Knowledge of ecosystems is an important and large topic under the Michigan science GLCE’s for sixth grade. From identifying abiotic and biotic factors to learning about the interconnectedness of species through their relationships in an ecosystem to learning about humans’ effect on ecosystems, there are many subtopics to be taught in the ecosystem unit. Rather than read this information from a textbook, it is important for students to interact with the material they are learning and participate in inquiry-based activities that will allow them to explore answers on their own instead of simply being told. This is an important topic because ecosystems are all around us and students should have knowledge especially of the Great Lakes ecosystem in which they live. Although this is an incredibly broad topic that would take more than five lessons to cover, I have chosen five inquiry-based lessons to give students a deep and long-lasting understanding of several components of ecosystems that will allow them to build their own meaning from the activities they complete.

In the first lesson, students are given a set of materials and asked to construct a mini aquarium in a bottle that will be an ecosystem for a real, live fish. Through creating their design and getting it approved by the teacher, they are learning what factors are necessary to include in the aquarium and that fish need both living (biotic) and nonliving (abiotic) factors to survive. In the second lesson, students will have a chance to explore a small section of the schoolyard or
playground, which is a mini ecosystem in itself. Through observation, they will note interactions among organisms and become familiar with the different roles and relationships organisms have within an ecosystem such as predator and prey, decomposers, or producers. The third lesson asks students to simulate a population that is found in the Great Lakes ecosystem and see what factors deer need to survive, as well as how these factors influence their population size. In the final two lessons, students are asked to consider humans’ impact on ecosystems. The fourth lesson asks students to investigate the effect of different liquids on an eggshell, applying that to how acid in liquids and acid rain can harm ecosystems here on Earth, which is one type of pollution. The fifth and final lesson has students model a common Great Lakes ecosystem, the wetland, which is a necessary component in supporting plant and animal life as well as preventing flooding and pollution. This lesson also gives students a chance to see the effects of humans destroying wetlands and how this can harm an ecosystem in many ways.

Though the topic of ecosystems is broad, these five lessons build on one another to give students an understanding of how ecosystems around them work. They begin by finding out how living and nonliving things work together to ensure an organism’s survival, understand how organisms are all connected by their unique roles but limited by resources and factors within the ecosystem, and understand how humans have and continue to effect ecosystems in a negative way through pollution and the destruction of ecosystems, which in this case is the wetlands. Students in this unit are exploring questions on their own to form their own conclusions, and thus have the activities to remember the information by as opposed to simply reciting what has been read from a book. By connecting with the material on their own, students will reach a more sophisticated and personal understanding of ecosystems.
GLCE’s covered:

- **K-7 Standard L.EC:** Develop an understanding of the interdependence of the variety of populations, communities and ecosystems, including those in the Great Lakes region. Develop an understanding of different types of interdependence and that biotic (living) and abiotic (non-living) factors affect the balance of an ecosystem. Understand that all organisms cause changes, some detrimental and others beneficial, in the environment where they live.
- **L.EC.M.3** Biotic and Abiotic Factors- The number of organisms and populations an ecosystem can support depends on the biotic (living) resources available and abiotic (nonliving) factors, such as quality of light and water, range of temperatures, and soil composition.
- **LEC.06.31** Identify the living (biotic) and nonliving (abiotic) components of an ecosystem.
- **LEC.06.32** Identify the factors in an ecosystem that influence changes in population size.
- **LEC.06.42** Predict possible consequences of overpopulation of organisms, including humans, (for example: species extinction, resource depletion, climate change, pollution).
- **LEC.06.11** Identify and describe examples of populations, communities, and ecosystems including the Great Lakes region.
- **LEC.06.41** Describe how human beings are part of the ecosystem of the Earth and that human activity can purposefully, or accidentally, alter the balance in ecosystems.
- **S.IP.06.12** Design and conduct scientific investigations.
- **S.RS.06.17** Describe the effect humans and other organisms have on the balance of the natural world.
- **S.RS.06.15** Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.
- **S.IP.06.11** Generate scientific questions based on observations, investigations, and research.
Lesson One:
Ecosystem in a Bottle: Aquarium

Grade level: 6th grade

Concept: An ecosystem consists of living things (biotic factors) and nonliving things (abiotic factors) that interact together to sustain life.

Objectives: Students will be able to design their own ecosystem for a single fish, including abiotic factors and biotic factors that will support life.

Standard/Benchmark:
- L.EC.M.3 Biotic and Abiotic Factors- The number of organisms and populations an ecosystem can support depends on the biotic (living) resources available and abiotic (nonliving) factors, such as quality of light and water, range of temperatures, and soil composition.
- L.EC.06.31 Identify the living (biotic) and nonliving (abiotic) components of an ecosystem.
- S.RS.06.15 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.
- S.IP.06.11 Generate scientific questions based on observations, investigations, and research.

Materials:
- Paper and pencils
- 2-liter bottles (1 per group)
- Aquatic sand
- Gravel
- Elodea plants (1 per group)
- **Water**
- Fish (1 per group)
- Thermometer (1 per group)
- Fish food
- **Water conditioner MUST be used to make tap water safe for fish**

Materials Guidelines: Students will not be allowed to access the fish until they have their plans approved by the teacher. Because the ecosystem will contain a live fish, the teacher needs to ensure students’ designs will fit the fish’s needs to sustain life. The teacher will add water conditioner to the student’s fish tanks when their designs are approved before the fish is added to make the tap water safe. Also, if students choose to explore adding materials that were not given into their ecosystems, they will need to get teacher approval so that materials are not ruined by the water or harmful to the fish.

References:
Engage: Teacher will build on students’ prior knowledge of ecosystems from their study throughout the unit and ask the following questions to pique students’ interests in the activity: How many of you have a pet fish at home? How many of you have seen an aquarium? This week, we have been learning about ecosystems, which you know are habitats where organisms live and grow. Since fish live in tanks or aquariums, that makes those tanks mini ecosystems because they can sustain life! Today we are going to design our own fish tanks and create our own mini ecosystem for a real life fish! What factors would you need to include in your mini fish tanks to make an ecosystem where a fish can live?

Explore: Students will be divided into groups of four and materials will be passed out for the mini fish tanks including the bottles, gravel, sand, plants, thermometer, and water. The fish will be withheld for the time being. Students can also use any other materials they choose after seeking teacher approval, because due to the nature of this activity students cannot have complete freedom with use of materials since they would become waterlogged in the fish tanks or may damage the fish’s life. Using the materials, students can first draw a design with pencil and paper of what factors they would need to consider and include when building their mini fish tanks. Students can begin to put their materials into the 2-liter bottle, but before being given the fish, they will need to have their design ideas approved by the teacher. If the mini tanks are missing anything vital to the fish’s life, students will be asked to go back and think about what else might need to be added to help the fish live.

Explain: Students will come together as a whole group and discuss their designs and show their mini fish tanks to the rest of the class. At this point, as each group shares, the teacher will distribute a fish to groups that have been successful in creating a mini fish tank ecosystem that can sustain life. The teacher will ask students what types of things they included in their fish tanks, including what was necessary and what was not necessary. The teacher will then ask students what types of things go into the mini ecosystems that are alive, and which things were not alive. Vocabulary words will be introduced here, as the teacher explains to students that the living things in the ecosystem are called biotic factors. Biotic factors in this situation include the fish and the plant. The teacher can ask the class for other examples of biotic factors that might be found in a fish’s ecosystem in a larger body of water at this time. Then, the teacher will explain that the nonliving things in the ecosystem are called abiotic factors. In the mini fish tank example, abiotic factors include water, gravel, sand, fish food and the temperature of the water as represented by the thermometer. The teacher can then ask for other ideas of abiotic factors that may be found in a fish’s ecosystem. The teacher should explain that although we often think of animals and plants as the most important things in an ecosystem, ecosystems depend on the interaction of both abiotic and biotic factors. If the temperature of the water was too hot or too cold, what might happen to the fish? Water itself is an abiotic factor; yet what would happen to the fish if we did not include water in the ecosystem? Abiotic factors and biotic factors are both necessary within an ecosystem to sustain life.
Extend and Apply: The teacher will have students individually pick another ecosystem that interests them and ask students to make a list of abiotic factors and biotic factors that would be found in that ecosystem. Then, they can draw a picture of the ecosystem and label the biotic/abiotic factors they drew. Students should be familiar with other types of ecosystems such as forests, deserts, lakes, etc. from their study of ecosystems throughout the unit. After completion of this extension activity, students will share their work with the class.

Performance Assessment: Students will have their mini fish tanks in front of them for reference and will draw a picture diagram of the fish tank they designed. Students will also be asked to label which factors they included were living (biotic) and which were nonliving (abiotic). They will write a paragraph explaining why what they included was necessary, and why living things need both biotic and abiotic factors to survive.

Lesson Two: Investigating Local Ecosystems

Grade level: 6th

Concept: An ecosystem includes organisms that interact with one another in relationships such as predator/prey and roles that include consumer, producer, and decomposer.

Objectives: After exploring local ecosystems such as the schoolyard or playground, students will be able to identify the different roles organisms play such as producer, consumer, and decomposer, and how organisms in an ecosystem interact with one another to survive.

Standard/Benchmark:
- **L.EC.M.2** Relationships of Organisms- Two types of organisms may interact with one another in several ways: they may be in a producer/consumer, predator/prey, or parasite/host relationship. Some organisms may scavenge or decompose another. Relationships may be competitive or mutually beneficial. Some species have become so adapted to each other that neither could survive without the other.
- **L.EC.06.21** Describe common patterns of relationships between and among populations (competition, parasitism, symbiosis, predator/prey).
- **S.IP.06.11** Generate scientific questions based on observations, investigations, and research.

Materials:
- Magnifying glass
- Pencils
- field journals
- shovel
- binoculars
- rubber gloves
Materials Guidelines: Since we will be outside observing living organisms in their own environment, we must be careful to leave the “ecosystems” we visit in the same way we found them. The teacher will need to make this clear to the students and show them gentle ways to dig in the dirt with the shovel, and warn them not to pick up any of the organisms. Students may touch plants and insects only with rubber gloves, but should not touch any other organisms in the area such as squirrels, rabbits, birds, etc. The teacher will explain to students that these are wild animals and should be observed but not bothered.

Accommodations for ELL students: Accommodations for ELL students within this lesson are noted in bold with an asterisk. This lesson allows for students to express their findings using pictures and diagrams as well as words so that communication in writing is not a barrier for students who are still learning English. The performance assessment also allows students to narrate what their picture is showing as opposed to just writing it. Finally, a word-wall containing the new science vocabulary words such as predator/prey, competition, and mutualism will be displayed on the board along with a picture of each that has been discussed and decided upon as a class as representing that concept, so students can accurately label their own drawings.

References:


Engage: The teacher will engage students by asking the following questions: Have any of you ever seen different organisms while you were outside playing in your backyard or on the playground? What kind of organisms have you seen? Where in your yard or on the playground do these organisms live? What do you think they eat? Do you think any of the organisms need each other, or do they all just happen to live in the same place? The teacher will then tell students that today they are going to go out to the playground/schoolyard and observe some organisms! They will be working to answer the following question: What interactions between organisms do you observe outside?

Explore: Students will go outside in groups of four to observe a small section of the playground/schoolyard/field, etc. They may choose an area as small as the ground around the bottom of a tree, or they may choose the field as a whole. They will then observe organisms within their chosen section of the schoolyard, and count the number of living things they see as well as what the organisms are doing and what other organisms they might interact with in their habitats. Students can use magnifying glasses or binoculars to help them see the organisms. They may also wear rubber gloves to touch insects or plants without picking them up. Students may also use a shovel to carefully dig in the ground and observe organisms that might be hidden in
the dirt, as long as they are not disturbing the habitat. They will keep track in their field journals of what organisms they saw and what the organisms were doing. They will also record other organisms they think the observed organisms might interact with and most importantly interactions they saw occurring. Students should be told to pay close attention to any organisms that seem to be eating, or any organisms that are near one another, or even touching one another. Also, think about any organisms that interact with you. *Accommodations for ELL students: Students may draw organisms/interactions in their field journals and communicate with pictures and arrows rather than words to better communicate their findings.

**Explain:** Students will share their findings with the whole class, telling what organisms they observed and what interactions they saw. The teacher will write on the board all of the interactions that were observed by the students. Some students may have observed a squirrel eating an acorn, a bird eating a worm, a rabbit eating grass, etc. The teacher will explain that this type of interaction is called a predator/prey relationship. The predator is the organism that eats another organism, which is its prey. Another type of interaction students might have seen occurring would be competition. Maybe they saw two squirrels fighting over a nut, or birds fighting for a worm. Competition usually occurs when there are limited resources and organisms must compete to get their food source. A third type of interaction that students may not have specifically noted is parasitism. Ask students how many of them have been annoyed by a pesky mosquito. Parasites, such as mosquitoes, feed off their hosts, which in this case would be humans. The last type of interaction students may have seen would be mutualism, in which both organisms receive an advantage from working together, such as a bee and flower. Both species benefit in this case.

**Extend and Apply:** To apply what they have learned to the real world instead of just the schoolyard, students will need to think of a different ecosystem that contains organisms different from the ones they would find in their own backyard or playground. They will draw a picture of that ecosystem and include in that drawing at least two organisms interacting in one of the relationships described during the explain phase. They will then write a short few sentences describing the relationship they have depicted. *For ELL students, the pictures will provide a more effective way to communicate their ideas. A temporary word-wall containing the new science concepts will be displayed on the board with the different types of relationships among organisms and a picture of each. For example, if students discussed during the explain phase that birds and worms are predators and prey, that picture will be displayed next to the word predator/prey, so ELL students can correctly identify the relationship they are looking for and label their drawing.

**Performance Assessment:** A picture of an ecosystem the students are familiar with (such as their backyard or a local pond or forest) will be placed on each desk. Each student will receive the same picture, but within the picture, multiple relationships and interactions among organisms will be shown. Students are to identify as many of these relationships as possible by circling in the picture the interacting organisms, and choosing three of these interactions to write about in a complete sentence, stating what the relationship is and how the organisms are interacting. *For ELL students, after they have circled as many interactions as they can find, they may dictate to the teacher what the relationship is, or record themselves on a tape recorder so
Lesson Three:
Oh, Deer!

Grade level: 6th

Concept: Factors such as food, water, and shelter influence population size, and when overpopulation occurs, there may be a shortage of resources.

Objectives: Students will be able to simulate a deer population’s ecosystem to determine what factors influence population size and how overpopulation can lead to resource depletion.

Standard/Benchmark:
- L.EC.06.32 Identify the factors in an ecosystem that influence changes in population size.
- L.EC.06.42 Predict possible consequences of overpopulation of organisms, including humans, (for example: species extinction, resource depletion, climate change, pollution).
- L.EC.06.11 Identify and describe examples of populations, communities, and ecosystems including the Great Lakes region.
- S.RS.06.15 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

Materials:
- Large space
- Pencils, paper
- Masking tape to mark floor

Materials Guidelines: Students should be careful when moving about the room during this simulation. When linking arms with their “match” during the simulation, they should be respectful of personal space and keep their hands/bodies to themselves other than linking arms. There should be no running.

References:


Engage: Ask students if they have ever seen a deer here in Michigan. Maybe they have seen deer up north, at the zoo, or maybe even around their homes in a wooded area. There are actually MANY deer in Michigan, and just like humans, deer have certain needs that must be met in
order to survive. Today, students will simulate a deer’s life in the wild. They will be working to answer the following question: What factors influence a change in size of the deer population?

**Explore:** The teacher should use masking tape to mark two parallel lines on the ground about 10 to 20 yards apart. This simulation should be done outside or in a space with lots of room, so in the classroom the desks may have to be pushed to the perimeter of the room. Students should then count off in fours. All the ones will stand behind one of the marked lines, and the twos, threes, and fours will stand behind the other marked line. The ones are the deer. At the start of each round, the deer will move from behind their line towards the other group of students looking for food, water, or shelter. If they are looking for food, they should hold their hands over their stomach. If they are looking for water, they should hold their hands over their mouths, and if they are looking for shelter, they should hold their hands over their heads in a triangle shape. The twos, threes, and fours will represent resources: food, water, and shelter. To signify which resource they represent, these students will make the same sign as the deer. The teacher will give the students a few minutes before each round to decide what resource they will either represent or be hunting for, if they are the deer group. The two groups will face away from one another until they are all making their signals, and then the teacher will start the round by saying, “Oh, deer!” Both groups will turn to face each other and the deer will move towards the food, water, and shelter. When they find the resource they are looking for by finding a student giving the same signal, the pair will link arms and return back behind the deer line. The student who has been found by the deer will then also become a deer for the next round. Any student who is representing food, water, or shelter but was not chosen will stay where they are for the next round. Any deer who could not find the resource they were looking for will become a part of the resource group for the next round. At the end of each round, the teacher should write on the chalkboard how many deer there are. Anywhere from 10-15 rounds will work.

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<thead>
<tr>
<th>Round #</th>
<th># of deer</th>
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**Explain:** Ask students to share what happened during this simulation. They should look at the chart the teacher wrote on the board that gives the round number and the number of deer at the end of each round. What could account for unusually high or unusually low numbers of deer? Among other things, deer need water, food, and shelter to survive. When a deer is able to meet its needs, it can survive and reproduce. This means the deer population grows. We represented this by having a deer who found its need bringing that resource back to the deer line with them and becoming a deer. However, when there are not enough resources to meet a deer’s needs, that deer would die. Ask students why they think we then had deer who could not meet their needs go to the resource side. This is because when an animal dies and decomposes, it becomes part of the environment again through decomposition. When there were not enough resources for all the deer, the deer population decreased. These factors such as food, water, and shelter influence how big or small the deer population will be. When there are too many deer, there will be fewer resources, which will lower the population. This is just one example of population change for the deer species in the Great Lakes ecosystem, but all populations and species have factors that determine their population size.
Extend and Apply: Have students work in pairs to make a real-life connection to the simulation they completed. In the simulation, if there was not enough food, water, or shelter, the deer would die. This is what occurs in the real world, but have students brainstorm ideas of why they think there would be a lack of resources. For example, a forest fire could cause a lack of shelter. A year with little rain would cause a lack of water, especially if lakes and rivers were not as full. A decline in other animal populations could cause a lack of food for the deer to eat. Discuss these ideas as a class after students have brainstormed.

Performance Assessment: Ask students to write a paragraph describing what they have learned about the factors that cause changes in the size of a population. Remind them to identify specific factors and resources a population would need, as well as what would happen if there were too many organisms in the population and/or too few resources.

Lesson Four: Acid Attack

Grade level: 6th

Concept: Ecosystems can be affected by humans, which can lead to detrimental, irreversible effects and imbalances within the ecosystem.

Objectives: After observing the effects of different liquids on eggs, students will be able to determine what liquids had negative effects on the eggs. They will understand that the acid in the liquids damages the eggs, much the same way humans damage their environment through emissions from cars and factories that cause acid rain.

Standard/Benchmark:
- L.EC.06.41 Describe how human beings are part of the ecosystem of the Earth and that human activity can purposefully, or accidentally, alter the balance in ecosystems.
- S.IP.06.11 Generate scientific questions based on observations, investigations, and research.
- S.IP.06.12 Design and conduct scientific investigations.
- S.RS.06.17 Describe the effect humans and other organisms have on the balance of the natural world.
- S.RS.06.15 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

Materials:
- Clear cups large enough for an egg to be submerged (at least 3 per group)
- Markers and labels to write on the cups
- Vinegar
- Water
- Cola
- Hardboiled eggs (at least 3 per group)
- Observation/record sheets
- Additional liquids to be tested at teacher’s discretion

**Materials Guidelines:** Students should wear safety goggles when doing this activity to avoid getting splashed in the eye by any of the liquids being tested. Students should also be reminded that this is a science experiment and the liquids are not for drinking under any circumstances, and monitored closely by the teacher. If students wish to test any additional liquids, they must first receive teacher approval. Also, either hardboiled or uncooked eggs will work for this experiment, but to avoid mess, hardboiled is preferred.

**References:**


**Engage:** The teacher will engage students by asking the following questions: How many of you have ever seen garbage thrown in the street or in water such as a lake, pond, or ocean? Have you ever seen someone dump any kind of liquid somewhere other than in the sink? What do you think happens to the environment when humans throw away their trash like that? Now, who has seen or driven by a factory? What do you see coming out of the factory? Do you see smoke or steam like this coming from anywhere else? Answers may include cars, trucks, buses, etc. The teacher will then ask what students think happens to the environment/ecosystem where this smoke is released into the air. Since we cannot really create harmful emissions to release into the atmosphere, the teacher will explain that students will investigate what effects different liquids have on eggs. Students will be working to answer the following questions: What effect do different liquids have on an egg?

**Explore:** *Procedures will differ slightly as instruction is differentiated for this experiment.*

Group One-Directed Activity: Students will label 3 cups as water, cola, and vinegar. They will then pour the designated liquid into each cup. The amount of liquid does not matter as long as when they drop an egg into the liquid, it is completely submerged. After the eggs and liquid are in the cups, students will refer to their observation sheet (see attached) to form a hypothesis about what will happen to the egg in each cup. The eggs will be left to soak overnight and the
next day students will observe their findings according to teacher-directed characteristics on the observation sheet.

Group One-Guided Inquiry: Students will label 3 cups as vinegar, cola, and water, repeating the same experiment as Group One. However, students will also have the choice of testing additional liquids, as shown by the extra columns on Group Two’s observation sheet and make a hypothesis for each. They will then decide on a few characteristics of their choice that they will observe the next day after the eggs have soaked overnight. They can also add more characteristics as needed when actually observing the following day, and those observations will go in their worksheet as well.

Group Three- Open Inquiry: Students will be given the same materials as Groups One and Two, but will choose their own explorable question to answer. They can test additional liquids if they choose, or they can test just one liquid and find its effect on the egg when the egg is submerged for different amounts of time, etc. Their observation sheet is not included because it will depend on the variable they choose.

**Explain:** Each group will share their findings with the class. Students can share their observations and what liquids seemed to cause harmful changes in the egg. The teacher will then explain that the vinegar, cola, and other acidic liquids contain acid that break down the egg’s shell. This same type of effect occurs in the real world. Emissions from factories and cars, especially burning fossil fuels which include coal and oil, are released high into the air where they mix with other chemicals, oxygen, and water to form acid rain. Acid rain looks just like normal rain, but since the rain contains water that has been mixed with these acidic compounds, it can be harmful to the environment! Acid rain can damage buildings and statues, harm soil in forests that will harm plants and trees, and pollute water as well as be harmful to wildlife. You saw what happened to the hardboiled eggs in our classroom when placed in acidic liquids. What would happen if real eggs outside containing baby birds were affected by acid rain? *The point here is not that students understand the complex science rationale behind acid rain, but rather that they understand one way humans can negatively impact their ecosystem through pollution is acid rain.* Now we know acid rain is one way humans can alter their ecosystems. This is one form of pollution. When we add harmful things to the land, water, or air, that is called pollution. This is just one way humans negatively impact and forever change their environment.

**Extend and Apply:** Students will now apply what they have learned about acid’s effect on eggshells to the real world, and how human-caused pollution in the form of acid rain affects wildlife and plants on Earth. The teacher will show students photos of different ecosystems and manmade structures that have been affected by acid rain (see attached photos at end of lesson). If time is permitting and computers are available, students may also browse the following sites to see more effects acid rain has on the environment: [http://uhohacidrain.blogspot.com/](http://uhohacidrain.blogspot.com/) and [http://envis.tropmet.res.in/kidscorner/acid_rain.htm](http://envis.tropmet.res.in/kidscorner/acid_rain.htm). Students can discuss ways to reduce acid rain such as carpooling and riding bikes to cut back on car use, or asking factories to reduce emissions.

**Performance Assessment:** Teachers will assign and collect the following task:
As sixth graders, you decide to spend part of your summer at a camp that includes a pond. Some of the other campers, and even some counselors!, do not know better than to throw away their used liquids into the pond. Using the cups in front of you that show the experiment we did, explain to your fellow campmates why we cannot throw some liquids into the pond!

You have the cup of vinegar, cup of cola, and cup of water each with a soaked egg in front of you. You may take out the eggs to touch them and observe them. Then, complete the following:

Observations of the egg in cola:
Observations of the egg in vinegar:
Observations of the egg in water:
Conclusion: What causes harm to the egg?
Construct an argument using pictures/words for which liquids should not be tossed into the pond: (You can include other liquids that should not be poured into the pond either, with an explanation why.)
Explain what might happen to the wildlife in the pond if those liquids are poured in:
Extra credit: Can you think of any other ways you and the others at camp can help to prevent pollution this summer? Hint: Think about what kind of smoke/emissions cause acid rain in the real world. If exhaust from our cars is part of the pollution problem, is there a way you could reduce the amount of exhaust that is released into the atmosphere?

Group One- Directed Activity Observation Sheet

<table>
<thead>
<tr>
<th>Hypothesis-What do you think will happen when the eggs soak overnight?</th>
<th>Cup with cola</th>
<th>Cup with water</th>
<th>Cup with vinegar</th>
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<td>Characteristics of eggs the next day: Size</td>
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<td>Texture</td>
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Group Two- Guided Inquiry Observation Sheet

<table>
<thead>
<tr>
<th>Hypothesis-What do you think will happen when the eggs soak overnight?</th>
<th>Cup with cola</th>
<th>Cup with water</th>
<th>Cup with vinegar</th>
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Characteristics of eggs the next day:

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Acid Rain Photos

![Image 1](image1.jpg)

![Image 2](image2.jpg)
Lesson Five:
Wetland in a Pan

Grade level: 6th

Concept: One feature of the Great Lakes region is Michigan’s wetlands, which function to support plants and animals, reduce flooding, filter pollution, and prevent soil erosion.

Objectives: Students will be able to build a model wetland and identify the importance and function of wetlands to the Great Lakes ecosystem, as well as what would happen if these wetlands were destroyed.

Standard/Benchmark:
- K-7 Standard L.EC: Develop an understanding of the interdependence of the variety of populations, communities and ecosystems, including those in the Great Lakes region. Develop an understanding of different types of interdependence and that biotic (living) and abiotic (non-living) factors affect the balance of an ecosystem. Understand that all organisms cause changes, some detrimental and others beneficial, in the environment where they live.
• **L.EC.06.11** Identify and describe examples of populations, communities, and ecosystems including the Great Lakes region.

• **L.EC.06.41** Describe how human beings are part of the ecosystem of the Earth and that human activity can purposefully, or accidentally, alter the balance in ecosystems.

• **S.RS.06.15** Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

• **S.RS.06.17** Describe the effect humans and other organisms have on the balance of the natural world.

**Materials:**

• Modeling clay
• Rolling paint pan, or small aluminum pan (1 per group)
• Sponges, carpet foam, or indoor/outdoor carpeting
• Watering cans
• Cup of soil (1 per group)
• Additional materials to decorate wetlands if desired: pine cones to represent evergreens, cotton swabs on toothpicks to represent cattails, pine needles for reeds, clay animals, etc.
• Paper, pencils

**Materials Guidelines:** The materials need to stay on the students’ desks within their groups. No soil or muddy water should be outside of the aluminum pans. At the end of the activity, students can return their materials in the pans to the back of the room and wipe up any stray water/dirt.

**References:**


**Engage:** The teacher will engage students by asking if anyone has ever been to or seen pictures of any of the Great Lakes. What do they look like? What kinds of plants and animals were there? Did you see big hills of sand? What was the water like? Then, the teacher will read *The Legend of Sleeping Bear* to the students to pique their curiosity and introduce them to the Great Lakes ecosystem region. The teacher should ask students to pay special attention to the pages showing illustrations of the bear near the lakeshore and the sand dunes. What do you see in the pictures? What kinds of plants and animals? Is the sand and soil flat or in a big hill? This is a great way to get students ready to complete the explore activity by asking the students what the sand dunes and area along the shore did for the mother bear. That environment seemed to help protect her from the elements. We can simulate this same environment in the classroom. Students will work on the explore activity to answer the following question: What will happen to the rainwater if we make it rain on this environment?
**Explore:**

1. Students will work in small groups (about 4 students) to complete this activity. Each group will be given an aluminum pan. They should spread clay to represent land in half of the pan and shape the clay so that it gradually slopes downward. The other half of the pan should be left empty to represent a body of water. In this case, it will represent one of the Great Lakes. Students should be sure to smooth the clay along the edges of the pan to seal it.

2. Next, students should take their foam or sponge (or indoor/outdoor carpeting) and completely fill the space along the edge of the clay, making sure there are no spaces between the sponge and bottom of the pan, or the sponge and sides of the pan. (see attached diagram for help if needed)

3. Optional: Students can decorate their wetland models by adding cattails (cotton swabs on toothpicks), pine needles to represent reeds, pinecones for evergreen trees, animals made of clay, etc.

4. Students should use a watering can to represent rain onto the land, which is the clay. They should observe where the water goes. The water should trickle down the clay into the sponge and then slowly into the empty pan, or lake. Ask students where the water went and to record it. They should note that some water flowed into the empty pan “lake,” but some was absorbed by their sponge. As the teacher walks around, if students do not seem to notice the water in the sponge, pick up the sponge and squeeze it out to demonstrate some water was absorbed.

5. Now what will happen to the rainwater if we remove the sponge? Have students dump the excess water in the pan and leave the sponge out, then pour water onto the clay again. Observe where the water goes. Does it fill the empty pan lake quicker or more slowly? What happens if you keep pouring water onto the clay?

6. Students should now put the sponge back into the pan and pour a layer of soil over the clay land. Then, pour water over the clay and soil to create another rainstorm. How does the water look? Observe what soil got trapped in the sponge and what soil spilled over into the empty pan lake.
7. Repeat step 6, but first take out the sponge and dump the water and soil out of the pan. Again, pour soil over the clay, followed by another rainstorm. Without the sponge, where does all the soil and water go? How does the water in the empty pan lake look now?

**Explain:** Ask students to share their results and observations. When the sponge was in the pan, it absorbed more water and only some of the water got through to the empty lake part of the pan. When the sponge was removed, all the water went into the empty pan lake and may have even flooded the clay land. Tell students that the sponge represents a wetland. Wetlands are an important part of the Great Lakes ecosystem. Wetlands have waterlogged soil and shallow surface water that support plants and animals suited to watery environments. Not only are wetlands an important habitat for plants and animals in the Great Lakes, but they also help to reduce flooding, prevent soil erosion, and filter pollution. When we had our sponge wetland in the pan, it absorbed a lot of the water, and prevented the lake from overflowing and flooding the land. With the soil, the sponge wetland also trapped a lot of the soil and prevented the water in the pan lake from getting too dirty. Without the sponge, the water and soil all reached the pan lake and made it much dirtier. Wetlands in the Great Lakes region help trap silt and pollutants in their thick plants, preventing much of these sediments from reaching the water and polluting it. Just as the sand dunes protected the mother bear in the legend from the elements, sand dunes and wetlands like your mound of clay and sponge help to protect plants and animals, as well as preventing flooding and pollution runoff.

**Extend and Apply:** Now that students have made a model wetland, they should connect their knowledge to the real world by thinking about what would happen to the Great Lakes ecosystem if wetlands were destroyed. They already removed the sponge wetland from their model and concluded that flooding could occur, or pollutants might reach the water easier, as well as cause soil erosion. If a wetland was destroyed and houses were built in its place, what would happen to the houses during a rainstorm? They could be flooded without the wetland to absorb some of the water flow from higher ground. Now, what if the wetlands were destroyed and all the soil and pollutants reached the water instead of being trapped in the wetlands? The muddy water makes it hard for fish to see and breathe. Plants may not be able to receive enough sunlight if they are blocked by the dirtied water. Other animals may lose their food sources if these plants and animals die, or if they cannot easily find them in the muddy water. What about ships and boats? The mud could fill important channels that are needed for navigation. What about YOU? Would the water still be okay to drink? Could you still swim in it? By destroying wetlands in the Great Lakes region, many aspects of our ecosystem would be affected from loss of plant and animal life, to problems with shipping and industry, to loss of tourism and decreased quality of drinking water due to pollution. Show the class photos of what this pollution and flooding looks like in the Great Lakes, followed by photos of what the wetlands look like when they are intact.

*Photo from [http://www.epa.gov/greatlakes/sediments.html](http://www.epa.gov/greatlakes/sediments.html)


Wetlands Photos
Performance Assessment: Teachers will assign and collect the following task:

- As you learned during our extension discussion, many wetlands are drained and filled by humans to build marinas and homes along the shores of the Great Lakes. Using what you now know about the importance of wetlands to the Great Lakes ecosystem, construct an argument of why wetlands should be preserved in this region. Your task is to write a letter to a developer who wants to destroy wetlands to build homes. Explain in your letter why it is important to preserve wetlands in this ecosystem. Give three reasons of how the ecosystem would be negatively altered if these wetlands were destroyed.
References


