Lesson Plans

MOSS

McCALL OUTDOOR SCIENCE SCHOOL

University of Idaho

College of Natural Resources

Title: Habitat, Got to have a habitat!
Grade Level: 5th or 8th

Topic: Habitat	This lesson is about the physical characteristics that make a habitat, not the chemical ones.
Background:	A variety of habitats within a stream usually enhance the diversity of aquatic life that you may find there. Shape of a stream or river affects the general habitat for any organism that lives there. Fish prefer undercut banks, and a variety of physical characteristics including riffles, runs, and pools (see attached diagrams). Many factors affect the shape of a stream including: erosion, sediment size, bank shape, fires, and how much water is in the stream during each season. Stream habitats are divided into three main types: riffles, runs, and pools. Healthy streams show alternating pool and riffle areas while lower quality streams generally consist of long, continuous runs. A riffle is an area of the stream that has a swift moving current and water that is normally "bubbling" due to shallow water moving quickly over rocks. This habitat type allows for a relatively high dissolved oxygen levels as the water flows over and around the rocks. (For more on dissolved oxygen see its specific lesson plan!) Riffles typically have high numbers of invertebrates and the small fish that feed on them. This is an important piece for river and stream habitats. A run can be characterized as having a moderate current, medium depth, and a smooth water surface. Runs can have mixtures of aquatic life, depending on the availability of other in-stream habitat components (boulders, logs, root wads, etc.). A pool has a slower current and is normally found in areas where the stream bends, upstream of riffles, or on the side of obstacles such as logs or large rocks. The stream bottom in a pool is often bowl shaped. Pools are great areas for fish and swimming. Fish and invertebrates need spaces between rocks where they can hide from predators, lay their eggs, and feed upon their favorite source of food. Algae and other aquatic plants need a stable substrate to which they can attach. Plants near streams are another important component of water ecosystems. Most food energy in streams begins as leaves or other plant debris, which cycles through breakdown processes and is eaten by microorganisms, which in turn feed larger life forms like fish. Humans have many impacts on stream and river habitats. On a large scale, farming and irrigation supplies our food, but it also takes water away from those aquatic ecosystems, and when water seeps back out from the ground it is often polluted with phosphates

	and nitrates from fertilizer. People can also carry invasive species unknowingly on boats, clothing, and other items inadvertently introducing them to new habitats. Fishing, commercial or personal, also impacts the ecosystem because fish are being removed. On a smaller scale, impacts on erosion through access to these aquatic ecosystems play a role, as does littering.
Next Generation Standards:	LS2.A ; LS2.C
Essential Questions & Goals:	1. What factors affect the shape of a stream/river? (Erosion; sediment size; forms undercut banks/habitat, speed of water, seasons/how much water in stream etc.) 2. How do plants affect habitat near water? (Food source, shade source, erosion control, water filtering/cycling, nutrient cycling 3. What are the impacts that humans have on stream/river habitats? (Erosion; nutrient pollution; diversion/dams irrigation; trash; fishing; invasive species). 4. What are some things we can do to make a better habitat for fish and bugs? (Depends on your location!)
Objectives:	By the end of this lesson students should know: 1. What factors affect the shape of a stream/river. 2. How plants affect habitat near water. 3. Some of the impacts of humans on water systems 4. That several physical factors influence habitat. 5. Some ways to make a better habitat for stream/river life.
Materials:	- A computer - A projection system for a computer/smart board etc. - Printed copies of the attached powerpoint slides - 'Habitat' song lyrics, enough for everyone in the class! - A big ball of yarn, or twine, or something similar - 2 plastic tubs per group. - Lots of sand, lots of pebbles/gravel, rocks, plastic bugs, plastic plants, clean water, dirty water, pictures of bank styles (see powerpoint slide on channel shape).
Set up:	The 'engage and elaboration' sections of this lesson plan both require internet set up. And some familiarity with the data base for 'elaborate'. The 'explore and explain' phases need the powerpoint documents

	printed out in advance And the 'evaluate' portion needs to have all the materials set up in advance. And you should learn the tune of the "Habitat" song by listening to the sound clip, or you can play the sound clip for the class.
Classroom Time:	One day; about one hour or longer depending on the material depth.
Introduction (Engage):	Have students draw a picture of a river. Have students share their drawings and engage them in a discussion about what the physical aspects of river habitat. Introduce ecosystems as a complex set of relationships that involve both living and non-living things. Ecosystems are dynamic in nature and they change over time. These changes depend on the environmental factors (fires, floods, drought, introduction of a new species, time, temperature fluctuations etc) and changes in species populations. When the environment alters in ways that affect an ecosystem's physical characteristics, temperature, or resources (such as food), some species adapt, survive, and reproduce, others change locations, and some die. Use the following video clips to expand your discussion of habitats and ecosystems. Narrated clips about freshwater: **http://www.bbc.co.uk/programmes/b0074sgj/clips** Narrated clip about the Colorado River: http://www.metacafe.com/watch/497574/colorado_river/ Photos: http://environment.nationalgeographic.com/environment/photos/freshwater-rivers/ Animal-focused clip about rivers in Zambia: http://video.nationalgeographic.com/video/places/regions-places/africa-tc/zambia_threerivers/
Activity (Explore): (JSJ)	In this activity, the students will have an opportunity to become experts on one physical component of aquatic habitats. Divide your students into eight equal groups. Distribute one physical component to each group (sand, pebbles/rocks, dirty water, clean water, plants, riffles runs and pools, food sources, and channel shape). These can be found in the attached powerpoint slides. Each slide has information and some have a larger question the group should work together to answer. Feel free to incorporate the student's utilization of other sources to learn more such as

	textbooks, worksheets, or the internet Important vocabulary to introduce before you hand the expert areas out: Ecosystem- complex sets of relationships between living and non living things Terrestrial- of the earth (i.e. not underwater) Aquatic- of the water (i.e. partially or completely underwater) Micro Organism- a small life form that can generally not be seen with the naked eye. Producer: provides a food source for other species (i.e plants) Consumer: eats consumers, but can also be consumed by other consumers (bugs can be eaten by trout which can be eaten by bears) Decomposers: break down dead organic material and release nutrients into the soil to help plants grow (worms). A healthy ecosystem has many different types of producers, consumers, and decomposers and are able to satisfy the needs of each level in the web of life.
Explanation (DH)	**Peer teaching** After all teams have investigated their expert area, each team presents its expert area to the rest of the class. Prompt each group during their presentation to *describe their habitat parameter and how its variability can affect desirability of habitat for different organisms.* Clarify, expand upon and make relevant connections between any components as appropriate. Some components that might require further explanation are noted here: ***Channel shape*** **Bank slope** depends on the hardness of the surrounding rock, the velocity of a stream and its sediment load and the geologic origin of the landform in which the water body is found. **V-shaped valleys** are formed by young streams as they erode their streambed and walls. **Point bars and cut banks** are components of meandering river systems. Point bars area areas of deposition on the inside of a river bend, and cut banks are regions of erosion found on the outside of a bend. **Sediment load** of a stream contributes to erosion that can be carried out by the stream. A stream's sediment load consists of its dissolved, suspended and bed load. Dissolved load consists of particles fine enough to form ionic bonds with water molecules. Suspended load is coarser sediment, heavy enough that it would eventually settle out of the water column if left to sit for long enough. Bed load is the coarsest sediment that the river can carry,

	only by rolling it along the river bed. **Stream meandering** is a phenomenon that occurs as a stream matures, and it is the result of point bar and cut bank formation and expansion. **Stream flow** is a measure of how much water is in a flowing water body. Stream flow is seasonal in most temperate locations, with highest volumes being recorded during spring runoff and snowmelt. ***Vegetation*** **Bank stabilization** by plants is due primarily to their root systems holding soil in place. Secondarily, plants also dissipate energy from the system by slowing overland runoff water as it bumps into the aboveground plant structures. Plants play a crucial role in the **water cycle**, absorbing water in their roots, translocating it through their vascular xylem tissue and either using it for photosynthesis or transpiring it through stomata. This process is powered by system analogous to a vacuum pump; water is essentially sucked up through the plant by the hydraulic pressure gradient generated by the loss of water to transpiration. In other words, the water cycle is powered by the sun. This cycling of water through plants helps retain water in a particular local system by storing water in biomass. Involvement in the water cycle also allows plants to serve as a **water filtration** system, releasing clean water and storing contaminants in plant biomass. Thus, plants near water bodies can help remove toxins from the water. Plants also participate in **nutrient cycling**. They may serve as a food source for other aquatic or terrestrial organisms. They store nutrients in more stable forms (biomass), which is eventually released to the local soil via decomposition. ***Human effects*** Humans can hasten (by walking along/in the river, clearing land for impervious roads and buildings) or slow (re-vegetation, erosion controls) rates of erosion near and sedimentation of water bodies. We can contribute to nutrient inputs (release of sewage or chemicals, leaky septic tanks, agricultural runoff) that can spawn rapid plant and algal growth and hasten eutrophication and maturation of a water body. Our utilization of water for municipal, agricultural and industrial purposes requires diversion of streams and drawdown of certain water bodies. This can drastically affect the size and shape of a stream or lake. Similarly, dams can have a profound effect on the landscape of a previous stream, creating large reservoirs by flooding areas behind a dam. In turn, this change in stream morphology can impact local species as well as interfering with the behavioral patterns of some migratory fish.

	Create a habitat web Use a ball of yarn to demonstrate the connections between different components of an ecosystem. Have each student represent a habitat parameter that (s)he just studied. If too much duplication occurs, appoint some students to represent more specific components (i.e., particular plants or animals). Start the ball of yarn at any student and ask them to hold the end of the yarn and toss the ball to an ecosystem component that is related to their own. Continue this process until all students have received the ball at least once. If necessary, cut the string to make single connections between just two components. The result of this process should be a web of yarn visually representing the web of interactions between ecosystem components. Have each student explain their connection to the two people directly attached to them and how their components work together. Then ask the students to hold their piece of yarn loosely so it can slide in their hand. Simulate a stress placed on one ecosystem component by pulling on that corner of the web and show that that pull can be felt in many other connected parts of the ecosystem.
Elaboration:	This part of the lesson is designed to elaborate the concept of habitat by looking at a local water source. If you can take your students to a local body of water, and ask them to make observations based on physical habitat characteristics. A good website if you can't go to a local water body is waterdata.usgs.gov/nwis. This website has historical and current data in 1,665 sites across the US. Look up the information you wish to access in advance and think about what local issues are important for students to understand about their local water sources. Consider: agriculture (see the nitrogen and phosphate lesson), precipitation, overall water quality, and habitat. 1. Hit the 'water quality' button on the left side of the screen 2. Select either current conditions or historical observations. 3. Choose some parameters to search by. Select search by state/territory. 4. Select a state or territory that encompasses your location, and some variables you wish to share with your class. Consider: altitude, stream velocity, blue green algae, water content of snow, etc. To your class, stress that there are connections between all of the different parts of an ecosystem. If something changes in an ecosystem, even something small, it affects the rest of the system. For precipitation rates you can also check out http://www.wcc.nrcs.usda.gov/snow/ Remember a water year is end of October one year- beginning October the following year.

Evaluation:	Start with the habitat song!! Habitat song Chorus: Habitat, Habitat, Have to Have a Habitat Habitat, Habitat, Have to Have a Habitat The trout that swim in creeks like ours need certain things that's how they are: food to eat like caddis flies and a place to hide from you and I Chorus: they like the water cold you see with plenty oxygen to breathe water that's moving fast and clear it's how the trout are healthy here Chorus: This is where things might get messy! Each group should be given two plastic tubs. One to create a healthy habitat for a trout, and the other to create an unhealthy habitat. You should have enough sand, pebbles/small rocks, clean water, dirty water, fake plants, plastic bugs, and picture of channel shape for each group to successfully sculpt two habitats. Instruct the students to recall prior knowledge from their 'expert' area as well as what they learned from the presentations to create the best possible habitat for a trout. Key points for a healthy habitat: representation of riffles, run and pools; a mixture of sand rocks and pebbles, clean water, some plants (not too many), bugs (food source), and an explanation of what type of bank they would choose (undercut is the best). An unhealthy habitat should include: too much sand or rocks, no plants, a lot of bugs or no bugs, dirty water, and no variety in riffles runs or pools.

Sand

Sand is an important component of aquatic habitats. Big rocks and stones are broken down into sand and soil. Through this breakdown process minerals are released. These minerals give nutrients to terrestrial and aquatic plants. Particles of sand traveling via erosion also help to sculpt the shape of rivers, streams, and lakes.

What would happen if rocks never broke down into sand?

Pebbles and Rocks

Salmon eggs on rocks

Pebbles and rocks play an important role in the habitat of aquatic life. First, they provide spaces for fish, frogs, and bugs to lay eggs. These spaces also act as shelters for when the animals are small. Rocks also house different types of algae that help to oxygenate the water.

Fish and bugs need spaces between rocks where they can hide from predators, lay their eggs, and eat. Algae and aquatic plants need a stable substance where they can attach.

Clean Water

Aquatic life needs water that is clean. What does clean water mean? Clean water is absent of most chemical pollutants, is clear and not cloudy, has a good amount of dissolved oxygen for organisms to breath.

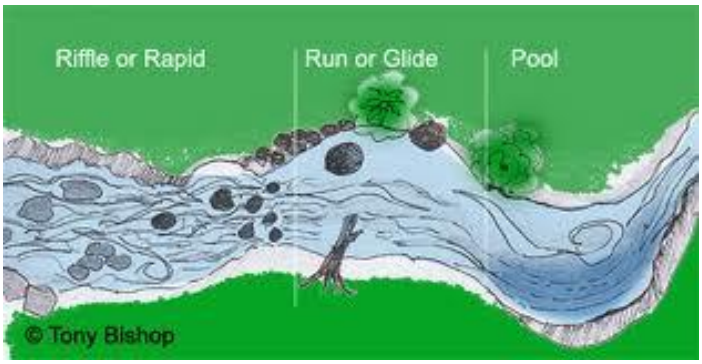
Think of the ocean compared to a lake. Is one 'cleaner' than the other? Think about what lives in each place.

Dirty Water

Dirty water is not good for aquatic life. It impacts the ability of organisms to breath, reproduce, and find proper food. Many organisms die if exposed to dirty conditions long term.

What do you think makes water clean or dirty? How can we make a water ecosystem cleaner?

Riffles, Runs, and Pools



Stream habitats are divided into three main types: riffles, runs, and pools. Healthy streams show alternating pool and riffle areas while lower quality streams have long runs.

A riffle is an area of the stream that has a swift moving current and water that is normally "bubbling" due to a rocky streambed. Riffles typically have high numbers of invertebrates and the small fish that feed on them.

A run can be characterized as having a moderate current, and a smooth water surface. Runs can have diverse mixture of aquatic life in-stream habitat (boulders, logs, root wads, etc.).

A pool has a relatively slow current and is usually found at stream channel bends, upstream of riffles, or on the side of obstructions such as boulders or fallen trees. The stream bottom in a pool is often bowl shaped. Pools are great areas for fish.

Plants

Plants near aquatic environments are an important component of water ecosystems. Most food energy in streams begins as leaves or other plant debris, which cycles through breakdown processes and is eaten by microorganisms, which in turn feed larger life forms like fish. Underwater plants also help to provide good living space for creatures, and oxygenate the water.

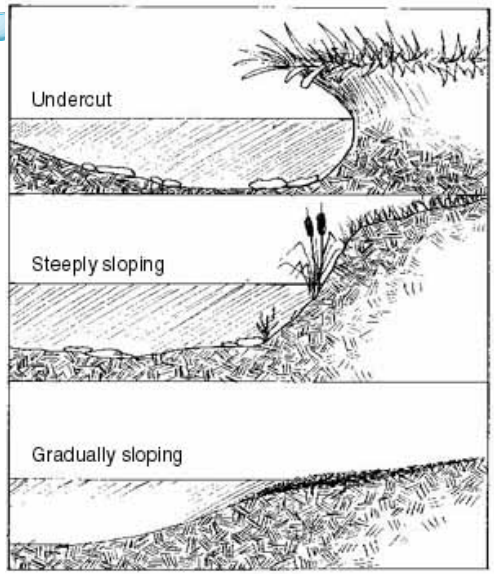
How do you think a stream with no plants around the side will be different than a stream with many plants?

Food Sources

Every organism needs to eat to stay alive. Plants transform light, water, and minerals into energy and food. Micro organisms, and bugs rely of plants as a source of food for them to eat. Fish in turn eat the bugs. It is important to have a variety of life in a body of water to make it healthy.

What would happen if one year the fish population dramatically decreased?

Channel Shape



Fish prefer undercut banks for habitat

Have you ever noticed how each river and stream are unique? Even place along the bank of the same river may look different than it did in a different location.

Erosion is a major contributor to the shape of a flowing body of water (stream, river, creek). Erosion transports sediment like rocks, pebbles and sand downstream. As the water carries these particles, it carves a path. This is what we see when we look at flowing water body.

If you were to sit in a river and look up stream or down stream you would be observing the channel shape.

Do you think rivers change there shape over time? Please explain your answer.

Additional resources:
Project WET – www.projectwet.org