects it has had on global food production.

By understanding these relationships, students should develop an understanding the life of their plant and the ecosystem it inhabits. The prairie garden begins as a simple planted area and as the relationship between the student and the plant develops; the garden then reveals itself as a complex ecosystem.
Observation Worksheet

*Initial Observations*

1. Where is the plant situated in the garden? ____________________________________________________________

2. What is the name of the plant (common name, taxonomic, tribal)? ________________________________________

3. Are there many of the same kinds of plants in the garden? And if so, where are they in relation to your plant?
   ____________________________________________________________

4. What plants are its neighbors? ________________________________________________________________

5. Do any animals live near it? And if so, which one(s)? ________________________________________________

6. What other places do your plants grow? ____________________________________________________________
**Sustained Observations**

1. How fast has it grown? 

2. What is the ambient temperature around your plant? 

3. What are the climactic conditions of the day that you are making? 

4. Where is the sun located in the sky and what are the light conditions? 

5. What are the leaf shapes and colors? 

6. Is there signs of animal activity around your plant? 

7. What are the soil conditions? 

8. What is the plant’s physical state (leafy, droopy, healthy, large, small, dry, woody, bendable)? 

9. Are there any flowers? And if so, how many?
Garden Gallery

Sketch your plant in the space below or take a picture of it and attach it below.
Is There Medicine in My Neighborhood?

Unit: The Living Histories of Tobacco  
Topic: Identifying Native Species of Plants in Chicago  
Lesson Length: 45 minutes - 2 hours (depending on class size)

Lesson Overview

Youth walk the neighborhood in order to recognize and interact with the micro-ecosystems that exist.

Throughout the walk, the teacher will facilitate a discussion about recognizing our plant relatives within the environment.

Our walk includes, but is not limited to, stops at cedar plants, sage plants, emergent prairie landscapes, and prairie restoration areas.

Teacher Eli Suzukovich (Chippewa/Cree) shows students how to identify various medicinal plants.
Lesson Objectives

- Youth will be able to identify cedar trees, honey locust trees, catalpa trees, and other heavy metal absorbing plants.

- Youth will have a working definition of soil remediation, prairie restoration, and ecosystems.

- Youth will create updates to their maps to include plants that they encounter on their journeys home.

- Youth will identify tobacco as a plant used in soil remediation efforts.

- Youth will recognize medicinal plants that live and grow in their neighborhood.

- Youth will participate in urban foraging.

Students pick and harvest plants for the making of traditional medicines.

Echinacea plant.
NAVIGATING WORLDS

It is a common stance for teacher and community members alike to view urban youth at a deficit for both culture and environment. Communities in urban centers are at ground zero for environmental issues and cultural revitalization efforts. Increasingly individuals are conceiving of the natural world as something outside of urban areas that are pristine untouched by human habitats. This is in fact not the case, the natural world is all inter-connected. This activity helps to support youth to see the sacredness of the natural world in urban environments. This activity engages youth in reconnecting with the traditional medicines that were once abundant in this area and are in fact still here. It is the idea that our plant relatives never left and these medicines are still here. One just needs to approach them in a certain way so they will make their presence known. The ability that these native plants have to live and survive in disturbed areas shows youth the resilience of these plants and the will they have to continue to live in their home.
Materials and Equipment Needed

- Senses checklist
- Pen or pencil
- Weather appropriate clothing
- Supporting media: “The Air WE Breathe in Pilsen”
- Optional Material: field journals, clip boards

Key Concepts & Terms

- medicine
- tobacco abuse
- landmarks
- native species
- invasive species
- ornamental plants
- environmental justice
- environmental racism
- prairie landscapes
- prairie restoration
- ecosystem
- habitat
- watershed/wetland
- graffiti
Lesson Activities

Circle Discussion
- Introduction to place and people
- Decide on end points

Break Into Small Research Groups
- Refer to the “Research Group” lesson for more details

Pre-walk
- Begin conversation about knowing your neighborhood and safety

Neighborhood Walk
- During walk facilitate conversation about practice of sustained observation and support youth in using

Closing
Discuss findings to share with the larger group.
Circle up in large group and selected youth representative will share highlights from their walk.

Teacher Ananda Marin (Choctaw) talks to students about their field work.
Discussion Points

- Medicinal plants grow in many ecosystems, including urban ecosystems. Many medicinal plants can be found in our alleyways.
- Many Native people believe that harvesting plants is a responsibility reserved for those that have built relationships with plants over time.
- Native people have known and believed that plants heal the earth. Only recently have great efforts been made to replant native species in polluted areas to absorb and process heavy metals that are leached in the soils by heavy traffic areas. A large part of this effort includes the production and safekeeping of native seeds.
- Plants may not be ready for harvesting for human consumption. Their role may be to heal the ecosystem they are living in.

Guiding Questions

- How do plants choose where to grow?
- Why do you think native plants can grow without landscaping efforts?
- Why do you think medicinal plants grow in our alleyways?
- What plants are growing in landscaped areas?
- How do corporate landscaping companies and/or municipalities choose what to plant (e.g. native species, invasives, ornamentals, pollution absorbing plants)?
  - What factors might go into their decision making process?
  - Do you think the medicinal qualities of plants influence landscaping decisions?
  - Were they planted for ornamental properties?
  - What kind of relationships do the inhabitants of the building have with this plant?

Skip Sandman (Anishinabe) teaching the youth the many uses of medicinal plants.

Teacher Lawrence Curley (Anishinabe/Navajo) talks to his son about the relationship between plants.
Lesson Links

- *Bio-mapping*

- *Leaf Prints*

- *Radial Observations*
Intro to Bunker Hill

Bunker Hill Forest Preserve is part of the Caldwell Woods network. This network is a 100 acre chain of forest preserves along the North Branch of the Chicago River that includes other Forest preserves such as Sauganash, LaBaugh, Gompers Park, and Caldwell Woods. The Caldwell forest preserve network follows the Chicago River from Pulaski and Foster Ave. northwest to Milwaukee Ave.

This forest preserve is named after Billy Caldwell who was a Mohawk/English trader who became a Pottawatomie ogima (chief) in the 1820s. In 1829, Caldwell, like other ogimek of the United Bands of Pottawatomie, Oddawa, and Chippewa, received a reservation for his band as part of the 1829 Treaty of Prairie DuChien as compensation for ceded lands along the Chicago shoreline. This reservation encompassed the current communities of Edgebrook and Sauganash and the forest preserves in those areas.

The following is an article from Into the Wild, about Bunker Hill’s natural landscape and management history. This is a good background for teachers.

As the bike path winds along the bluff above the North Branch of the Chicago River, it takes the rider or hiker through the Forest Preserve known as Bunker Hill/Edgebrook Flatwoods. Bounded by a parking lot on the north, Caldwell Avenue on the east, the North Branch on the west, and Devon Avenue on the south, the site is approximately 100 acres and lies primarily within the Chicago city limits. It encompasses a mosaic of open savanna, oak woodland, and flatwoods.
Flatwoods are unusual communities that have an underlying stratum of clay, causing them to hold water for long periods of time in the wet season. The presence of this rather rare community earned the site its designation as an Illinois Natural Areas Inventory site. Soil cores show a 12-inch layer of beautiful white sand under the clay: this area was once covered by glacial Lake Chicago.

This tract was part of the lands granted to Native American Billy Caldwell, who was also called Sauganash. Its history includes both logging and grazing activity. The land was acquired by the Forest Preserve District in five separate purchases between 1916 and 1931.

Early maps and aerial photos show that the area now recognized as open savanna was maintained as open ground apparently by regular mowing for as long as the District has held the property. In 1977, after gaining the approval of the Forest Preserve District, a small group of volunteers began to remove encroaching brush and restore the native grasses and wildflowers. Known today as the North Branch Restoration Project, this group of citizens has been assisting the Forest Preserve District in restoring health to natural areas for the last 20 years. The work started at a time when scientists and land managers had just begun to recognize that salvaging remnants of native ecosystems was terribly important.

NBRP is a community organization made up of teachers, office workers, students, doctors, truck drivers, writers, musicians, young and old and mostly in between. The common denominator among these citizens is an abiding concern for the health and continued existence of these rare places.

In the spring, a visitor to the open savanna at dusk may be privileged to enjoy the mating displays of woodcocks spiraling into the air and singing their queer "peenting" song. In the woodland just south of the savanna, hepatica, toothwort, and bloodroot announce the beginning of the new season, rushing to grab the sunlight before the trees leaf out. Later, phlox, geranium, and golden Alexanders will brighten the woodland floor.
By late May, balsam ragwort and mountain blue-eyed grass will begin to flower. When restoration work began here, most native savanna plants were just hanging on. The return of fire in 1984 began the road back to good health. Since then, there have been a total of 17 prescribed burns of various parts of the site.

The area now abounds with native wildflowers such as blazing star, obedient plant, mountain mint, prairie sundrops; native grasses such as big bluestem, northern dropseed, Indian grass; and a healthy population of the state-endangered mountain blue-eyed grass. Many young pin oaks and swamp white oaks now dot the opening. Song sparrows sing from the tops of bushes. American painted lady and swallowtail butterflies nectar on the wide variety of wildflowers, while purple maniac and great golden digger wasps hover among the blossoms. An unusual dragonfly, one of the rain pool gliders, was sighted for the first time just last summer, cruising in large numbers over the open savanna.

While it has been inspiring to many to watch the land respond to management over the last 20 years, this site was one of two that were caught up in politics that resulted in a moratorium on management activities. Under a moratorium imposed in spring of 1996, changes have begun to occur that foretell trouble for the site. In the absence of fire, brush is increasing rapidly throughout the open savanna and, if unchecked, will eventually shade out the sun-loving plants and all the animals that depend on them. These fragile islands of nature, embedded as they are in a populous urban area, require good stewardship to prosper. Some would say that we humans also need the presence of these places to prosper ourselves. — Jane Balaban
Extension Activity

Give youth the task of creating a map using the grid paper and let them create a path to school from their homes.

*This map cannot contain street names!*

We ask youth to refrain from using street names in their maps because we hope to broaden their senses to other ways of identifying place. When youth use landmarks that are not street name specific, it tends to enable more depth when explaining their routes.

*Note: Please focus on anything that could help someone navigate to and from your house without using names of streets.*

*The map should contain:*

- building descriptions and/or names,
- neighborhood names, graffiti art and/or murals,
- stores

At this point connect this lesson with others for building multiple day activities to extend the Neighborhood Walk lesson see the following:

- Mapping Activity
- Native Plants and Off-ramps
- Wave Points
- Radial Observation

Upper Left: A student draws her map on-site, marking specific areas of field study. Bottom Left: An example of a student’s neighborhood map.
Scavenger Hunt
Oxbow Scavenger Hunt

Unit: Seeing & Representing Place
Lesson Length: 2-3 hours

Lesson Overview
The purpose of the Scavenger Hunt activity is to familiarize youth and parents to the Oxbow at Bunker Hill.

The activity is designed to serve as an introduction and allows youth to see the diversity of micro-environments within the Oxbow ecosystem.

Bunker Hill will be frequently visited to explore various relationships and concepts related to different scientific fields.

It will provide a place for youth, parents, and teachers to experiment with and apply scientific concepts and practices.
Lesson Objectives

• Youth and families will use their senses to solve riddles, identify plants/animals/insects, and map their way through the Bunker Hill Oxbow.

• Youth and families will become familiar with the Oxbow.

• Youth will be introduced to wetland ecologies.

• Youth and families will learn how to read topographic maps.

• Youth and families will make connections between layers in place and layers in traditional stories.

• Youth and families will develop an understanding about the relationship between the inhabitants of the Oxbow and distinguish between which relationships are visible and which ones need deeper investigation.

BIG IDEAS

There are no voids in nature; all life has a place and purpose. In 1922, Robert Morin purposed that science (all sciences) is the study of systems and the relationships and patterns within and without such systems. Bunker Hill is such a system. The plants, animals, sediments, the river, even the cars, recreational users, and surrounding homes are all connected to each other. Sometimes the connections are obvious and in other cases they are not.
Materials and Equipment Needed

• Plant Identification Pages (by zones)
• Animal/animal track identification cards
• Insect identification cards
• Zone map check list
• Oxbow topographic map
• Riddles from the Oxbow page
• Small notebook
• Pencils (lead and grease)
• Supporting media & technology: Digital camera
• Optional materials: Scavenger Hunt prize

Key Concepts & Terms

geology  topography  stratigraphy
sub-surface  ground water  zone map

oxbow
Lesson Activities

Opening Activity (at base)

• Introductions: the “Ball of Twine” activity will be used as a way to learn everyone’s name and tribe.

• Explanation of the day’s activities.

• Scavenger Hunt teams will be created.

• Depart to Bunker Hill.

Circle Discussion (on location)

• Once the teams have arrived at Bunker Hill, there will be a quick huddle to note the time and when to meet up again for the closing activities.

• Teams will gather supplies.

• Each team will then pick an entry point into the Oxbow and surrounding area.

• The next step will be for each team to sally-forth into the Oxbow and woods.

Scavenger Hunt

• Once you get your bearings notice your surroundings, use the topographic maps and see if you can find some of the plants, animals, and or insects on the identification pages.

• Solve the mysterious riddles on the Oxbow Riddle page or solve them as you explore the Oxbow.
Lesson Activities Con’t

Scavenger Hunt (con’t)

• Once you have identified a plant/animal/insect use the Check List to write down the Identification number (found at the corner of the plant/animal/insect identification picture) in the topographic zone where you spotted the living thing in.

• As you go through the oxbow area and find the plants on the list, tie a tobacco tie next or near the plant you found.

• As you notice and observe the Oxbow, take notes about what you see and your thoughts regarding the Oxbow.

• Use the journal/notebook to also sketch plants and animals or land/sediment features that you are not familiar with. Gather as much visual, textural, and/or audio information as you can to help you find out what it is that you are looking at. Each student finds an item in the oxbow that represents their experience at the oxbow with their family.

Closing

After each team has explored the Oxbow, they will reconvene at the designated spot. Each team will share their experiences and provide some reflection on the day’s events.

Extension Activity

Building the Lesson Out - *make connections with other lessons for building*

To extend the Oxbow Scavenger Hunt lesson see the following:

• GPS – Wave Points
• Making Relatives
Discussion Points

The Topographic zones correspond with the Topographic map that has 4 different elevations zones. A Topographic map is used to map out different elevations in a given area. We are going to use it to help map the different areas that you find the plants/animals/insects in. So remember to put the number on both the Checklist Page and on the map were you think you spotted it.

- *Leaving a tobacco tie is a way of showing respect to the plant and will also act as a marker of where you have been. As we come back to the oxbow at various times, you should be able to see where you have already walked and how the area has changed over the year.*

These observations will be important as you make several trips to the Oxbow. These trips will be throughout the year and through the seasons. Think about how you would make a representation of the Oxbow and all that you have observed there. Closer to the end of the year you will have the opportunity to create your own representation.

One way to think about the notebook is as an Oxbow journal. This journal is similar to what naturalists use to make notes of what they find and see in wild places. This journal will be necessary for creating one’s own representation of the Oxbow.

During the closing ask families what questions they had and if they found out the answer and how they did it. Here are some examples of questions to consider:

- *What plants and animals didn’t they find and possible explanations.*
- *What features of the landscape did they notice the most or found interesting and why?*
- *What areas would they like to explore next?*
UNIT 2:
SEEING & REPRESENTING PLACE
What is Medicine?
What is Medicine?

Unit: Seeing & Representing Place
Topic: Identifying Cultural Differences in Defining What Medicine Is
Lesson Length: 45 minutes - 1 hour (depending on class size)

Lesson Overview
Youth will get a chance to think about the ways in which the term “medicine” changes for different communities. Youth will brainstorm their ideas about medicine and how it sits within their community, taking time to focus on the idea that where you come from matters for both Native and Non-Native people.

What we classify as medicine changes based on where you live and what your values are. Youth will learn about the four sacred medicines of tribes of this region. They will get a chance to touch and smell the different medicines. This will bring the group into a larger discussion of Chicago and how this place sits historically with Native people.

Youth will begin to focus in on tobacco as a medicine and the different cultural constructs that surround both consumption and production of tobacco historical and contemporary settings.

Finally, wrap up by telling the youth that your next meeting will be outside in their neighborhood.

They will be looking for these very plants and other medicines that are growing right in their neighborhood. But to prepare for the neighborhood walk, they need to make observations in their neighborhood to bring back to the group.
Students become introduced to different ways of defining medicine by different communities. Students will begin to think about the differences of emergent relationships to these medicine by these communities

Lesson Objectives

• Youth will come up with working definitions of medicine for their communities.

• Youth will be able to say and translate the Miami word for Chicago

• Youth will be able to identify sage, sweet grass, cedar, and tobacco.

• Youth will listen to first voice perspective on the role of tobacco in Native Communities.
Materials and Equipment Needed

- Sage
- Sweet grass
- Cedar
- Tobacco
- Computer
- Projector (*for music video*)
- Graph paper

Key Concepts & Terms

**medicine**

**Miami tribe**

**Chicago**

**tobacco abuse**

**abusive relationships**

**visual observations**

**landmarks**

**asehmaa**

**chonlee**
NAVIGATING WORLDS

As people get further and further from the sources of medicine and the knowledge of the basis/source of the chemical content of prescription medicines, individuals lose the power of that knowledge. As with most prescription medicines, their source of their chemical compounds lie in plants. Native people have a vast knowledge of medicinal plants and this activity is used to explore the sources of knowledge for medicines and explore individual familial and tribal medicinal practices. The point is not to teach what plants are used for what ailments; it is to explore these perspectives as plants as a source of knowledge and medicine.
Lesson Activities

Opening
• Talking Circle Introductions (name, tribe, ethnicity, something about themselves)

Small Group Activity
• 2 objectives
  • Come up with a definition of medicine or “what is medicine?”
  • Brainstorm medicines

Context & Place Matters
• Speaker introduces the Chicago Native perspective
  • Speaker focuses on the Chicago landscape pre-contact as well as the Chicago wetlands
  • Discuss Chicago, or “Chicagoua”, in the Miami language as well as the definition and literal translation (“skunk weed” or “wild onion”)

Medicine Introductions
• Introduce sage, sweet grass, cedar, and tobacco
  • Pass out bags of each medicine and see if youth can identify them
  • Talk about how people have lost their relationships with plants and subsequently the environment

• Play the song Put Your Asehmaa Out

• For more information, inform youth of the website www.keepitsacred.org
John Low (Potawatomi) receives an offering of traditional medicines from teacher Eli Suzokovich.

Traditional healer Skip Sandman (Ojibway) discusses the medicinal effects of certain prairie plants.

Discussion Points

- Encourage youth to think about differences in group/community definitions of medicine.
  - Does where you come from matter?
  - Points of inquiry are: water, music, air, food, laughter, or plants medicine?

- Focus on the idea that the plants are vital to Natives physical and spiritual health are growing here in Chicago.

- Speaker will briefly explain the medicinal properties of each medicine, focusing on tobacco and the loss of relationship with this plant.
  - Focus on: changes in nicotine, uses of nicotine, and then talk about how tobacco has affected their community.

Take Home Activity

Youth are to make observations and record them in a journal for the next meeting. This is an ongoing observation log.

Youth will make a map to school from their houses. Identifying the landmarks that they use to navigate the city. Please see homework sheet from more details (CS Homework Lesson 1).
Introduction to Representations

Unit: Seeing Relationships in Place  
Topic: Introduction to Representations  
Lesson Length: 45 - 90 minutes

Lesson Overview
This lesson is designed to draw on youths’ everyday experiences.

Together, youth and teachers will explore the meaning of external representations.

Also, Youth will reflect on two different representations of Chicago and discuss the affordances of each.
Lesson Objectives

• Youth will discuss their relationships to Chicago.

• Youth will “narrate” or tell a story about place using various types of representations (i.e. maps, stories, and songs).

• Youth will have a working definition of representation.

• Youth will understand that we use representations to store knowledge and that once created representations can take on multiple meanings.
Materials and Equipment Needed

- Projector
- White board and dry erase markers
- Copies of CTA map
- Lyrics from Thin Red Line by Typical Cats
- Pencil and paper

Key Concepts and Terms

representation
represent
Three Sisters
place
Lesson Activities

Circle Discussion
- *Introductions*
  
  - *Overview of activity’s purpose, explaining that we will be discussing multiple forms of representations and how they depict place.*

Representation 1: Three Words
- *Ask youth to share three words that they think best describes Chicago.*

  - *Keep a running list on the white board for later use in this session.*

Representation 2: CTA Map
- *Project a map of the CTA.*

  - *Introduce map as a representation of Chicago.*
    - What does the map tell us about Chicago?
    - What do we know about the places on the CTA map?
    - What is going on around the Red Line? What are the neighborhoods?

  - *Discuss other ways that the CTA or Red Line is portrayed.*

Representation 3: Thin Red Line
- *Introduce the song Thin Red Line by Typical Cats as one way of portraying space.*

  - Give background on Typical Cats and explain that the song is about a train ride on the Red Line.

  - *Listen to the song.*

    - As youth listen to the song, they should create their own list words or phrases the Typical Cats used to describe space and “L” stops.
Representation 3: Thin Red Line (Con’t)

- Break up into small groups.

- Use lists to map out the route that Typical Cats are narrating or identify where Typical Cats are in the song.

- Project map on white board and have groups mark route in different colors.

Group Discussion

- Have youth explain their route and how they knew what places Typical Cats was talking about.

- Facilitate discussion about what it means to represent space/place.
**Discussion Points**

- What did Typical Cats call our attention to?

- How did we know what spaces/places Typical Cats was referring to?

- What is the CTA map good for?

- What is the Typical Cats song good for?

- If you had to get somewhere to a part of the city you didn’t know, would you want to have a CTA map of or a song that told you about the place?

**Extension Activity**

To extend the Introduction to Representation lesson, see the following:

- Human knot

- Zip Zap Zop

- Scavenger hunt (build on zone maps as a representation).
Seeing Water & Soil Layers
Seeing Water & Soil Layers

Unit: Seeing & Representing Place
Topic: Seeing Water & Soil Layers
Lesson Length: 3 - 4 hours

Lesson Overview
Because water and soil systems affect our plant and animal relatives, it is necessary to understand the importance of a healthy environment. Learning how we fit within this system requires active participation.

This lesson will introduce students to field research that directly relates to seeing indicators of a healthy river and soil, or the lack thereof, within the vicinity of the Caldwell Woods - Bunker Hill Preserve (described hereafter as Bunker Hill).

Families will participate during a Saturday field trip to Bunker Hill in which a scavenger hunt will initiate investigations that intend to prompt observations and questions concerning the complexity of a river’s ecosystem.

Youth examine water life via water nets (above)/Teacher Lawrence Curley talks to the youth about the importance of soil conservation (below).
BIG IDEAS

Seeing Layers in Place

Seeing layers of characteristics that interconnect within a system of water and soil will allow us to better understand the complexity and interdependence of this system. Students will reflect on the cause and effect of human actions to our plant, animal, spirit and human relatives. Certain plants have the power to heal the Earth of toxins and contaminants, also known as phytoremediation. During the program, students will be introduced to our plant relatives and a portion of programming entails asking, from plants, for medicine in a respectful way. It is important to understand whether our relative’s priority is to heal the Earth first. Therefore, it is important to know how healthy water and soil is before harvesting in order to make a sensitive and knowledgeable decision to ask for medicine.
Lesson Objectives

• Youth will have a beginning understanding of topography and surface.

Materials and Equipment Needed

• First Aid kit (complete, not half empty).

• Field diary or clipboards with paper.

• Fine tip Sharpies, pens or pencils

• Data sheets (not prepared yet)

• Aerial location maps

• Topographic location maps

• Simple Green (environment-friendly detergent in spray bottle) diluted with 1/4 part water

• 2 gallons of clean water

• Paper towels

• White, tall kitchen trash bags for soil observations and trash pick-up

• 2 tape measures (100 ft)

• Animal track sheets

• Bird and insect identification sheets

• Soil Investigations

  • Hand auger with 4ft rod extension
  • Tape measure
  • Soil test kits
  • Long rod such as a long screwdriver to remove soil from auger
  • “Soil Layers” sheet (Exhibit B)

• Water Investigations

  • Waders
  • Latex gloves or any other type of fitted disposable and waterproof gloves
  • Water test kits
  • Macroinvertebrate info sheets
  • 2 yard sticks with leveler
  • “Water Layers” sheet (Exhibit A)
  • “River Cross Section” sheet (Exhibit C)
  • Eye Wash
  • Hand sanitizer
  • Small container to examine macroinvertebrates
Key Concepts & Terms

- water quality
- PH
- base
- dissolve oxygen
- chlorides
- flow velocity
- macroinvertebrates
- spawning
- hypotheses

- turbidity
- acid
- conductivity
- nitrates
- fecal bacteria
- flow variability
- habitat
- phytoremediation
Lesson Activities

Opening

- *Introductory*
- *Lunch*

Circle Discussion

- *Smudging and prayer*
- *Introductions for first timers*
- *Recap of what has been done at the Oxbow*
- *Overview of plan for the day*
  - Remind the groups to continue to search for their plant relatives regardless of whether one was chosen or not
  - Make a plan to meet at a designated area at a specific time in order to make the transition between soil and river activities smooth.

Measurements

- *Take notice of the surrounding environment (360 degree radial observation)*
- *Each person will be asked to record their footsteps*
- *Draw tape measure out on the ground 100 ft*
  - Count footsteps as you walk along the measuring tape from the beginning (zero) and ending at the 100 ft marker.
  - The information will be used as a part of the Soil Investigation unit

Regroup

- *Make a plan to meet somewhere to switch between the soil and river regions*
- *Participants will now separate to either the Oxbow or the river*
Lesson Activities (con’t)

Soil Investigations & Topo Introduction (1 hour)

- Agree on a location in the Oxbow area that has somewhat of a clearing, is not completely covered by tall vegetation and allows for surface access.
- Take a moment to talk about the immediate signs of life (possible questions to ask are on the work sheet).
- Assemble the hand auger and collectively decide who will collect the soil sample.
  - While boring into the earth, it may be necessary to pull out auger and begin again in a new location if digging halts due to a rock or dense root systems. A perfect chance to investigate what you can see so far.
- When a sample is collected, pass around the soil and solicit ideas regarding: color, grain size, permeability (ability of water to penetrate), elasticity (does it stick together or fall apart easily), and moisture.
- Now put the soil assessment together with previous observations and create hypotheses that account for the type of vegetation and animals in the immediate vicinity.

Understanding Elevation

- Collectively as a group, decide on a location that has a slope/hill. Now ask them to picture themselves looking directly down on this location from a very high position. Like floating directly above, stationary, at 50 feet up (use half of their recorded footsteps as a reference of what 50 feet is like).
- Choose two locations on this slope/hill, A and B, that depict the highest point, call it A, to the lowest point in elevation, call that point B.
- Ask each individual to count their footsteps starting at point A and ending at point B. Now have them record their own personal footsteps in the soil worksheet.
- Use the math formula on the worksheet and calculator to convert number of footsteps into a unit of feet (12 inches, not an actual foot with 5 toes).
- Now take a tape measure and have someone hold an end directly on Point A, while another person stands on Point B but hold the tape measure up so that the length of the tape is as horizontally level as possible. Record the distance.
- Notice the difference in measurements and ask the group to draw a map that represented the slope/hill used in the activity in the appropriate location on the Soil Worksheet. Tell them to pretend that this map will be used by a stranger that has never been here before.
- Clean equipment using the Simple Green and rinse with water.
Lesson Activities (con’t)

River Investigations (1 hour)

- Agree on a location along the river that has as shallow and rocky access as possible. Looking for macroinvertebrates in deep water doesn’t work well. Knee depth and below is ideal.
- Take a moment to talk about the immediate signs of life. Possible questions to ask are on the work sheet.
- The components of subsurface, surface water and above surface (trees, sky, etc.) should be highlighted in the search for life.
- Ponder the possibilities of life in each of these components. For example, bugs, water & roots in the soil.
- Search for evidence of life, such as trails, bore holes, animal sightings, etc.
  
  *For safety assurance, participants should pair up and have first aid including eye wash, cotton towels (in case someone submerges in the river), paper towels and hand sanitizer ready for immediate use. If putting on boots, gloves and/or waders, hand sanitizer should be used regardless of whether a person has gotten wet or not.*
- Dependent upon the number of available waders, alternate between taking notes & holding the container for the collection of macroinvertebrates from the shoreline AND collecting macroinvertebrates with waders in the river;
- If switching, it’ll be a good approximation to make the switch of equipment after 15 mins of macroinvertebrate collection time.
- 40 mins into the activity should be used as a guideline to begin the assessment of the findings and compare to the macroinvertebrate guide sheet. Observations should be made regarding the presence of the findings and what it may say towards the health of the river.
- Don’t forget to take into account life already found before entering the river!!
- Use the Simple Green with paper towels to decontaminate the equipment used.
Discussion Points

- Is there any evidence of life present? And can we put findings in a bigger picture of roles?

- Can we place these roles to any specific layers within the system or either water or soil?

- What is necessary for a healthy river at Bunker Hill?

- How can we learn from the life that is present to determine the health of a river or surrounding soil? Likewise, what may be missing in order to create balance for a healthy river or surrounding soil?

The components of subsurface, surface and above surface (trees, sky, etc.) should be highlighted in the search for life.

- Ponder the possibilities of life in each of these components. For example, bugs, water & roots in the soil.
- Search for evidence of life, such as trails, bore holes, sightings, etc.
- During the visual investigations, direct the conversation to what may be signs of health indicators in this environment. Remind participants of the importance of a healthy environment for collecting medicine from our plant relatives.

While on the concept of soil characteristics and the life that chooses to live there, call to attention the plants that also choose to present themselves differently at different levels of elevations. For example, cattails and blue flag love low watery areas in contrast to whatever you find within view of a plant at a higher elevation.
Water quality:

a) **Consistent seasonal temperatures**
   i) Comparing historical temperatures can point out irregularities that may signal periods of trauma that can be used for warning flags for the future.
   ii) A diverging trend may be indicative of potential imbalance.
   iii) Local history can assist in an investigation/explanation of river status. (Example: Abrupt changes in temperatures can coincide with the Chicago Fire or an implementation of factory dumping policies)
   iv) Certain species can only exist in specific temperature ranges. For example, temperatures greater than 18°C (64.4°F) are normally harmful to fish species in streams and rivers.

b) **Turbidity** (water clarity and measurement of how much light can penetrate water.)
   i) Clarity can be effected by sediment (river velocity) or dyeing of water from leaves and/or chemicals.
   ii) Useful because turbidity can account for plant life which is dependent upon sunlight or lack thereof.
   iii) Turbidity can give insight into upstream forces of erosion/velocity, or source of contamination.

c) **pH**
   i) Scale of 0 to 14 with zero being most acidic and 14 being most basic
   ii) ACIDS Vs BASES:
      (1) the pH scale focuses on the presence of the acidic solutions that contain an excess of hydrogen ions (H⁺).
      (2) and the basic solutions with excess of hydroxide ions (OH⁻);
      (3) the perfect balance of these two ions neutralize themselves at the value of 7 on the pH scale.

*NOTE: If it helps, remember that a water molecule has two hydrogen atoms and one oxygen atom (H₂O). When this molecule rearranges with other molecules, they split into ions of H⁺ and OH⁻ which try to connect to other foreign molecules but not always successful. What that means is that some, many times more than one, are left alone like a loser in a musical chair game. These lonely ions gather strength with numbers. In other words if there are more H⁺ ions the stronger the acid; and likewise, if there are larger number of OH⁻ ions, the stronger the base.*
i) pH measurements are useful because most chemical properties and processes occur because of these acidic or basic properties. Because when new molecules are introduced there's another round of musical chairs with either too many chairs or way, way, too few chairs for these excess ions.

b) Conductivity - also know as specific conductivity which is measure in microsiemens per centimeter (μS/cm)
   i) The ability to conduct electricity
   ii) Electrical conductivity is an indirect measurement of ion concentration.
   iii) INTERESTING FACT: The more ions, the more electricity can be conducted by water.
   iv) Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, nitrate, sulfate, and phosphate anions (anions are ions that carry a negative charge)
   v) .....or sodium, magnesium, calcium, iron, and aluminum cations (cations, pronounced kat-i-unz, ions that carry a positive charge).
   vi) Organic compounds like oil, phenol, alcohol, and sugar do not conduct electrical current very well and therefore have a low conductivity when in water. Very important information when presented with a low specific conductance measurement.
   vii) Ion concentrations are useful in understanding why certain types of rocks and plants are present.
   viii) Ion concentrations are used to calculate the concentrate of remedial chemicals in the instance of chemical or phyto (plant) remediations. (The methods used to clean up impacted water and/or soil contaminated area.)

c) Dissolved Oxygen
   i) The ability of water to hold oxygen
   ii) Dissolved oxygen is vital for aquatic life
   iii) General rule, the cooler the temperature the more oxygen water can hold

a) Nitrates
   i) Nitrates are used in fertilizers.
   ii) High levels of nitrates in streams can produce an unhealthy balance of aquatic plant life. Like an explosion of algae for example.
   iii) Higher levels of nitrates can possibly be attributed to surface water runoff contaminated with fertilizers from farms or neighborhood lawns.
a) **Chlorides**
   i) A large source comes from salting the roads
   ii) In soil, they have known to affect the moisture intake properties of plant creating brown wilting plants. Think of the phrase, “salting the earth.”
   iii) Natural species, such as the Sugar Maple trees, have been replaced by species with higher tolerance of chlorides.

b) **Fecal bacteria**
   i) The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of humans or animals.
   ii) There is a potential existence of pathogens or disease producing bacteria and viruses. Some waterborne pathogenic diseases include viral & bacterial gastroenteritis and hepatitis A.
   iii) Fecal bacteria may exist in streams as a result of the flooding and overflow of sewage structures and from nonpoint sources of human and animal waste.
   iv) INTERESTING NOTE: Flooding in Chicago occurs because too much land is cover with impervious surfaces like concrete. Also, because rivers are put under constraints, such as artificial shorelines made of concrete, that don’t allow for natural river location movement.

**Water quantity**

a) **Flow velocity**
   i) We can use a flow meter made specifically for this.
   ii) Or we can drop a leaf in the water and time how long it takes to travel a certain distance.
   iii) Velocity multiplied by area gives us volume of water flowing at a certain point in the river. Analyzing volume of water can be useful in regards to concentrations of contaminants, seasonal change trends, it can send warning signals if volume is higher or lower than normal, and can support different types of life.

b) **Flow variability**
   i) Flow variability is an observation of difference in velocity of a point in a stream due to bends in the river, different depths of water, logs or rocks, etc
   ii) Variability can account for life present in stream
   iii) Variability can guide research to potential concentrations of contaminations if present at all. It provides a starting point for testing under the theory that higher levels of contamination may accumulate in certain areas of congestion or lower volume and flow.
UNIT 3: SEEING DYNAMIC RELATIONSHIPS IN PLACE
Historical Mapping
Historical Mapping

Unit: Seeing & Representing Place
Topic: Historical Mapping
Lesson Length: 45 minutes - 2 hours (depending on class size)

Lesson Overview
This lesson has youth map historic locations of major and minor villages of tribes located in the Chicago area.

The distribution of Native people in this area is vital in understanding transportation, displacement, industrialization, and urbanization. The locations of villages were strategic in their access to natural resources and transportation routes.

This lesson builds from recognizing historic locations of Native people and how that has affected the urban sprawl of Chicago and its extensive forest preserves but also calls into question locations of industries.

This lesson is dovetailed with the toxic tour lesson to historicize environmental racism.

Finally, this lesson works to situate youth historically and contemporarily in place.

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BIG IDEAS

Chicago has always been a sacred home for Native American People. The evidence of this is depicted in the Scharf map by both large and small villages, extensive trails, chipping stations and sacred mound sites. The two maps represent two very different Chicago landscapes but the essence of Chicago remains the same. The same plants and animals call Chicago home with the exception of those that are now endangered or extinct. The Chicago River has always been the main bloodline for Native people in Chicago. But people’s relationship with this sacred water way has changed significantly over time.
Lesson Objectives

- Youth will be able to read both Scharf map and the CTA map. Students will be able to identify the historic locations of Native villages and trails.

- Youth will also be able to identify contemporary landmarks and what kind of proximity they had to Native people.

Materials and Equipment Needed

- 1809 Scharf Map

- GoogleEarth or comparable software used to view multiple maps, projector, and computer
Lesson Activities

This activity acts as an introduction to recognizing the Chicago area as a place that was once totally inhabited by Native people. It also is the first time youth can see areas that were once Native villages to serve other purposes.

Projection
- Start by projecting the Scharf map of the project.
- What do you see?
- What do you think the map design? What has the cartographer mapped out?
- Does the map legend give you any hints?

Location
- Where are we?
- Overlay the CTA map over the Scharf map. On the projector and mark the location of where your school is located.
- You can also use Google maps to make an overlay.

Landmarks
- Add symbols for landmarks.
- Identify the location of major landmarks to help the students easily understand the scale of the map. (Ex. Loop (mouth of the river), neighborhood boundaries, and land forms.)
- Label all the symbols and landmarks.
- Explain that this map was made in 1806 to show where significant Native sites were located (as defined by the map maker), Native trails, and the beginnings of the urban sprawl of Chicago.
NAVIGATING WORLDS

This activity uses historic documents and images to tell the story of the relocation and then dislocation of Native people in the Chicago area. This is important in giving multiple entry points to historicize Chicago so youth can prepare for visiting these different forest preserves. With many sacred sites still existing in the Cook County Forest Preserves, it is important to show youth that there is a reason these places exist for us. It also opens a space for youth to understand how we show respect to these places when they know that we are literally walking on the bones of our ancestors and we need to walk light and with a great deal of respect.
Discussion Points
What is the same for all Native villages in Chicago?

What is different about the two maps?

How do you think peoples’ relationships with Chicago has changed from one map to the other?

Connecting Activities
• Mapping Toxic Sites in Chicago

• Historicizing Environmental Racism
Tobacco Timeline

**Unit:** Seeing & Representing Places  
**Topic:** Tobacco Timeline  
**Lesson Length:** 90 minutes

**Lesson Overview**

This lesson will act as an introduction to what soil remediation is and how it is being used in contemporary environmental remediation projects.

Youth will read a series of short writings about the relationships African and Native American Communities have had with Tobacco and the subsequent effects of the European exploitation of the plant and these two communities of people.

The jig sawing of readings will conclude with a presentation of a class tobacco timeline.

The activity concludes after the presentation of the last group.

Finally, youth will have a take-home activity which involves them talking to an elder in their lives regarding any stories about their family’s relationship with tobacco or Native ancestry.
Lesson Objectives

• Youth will create a timeline of tobacco and its role in Native American, African, and European communities.

• Youth will read and interpret historic documents.

• Youth will create critically think about the different perspectives and relationships Native American, African, and European communities have had with tobacco.

• Youth will identify tobacco as a plant used in soil remediation efforts.

BIG IDEAS

Youth can see the ways in which two different perspectives on a plant that in one community is a sacred medicine and another perspective used this same plant to justify the enslavement, mass killing, and exploitation of both Native and African people for hundreds of years. They will also be able to think deeply about the dynamic relationships that people have had with tobacco and how it is now changing again.

Youth use dried tobacco as an offering before harvesting medicinal plants.
NAVIGATING WORLDS

In the human centric view that science usually takes, youth are not given a chance to think about how plants can heal the earth. Tobacco is a sacred plant for many tribes. And one thing that all tribes have in common is the belief that these plants let you know when they are ready to be harvested for medicine. In some areas, these plants have to be utilized to heal the earth before they are ready to be used as medicine for human consumption. It is this belief that has been overlooked for centuries as tobacco has only been used to feed the addictions of humans. Therefore, the idea of tobacco as medicine has been lost over time. Science is now using tobacco as a soil remediation plant. In other words, it is a medicine to heal Mother Earth.
Materials and Equipment Needed

• Image Worksheet

• Reading Thematic Web

• Chalkboard

• 4 Group Readings:
  Group 1: “Why turn to Slavery?”
  
  Group 2: Tobacco Timeline: “Columbus is gifted tobacco”
  www.tobacco.org/resources/history/Tobacco_History.html
  
  Group 3: The Tobacco Boom in Virginia
  www.slaveryinamerica.org/history/hs_es_toboacco_slavery.htm
  
  Group 4: Slave Populations in America
  www.slaveryinamerica.org/history/hs_es_toboacco_slavery.htm

Key Concepts & Terms

medicine               indentured servitude           plantations

tobacco                Columbus

slavery                Arawak tribe

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Lesson Activities

Circle Discussion
Introductions: Name, Tribe/Ethnicity, something about themselves.

To-Do Worksheet
• Image interpretation worksheet (25 min).
• Discuss what they thought about the differences in relationships to tobacco.
• Speaker shows the class his/her medicine bag and talks about their personal relationship to the medicines in the their bag.

Break Into Groups
• Youth break up into groups and summarize their readings as a small group (25 min).
• Reading summary using a thematic web organizer.
• Youth connect main ideas in readings to tobacco.
• Have youth write the word ‘Tobacco’ in the center of the web.
• Once youth complete their webs with the readings, have them share with the class (20 min).
• Each person from the group will share while one designated person writes on the board.
• Other groups should be filling out their organizer.
• As a class we will put the groups in Chronological order to create a working idea of the timeline of tobacco and its relationship with African American, Native American, and European communities.

Take Home Activity
Have youth talk to the elders in their lives and see if there are any stories about their family’s relationship with tobacco or Native Ancestry.
Discussion Points

Main Points of Readings (see listed readings under previous Materials and Equipment Needed section)

Group 1
• To hard to enslave Indians because they knew the land and how to live from it
• The more tobacco they wanted to produce the more labor they needed
• Africans were stripped of language, culture, land, and brought to a new continent
• Indians and African had a vibrant and sustainable way of living but colonists felt their way was superior

Group 2
• Columbus is given the gift of tobacco
• Arawaks give tobacco as a gift.
• What kind of relationship do Natives have with tobacco?
• What types of things do you give as gifts?
• Jerez and Torres Observe Smoking and bring it to Spain

Group 3
• Tobacco depletes nutrients from soil
• Ties to contemporary soil remediation techniques
• Growth of plantations
• Effects on European and Indian Relations
• Indentured Servitude of European Poor in Virginia

Group 4
• Growth of slave population
• General economics of slavery more slaves = more profits
• Plantation owners measured wealth by land, tobacco, and slaves.

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Lesson Overview
This lesson focuses on recognizing different habitats, webs of relationships and interactions that exist.

Human manipulation of environments will also be explored and consideration given to how permeable and non-permeable surfaces affect habitats.
Lesson Objectives

• Youth will inventory the plants, animals and insect life in each habitat.

• Youth will determine the surface area of a given space and determine the percentage of that space that is permeable and non-permeable.

• Youth will critically think about how these different levels of human manipulation/levels of respect for the environment affect these habitats.

• Youth will describe, explain, and create hypotheses about their observations.

• Youth will determine the biodiversity of the selected habitats.

• Youth will be able to identify several characteristics of wetlands.

The wetlands of Bunker Hill.
Materials and Equipment Needed

- Colored Pencils
- Paper
- 40 ft piece of rope for roping off section of the habitat
- Meter sticks
- Notebooks and data sheets
- Satellite pictures of the Chicago River

Key Concepts & Terms

habitat  biodiversity
ecosystems  soil filtration
watersheds  storm water
infiltration rates  ponding
Lesson Activities

Circle Discussion

• Discuss the ways in which people all over the world live in interconnected relationships with their surroundings.

• Introduce language of habitat and ecosystems.
  • Give an example of habitat
  • Discuss the concept of urban habitats

Observations

• Have youth define the characteristics of the different ecosystems as a group.

• Have youth try to come up with examples of the ways that plants and animals may live in different habitats then they would in some other part of the state/country/world. (For example, birds that live in air conditioning units rather than trees.)

• Now have youth think about how the changes to Chicago have changed the way plants and animals live in Chicago.
  • Show a satellite picture of different parts of Chicago (please see Habitat Chicago River Pics.doc.)
  • Have youth make observations about differences and similarities between the pictures.

• Now take the point that there are a lot more buildings and pavement to talk about watersheds and soil infiltration rates.

• Explain the difference between permeable and non-permeable surfaces.
  • Explain that in Chicago the more non-permeable surfaces that exist mean the more water that ends up in sewers and water treatment plants rather than back into the soil.
Lesson Activities Con’t

Walk-About

• *Take youth out on to the streets, sidewalks, alleys, train tracks, vacant lots, and other parts of the neighborhood to find a habitat they would like to rope off.* (Note: each teacher should already have a spot chosen that is different from the other research groups)

• *Once a habitat has been selected, students should measure off a plot by planting sticks in the four corners of the plot.*
  • Use the meter sticks to measure an appropriate length of string. Tie the string to the stakes, then use a permanent marker to mark 5 meter increments.
  • Use the rest of the string to further divide the plot.

Documentation

• *The camera person needs to count and photograph all the different plants that are growing in their section.*

• *The recorder needs to tally the plants and measure the total surface area of the permeable surfaces and the non-permeable surfaces.*

• *There also needs to be a recorder that draws a diagram of the area showing:*
  • Density of foliage
  • Permeable and non-permeable surfaces
  • Any standing water
  • Any exposed top soil

Conclusion Activity

• *Reconvene the groups and discuss the findings.*
Lesson Activities Con’t

Conclusion Activity Con’t

- Have the group make a collage of their pictures to depict the habitat in which they studied.
  - The goal of this is to show how the different habitats reflect peoples relationships to those areas
  - It will show some areas that have a lot of bio-diversity, permeable vs. non-permeable surfaces

- Once the groups finish they will need to share they findings with the whole group.
  - Then based off the presentations youth could make predictions to which groups habitat would have the best water infiltration rates.
  - We can also ask the groups to identify characteristics of these sites that they would change to promote bio-diversity, soil infiltration, and decrease water run off.
**Discussion Points**

**Suggested Questions**
- How do different organisms decide where they are going to live?
- Who are our relatives here? What effects do people have on habitats?
- Where does rainwater go? Where do plants and animals live?

At this point you could also talk about tribes of the Chicago area.

**Watersheds**
As the land in a watershed becomes developed – as forests, prairies, and wetlands are converted to roads, homes, offices, shopping malls and parking lots – less and less water is able to infiltrate into the ground. Consequently, more water runs off over the land (and through stormwater and sewer systems). In natural areas, 10% of the rainfall runs off the land compared to 55% in urban areas. Fifty percent of the rainwater soaks into the ground in natural areas, compared to 15% in urban areas. (The remaining water is evapotranspirated – transpired by plants, or evaporated from surfaces.)

**Infiltration Rates**
They are determined by measuring the amount of time it takes for water to drain into soil. Infiltration rate is determined by measuring the time it takes for water sitting on a soil to drop a fixed distance. This rate changes with time as the soil pore spaces fill with water. There are three flow rates. Unsaturated flow is the initial flow rate and is high as the dry soil pore spaces fill with water. Saturated flow is a steady flow rate that occurs as water moves into the soil at a rate determined by soil texture and structure. Ponding is the flow rate that occurs when the ground becomes totally saturated and is no longer able to conduct water through its pores (from online lesson).
Extension Activity

- Begin the lesson with the Ball of Twine activity.

- Ask youth to lead their family on a walk of their neighborhood and capture images.

- Ask youth to interview parents/caregivers about the relationship that animals and plant played in their childhood.

- Have youth figure out how many different plants are living in their back yards or alleys. Have their parents help them record and identify there different plants.

- Use a NETLOGO model to show how the different percentage of an area that is permeable vs. non-permeable vs. density of foliage affects water infiltration rates or run off could be cool.