

Lesson: Forest Around Us

Environmental Literacy Question: How has human land use affected the living things in the Chesapeake Bay?

Topic/Essential Question: What is the human impact on the interactions of organisms in Maryland habitats?

Unit/Lesson Sequence: This lesson is one of three interdependent lessons in the “Habitat Happenings Module”. The lessons are based at Arlington Echo Outdoor Education Center. The focus of the lesson is on investigating organisms in a human-made habitat. Prior to this lesson the students will have engaged in an introduction conducted by the Arlington Echo staff.



Content Standards:

- **Environmental Literacy:**

8.Sustainability F. Action Component 1. b. Identify actions that can be taken as individuals and those that require the involvement of other people, organizations and government.

- **Social Studies:**

3.Geography D. Modifying and Adapting to the Environment.1.b Describe ways and reasons people in Maryland and the U.S. modify the natural environment and the consequences of modifications.

- **Science:**

3.Life Science 4.D.1.a. Describe ways in which organisms in one habitat differ from those in another habitat and consider how these differences help them survive and reproduce.

3.Life Science 4.F.1.a. Identify and describe interactions of organisms present in a habitat.

3.Life Science 4.F.1.b. Explain that changes in an organism’s habitat are sometimes beneficial to it and sometimes harmful.

Length of Lesson: 35 minutes

Student Outcome:

The student will study and describe one to two living organisms located within a human-made habitat at Arlington Echo and will document their findings in their investigative journal.

Knowledge of the Learner:

Students have a basic knowledge of the difference between natural and human-made systems. Animals have four basic needs which are found in their habitat: food, shelter, water and enough space to meet those requirements and to reproduce. Students will use their skills of observation, listening, and following instructions to learn to use the compass and find the caches to answer questions at each activity and then the overall summary question at the end of the module.

- Student needs, interests, previous learning: These will vary among students.
- Conceptual difficulties: learning to use the compass properly. Being able to find and identify the organisms.
- Differentiation: Teachers will adjust the lesson based on the knowledge of their students’ skills.

Knowledge of Content:

- Content knowledge for instructor: Provided in lessons and Supplements.

- Vocabulary:
 - **Module Introduction:** Scavenger hunt, cache, habitat, compass, waypoint, orientation.
 - **Forest Around Us:** Circumference, photosynthesis, Canopy, Nutrients, Forest Atlantic White Cedar
- Resource materials:
 - **Materials carried and used by group:** Compass, Echo Investigative Journals
 - **Waypoint Root:** cache container with flag, clue card, root display, planting materials (soil, plants, pots, trowels), graph charts, fish tank filter, planning visual

Instructional Delivery

Pre-Assessment: Introduction: Led by Arlington Echo staff at the Main Pavillion

Forest Around Us

Lesson Setup:

Gather resource materials located in the Forest Pavilion chest. Planters and materials for planting should all be laid out at a picnic table under the Forest Pavilion.

Motivation/Warm up

1. Students should arrive at the Forest Pavilion. Instructor will introduce the students to the lesson. **“Here we will explore two different roles that living trees-specifically Atlantic White Cedars- play in supporting the Chesapeake Bay Watershed”**
2. Open a root-bound, small-potted Atlantic White Cedar and examine its roots or view the roots of the tree through an acrylic glass and cedar planting box. Have students describe what they see.
 - What is the purpose of these roots? (absorb water and nutrients)
 - In what ways do you think this process is helpful to the forest ecosystem? (filtration of nutrients, soil stabilization/erosion control)
3. Show students a sample carbon fish tank filter and discuss filtration.
4. Ask the students how humans have impacted this process, positively and negatively, in the past and how we can have a positive impact in the future.
5. Discuss algae blooms and how they are formed. Show the students a picture of an algae bloom.
6. Have the students do an action/planting project (To be announced at training)

Procedure:

Root- Part 1

1. Have the students sit on the benches and survey the area around them. What is significant or unique about this section of the forest? (Dead, rotting trees)
 - Are these examples of living or dead trees? How do they know? (missing leaves, branches, bark, or is hollow with holes)
 - What are some things that might kill a tree? (old age, sickness, insect attack, fire, lightning, or wind).
 - Do dead trees provide habitat? What do they observe? (woodpecker holes)
2. Explain that eventually a dead tree falls down. Have students observe a log on the ground. If the roots are visible, show the roots to the students. Ask the students to explain the function (job) of the roots in a living tree. *Take in water, help tree stand up.*

- What do humans often do with fallen trees soon after they hit the ground especially around our homes? (remove and cut up for firewood).
3. Explain that the fallen log is a home for many plants and animals. Use picture cards to show students what might grow on a log. Allow students to look for moss, lichen, mushrooms or other fungi.
 4. Ask students to examine fallen logs around them and find evidence of habitat. Have them look for small holes that termites, ants, bees and other insects (“bugs”) may have made for their homes and large holes that woodpeckers may have made searching for bugs to eat, as well as creating cavities for nesting.
 5. Roll over a dead log and allow students to look under it. Look for living things or signs of living things (holes, tunnels, saw dust). Replace the log. Tell the students to replace any logs they roll over because this is the habitat (home) of insects and other living things.
 6. Have students look for their own insects and other living things. Students should use hand trowels to move the leaf litter aside and explore on the logs and under the dead logs. They can collect what they find with the bug boxes and use the hand lenses to observe. (See identification sheet provided.) Rules for collecting:
 - Invite students to handle the earthworms gently.
 - ***Leave spiders in place. Do not touch or collect them.***
 - Other living things may be scooped up with trowels and placed into trays for observation. If possible, identify for the students what they find. (See identification sheet provided.)
 - Everything should be placed back in the general location of finding them when everyone gets a chance to look at the insects.
 7. Have students share their findings.
 8. Ask students to describe the soil under the log (look, feel, smell). Many living things need this damp (wet) place to live.
 9. Ask students why these living things are here.
 - Explain that the log is their habitat (home or shelter). Their food is here, too. Discuss the eggs—they also reproduce here.
 - Some things are eating the log and leaves. **They are recycling the log and leaves back into the soil when they poop. They are helping to break the log into smaller and smaller pieces. The pieces become part of the soil. Another way to say this is that the log is being decomposed.**
 - This shows the cycle of nutrients, or food web and how energy can be transferred between each cycle of life. **Show student the decomposers food web (supplement E)**
 - Ask students why arrows are pointed from the animals to the decomposers. *Decomposers break down organisms and return the nutrients to the soil. They are called nature’s recyclers.*
 - Show other fallen logs to students. Have them compare the logs. Ask them which has decomposed the most. Ask what will happen to the logs after a very long time. *They will decompose and become part of the soil. You won’t be able to see them anymore.*
 10. Have students return the living things to the soil, push the leaf litter back into place.
 11. Look into the Terrarium if they do not find insects under logs.

Root - Part 2

1. Trees not only provide roots to stabilize soil and filter nutrients they also provide other things as well.
2. Take students out from under the Forest Pavilion, into the open.
3. Have the students sit in silence for 30 seconds encourage them to take in their surrounding by listening, smelling and looking around –and up. Have the students share what they observed.
 - Be sure to look up at the canopy. Is there evidence of animals in the trees? What are they doing?

(Making homes, finding food, storing food etc)

- Are there other plants living on the trees?
 - What do trees provide? (Shade, shelter, oxygen, soil stabilizing, filtration, habitat)
4. Ask students to guess how many breaths of oxygen they take per day.
 - Average person: 20,000 breaths per day
 5. Using the measuring tapes, have students pick a tree and measure its circumference (distance around its trunk-similar to perimeter) at the height of their shoulders. Use the graph to discover how many breaths of oxygen the tree gives each day! Have them mark it on the graph in the journal.
 - Discuss how humans are impacting the world's forests, positively and negatively, and how we can make a positive impact in the present and future

Assessment:

1. Discuss and answer the first clue question:

Question: **What do the roots of trees, particularly Atlantic White Cedars, do to prevent algae blooms from forming in the Chesapeake Bay?**

Answer: FILTER NUTRIENTS

2. Discuss and answer the third clue question

Question: **How do dead trees play a role in the life cycle of the forest?**

Answer: RECYCLE

3. Discuss and answer the third clue question:

Question: **Trees and photosynthesizing plants produce oxygen. What do humans do with oxygen?**

Answer: BREATHE

4. Have students record their key letters (N, Y, and E) on the map of the investigative journals on page 3 (page 4 during inclement weather).
5. Have the students find the next waypoint using their map and compasses (MUD for the first group; CLUES for the second group).

Notes for setup:

An Arlington Echo staff member will assist in the setup of this activity the morning you arrive.

Notes for clean up:

Please clean, organize and return the lesson materials to their proper locations at the end of the day of instruction. Remember to inform the Arlington Echo staff if you need assistance or if any materials are damaged or missing.

Notes for inclement weather:

Arlington Echo encourages keeping our outdoor activities, outdoors whenever possible—even in the rain—in the case of severe weather (thunder, extreme cold, etc.), The Forest Around Us activity will remain under the Forest Pavilion.

Supplement A: Clue letters

Question	Answer	Letter
What do the roots of trees, particularly Atlantic White Cedars, do to prevent algae blooms from forming in the Chesapeake Bay?	Filter Nutrients	N
How do dead trees play a role in the life cycle of the forest?	Recycle	Y
Trees and photosynthesizing plants produce oxygen. What do humans do with oxygen?	Breathe	E

Supplement B: Investigative Journal- Map

Supplement C:

Information on Forests

What is a **forest**? It is a dense growth of trees, plants, and underbrush covering a tract of land.

Most forest floors are covered with the debris of fallen branches and trunks of trees. These scattered logs and branches undergo the process of **decomposition**, or the process of breaking down organic material, such as dead plant or animal tissue, into smaller molecules that are available for use by the organisms of an ecosystem. Decomposition is accomplished by a wide variety of decomposers, such as bugs, mushrooms, worms and bacteria, which act as **nature's recyclers**, recreating soil. When a tree dies, decomposers chow down on the dead bark and leaves and turn that old tree into soil, which allows new plants to grow. Humans exercise a major impact on forests when they cut trees down or remove fallen logs and haul them away to make paper or firewood, leaving decomposers exposed in the hot sun with very little to eat, resulting in the death of their populations.

Nutrients and Trees

The roots of the trees in a forest, particularly those of the Atlantic White Cedar tree, perform two major functions. They anchor the tree into the ground and they absorb water and **nutrients**, which the tree uses in the process of **photosynthesis**, through which plants use the energy from sunlight to produce sugar, converting that into ATP, the "fuel" used by all living things. The root anchoring mechanism prevents soil erosion and, consequently halts the flow of sediment into our streams, creeks, rivers, and, eventually, the Chesapeake Bay. The root systems of the trees are actually comprised of both living and dead matter, which absorbs the aforementioned nutrients, as well as pollutants, from storm water runoff. The dead roots form a dense carbon mass under the tree. The primary **nutrients** absorbed by this system are phosphorous and nitrogen, which are found in fertilizer, animal waste, air pollution, and leaking septic tanks and wastewater plants. These are the very nutrients that feed the algae in the bay and eventually cause large algae blooms, blocking sunlight from reaching the Submerged Aquatic Vegetation (SAV's), or bay grasses, leading to dead zones, where nothing can survive. In short, these root systems act like the carbon filters that people place in their fish tanks to control the growth of algae.

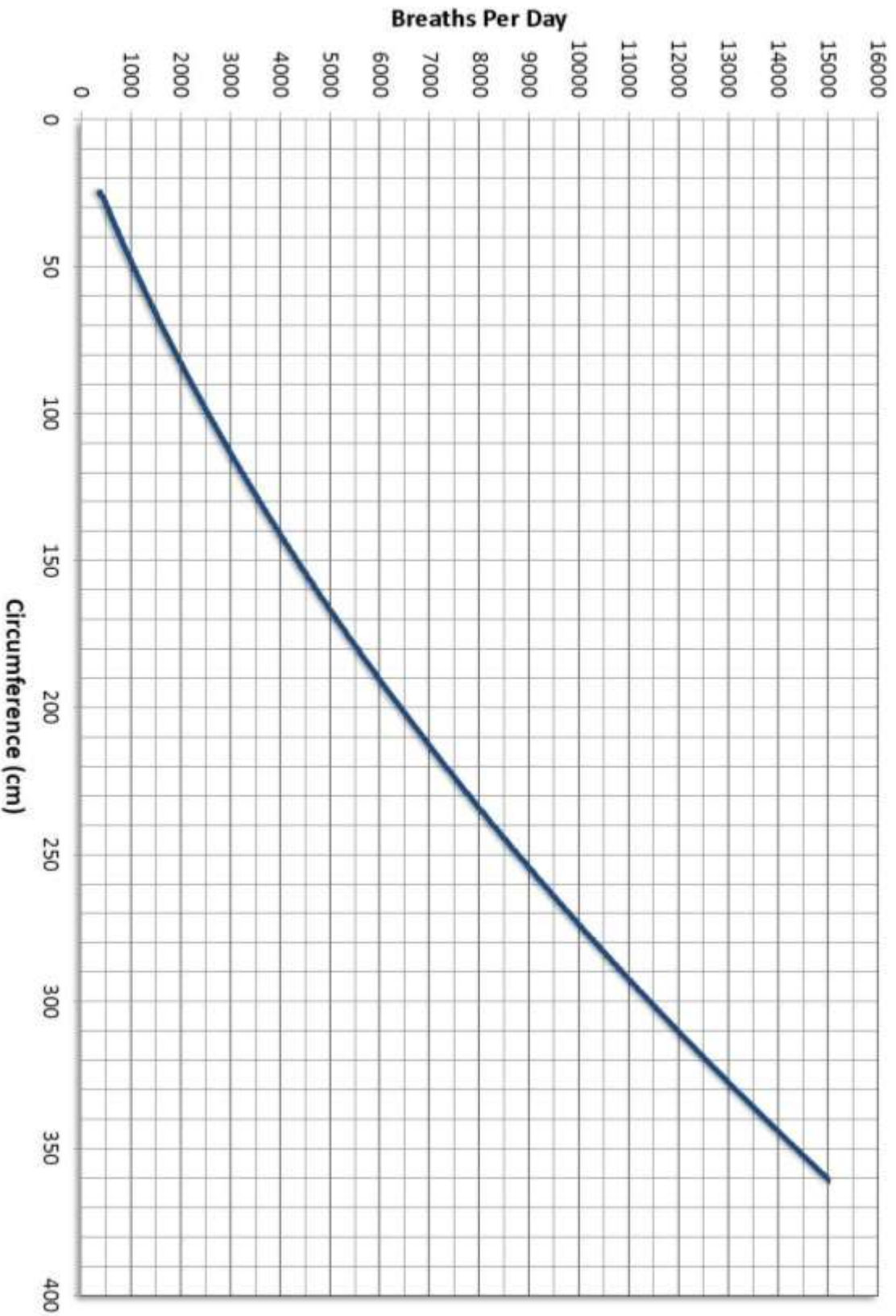
Oxygen

One byproduct of photosynthesis is the release of **oxygen**, which we must have to stay alive. The chlorophyll, or green pigment, found in the tree's leaves, is necessary to the process of photosynthesis. Looking up into the tree **canopy** (upper layer or habitat zone), the green leaves can be clearly seen. A fascinating recent discovery is that a person can actually determine how much of their human oxygen needs are being provided by a tree by measuring its **circumference** (the perimeter or distance around the edge of a circle) at approximately an adult's chest height. Trees supply 15-20% of the Earth's oxygen, estimates for oxygen production by phytoplankton in the ocean range from 20% to 50%.

Supplement D: Forest Investigative Journal Page

The Forest Around Us

How Many Breaths of Oxygen a Tree Produces in a Day



Forest Food Web

