

Division of Outdoor Experiences

Stream Ecology

Grade Level: 5 & 6

Length of Program: Two, 10–15-minute videos

Setting: Asynchronous Remote Learning

State Standards:

Topic: Interactions within Ecosystems

5.LS.1: Organisms perform a variety of roles in an ecosystem.

5.LS.2: All of the processes that take place within organisms require energy.

Topic: Rocks, Minerals and Soil

6.ESS.2: Igneous, metamorphic and sedimentary rocks have unique characteristics that can be used for identification and/or classification

6.ESS.3: Igneous, metamorphic and sedimentary rocks form in different ways.

Theme:

There are abiotic and biotic factors that construct a stream ecosystem. Studying these factors can allow us to discover the overall health of the stream ecosystem.

Objectives:

Students will:

- Learn how abiotic factors contribute to the health of a stream ecosystem
- Learn that biotic factors contribute to the health of a stream ecosystem
- Study the basic geology of streams to learn about differences in rock types
- Learn that energy is transferred between trophic levels in stream food webs
- Explore the biodiversity in stream ecosystems
- Understand how organisms are adapted/designed to survive in a specific habitat, like streams

Vocabulary

- Biotic - relating to or resulting from living things, especially in their ecological relations.
- Abiotic - physical rather than biological; not derived from living organisms.
- Ecosystem - a biological community of interacting organisms and their physical environment.
- Photosynthesis - the process by which green plants and some other organisms use sunlight to synthesize foods from carbon dioxide and water.

- Respiration - a process in living organisms involving the production of energy, typically with the intake of oxygen and the release of carbon dioxide from the oxidation of complex organic substances.
- Eutrophication - excessive richness of nutrients in a lake or other body of water, frequently due to runoff from the land, which causes a dense growth of plant life and death of animal life from lack of oxygen.
- Food chain - a hierarchical series of organisms each dependent on the next as a source of food.
- Food web - a system of interlocking and interdependent food chains.
- Trophic level - each of several hierarchical levels in an ecosystem, comprising organisms that share the same function in the food chain and the same nutritional relationship to the primary sources of energy.
- Producer - an organism that produces organic compounds from simple substances such as water and carbon dioxide
- Consumer - an organism that derives the organic compounds and energy it needs from the consumption of other organisms
- Decomposer - an organism, especially a soil bacterium, fungus, or invertebrate, that decomposes organic material.
- Macroinvertebrate – a spineless creature that is large enough to be seen without the aid of a microscope
- Larva - the active immature form of an insect, especially one that differs greatly from the adult and forms the stage between egg and pupa, e.g. a caterpillar or grub.
- Nymph - an immature form of an insect that does not change greatly as it grows,
- Metamorphosis - the process of transformation from an immature form to an adult form in two or more distinct stages. Usually involves a pupa stage.
- Incomplete metamorphosis – the process of transformation from an immature form to an adult form, without a pupa stage.
- Igneous rock – Rocks formed by the cooling and solidifying of molten materials. Igneous rocks can form beneath the Earth's surface, or at its surface, as lava.
- Sedimentary rock – Rock that has formed through the deposition and solidification of sediment, especially sediment transported by water (rivers, lakes, and oceans), ice (glaciers), and wind.
- Metamorphic rock – Rock that was once one form of rock but has changed to another under the influence of heat, pressure, or some other agent without passing through a liquid phase.
- Glacier – a slowly moving mass or river of ice formed by the accumulation and compaction of snow on mountains or near the poles.
- Glacial erratic - glacially-deposited rock differing from the size and type of rock native to the area in which it rests.
- Erosion - the process of eroding or being eroded by wind, water, or other natural agents.
- Riparian area - the interface between land and a river or stream.
- Riffle - a rocky or shallow part of a stream or river with rough water.
- Run – a deeper, fast moving area of a stream
- Pool - a small area of still water, typically one formed naturally.

Program Outline:

Video A: Physical Assessment

1. Citizen's Qualitative Habitat Evaluation Index (QHEI)

- a. What do scientists use to study the physical health of a stream?
 - i. Appearance – color, flow, depth
 - ii. Odor – natural, musky, chemical
2. Substrates
 - a. What size are the sediments on the bottom of the stream?
 - i. Northeast Ohio was an ancient sea 300 – 400 million years ago. This caused many sediments (such as sand and silt) to be deposited at the bottom of the sea. The pressure from the water turned these sediments into sedimentary rocks, such as sandstone and shale.
 - b. Are the rocks covered in sand and silt?
 - i. Is there “smothering” or “silting” of the rocks – is sand and silt present on top of the rocks, indicating high sediment loads and low flow?
3. Fish Cover (Hiding Places)
 - a. What areas are present that fish can hide in?
 - i. Fallen logs, pools, aquatic plants and more provide great habitat for fish to hide and survive
4. Stream Shape and Human Alterations
 - a. How curvy or “sinuous” is the stream?
 - i. The more “bends” or “curves” the stream has, the more diverse habitat it can offer, and it allows the water to slow and drop sediments.
 - b. How natural is the site?
 - i. Have humans channelized the stream or culverted it? This will decrease habitat as well as the natural flow regime, resulting in a poorer quality stream.
5. Stream Forests & Wetlands (“Riparian Areas” & Erosion)
 - a. What is the width of the natural areas on each side of the stream?
 - i. Wide Riparian Areas help to protect the stream by stabilizing banks and acting as floodplains.
 - b. What is the surrounding land use?
 - i. Streams with natural riparian areas full of forests and wetlands are healthier than others due to their ability to stabilize banks, absorb and filter water, and slow and hold flood waters.
 - c. How much erosion is present on the banks?
 - i. Pervasive erosion – the washing away of sediments – causes high sedimentation in streams, decreasing stream quality
6. Depth & Velocity
 - a. How deep is the deepest pool?
 - i. Deep pools provide cooler spaces for large fish to live.
 - b. How many different speeds of water are present in the stream?
 - i. Streams that only flow very fast, or only flow very slow can’t sustain a healthy population of organisms.
 - ii. A healthy stream has a mix of faster areas and slower areas.
7. Riffles/Runs
 - a. Are there areas in the stream that have fast shallow water, and fast deep water?
 - i. The presence of riffles and runs indicates a healthier stream with more habitat available for a variety of organisms

- b. If these areas are present, what size are the sediments in this area?
 - i. If the sediments are still very small in this area, the flow is too slow, allowing these small sediments to fill in gaps that could be used as habitat.
- 8. Scoring our stream
 - a. What do the physical parameters of our stream tell us about the health of the stream?
 - i. Scoring higher means this stream has great habitat available for a variety of fish and other stream ecosystem organisms.
 - 1. These organisms *may* be present or they *may* not be: other factors – such as water chemistry – can help determine the overall quality of the stream

Video B: Biological Assessment

- 1. Stream Organisms
 - a. What organisms live in a Stream? What is a macroinvertebrate?
 - i. Discuss how roles may change at various life stages, such as a nymph or larval stage vs. adult
- 2. Collection and study of Macroinvertebrates
 - a. Demonstrate how to use equipment to collect and examine stream wildlife safely.
 - b. Show how to identify macroinvertebrates using a dichotomous key.
 - c. Discuss where the organism may fit in food web
 - d. Point out & have students depict adaptations of organisms found and discuss their roles
 - i. Different organisms occupy different roles in the ecosystem and thus different trophic levels in the stream food web.
 - ii. Energy passes from producers, to different types of primary consumers, to predators.
 - e. Discuss biodiversity and how that plays a role in determining a healthy ecosystem
 - i. Different macroinvertebrates have different tolerances of pollution/oxygen levels, etc. The diversity of these species as well as their tolerance levels allow us to know the basic quality of the stream

Enrichment:

Citizen's Qualitative Habitat Evaluation Index (QHEI)

<http://www.middleparkcd.com/wp-content/uploads/2013/08/Stream-Habitat-Evaluation-CQHEI.pdf>

Images/close-ups of macroinvertebrates, ID and adaptations:

<https://www.macroinvertebrates.org/>

Videos of live macroinvertebrates from Stroud Water Research Center:

<https://www.youtube.com/playlist?list=PLrmuh958ChiYW8rl8-i6jmuYncr7LHb7j>