Lesson: Sustainable Table

*Arlington Echo works to continuously improve our lessons. This lesson may be modified over the course of the school year.

Environmental Literacy Question: How have humans affected the Chesapeake Bay and its watershed?

Topic/Essential Questions: How do the structures of plants and animals help them survive in their habitats?

Content Standards:

- **Environmental Literacy**
  5.B.1. *Analyze*, from local to global levels, the relationship between human activities and the earth's resources.
  1.B.1: Use recommendation(s) to *develop* and *implement* an environmental action plan.
  f. *Recognize* and *explain* that activities and technology of the human species have a major impact on other species in many ways such as: Destruction of habitats through direct harvesting, pollution, atmospheric change *(and erosion)*.
  5.A.2. Analyze the effects of human activities that deliberately or inadvertently alter the equilibrium of natural processes.
  8.A.1. Understand and apply the basic concept of sustainability to natural and human communities.
- **Science**
  5.A.1. Analyze the effects on human activities on earth's natural processes.
  4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
  1.A.5.f. Make recommendations supported by data to help address or resolve the issue.
  4-LS1-2 Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
- **Social Studies**
  3.D.1. *Describe* how people adapt to, modify and impact the natural environment
  b. *Describe* ways and reasons people in Maryland and the United States modify the natural environment and the consequences of modifications.
- **Common Core State Standards**
  CCSS.ELA-Literacy.RI.4.7 *Interpre*t information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

The 5 E's of Instruction:

1. The garden tour will **engage** students with their surroundings and nature. The tour and gardening activities will stimulate their thinking by having them be outside and touching and connecting with the subject. They will access their prior knowledge about plants and where food comes from.
2. The students will **explore** the relationship between pollinators and produce by playing a game and acting out the relationship.
3. After the game, students will work through the **explanation** of the relationship between pollinators and produce. They will discuss the benefits of the symbiotic relationship and why wildflowers are

beneficial for this.

4. **Extension**: Students will expand and solidify their understanding by creating a recipe with pollinated ingredients (*cucumbers - may change seasonally*). This will help them to understand the importance of pollinators.
5. **Evaluation**: students will discuss what they've learned and answer questions, demonstrating their knowledge on the subject.

Lesson Sequence: This lesson is one of the lessons for Q1 at Arlington Echo Outdoor Education Center. This lesson's focus is on decreasing negative environmental impacts of agriculture and eating habits by encouraging sustainable practices such as eating local, seasonal, whole, and organic food.

Length of Lesson: 60 minutes for overnight programs, 45 minutes for day programs.

Student Learning Outcome: The students learn that the food we eat plays an important role in determining the size of our environmental footprint. They will also learn about the different processes involved in the production of that food, including pollination and farming practices. They will follow a recipe to prepare a simple snack using whole ingredients that required pollination to grow.

Knowledge of the Learner

- Prerequisite knowledge, skills and processes: Students will complete two lessons in school and conduct research on human impact.
- Student needs, interests, previous learning: Conduct pre-assessment to see level of prior knowledge and address any special needs of students that might need modification.
- Conceptual difficulties: relating pollination, production, farming practices, and cooking practices to the cost and ecological impact of food.
- Differentiation: Students are 4th graders, with a diversity of backgrounds and skill levels.

Knowledge of the Content

Vocabulary:

Blight	Habitat	Preservatives	Sustainable
Compost	Local/Seasonal	Pollinator	Symbiotic
Crop Rotation	Monoculture	Polyculture	Watershed
Fertilizer	Organic		

Materials:

Food packages with labels	Garlic cloves	Knives
Pompoms with Velcro	Water	White vinegar
Soil thermometers	Recipe sheet	Deli containers and lids
Flower canvases (2)	Cucumbers	Felt board
Cutting boards	Dill	Salt
Peppercorns	Mustard seeds	Story cards

Supplements

A: Vocabulary
B: Reading Food Label
C: How to Care for Your Garden
D: Plant and insect Identification cards
E: Pickle Recipe
F: Sustainable Farming Activity

Lesson Setup

- Have food containers ready to pass out to students for them to read the labels.
- Garden: Set out materials needed for Busy Bees pollinator game.
- Ensure that all ingredients and supplies are ready for making pickles.

Instructional Delivery

Pre-Assessment:

Start asking simple questions to stir interest in the topic:

- **"What does it mean to be sustainable?"** *To be sustainable is to be able to maintain what you are doing. So if you were running at a sustainable pace, it means you could keep doing it for a long time.*
- **"This lesson is called sustainable table. What do you think the lesson is going to be about?"** *This lesson is about how we can produce food in a way that is sustainable to the earth, meaning we can keep doing it for many years to come. We are also looking at ways that we can eat that is sustainable to our bodies. What is really cool is that things that are sustainable to our earth are usually sustainable to our own bodies too.*

Lesson:

Nutritional Garden Tour

- Explain that today we will visit our garden, which does not use pesticides, and make a snack following a recipe that uses mostly whole and local ingredients.
- Bring students to the garden behind the dining hall. Point out the vegetable garden and ask them to try to identity the vegetables and herbs that are growing. We have tomatoes, cucumber, squash, parsley, and red and yellow onions. In the herb garden we have thyme, oregano, chives, common sage, lemon thyme, and lemon balm. Have the students try to identify them first, then consult the identification guide.
- Show the students the flower garden. Explain that we call it a pollinator garden. Ask the students the following questions:
    - **Why it is a called a pollinator garden*?*** *It has plants that were specifically chosen to attract pollinators, such as bees.*
    - **What about the plants are so good for pollinators*?*** *They have large amounts of nectar and protein, their color contrast and patterns help the bees to locate the nectar, the bees are attracted to them, and their sizes and shapes make it easy for bees to land and feed on.*
    - **Why is it important to have a pollinator garden here?** *It attracts bees and other pollinators to the area so they can also pollinate the vegetables. It also helps them because bees face a lot of threats and they need to have consistent food sources. Bees pollinate about 30% of the food we eat!*
    - **Do you notice anything interesting about some of these vegetables/herbs? Some of them have flowers, and some do not. Why do you think this is?** *Some vegetables, the ones that do not have flowers, are self-pollinating meaning they do not need the assistance of insects or the wind for pollination and the production of fruit. Other vegetables, the ones with flowers, need to be pollinated and rely on bees, butterflies, or wind in order to produce.*
    - **Do you know what insects pollinate plants?** *Bees! Also butterflies, bats, hummingbirds.*

Garden Care: (For overnight programs only)

- Ask the students: **"What does a plant need in order to grow?"** *Soil, sunlight, and water.*
- Tell the students that we need to make sure a plant has the right amount of those things. Different kinds of plants have different needs when it comes to soil, sun, and water.
- Let's observe the garden. (See Supplement C: How to Care for a Garden.)

Pollination Simulation

- Ask the students: **why do pollinators go to flowers?** *To get food/nectar.* **What happens when they collect the nectar?** *They take pollen from one flower to the next as they search for nectar. If the flowers are the same kind of plant, then the flower is pollinated. Some of these flowers turn into fruits we like to eat.*
- Instruct students to look at both scenes. (Scene 1 = blueberry bushes and flowers. Scene 2 = blueberry bushes and non-flowering plants.) Ask the students: **Which scene do you find more appealing? Which one do you think a pollinator would find more appealing?**
- Tell students: We will be doing a pollination simulation. We have two different scenes: one has just blueberry bushes, and one has both blueberry bushes and wildflowers native to Maryland. You will be

playing the parts of pollinators. You are going to fly to the scene that you find more appealing. Once at the scene, take the pollen balls from the flowers at the base and stick the pollen to the flowers. You will have 20 seconds to pollinate as many flowers as possible. Demonstrate how to stick pollen balls to scene. Have student congregate in a group by the cones next to the garden. Tell them that when you say "Begin Pollination Simulation" they are to flap their arms and fly like a pollinator to the scene that they thought was more attractive when they were asked a few minutes ago.

- Set timer for 20 seconds. Start the timer and say "Begin Pollination Simulation"
- After 20 seconds, announce that the time is up.
- Count the number of blueberries that were pollinated on each scene. *(More flowers in Scene 1 should be pollinated than in Scene 2).* Ask students: **Why do you think this happened?** *The pollinators were attracted to the wildflowers.*
- Count the total number of flowers that were pollinated. Explain that each flower that was pollinated also gave nectar to the pollinators. Ask the students: **Why is nectar important to pollinators?** *It is their food!*
- Explain that next we will go inside to learn about farming and to make a recipe using fresh ingredients from our garden/local produce.

Whole Foods

- Have the students come in and wash hands. Have them sit down and discuss Whole Foods. Ask the following questions to begin the discussion:
    - **"What is your favorite food?"**
    - **"A whole food is a food that has not been changed much from what it started. It is often free from additives and artificial substances. Is your favorite food a whole food or is it made from lots of ingredients?"**
    - **"Where do you think your favorite food comes from?"** *A farm, the grocery store*
    - **"Do any of you have a garden at home?"**
    - **"How many of you have been to a farm or farmers market?"**
- Hand out a variety of foods or food containers supplied for this lesson. Have the students look at these examples together in pairs.
- Tell the students to find the ingredients in the example you are holding.
    - **Does your "food" have 5 or more ingredients?** *It is a general rule that the less processed a food is, the better it is for you and the earth. Usually more ingredients means it is more processed.*
    - **Are there any ingredients that you cannot pronounce or have no idea what it is?** *In order to prevent foods from spoiling during long distance transport and to prolong shelf life, manufacturers often use chemicals or preservatives to keep our food fresh. Some of these ingredients are not healthy for us or the environment. They are not actually food.*
    - **Are all these foods made from whole ingredients?** *No. Some are, but most are not.*
- Explain that even fruits and vegetables, which are whole foods, can have negative impacts on the environment. In order to make fruits and vegetables consistent and attractive, and also to get the highest yield possible, farmers may use pesticides and chemicals on their crops. These chemicals can negatively affect us when we eat the food and negatively affect the environment when it rains and they end up in our waterways.
- We learned today that food can come from your backyard. But a lot of food comes from far away. Ask students, **"Why it is important to eat local foods?"** *The foods are better for you because they do not have to a preservatives to keep them from rotting. It is better for the earth because they do not use as much fuel to get them to you. It is also better for the local economy.*

- It is important to eat local whenever possible for all these reasons. Today we are going to use VERY local ingredients to make homemade pickles.

Pickle Activity

Today we will be making pickles!

- Discuss ingredients. Ask the students: **"What is a pickle made of?"** *We use cucumbers to make pickles.*
- We have cucumbers growing outside in our garden. Ask the students: **"What did you notice about the cucumber plant?"** *They have flowers - they need to be pollinated in order to produce*. Make sure to mention that cucumbers are a whole ingredient.
- To flavor our pickles, we will be using dill, which is an herb that we have growing here at Arlington Echo.
- Have the students look at the recipe and ingredients (Supplement E).
- Have each student follow the recipe to make the pickles
- If there is compost from peeling or chopping the ingredients, have the students put it in a bucket. Show the students the 3 stages of composted material: recently composted, partially degraded, and finished compost. Explain when we compost during the meal cleanup, Arlington Echo staff adds it to our compost bins and the compost is used in our gardens.

Arlington Echo staff will distribute the pickles to students or teachers before they leave the site (during lunch next day for an overnight). The pickles can be eaten them as little as 1 to 2 hours later, but they become ideal at 6 to 8 hours. They'll keep in the fridge, submerged in their brine, for 3 weeks. Explain that once the pickles are eaten, the brine can be used again with more local cucumbers.

Sustainable Farming Activity

Introduction:

This activity will demonstrate what it means to be a sustainable farm by exploring different farming practices.

Materials:

One sustainable farms felt board
Felt board farm pieces
One set of story cards

Instructions:

- Keep students seated at the table. Introduce the felt story board and explain that the students will be using the board to see scenarios affect two different farms (Bob's Farm & Simone's Farm). If there is time, introduce the activity with the following questions:
    - **"What do we call people who grow crops?"**
    - **"What are we learning about today that may involve famers?"**
    - **"Why do we need farmers?"**

    - **"How can a farm practice sustainability? Why should a farmer practice sustainability?"**
- Distribute the numbered cards to students. Students will read the cards in order from 1 – 7, alternating between Bob and Simone, starting with the card labeled "Bob 1." Each card contains an action component in which they will walk up to the instructor to receive necessary pieces to be placed on the board. These pieces will be laid on a piece of felt for the instructor to pick from.
- The goal of the activity is to decide which farm performed more sustainable practices.
    - **Monoculture** is the production of <u>one</u> crop.
    - **Polyculture** is the production of <u>more than one</u> crop.

Debrief:

Ask the students the following questions.

- How did the different story cards affect the farms? Were there certain story cards that affected one farm more than the other?
- What were some things that affected your farm that were beneficial? Harmful?
- What are some advantages and disadvantages of each farm?
- Which farm would you consider to be more sustainable?
- Which farm won in the end?

Discussion:

- Ask the students to explain the relationship between pollinators and produce.
- Ask the students: **"Where we can get food that would reduce our impact on the environment?"***(Buy food that is produced closer to home.* ***Local*** *food means it was grown close to you. The ingredient we used today was grown in* _____. Have students point out Maryland on the map and discuss the shorter travel distance, less pollution, and fresher food that was harvested recently. Ask the students: **"How can we eat more sustainably?"** By planting our own gardens or buying from local produce stands and farmers markets.
- Point out that *buying locally does not always mean that it is sustainable!* Make sure the food was not only local, but also produced without using chemicals like fertilizers, pesticides, or preservatives.
- Discuss the effects on the environment and habitats when we are not sustainable. *(Farming can harm the land- chemicals can contaminate soil; large clearings can be susceptible to erosion with no trees to hold soil in place; polluted runoff flows into water sources; without reducing/reusing/recycling, more trash is generated and contaminates habitats).*

    We know that it is not always possible to buy locally, due to factors including financial restrictions, convenience, seasonal availability, etc. It's ok that we can't always go to a farm stand to buy local food, but when possible, buying or growing sustainable produce is much better for us and for our environment. This is not the only way to be sustainable; every little step we take makes a big difference!

Assessment

Ask students about the benefits of eating local foods. You may guide the discussion using the following questions:

- **When we buy foods that are not grown locally/organically, how does that impact our environment?** *Large farms generally have more harmful impacts on the environment and use more pesticides on food, which we then eat.*
- **What options are available when buying produce**? *Buy local produce from store, go to a farmer's market, grow your own.*
- **What can you do at home or at school to make wise food choices to protect the bay and have a "Sustainable Table"?** *Eat more whole foods, use local ingredients, plant flowers to help pollinators, refuse a bag when not needed, reduce the amount of food waste, and teach others what you have learned.*

Between lessons, wash materials (if students ate from them) in the Resource Lab sink.

Supplement A: Vocabulary

Blight: A plant disease characterized by sudden and severe browning, withering, or dying. Typically caused by a bacteria, fungus, or virus.

Compost: The process of using organic food waste to produce nutrient-rich soil.

Crop Rotation: A system of growing different crops one after the other on the same area of land. This process avoids depleting resources in the soil and controls weeds, diseases, and pests.

Fertilizer: A chemical or natural substance added to soil to help the growth of plants.

Habitat: A natural environment suited to specifically support life of the plants and animals living in that area; every habitat must have food, water, shelter, and sufficient space for its inhabitants.

Local/Seasonal: Local and seasonal food is more sustainable because it reduces the need for our food to be preserved, transported long distance, or refrigerated before it ends up on our plate.

Monoculture: The production of one crop.

Organic: Food produced without using any chemical fertilizers, pesticides, or preservatives

Preservatives: Chemicals used to prolong the freshness of certain produce, especially when being transported over long distances.

Pollinator: A pollinator is an animal that causes plants to make fruit or seeds. They do this by moving pollen from one part of the flower of a plant to another part. This pollen then fertilizes the plant. Only fertilized plants can make fruit and/or seeds, and without them, the plants cannot reproduce.

Polyculture: The production of more than one crop.

Sustainable: A way of harvesting a resource so that it is not used up or permanently destroyed.

Symbiotic: A mutually beneficial relationship between two different organisms.

Watershed: An area of land where all water sources flow into a particular body of water.

Supplement E: Make Your Own Perfect Pickles!

Ingredients:

Brine: (made as a whole group)

2 peeled cloves of garlic

4 cups warm water

4 cups white vinegar

1/4 teaspoon of salt

Pickles: (Made individually)

1 Small (3 inches or less) rinsed cucumber (If larger cut into 3 inch sections)

1/4 teaspoon of fresh dill

5 peppercorns

Pinch of mustard seeds

Directions:

Brine: Press the garlic through the garlic press and add to large jar with warm water and vinegar .

Pickles:

1. **Cut your cucumber into thin slices or spears, about 1/8-inch thick.**
2. **Place cucumber slices into provided containers.**
3. **Add dill, peppercorns, and mustard seeds to the container.**
4. **Add enough liquid from the group jar of brine to just cover the cucumbers.**
5. **Write your name and your teachers name on the lid. Place lid on the container and swirl together to mix the ingredients.**

Supplement F: Sustainable Farming Story Cards

Bob's Farm
1) Bob purchases 100 acres of land and clears all of his land to start his farm. ***Remove trees from board and add barn.***
2) Bob decides to grow cucumbers and plants them all over his land. ***Place both cucumber strips on board*.**
3) Bob walks out onto his farm one day to find his cucumbers covered in harmful cucumber beetles. ***Add 5 beetles above cucumbers.*** He decides to spray pesticides to protect his cucumbers from the beetles. ***Add pesticides to board.***
4) The pesticides worked and killed the beetles. However, there are now chemicals in his topsoil. ***Remove beetles and add chemicals to topsoil.***

5) There is a big rainstorm that has hit Bob's farm. There are no trees to soak up the water. Therefore, the topsoil, along with the chemicals from the pesticides, run into the local stream.
Remove topsoil from board.

6) Oh no! Bob's topsoil is gone. Bob needs to add fertilizer to replenish the nutrients he has lost.
Add fertilizer to board.

7) Bob sprayed pesticides on his farm and as a result has no pollinators coming in. He now has to hire a local beekeeper to help pollinate his cucumbers so that they will grow.
Add beekeeper to board.

8) The season has been eventful but ended well. Bob is ready to harvest his cucumbers. After harvesting, Bob sells his cucumbers to Mount Olives pickle factory for a large sum of money.
Remove cucumbers from board.

Simone's Farm
1) Simone purchases 100 acres of land and clears 80 acres to start her farm. ***Remove most of the trees from the board and add barn.***
2) Simone decides to raise animals and plant a variety of crops. ***Place the strip of different crops and animals on board.***
3) Simone walks out onto her farm one day to find one row of cucumbers covered in cucumber beetles. ***Add 2 beetles above one of the cucumbers.***
4) Only one row of her cucumbers is affected by the beetles, so she decides to release ladybugs which eat the beetles. ***Add ladybugs and remove beetles on board.***

5) Simone has been hit with a rainstorm but does not lose her topsoil because the roots of the trees hold the soil in place. ***No action.***
6) Simone will still need to add nutrients to her soil to help her crops grow. She adds compost made up of animal and plant waste to her crops. ***Add compost to board.***
7) Simone planted native flowers near her crops to attract pollinators. The pollinators love the flowers and will help the growth of her crops. ***Add flowers with pollinators to board.***
8) Simone has had a good year and has harvested and sold her crops to the local farmers market. She is able to sell her crops for more money per crop, but makes less money in total because she has fewer crops to sell. ***Remove crops from board.***