Dream Stream

Grade: 5

Subject Areas:
Life Science, Earth Science, Social Studies

Skills: identifying, sorting, reading, discussing, recording,

Duration: 1-2 hours

Connections:
physical education, resource management, precipitation, water resources, vegetation, wildlife

Vocabulary
vegetation

riparian habitat

aquatic area

area of influence

upland zone

riparian buffers

sediment

nutrients

discharge

Objective:
Students will understand what a riparian habitat is and why it is important to a healthy aquatic ecosystem.

Materials
- scenario cards
- category titles
- pictures of various streams, both healthy and unhealthy
- 4—6 orange traffic cones
- labeled cloth bags with sand (sand bags need to be made)
- long measuring tape (optional)
- a whistle or horn and timing device
- clipboard and recording paper and pencil
- a person who will be "the recorder"
- labels for "tree people"

Standards

Strands: Excellence in Environmental Education Guidelines

Strand 1 —A) Questioning: Learners are able to develop, focus, and explain questions that help them learn about the environment and do environmental investigations. **E) Organizing Information:** Learners are able to classify and order data, and to organize and display information in ways that help analysis and interpretation. **F) Working with models and simulations:** Learners understand many of the uses and limitations of models. **G) Developing explanations:** Learners are to synthesize their observations and findings into coherent explanations.

Strand 2 — 2.1 A) Processes that shape the Earth: Learners have a basic understanding of most of the physical processes that shape the Earth. They are able to explore the origin of differences in physical **patterns. 2.2 C) Systems and connections:** Learners understand major kinds of interactions among organisms or populations of organisms. **2.4 A) Human/ Env. interactions:** Learners understand that human-caused changes have consequences for the immediate environment as well as for other places and future times.

Strand 3 —3.1 B) Sorting out the consequences of issues: Learners are able to apply their knowledge of ecological and human processes and systems to identify the consequences of specific environmental issues.

California State Educational Standards:

Life Sciences 2a: Students know many multicellular organisms have specialized structures to support the transport of materials. **2f.** Students know plants use carbon dioxide and energy from sunlight to build molecules of sugar and release oxygen.

Earth Sciences 3c: Students know water vapor in the air moves from one place to another and can form fog or clouds, which are tiny droplets of water or ice, and can fall to Earth as rain, hail, sleet or snow.

I and E 5d: Students will predict the outcome of a simple investigation and compare the results with the prediction.

Background

Healthy Streams

A dream stream is surrounded by vegetation. **Vegetation** or the plant community along a stream or lake influences the entire aquatic ecosystem in many different ways. It provides shade and food for all sorts of wildlife. The roots of trees anchor soil to reduce sedimentation and fallen snags act as hiding places for fish. Vegetation nourish a stream by slowly releasing nutrients. This important green strip or corridor, filters and stores water as well. The strip of vegetation on either side of a waterway is called a **riparian habitat.**

A riparian habitat is defined by three distinctive areas. The water way which is normally wet most of the year is the aquatic area. The vegetation adjoining the waterway or **aquatic area** is the riparian area or zone. The type of vegetation that grows here, is influenced by soil wetness, the amount of water in the waterway, and the height of the water table among other things. Lastly, there is an **area of influence** which is a transitional zone between the riparian area and what you find upland from there. The **upland zone** is the area uphill from the riparian habitat. Because it isn't as wet, it usually includes a slightly different plant community which provides a different habitat for wildlife. All three of these areas are important components to a healthy stream.

Riparian habitats are often referred to as buffer zones or **riparian buffers**. They act as buffers because they protect water quality by capturing, treating, and storing water before it gets to a stream. Widespread roots of trees and the many other herbaceous plants, like reeds and shrubs, found along a stream help hold soil in place. This reduces sedimentation and erosion. **Sediments** are bits of rocks and debris that are easily carried by water. Trees and herbaceous plants also absorb excessive **nutrients** like nitrogen and phosphorous.

Excessive nutrients can be caused by grazing animals next to streams, run off from fertilizer application or leaky septic systems. High amounts of nitrogen and phosphorous can trigger a chain reaction. High levels of these promote algae and weed growth. These can clog the water way and lower the availability of light and oxygen. The lack of light and oxygen kills many organisms. Some macroinvertebrates like caddis flies and mayflies, are sensitive to excessive nutrients.

Life Along a River

The type of vegetation that grows along a waterway varies depending on the slope, soil type and water availability. Dominant tree species growing in riparian areas within the King Range National Conservation Area (NCA) include alders, maples, cottonwoods and willows. Where places are flatter and more open, grasses are more prolific. Exotic or introduced species like periwinkle and English ivy can push out native vegetation which reduces the **diversity** (amount and complexity) of plants and animals.

There are a host of animals that depend on a riparian buffer zone. These include aquatic insects, mammals, birds, and fish. A diverse population of insects depends on a wide variety of food. Stream food chains are greatly influenced by the amount of nutrients and organic debris. Nutrients and organic debris come largely from the vegetation that lines the waterway such as twigs, decaying leaves, wood and bark. When there is an abundance of food for insects, a greater diversity of larger animals like salmon can exist because they depend largely on insects as food.

Holding Strong

A healthy, intact, riparian habitat is vitally important for fish. In the King Range NCA there are many species of salmon including coho salmon, Chinook salmon, and steelhead. Salmon and trout need cool water, abundant food sources, places to hide and coarse gravel to spawn in. Downed logs create pools and riffles. A pool is an area of deep slow water which gives salmon and other animals a place to rest and a cool water source. Riffles are swift, shallow places that continual aerate (replenish oxygen) the water. When riparian habitats are removed, excess sediment and erosion develop. Too much sediment in a stream, decreases light and the availability of oxygen. The spaces between coarse gravel gets filled in by silt and sand, smothering both salmon eggs and freshly hatched eggs called alevin.

A riparian forest helps shade the stream as well. Shade can increase the amount of water available during periods of drought or seasonal dry weather. One of the biggest threats to fish is when water gets too warm. Warm water decreases the amount of

dissolved oxygen available for fish. The last nine years have been the driest on record for the Mattole River. In 2008, thousands of salmonids were trapped in warm water pools and perished. This caused great concern among local conservationists and property owners.

During the wet season, on the other hand, precipitation in some parts of the King Range NCA is extreme. Honeydew, a coastal community in this region, can receive upwards of 100 inches of rain annually. Once rain hits the ground, it is either absorbed by the surface or it runs off the surface. Where terrain is steep, runoff speeds up, causing gullies and other erosional features. As water runs off it takes pieces of sediment with it. Where there are impervious (non absorbent) features like paved roads and rooftops, water accumulates quickly. In addition, as water flows over these non-absorbent areas, pollutants like oil, heavy metals and other residues are easily picked up and carried to waterways. Studies have shown that impervious surfaces also increase water temperature because they replace areas of vegetation.

A riparian buffer acts like a sponge. Permeable soils and roots slow down the **discharge** (release) of water and increase the absorption of water by the soil. Water is filtered because it is able to penetrate into the leaf littered ground and web of roots that plants provide. Vast quantities of water can be stored here which decreases the potential for flooding.

Almost all of the pristine riparian areas in the United States have been modified and degraded to some degree. Large trees have been replaced with patchy or scrubby plant growth. Soils have been impacted, noxious weeds have taken over, and biodiversity has been reduced. It is important that people understand the value of these precious areas. By maintaining a healthy riparian habitat, streams become cooler, more stable and richer in diversity. These places acts as important corridors for wildlife and provide people with recreational opportunities like bird watching and fishing. Riparian habitats are crucial components of a dream stream.

Local Connection

Pacific Salmon Life Cycle

Salmon no matter where they live are a unique species. They are anadromous, meaning they spend a portion of their lifecycle in freshwater and saltwater. Pacific salmon, unlike other fish, die after spawning. They go on an incredible journey to return to the rivers where they are born. Locally there are four species of salmon: Chinook, coho, cutthroat, and steelhead. Some species are able to spawn more than once such as steelhead.

A female salmon will lay her eggs once she reaches a desirable area of streambed. Before she does, she builds several nests; each nest is called a redd. A redd will be an area of coarse gravel, where the water depth averages one to two feet. As the female builds her series of nests, one male becomes dominant, chasing off competing males. Simultaneously, the female will deposit batches of 300-1200 eggs and the male salmon will fertilize them with sperm. To protect her eggs from predators, the female will immediately cover the fertilized eggs with gravel.

A fertilized egg hatches after 35-45 days, depending on the water temperature. Hatched eggs are called alevin. Alevin have a yolk sac, which they use as nourishment while they hide in the gravel. Alevin grow up to become a fry and eventually a juvenile or fingerling which feed mostly on insects. Depending on the species, a salmon will spend a variable amount of time in a river and then it heads out to sea. The time spent in the river is when it is most vulnerable. Young fish need pools of deep cold water where they can hide from predators and escape the lethal temperatures of summer. Upon entering the ocean, juvenile fish undergo an incredible physiological transformation and become smolt. Smoltification allows them to move from a freshwater to a saltwater environment. Once in the ocean, salmon eat for several years and get big before they begin their arduous journey back home to spawn. Only a few fish will make it after overcoming many obstacles.

Activity 1: Modeling a Riparian Buffer Zone

Preparation

Outside, in a playing field, situate the cones to represent a construction area along side the edge of a "stream". Decide where the edge of a stream will be and put two cones 15 feet apart here. This marks the riparian buffer zone. Next, move down 30 feet and spread out 2-4 cones 25 feet apart. This represent a construction zone in an area of transition or upland zone.

Materials

- 4—6 orange traffic cones
- labeled cloth bags with sand (sand bags need to be made)
- long measuring tape (optional)
- a whistle or horn and timing device
- clipboard and recording paper and pencil
- a person who will be "the recorder"
- labels for "tree people"

Procedure

1. This activity should reinforce the importance of vegetation along a stream. There are several modifications possible. Basically, students will represent either trees or raindrops carrying sediment and nutrients to a stream. The raindrops are coming from a construction site that has loose soils and no erosional control. It is a rainy day. The purpose is for the "trees" to catch as many "raindrops" as they can before they enter the riparian buffer zone. They do this through a game of tag. All students who are raindrops, have a sand bag marked either sediment or nutrient. This bag can go in their pocket or they can hold onto it.

2. Explain, the overall purpose of the game to the class. To begin, assign two students to be trees. These two students must tag the other students as they run towards the edge of the stream. Because these students are trees, however, they must always keep one foot firmly rooted on the ground. Their one leg and two hands can tag people. If they move their rooted leg, they are disqualified and removed from the game. Once a person (raindrop) is tagged, they need to drop their bag at the foot of the tree that tagged them and stand outside the zone to wait for others to finish.

3. To begin the race to the stream, count 1, 2, 3, and blow a whistle. Give the students 10 seconds to run to the stream. They must run between the two traffic cones designating this area which is where the two trees are. Tell them that they will only be given 10 seconds to run between the two cones to get to the stream. Safety is important here. Lay down some firm rules about pushing, tripping, and other unsafe practices.

4. After the first race, have the trees count how many bags of nutrients and sediments they have accumulated. Have a student who has opted out of running or an adult record these numbers. All students who were tagged now become trees. Repeat the race one or two more times with more trees and fewer raindrops. All raindrops go to the construction site, and all trees stand within the riparian buffer zone. Depending on the number of students, you may want to move the cones further apart. After two or three races to the stream, have the students gather around and compare numbers. Ask to have them explain, what they think this activity is trying to model. Have the person who recorded the data share it at this time.

- *What role did the trees have?*
- *What is the relationship between number of trees and amount of sediment and nutrients caught?*
- *Why was it important for the trees to stay in one place?*
- *Why was it important that the nutrients and sediment stayed at the base of the trees?*
- *How does a construction site differ from say a field or someone's yard?*
- *How could we modify this game to include other things that affect a riparian habitat?*

Extensions

- Take a field trip to a riparian habitat and take measurements there.
- Have the students draw or paint a picture of a dream stream
- Grow plants and compare how many can live close to each other in a wet environment compared to a dry environment.
- Make a model of a riparian habitat in a roller tray or oblong baking pan using sponges.
- Put up transects through different vegetative zones. Have the students study things living among the transects.
- Participate in a restoration project by planting trees in disturbed habitat.
- Conduct chemical tests for phosphates, nitrates and other nutrients in a water sample.

References

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Salmon Life Cycle, Egg and Onward: http://www.thinksalmon.com/learn/life_cycle/salmon_life_cycle/, 2011

Understanding the Benefits of a Healthy Riparian Areas, http://ohioline.osu.edu/ls-fact/0001.html, Ohio State University Fact Sheet, 2010

cool water	warm water
low levels of algae	high levels of algae
lots of tree roots	mostly grass, very few trees
river bed, mostly large gravel	river bed, mostly sand and silt
deep pools	no pools, mostly rocky
slow discharge	fast discharge
thick vegetation	thin, scrubby vegetation
steep stream bank	flat stream bank
water level varies moderately	water level varies greatly
high diversity of wildlife	low diversity of wildlife

Top *Garcia River in 1993* **Bottom** *Garcia River in 2003 after restoration http://www.krisweb.com*

Top *Navarro River http://www.krisweb.com* **Bottom** *Six Rivers http://fs.fed.us*