

CHILDREN'S FOREST OF CENTRAL OREGON

CURRICULUM KITS FOR FIELD EXPERIENCES IN CENTRAL OREGON

Science Inquiry: Interconnections

Grades 4-5

Developed for Skyliners Lodge

**CHILDREN'S
FOREST**



**CENTRAL
OREGON**

The Children's Forest of Central Oregon provides a network of outdoor places and programs dedicated to moving all children along a continuum of learning, exploration, and healthy living through engagement with nature.

childrensforestco.org

Table of Contents

The Children's Forest of Central Oregon has the mission of providing opportunities for ALL children in Central Oregon to learn, play, and explore in nature. In addition to providing a network of high quality environmental education programs for K-12 students, one of our strategies is to provide teachers skills and resources to implement field experiences themselves. This curriculum kit is intended to provide teachers everything that they would need to plan a field trip for their classroom or grade level. Included in the kit is:

Field Trip Overview.....	3
Planning for the Field Trip.....	4
• Suggested Timeline.....	4
• Site Location and Information.....	4
• School Engagement Fund.....	5
• Packing list.....	5
• Tips for Group Management in the Outdoors.....	5
Sample Itinerary.....	7
 Activities	
• Seed Game.....	8
• Silent Hike.....	11
• Forest, Field, and Stream.....	15
• Macroinvertebrate Investigation.....	21
• Healthy Stream Features Study.....	27
• Macroinvertebrate Mayhem.....	33
 Student Handouts/Data Sheets	
• Forest, Field, and Stream Data Sheets.....	17
• Macroinvertebrate Sampling Data Form.....	26
• What is a “riparian zone”?.....	29
• Features of Healthy Stream Habitat.....	30
• Healthy Stream Scavenger Hunt.....	31
• Riparian Area Mapping Data Form.....	32
 Teacher Handouts/Supplemental Materials for Activities	
• Seed Game Cards.....	10
• Silent Hike Cards.....	12
• Insect Groups Arranged by Tolerance to Pollution.....	23
Materials List.....	35

Field Trip Overview

Field Trip Goals:

- Provide students opportunities to explore and build connections with the natural world
- Apply and expand on science concepts learned in the classroom to investigate real-world examples in nature
- Provide opportunities for students to develop inquiry skills, making observations and collecting data about the natural world to develop an understanding of interconnections between living and non-living things
- Provide students time for physical activity and reflection in an outdoor setting

Suggested Timeframe:

- We recommend 4-5 hours in the field, to provide adequate time for in-depth exploration, questions, and reflection.
- Some lessons can also be taught independently in your school yard, neighborhood park, or other location.

About Skyliners Lodge:

- The curriculum kit was specifically developed for Skyliners Lodge, located 8 miles west of Bend on Skyliners Road.
- The lodge is leased by HDESD and available for educational use at no charge. The lodge must be reserved in advance (we recommend at least 6 months in advance to guarantee your preferred date). For reservation information, visit hdesd.org/about/skyliner-lodge.
- The kit could easily be adapted for other locations in Central Oregon. Note that we have also developed kits for Shevlin Park (Bend) and the Dry Canyon (Redmond).

Standards Alignment:

Oregon State Science Standards	<p><i>4.2L.1: Describe the interactions of organisms and the environment where they live</i></p> <p><i>4.3S.2: Summarize the results from a scientific investigation and use the results to respond to the question being tested</i></p> <p><i>5.2L.1: Explain the interdependence of plants, animals, and the environment, and how adaptation influences survival</i></p> <p><i>5.3S.2: Identify patterns in data that support a reasonable explanation for the results of an investigation or experiment and communicate findings using graphs, charts, maps, models, and oral and written reports</i></p>
Common Core State Standards	<p>ELA-LITERACY: RI.4.1, RI.5.3</p> <p>MATH.CONTENT: 4.NBT.B.6, 4.MB.B.4, 5.NBT.B.6</p>
Next Generation Science Standards	<p><i>4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.</i></p> <p><i>4-ESS2-1 : Make observations and /or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation</i></p> <p><i>4-ESS3-2: Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.</i></p> <p><i>5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.</i></p> <p><i>5-ESS2-1: Describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.</i></p> <p><i>5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.</i></p>

Planning for the Field Trip

Suggested Timeline

- ✓ 3-4 months in advance
 - ✓ Check with transportation department and Skyliner Lodge availability
 - ✓ Confirm field trip date, reserve bus, and reserve Skyliners Lodge
 - ✓ Reserve curriculum kit with CFCO (if you'd like to use materials)
 - ✓ Apply to the School Engagement Fund if you need funding for transportation or substitutes

- ✓ 1 month in advance
 - ✓ Send permission slips home
 - ✓ Recruit parent chaperone volunteers
 - ✓ Review curriculum with grade level team and determine responsibilities

- ✓ 2 weeks in advance
 - ✓ Confirm reservation with transportation department
 - ✓ Meet with school nurse to compile a list of medical issues, allergies, and necessary medications for all students attending. If students have severe allergies and epi-pens, find out if the student can self-administer or if you need to do it.
 - ✓ Make list of student groups (if you are splitting the group) and divide emergency contact/medical information into groups

- ✓ 1 week in advance
 - ✓ Discuss field trip behavior rules with your students
 - ✓ Give students a list of required items of the field trip
 - ✓ Confirm itinerary with parent chaperones
 - ✓ Make copies of any necessary data sheets
 - ✓ Pick up curriculum kit with CFCO
 - ✓ Make nametags for students

- ✓ Day before
 - ✓ Review field trip behavior rules with your students
 - ✓ Pack items on the teacher packing list (below)

Site Location and Information

Skyliners Lodge is located 8 miles west of Bend on Deschutes National Forest. The lodge is on the National Historic Registry and holds 60-70 students indoors. The lodge has easy access to Tumalo Creek, a great spot for stream exploration, and hiking trails through forest that lead all the way to Tumalo Falls. There are 2 outdoor restrooms, as well as 2 indoor restrooms. The lodge has a kitchen, refrigerator, tables, and a fireplace. Just outside of the lodge are benches and views of Tumalo Creek.

Reserving the Lodge:

Skyliners Lodge is leased by HDESD and available for educational use at no charge. The lodge must be reserved in advance (we recommend at least 6 months in advance to guarantee your preferred date). For reservation information and forms, visit hdesd.org/about/skyliner-lodge. School groups using the lodge do not need to supply a Certificate of Insurance.

Address and Directions:

Skyliners Lodge is located at 16125 Skyliners Road, west of Bend. From Bend, head west on NW Galveston Avenue, which turns into Skyliners Road. Stay straight through the last roundabout (with Mt. Washington Drive). Continue 8.7 miles on Skyliners Road (FS Road 4601), past the Skyliner community. Turn left into the driveway for Skyliner Lodge (High Desert ESD is on the sign). If you cross Tumalo Creek, you've gone too far! There is a bus turnaround in front of the lodge.

Emergency Information:

Closest medical facility: BMC Urgent Care - Bend Westside Clinic, 1080 Mt Bachelor Drive, (541) 550-4400

Skyliners Lodge phone: (541) 693-5695

Skyliners Lodge Facility Manager: Bob Martin, (541) 280-3108

School Engagement Fund

Deschutes Children's Forest has a School Engagement Fund that teachers can apply to receive funds for transportation or substitute costs associated with field trips. Funds are prioritized for field trips that are inclusive of students with disabilities, aligned with standards, and for Title I schools. To download an application, visit deschuteschildrensforest.org.

Packing List

For Teachers:

- Copies of emergency contact information and medical information for all students
- Phone numbers for your school and emergency services (there is no cell service at the lodge)
- Copy of student groups and schedule
- First aid kit
- Plenty of extra pencils
- Hand sanitizer
- Camera

For Students:

- Day pack
- Water bottle (with water)
- Closed-toe shoes
- Sunscreen
- Lunch with extra snacks
- Ziplock bag with pencil and field journal

Tips for Group Management in the Outdoors

Before You Go...

- **Discuss field trip behavior rules with your students beforehand.** Students should understand that the same rules that apply in school, apply on the field trip. Explain the consequences of inappropriate or unsafe behavior. Emphasize that they are representing their school's reputation when they are off-campus and that we want to present our best behavior to the outside world.
- **Prepare your students before the trip.** Discuss the subject matter they will be learning in the weeks before the field experience. Give the students a list of questions they will be looking to answer during the field experience. This will keep them focused, informed, and engaged in learning all day long.
- **Choose parent chaperones wisely.** Field trips require extra eyes and ears. Depending on the site, recruit one chaperone for every 5-10 students. The ideal chaperone is one who is engaged, responsible, and caring. Be sure that

chaperones understand that they are there to manage their entire group, not just to spend time with their son or daughter.

- **Establish a signal to get students' attention.** This could be a simple call and response such as "One, Two, Three. Eyes on Me!" and students respond "One, Two. Eyes on You!"
- **Give your chaperones the tools they need to be successful.** Make nametags for all chaperones and students. Create a "cheat sheet" of the day's itinerary, special rules, and the names of all kids in each chaperone's group. Give chaperones tips for managing challenging students beforehand.
- **Be considerate when creating student groups.** Avoid grouping students who tend to have problems when together. Assign problem-prone students to chaperones with good management skills or to your group. Field trips can also be a great time to allow students from different classes to get to know each other.
- **Make sure you have all necessary medications.** Talk to the school nurse in advance and gather any medications that your students take during the day. Students with severe allergies need to always have immediate access to their epi-pen. Find out from your school nurse if the student is able to self-administer their epi-pen or if you need to do it.

In the Field...

- **Travel responsibly and safely.** When hiking, travel in a "chaperone sandwich" with an adult in the front and back of the group. Students should stay on designated trails (when appropriate) and should be instructed not to run. When doing activities that require students to spread out, establish clear boundaries before you start and ensure that all students are always in sight.
- **Establish the "Rule of Threes" or "Buddy Rule".** Anytime that students leave the larger group, they should travel either with another student and an adult (rule of threes, for younger students) or with another student (buddy rule, for older students).
- **Count all day.** Your biggest responsibility as a teacher is keeping track of each student. Chaperones should count the students in their group, but also be sure to get a head count any time the whole group is gathered.
- **Environmental Factors.** Regularly check-in with students to make sure they are staying warm (or cool) and dry, drinking water, and using the restroom. Many student complaints can be avoided by staying hydrated!
- **Leave No Trace.** All students should understand to be respectful of the living and non-living things they encounter. A good rule of thumb is to "leave nothing but footprints and take nothing but pictures." To find more information about Leave No Trace Principles, visit Int.org.

Sample Itinerary – 1 class (or each teacher stays with their class)

Time	Activity
9:15	Depart School
9:45	Arrive Skyliners Lodge
9:45 – 10:00	Restroom break, divide into groups
10:00 – 10:30	SEED game
10:30 – 12:00	Forest, Field, and Stream
12:00 – 12:30	Lunch
12:30 – 1:30	Riparian Investigation OR Macroinvertebrate Study
1:30 – 2:00	Silent Hike or Macroinvertebrate Mayhem
2:00 – 2:15	Restroom break, load bus
2:15	Depart Skyliners Lodge

Sample Itinerary – Multiple classes (station model)

Time	Activity	Lead
9:15	Depart School	
9:45	Arrive Skyliners Lodge	
9:45 – 10:00	Restroom break, divide into groups	
10:00 – 11:15	Rotation 1: Group 1: SEED game and Silent Hike Group 2: Forest, Field, and Stream Group 3: Macroinvertebrate Investigation OR Healthy Stream Features Study AND Macroinvertebrate Mayhem!	Teacher 1 + volunteer Teacher 2 + volunteer Teacher 3 + 2 volunteers
11:15 – 12:30	Rotation 2: Group 1: Macroinvertebrate Investigation OR Healthy Stream Features Study AND Macroinvertebrate Mayhem! Group 2: SEED game and Silent Hike Group 3: Forest, Field, and Stream	Teacher 3 + 2 volunteers Teacher 1 + volunteer Teacher 2 + volunteer
12:30 – 1:00	Lunch	
1:00 – 2:15	Rotation 3: Group 1: Forest, Field, and Stream Group 2: Macroinvertebrate Investigation OR Healthy Stream Features Study AND Macroinvertebrate Mayhem! Group 3: SEED game and Silent Hike	Teacher 2 + volunteer Teacher 3 + 2 volunteers Teacher 1 + volunteer
2:15 – 2:30	Restroom break, load bus	
2:30	Depart Skyliners Lodge	

Grade Level: 4-5

Duration: 30 minutes

Time of Year/Day: Any

Ideal Location: Any, ideally with pine trees

Materials Needed: Seed Game cards, White board and markers (optional)

Objectives:

- Students will learn about the basic needs for plant growth
- Students will learn that plant adaptations make them suited to grow in different environments

Science Standards:

Oregon State Science

Standards:

4.2L.1: Describe the interactions of organisms and the environment where they live

5.2L.1: Explain the interdependence of plants, animals, and the environment, and how adaptation influences survival

Next Generation Science

Standards:

5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Connections to FOSS Kits:

Environments

Seed Game

Rotation 1: Activity 1 of 2

Preparation:

- If you aren't doing the activity near Ponderosa pine (or Lodgepole pine) trees, bring in a collection of cones for the activity.
- Print and cut the seed game cards, enough so each student will have 1, plus a few extras in case they get lost.

Background:

Plants are one of the few living organisms that can produce their own food. They do this by capturing the sun's energy and using it to build sugars with water and CO₂ from the air in the process of photosynthesis. Plants need light, air, and water to make their food (sugars), but they also need mineral nutrients from the soil in order to be healthy and grow. Because plants are uniquely adapted to capture the sun's energy and make their own food, they are called producers and create the first link in a food chain. Photosynthesis allows plants to start the flow of energy and nutrients in an ecosystem.

Examining and identifying plants can reveal many secrets about an ecosystem. Plants need a unique combination of light, temperature, moisture, nutrients, and soil conditions in order to grow. Over the millennia plants have adapted to survive and thrive in their ever changing environments. Adaptations such as drought tolerance, shade tolerance, fire resistance, pollination, and seed dispersal mechanisms have helped plants develop specific niches in which they fit into a forest ecosystem.

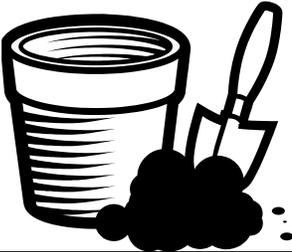
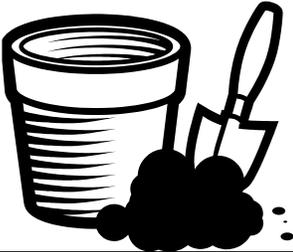
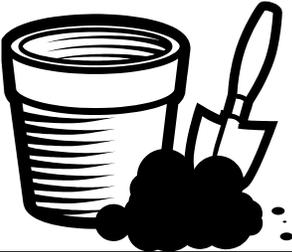
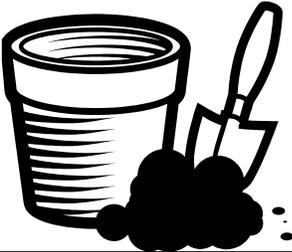
Activity:

1. Begin by having the students observe the plant life around them. Ask students how old they think some of these trees and plants are? What are some adaptations they can notice?
2. Ask students if they know another name for plants (producers). Ask students what makes producers unique (producers make their own food using photosynthesis)? Review the process of photosynthesis, asking students to come up with the necessary "ingredients" for plants to make food (or sugar). These components are light, air, water, and soil (LAWS). Have the students write LAWS down in their journals.
3. Ask students to review what producers role are in ecosystems. How are they connected with consumers and decomposers?
4. Connect LAWS to plant adaptations. Ask students if they can think of an example of a plant that doesn't need very much water to grow. Can they find a plant growing around here that might not need as much sunlight to

grow? Explain that every plant has a different set of adaptations which determines where they best like to grow. Plants that grow in drier regions have adaptations that make them “drought tolerant”. Plants that can grow with less light have adaptations that make them “shade tolerant”. Ask students to brainstorm what some of these adaptations might be. Explain that students will get to learn about native plants in the area and their adaptations.

5. Explain that because producers can’t move around and are stuck where they land as seeds, they can’t always find everything they need to grow and so not all plants successfully grow. Have the students find a cone on the ground, and show them where the seeds are. Have students quickly count the number of seeds per cone and then count the number of cones they see around where they are sitting. Have them do some quick multiplication to figure out how many seeds are in the area around where they are sitting (a lot!). Next ask them how many trees they see growing in the same area (it’s a lot less). Ask students why only a few seeds are successful in growing into trees.
6. Next, introduce the Seed Game. During this game, students are trying to gather the right components to make a seed grow. In each game, there are the following cards: 4 seeds, 4 light, 4 air, 4 water, 4 soil, 2 chipmunks, and 2 squirrels (if you are playing with more than 24 students, add 1 of each card so each student gets a card). Explain that each student will get 1 card face down and they can’t look at the cards. When you say “go”, students will start to mingle, trading cards with the other students, continuing to not look at their cards. When you yell “springtime!” the students split randomly in 4 groups and reveal what cards they have. The group determines if they have the necessary components to make a seed grow. If your group has a squirrel, the squirrel eats the seed, and the seed doesn’t grow. Have the groups report back with whether or not their seed was successful. Record the number of successful “plants” that grew, compared to the number of tries.
7. Repeat the game several times, continuing to record the number of successes vs. trials. After 5 or 6 rounds, gather the large group back together and have the students sit down. Review with the students how many times they were successful and how many attempts they made. In their game, what percentage of seeds grew into a plant? Ask students to relate this to the cones they counted earlier and the forest around them.
8. Revisit plant adaptations. Explain that the Seed game is a simple model and doesn’t incorporate specific plant adaptations. Use the example that plants that need to grow by water might need 4 water cards (for example) or that seeds that need full sunlight to grow might need 2 light cards (for example). If you have time, have the group repeat the activity, requiring that each group gets these requirements.
9. Optional extension: Use field guides to identify plants in the area. Read about the ecology of different plants in the field guide to see what types of environments they like to grow in.

SEED GAME CARDS (you will need 1 card per student)

<p>LIGHT</p> 	<p>LIGHT</p> 	<p>LIGHT</p> 	<p>LIGHT</p> 
<p>AIR</p>	<p>AIR</p>	<p>AIR</p>	<p>AIR</p>
<p>WATER</p> 	<p>WATER</p> 	<p>WATER</p> 	<p>WATER</p> 
<p>SOIL</p> 	<p>SOIL</p> 	<p>SOIL</p> 	<p>SOIL</p> 
<p>SEED</p> 	<p>SEED</p> 	<p>SEED</p> 	<p>SEED</p> 
<p>SQUIRREL</p> 	<p>CHIPMUNK</p> 	<p>SQUIRREL</p> 	<p>CHIPMUNK</p> 

Grade Level: 4-5

Duration: 30-45 minutes

Time of Year/Day: Any

Ideal Location: Any trail, preferably one without junctions and away from other groups

Materials Needed: Silent Hike cards

Objectives:

- Students will have time to personally reflect on their field experience
- Students will have the chance to enjoy quiet time walking in the forest, building upon their observation and sensory awareness skills

Silent Hike

Rotation 1: Activity 2 of 2

Preparation:

It's a good idea to have a writing activity, drawing activity, or game prepared for the students that are waiting at the beginning and end of the hike.

Activity:

1. Sit the group in a circle and give instructions for the silent hike. Suggest that students spend the next 30 minutes being as quiet as they can. When we are quiet we have a chance of seeing and hearing all sorts of things that we may never notice when we are loud.
2. Explain that you will go down the trail first, laying down the silent hike cards in the path as you go. When you get to the end you will be sitting waiting for each of the students to show up. The students will hike the trail one at a time, travelling quietly as they go. As each student travels down the trail they should stop and read what is on the card. The cards will ask the student to do something (look up, take a deep breath, etc). When they are done they should continue down the trail until they find the instructor at the end. ***Students should leave the cards where they are.*** Also, explain that this is intended to be a solo-hiking experience. If the students come upon a student hiking in front of them, tell them to pause until that student has plenty of space. Explain that at the end they will have time to do some writing and reflection.
3. Ask the chaperone to send a new student down the trail every 60 seconds or so depending on group size, speed, and time left in the hike. It is helpful to give the students a game or a task to do while they are waiting to start their hike.
4. As each student arrives at the end of their silent hike explain that they are going to spend some time reflecting on their experience. It may be helpful to give students a prompt for their writing such as "when I'm in the forest, I feel..." or "what do you want to share with your family when you go home."
5. After all the students arrived, ask students to share their experiences on the silent hike. Did they notice anything they wouldn't have if they were hiking with other people? Did they enjoy spending time alone in the forest?

SILENT HIKE CARDS (page 3)

Close your eyes and listen closely for the sounds of the forest. What do you hear?



Imagine what this place would look like at night.



How many different shades of green can you find?



What would this place look like in a rain storm? Imagine the rain drops on your skin.



Do you like spending time outside alone?

Take a moment to feel the texture of this object. How would you describe it.

SILENT HIKE CARDS (page 2)

Do you know what kind of plant this is? Look closely at its leaves, bark, and seeds.

What do you think might live here? Where would it find shelter?

What is one thing you would like to share with your family about today?

Can you hear any birds around you? What might they be saying?



What is the smallest thing you can find?



Take a moment to feel the air against your skin. Is it warm or cool?

SILENT HIKE CARDS (page 3)

<p>Look up at the sky. What do you see?</p>	<p>What do you think this place looked like 100 years ago? How about 1,000 years ago?</p>	<p>Great job...you're almost there! Give yourself a pat on the back!</p>
<p>How long do you think people have been visiting this area?</p>	<p>How old do you think this tree is? Why?</p>	<p>What is your favorite thing about being outside?</p>

Grade Level: 4-5

Duration: 60-90 minutes

Time of Year/Day: Any

Ideal Location: Any, with 2-3 different environments to compare (i.e. meadow, conifer forest, riparian area, rocky outcrop, young vs. old forest, etc.)

Materials Needed: Forest, Field, and Stream Data Sheets, Transect tape or flags (to mark study plots), thermometers (2), trowel or soil collection tube (2), plant field guides (4), animal tracking field guides (4), compasses (2), soil thermometer (2, optional), soil pH probe (2, optional), hand lenses

Objectives:

- Students will describe similarities and differences they observe in the non-living (abiotic) and living (biotic) components of 2-3 ecosystems
- Students will identify ways that abiotic components of an ecosystem affect the biotic components

Science Standards:

Oregon State Science Standards:

4.2L.1: Describe the interactions of organisms and the environment where they live

4.3S.2: Summarize the results from a scientific investigation and use the results to respond to the question being tested

5.2L.1: Explain the interdependence of plants, animals, and the environment, and how adaptation influences survival

5.3S.2: Identify patterns in data that support a reasonable explanation for the results of an investigation or experiment and communicate findings using graphs, charts, maps, models, and oral and written reports

Next Generation Science Standards:

5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Forest, Field, and Stream

Rotation 2: Activity 1 of 1

Adapted from Project Learning Tree

Preparation:

- Scout the location to locate 2-3 sites that are somewhat different from each other in terms of sunlight, air temperature, soil moisture, wind, topography, and number and types of plants and animals living there.
- Optional: Set-up 10x10m plots at each site (you can also have the students do this)

Background:

An ecosystem is a community of different species interacting with each other and with the chemical and physical factors making up its nonliving environment. It is a system of interrelationships among organisms and between organisms and the physical environment. Plants and animals in an environment interact with each other in various ways. For example, plants may depend on insects or birds to pollinate flowers and on earthworms to aerate the soil, animals may depend on plants for food or shelter. However, plants and animals also interact with the nonliving elements of their environment.

In a local environment, physical factors such as sunlight, moisture, temperature, wind, and water flow influence the suitability of an area for particular organisms. Those factors determine the kinds of plants and animals that live there. Physical factors may be determined by the environment's geography, such as its proximity to water, its elevation, or its geological features. In addition, the resident organisms (particularly plants) may affect the sunlight, moisture, temperature, and wind of the area. For example, the tall trees of a redwood forest tend to block sunlight and thus create a dark, moist environment, or microclimate on the forest floor that is suitable for shade-loving plants but is too shady for other kinds of plants. Microclimate refers to special conditions of light, moisture, and temperature that occur in a narrowly restricted area within an ecosystem, for example, under a bush or in a small woodland opening.

Activity:

1. Ask students to think of an outdoor place they enjoy visiting (like a park, trail, or their backyard). Ask students to think about what they enjoy about that place? What living things make your place enjoyable? What nonliving things make that place enjoyable (water, mountains, climate, etc.). Help students see that any place has both living and nonliving parts that work

together to make an ecosystem. Explain that students will investigate ecosystems at two or three different study sites to find out how living and non-living elements affect each other.

2. Introduce the rule: look, learn, leave alone. Explain that students will be making observations, but should be respectful of living things, including plants.
3. Divide your group into teams of 3 students. Explain that each team will investigate and record observations of a different component of two or three different study sites. If you have a full class, there will be two teams for each of 5 components.
 - a. **Team 1 – Soil.** Students will dig a small soil sample using a trowel or soil collection tube. Students will measure soil temperature (using a soil thermometer) and soil pH (using a soil pH probe). Students will also record soil color, smell, and use hand lenses to see if there are any soil organisms.
 - b. **Team 2 – Sunlight, Wind, and Temperature.** Students will use a photographic light meter to measure light intensity from the forest floor. For wind, one student will hold a small strip of paper away from the body, while the others observe whether it hangs straight down or blows at an angle. Students can use a compass to determine the direction from which the wind is blowing. To measure temperature, use a thermometer to measure temperature at ground level and 1 yard above the surface.
 - c. **Team 3 – Lay of the Land.** Students will draw a map of the site and record any land features such as streams or rocky outcrops. Students will record if the site is flat or sloped. If the site is sloped, students should record slope aspect, or the direction the slope faces. To do this, have students face downhill and measure the direction with a compass.
 - d. **Team 4 – Plant Life.** Students will record the number of trees in the plot, measure the biggest tree in the plot, and record tree species. Students will also record ground cover (plants under 1 yard tall) by recording whether there are shrubs, moss, grasses, or bare ground, and which one is dominant.
 - e. **Team 5 – Animal Life.** Students will search the site for evidence of animal signs (scat, tracks, burrows, leaves that have been chewed) or actual animal sightings. This can include insects.
4. Visit the first site. If you haven't set up a plot, use the transect tape to lay out a 10x10m square plot (or larger, as long as you are consistent across sites). It is best to randomly select your plot location within the habitat type. This can be done a number of ways, even having a student spin around with their eyes closed and throw something over their shoulder. Where it lands marks one of the corners.
5. Give the students 10-15 minutes to collect data in their teams. Assign a recorder for each team to collect quality data.
6. Move to the second site and repeat the process. If you'd like, have the teams switch so they learn about a different type of data collection.
7. Repeat at a third site, if you have time.
8. Regroup all of the students. Give each group 1 minute to summarize what they found at each site. Have them share which site had the most sun, highest temperature, wettest soil, steepest slope, most trees, most diversity, etc. Ask students if they think there are any connections between any of these factors. For example, did the site with the most sun have different plants than the one with the least sun?
9. **Classroom Extension:** Gather all student data on the board or spreadsheet. Have students develop graphs showing comparisons between different factors. Can they draw conclusions about relationships between abiotic and biotic components?

FOREST, FIELD, AND STREAM DATA SHEET

SOIL DATA

	SITE 1	SITE 2	SITE 3
SOIL TEMPERATURE			
SOIL pH			
SOIL COLOR, TEXTURE, AND MOISTURE			
SOIL ORGANISMS (How many did you find, how many different kinds?)			

SUNLIGHT, WIND, AND TEMPERATURE

	SITE 1	SITE 2	SITE 3
TEMPERATURE ON SURFACE			
TEMPERATURE 3FT. ABOVE THE SURFACE			
WIND DIRECTION			
WIND SPEED (no wind, slight wind, strong wind)			
SUNLIGHT (full sun, partial sun, no sun, or use a light meter to measure)			

LAY OF THE LAND DATA

<p>SITE 1: Slope (steep, flat, etc.): _____</p> <p>Direction of slope (use a compass): _____</p>	<p>SITE 2: Slope (steep, flat, etc.): _____</p> <p>Direction of slope (use a compass): _____</p>	<p>SITE 3: Slope (steep, flat, etc.): _____</p> <p>Direction of slope (use a compass): _____</p>
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Draw the sites below, including special features like large rocks, bodies of water, etc.

SITE 1

SITE 2

SITE 3

PLANT DATA

Trees = plants with woody stems that are taller than you

Ground cover = any plant that is shorter than you (could be shrubs, grasses, moss, or other plants)

Shrubs = plants with woody stems that are shorter than you

	SITE 1	SITE 2	SITE 3
Total number of trees			
Circumference of the biggest tree (use the transect tape)			
Species of trees in the plot (list all that you can identify)			
GROUND COVER DATA: Estimate the percentage of ground covered by each of the plant types listed below			
Shrubs	____%	____%	____%
Grasses	____%	____%	____%
Moss	____%	____%	____%
Other Plants	____%	____%	____%
Bare Ground	____%	____%	____%

WILDLIFE DATA

List all animal signs that you find in your plot, including the type of sign (scat, tracks, bones, chewed leaves, borrows (holes in the ground), nests, holes in trees) and what kind of animal you think left the sign.

	SITE 1	SITE 2	SITE 3
1			
2			
3			
4			
5			
6			

Grade Level: 4-5

Duration: 30-45 minutes

Time of Year/Day: Any, not when the water is too high

Ideal Location: Stream, not too fast (Tumalo Creek is great)

Materials Needed: D-nets, rubber boots or waders, ice cube trays, turkey basters, plastic tubs, hand lenses, macroinvertebrate keys (below) or field guides, Macroinvertebrate Data Sheet, clipboards, pencils

Objectives:

- Students will learn about indicator species, and how scientists can study them to learn about the environment
- Students will understand that adaptation is important in determining the types of conditions that organisms can live in
- Students will learn about healthy stream conditions

Science Standards:

Oregon State Science Standards:

4.2L.1: Describe the interactions of organisms and the environment where they live

4.3S.2: Summarize the results from a scientific investigation and use the results to respond to the question being tested

5.2L.1: Explain the interdependence of plants, animals, and the environment, and how adaptation influences survival

Next Generation Science Standards:

4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

5-LS2-1 Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Macroinvertebrate Study

Rotation 3: Activity 1 of 2 (Option 1)

Preparation:

- Reserve the Aquatic Investigations kit from Deschutes Children's Forest's Resource Co-op (and pick-up)
- Copy data sheets

Background:

Macroinvertebrates are animals that lack a backbone (invertebrates) and can be seen with the unaided eye ("macro"). They include insects such as mayflies, mosquitoes, and beetles, as well as mussels, leeches, sideswimmers, and worms. Aquatic macroinvertebrates spend the majority, if not all, of their lives, in streams, wetlands, lakes, and other aquatic environments, and depend on healthy aquatic and upland ecosystems to survive.

Aquatic macroinvertebrates are beautiful and diverse animals, with adaptations that allow them to live in different parts of streams or lakes. Some mayflies that live on rocks in fast flowing water have very flattened, streamlined bodies, and some even have a suction cup-like structure on the underside of their bodies to help them from being washed off the substrate. Black flies use hooks to anchor themselves to a little pad of silk they place on the rocks and caddisflies build a variety of cases from sand, stone, pine needles, bark, and leaves and live and feed within their protective shells.

Like humans, aquatic macroinvertebrates require oxygen to breathe. They acquire dissolved oxygen through various adaptations including through the surface of their bodies, using gills, breathing tubes, and other methods. Aquatic macroinvertebrates are affected by physical and chemical factors in the stream and surrounding watershed. Some macroinvertebrates require cold, clean water with lots of dissolved oxygen to survive, while others can tolerate poorer water conditions. Because of these differences in adaptations, macroinvertebrates are considered indicator species, as they indicate how healthy an aquatic environment is, often better than through just measuring water chemistry (temperature, pH, heavy metals, etc.). Because macroinvertebrates live in water all the time, they can indicate whether there are other contaminants that are making the stream environment unhealthy. Additionally, because macroinvertebrates are found everywhere, generally in large numbers, and are confined to the aquatic habitat for most of their life cycle, they provide a way to learn a lot about a stream through a fairly simple assessment. They can also be sampled over time to see how the health of a stream is changing.

Teaching/Safety Tips:

- Avoid fast-moving water

- Macroinvertebrate sampling should be done well away from and downstream of spawning salmon and reds
- No more than 4 students in the stream/river at a time
- For younger students, have them wear rubber boots instead of waders to keep them from going in above their shins
- Take care when on slippery rocks
- Never drink the water – it could make you sick

Activity:

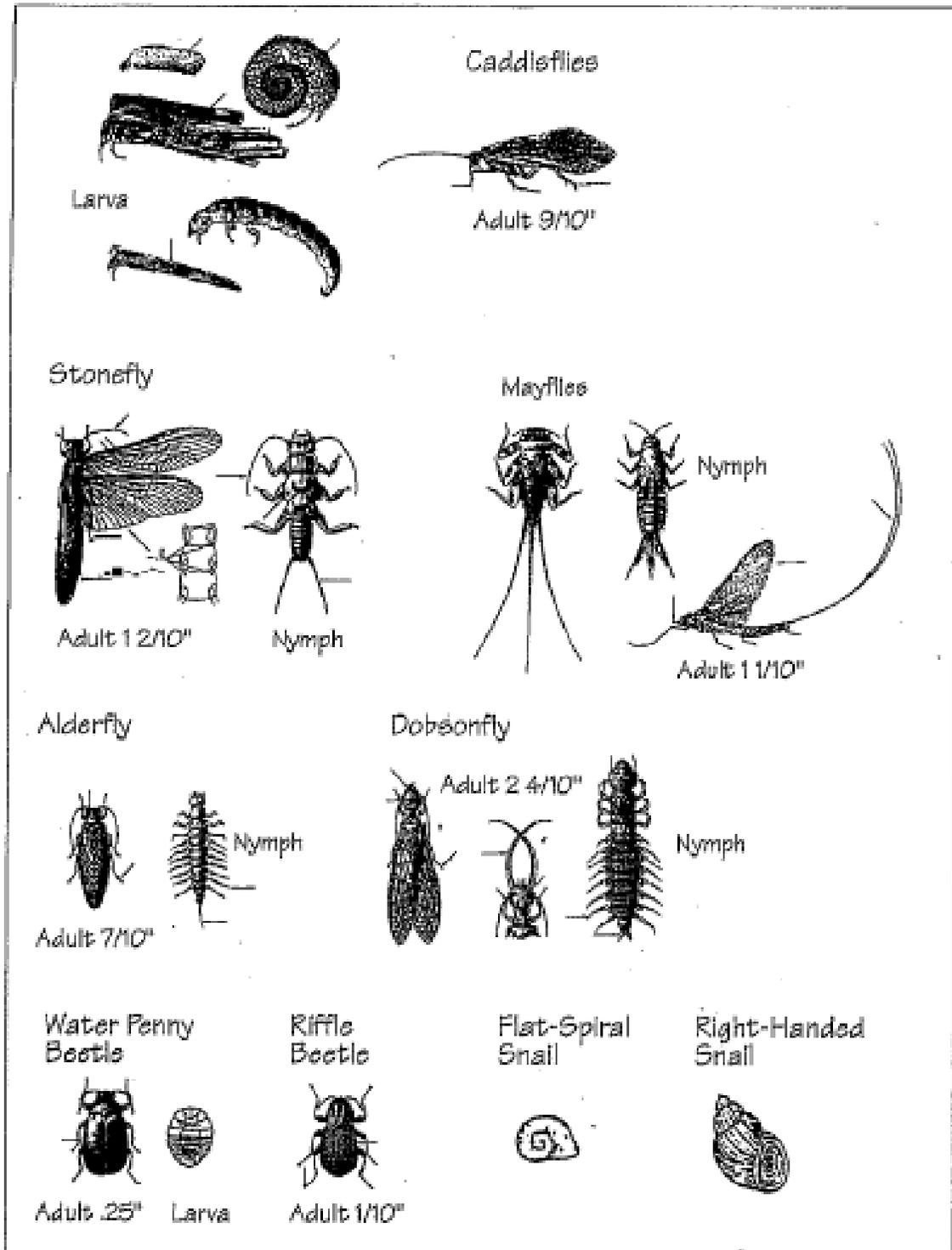
- Ask students if they have ideas about what types of animals can be found in the stream. In addition to fish and amphibians, students might also list insects. Explain that in streams and lakes, there are macroinvertebrates. Ask students if they can break down the word to understand what that means (animals without backbones that are large enough to see with the naked eye).
- Explain that aquatic macroinvertebrates are considered indicator species (or bioindicators) because they can tell you a lot about the condition of the environment. Explain to students that there are some species that are very sensitive to pollution (kind of like only staying in 5 star hotels), others that are very tolerant to pollution, and some in between. By doing a survey of macroinvertebrates in a given body of water, it can tell you how healthy the stream is, based on what you find. For example, if you find no intolerant species and lots of tolerant species, it means that water quality is low. Explain that students will soon get a chance to sample macroinvertebrates in the stream to answer the question “Is Tumalo Creek a healthy stream?”
- Identify boundaries for the activity and review safety procedures. Explain that there will only be 4 students in the stream at a time and each group will be sampling a different habitat in the stream including a riffle, pool, slide, and backwater.
- Send the first group to sample the first location for 5 minutes. They will work from downstream to upstream. 1 or 2 students should place the net downstream from a 1x1 foot area to be sampled, holding the net perpendicular to flow. The other students will work just upstream, rubbing rocks and leaf litter to remove any invertebrates. The invertebrates should flow into the net. Replace the rocks.
- Bring the contents of the net to the shore and put into a plastic tub of water for another group to look at. Allow group 1 to collect 1-2 more samples for the other student to investigate.
- Rotate through groups to allow any interested students to sample.
- For groups on the shore, have them sort through their sample and separate individuals into the ice cube tray using the turkey baster. If they find more than 1 of the same kind, they can put them together in a compartment of the ice cube tray. Give them time to identify the macroinvertebrates using the field guides.
- Count the different kinds of invertebrates and numbers of each kind and record on the data sheets provided. If possible, separate each habitat onto a different data sheet to allow for more comparison.
- If time allows, students can sketch, label, and describe their favorite macro, how they move, feeding habits, breathing adaptations, etc.
- After all groups have had a chance to fill out a data sheet about their sample, ask them to determine the health of the stream based on the number and variety of insects found. Use the tolerant/intolerant insect group cards provided. Which group best reflects the insect community found in the stream sampled?
- If you were able to collect samples from different habitats, ask students to compare the communities found in each. What species are you more likely to find in moving water vs. calm water? Which area do they think has more dissolved oxygen? Why might one insect need less dissolved oxygen than another?

INSECT GROUPS ARRANGED BY TOLERANCE TO POLLUTION

Group 1: Intolerant

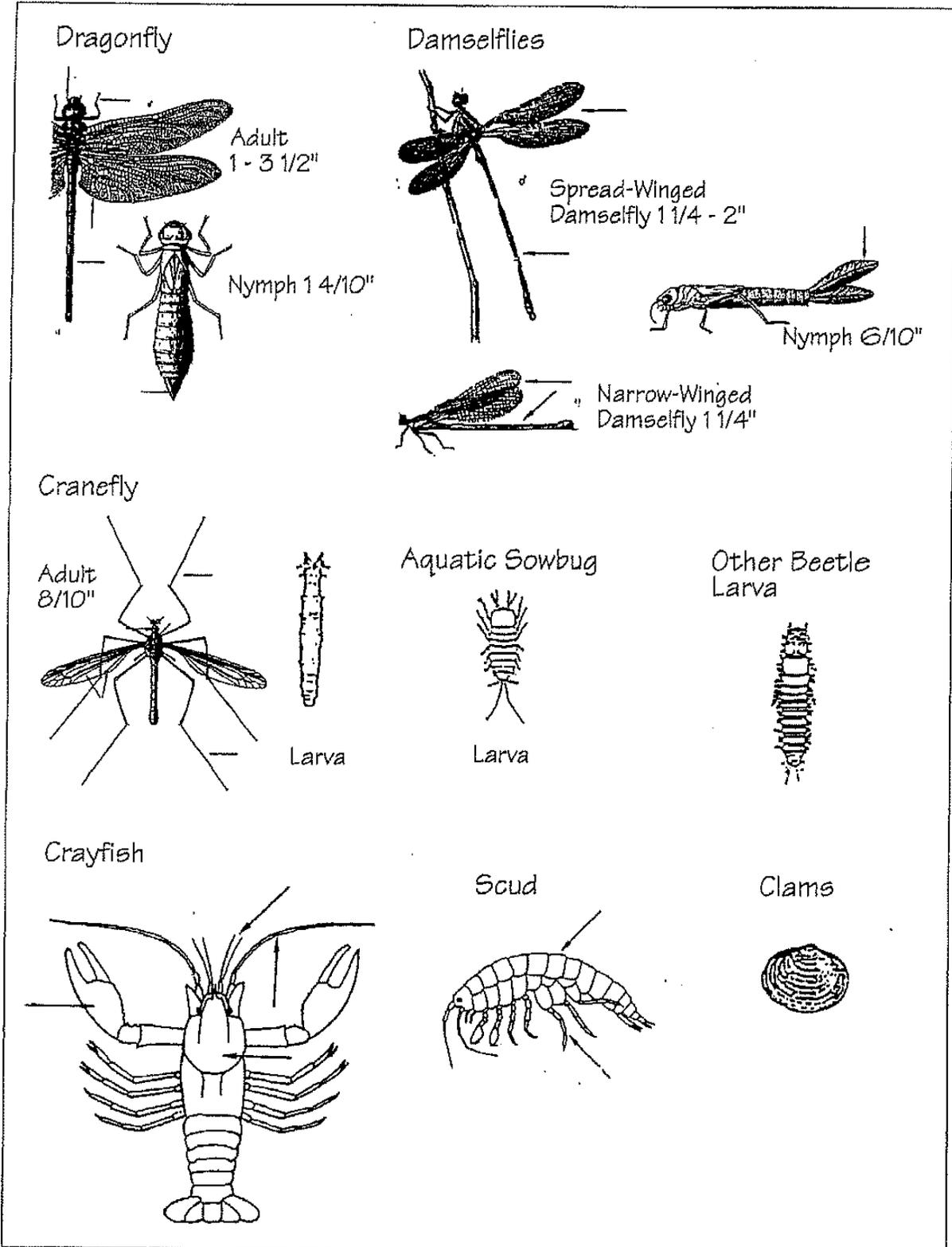
These organisms are sensitive to pollution.

Their dominance generally suggests good water quality.



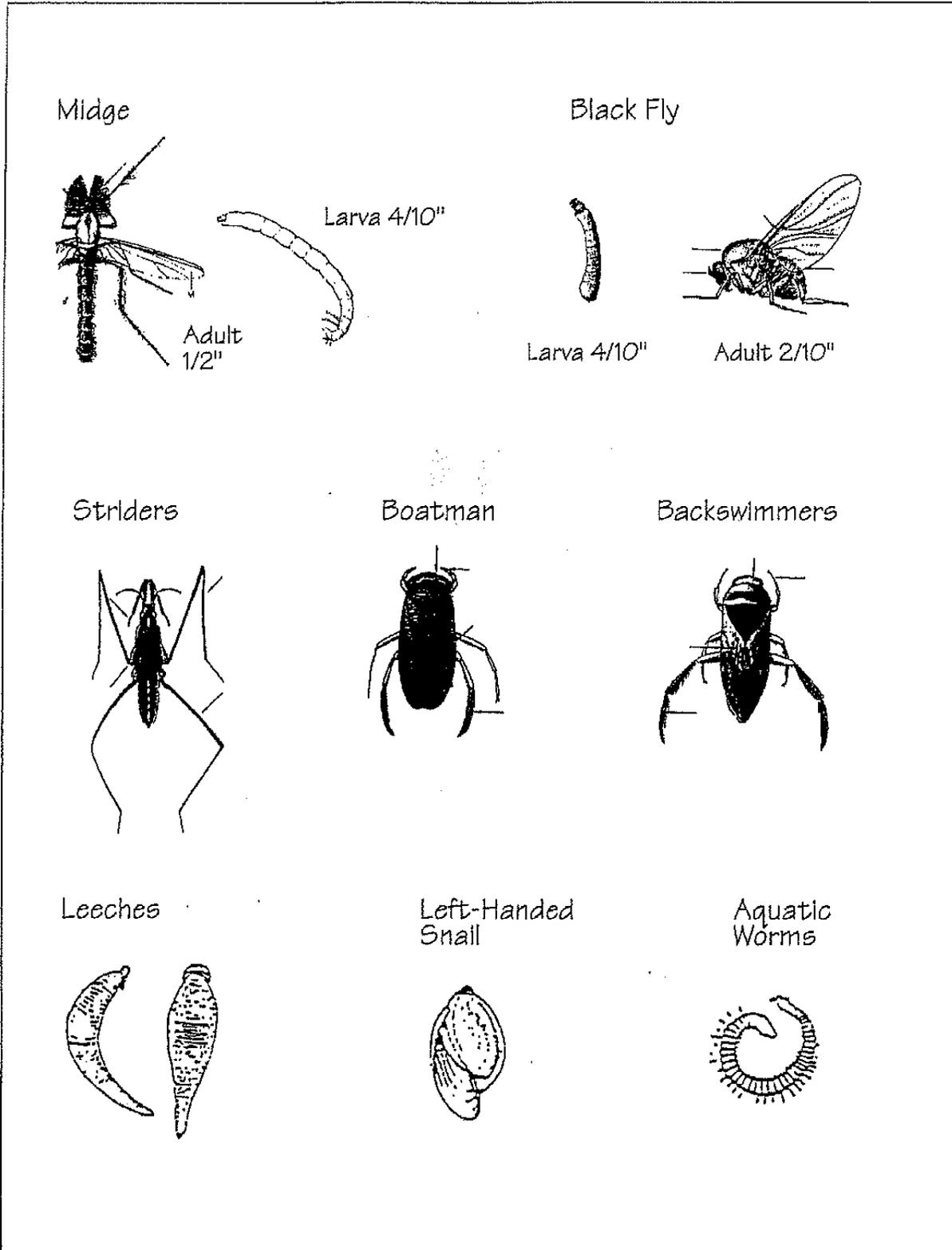
Group 2: Somewhat Tolerant

These organisms can tolerate a wider range of water quality conditions.



Group 3: Tolerant

These organisms are generally tolerant of pollution. Their dominance suggests poor water quality.



MACROINVERTEBRATE SAMPLING DATA FORM

School: _____ Teacher: _____

Date: _____ Time: _____ Weather: _____

Stream/Site Name: _____ Time spent sorting/identifying: _____

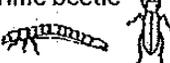
of people sorting/identifying: _____ Riffle Pool

Directions:

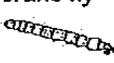
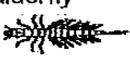
1. Record the number of each type of organism found in the # found column of each section.
2. Then circle the number in the score column (3, 2, or 1) if any of that organism was found.
3. Complete the equation at the bottom by adding up the circled numbers from each score column.

SENSITIVITY TO POLLUTION

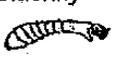
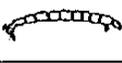
Sensitive / Intolerant

	# found	score
caddisfly 		3
mayfly 		3
riffle beetle 		3
stonefly 		3
water penny 		3
dobsonfly 		3
Sensitive TOTAL =		

Somewhat Sensitive

	# found	score
clam/mussel 		2
crane fly 		2
crayfish 		2
damselfly 		2
dragonfly 		2
scud 		2
fishfly 		2
alderfly 		2
mite 		2
Somewhat Sensitive TOTAL =		

Tolerant

	# found	score
aquatic worm 		1
blackfly 		1
leech 		1
midge 		1
snail 		1
mosquito larva 		1
Tolerant TOTAL =		

Sensitive total
 + Somewhat sensitive total
 + Tolerant total
 = **Water Quality Rating**
 Excellent (>22) Good (17-22)
 Fair (11-16) Poor (<11)

Adapted from: Environmental Services
City of Portland

Grade Level: 4-5

Duration: 45-60 minutes

Time of Year/Day: Any

Ideal Location: Stream

Materials Needed: Copies of student handouts and data sheets, clipboards, pencils

Objectives:

- Students will know the definition of a “riparian area” and its importance.
- Students will be able to name, identify, and understand the role of features in and alongside the stream that are needed for good stream health
- Students will be able to determine stream health by observing these riparian and in-stream features and recognize how humans can impact and improve stream health

Science Standards:

Oregon State Science Standards:

4.2L.1: Describe the interactions of organisms and the environment where they live

5.2L.1: Explain the interdependence of plants, animals, and the environment, and how adaptation influences survival

Next Generation Science Standards:

4-ESS2-1 : Make observations and /or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation

4-ESS3-2: Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

5-ESS2-1: Describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.

Healthy Stream Features Investigation

Rotation 3: Activity 1 of 2 (Option 2)

Preparation:

- Print copies of data sheets
- Read background information about riparian areas (in classroom if possible)

Background:

Plants along the streambed influence the entire stream ecosystem. This green zone is called a **riparian** area which has an important role in contributing to stream health. Riparian areas provide cover for aquatic and terrestrial animals, creating shade that moderates water and air temperatures. Many aquatic species require cold water temperatures to survive. Cold water also has greater capacity for holding oxygen, also an important element for life in the stream.

The roots of vegetation, along with the soil of healthy forests, limits water contamination, slows water velocities, and filters and collects large amounts of sediment and debris. Uncontrolled sediments can kill fish and destroy spawning areas. Also, when large debris from riparian vegetation falls into streams, it serves as a way to create habitat for fish and macroinvertebrates, creating pools, riffles, and cover. Leaves that fall into streams, particularly in headwater streams, are the most important food source for aquatic food webs.

Riparian areas are also very important for providing essentials of wildlife habitat – food, water, and cover. In general, the area within 200 yards of a stream is used most heavily by wildlife.

See “What is a riparian zone?” for more background information.

Activity:

1. Read “What is a ‘riparian zone’? And why is it important?” handout with students either in classroom before trip or at field site. Review with students some of the features of healthy streams and why they are important.
2. Hand out Healthy Stream Scavenger Hunt handouts with clipboards and pencils. Students can work in pairs or individually.
3. Walk down to stream and have students take 5-10 minutes to search for the features on the sheet.
4. When completed, lead a discussion and ask students to point out various features and tell why they are important to health of stream.
5. Hand out Riparian Area Mapping Data Form (Birds-Eye View) and have students take 10-20 minutes to sketch the stream

including as many details as possible and labeling the parts. Have them include how these parts affect the health of the stream.

6. Lead discussion about the parts included in their maps. Review how these features add to health of stream.
7. Discuss ways that humans can help to restore a section of stream that isn't healthy. (possible answers could be: add logs into river for fish habitat, plant native plants and trees along stream to improve riparian vegetation, build up banks, pick up trash, stay on trails, etc.). Explain that this is the site of a large-scale restoration project completed in 2000 to help improve the water quality of Tumalo Creek that was being affected after a large fire in 1970. The logs in Tumalo Creek at Skyliners were placed there during the restoration project in 2000, and many plants were planted along the banks by students and community groups.

What is a “riparian zone”? And why is it important?

Lesson from
the Editor

Have you ever heard the word riparian before? It kind of sounds like the word repair doesn't it? The forested land along rivers and streams is known as the “riparian zone”. Riparian comes from the Latin word *ripa*, which means bank. Riparian zones are areas of transition where the water and land meet and they offer many, yet often overlooked, benefits to wildlife and people. Only within the past few decades have we come to realize the value of riparian areas. In fact, until the late 1960s, riparian and stream ecosystems of the western United States were viewed as “sacrifice” areas, dedicated primarily to providing food and water for livestock.

Riparian areas are among the most diverse biological systems on earth and they perform important services to people and animals. As our population increases, there is increased pressure to use riparian areas for many purposes. It is important that we all become involved in the conservation and restoration of these areas as super stream stewards!

Removing streamside plants and trees causes serious problems for fishes and other animals living in the water. Overhanging vegetation and trees shade the stream channel, keeping the water nice and cool. When riparian trees are removed, summer water temperatures can increase by up to an average of 3°C. Warmer water temperatures reduce the oxygen-carrying capacity of the stream.

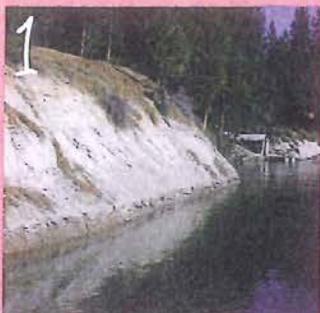
The many trees and plants in the riparian zone help to hold on to riverbank soil. Much like the steel rods found in concrete bridges, trees and plants along streambanks reduce soil erosion by their roots holding the soil together, making it more difficult for streamflow or rain/runoff to wash the soil away. Plants also help prevent erosion by reducing the impact of raindrops on exposed soil. The result is less sediment or soil in the stream. Healthy riparian areas also help hold floodwater after heavy rains or snowmelts. These streamside wetlands act like huge sponges absorbing and filtering the water, which reduces high flows in streams. Sediment from erosion can affect salmon and other fishes in many ways. They can destroy spawning habitat by covering the gravels needed to lay their eggs. Sediment settling out on spawning gravels will smother the eggs, or smother macroinvertebrates needed by fish for food. Suspended sediment also reduces visibility in the water and interferes with the ability of fish to catch what prey is available.

So, now that you know why riparian plants are so important for healthy streams, healthy fish, and healthy water, talk with your teacher about how you can become a super stream steward by fixing riparian areas near you!



One of many of the schools who have stepped up to be super stream stewards is High Lakes Elementary in Bend, OR. The entire fifth grade community at High Lakes has committed to adopt and restore the riparian area, or streambank, along Whychus Creek at Camp Polk Meadow Preserve.

DIRECTIONS: Mark the box next to each photo depending on whether you think what is shown is healthy for the stream, or unhealthy. Then explain why you think that is.



Healthy Unhealthy

Why? _____



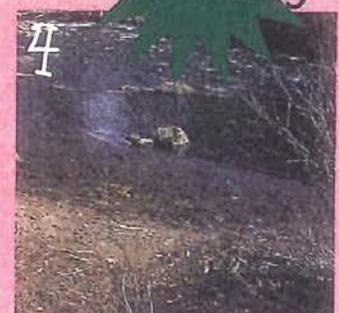
Healthy Unhealthy

Why? _____



Healthy Unhealthy

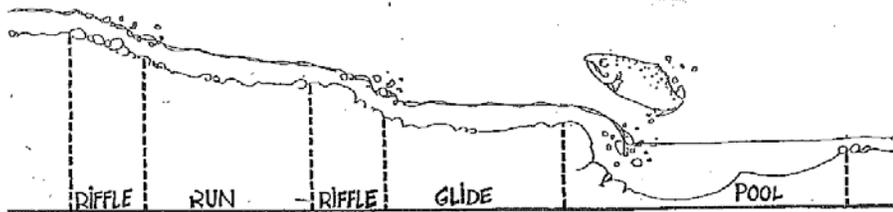
Why? _____



Healthy Unhealthy

Why? _____

FEATURES OF HEALTHY STREAM HABITAT



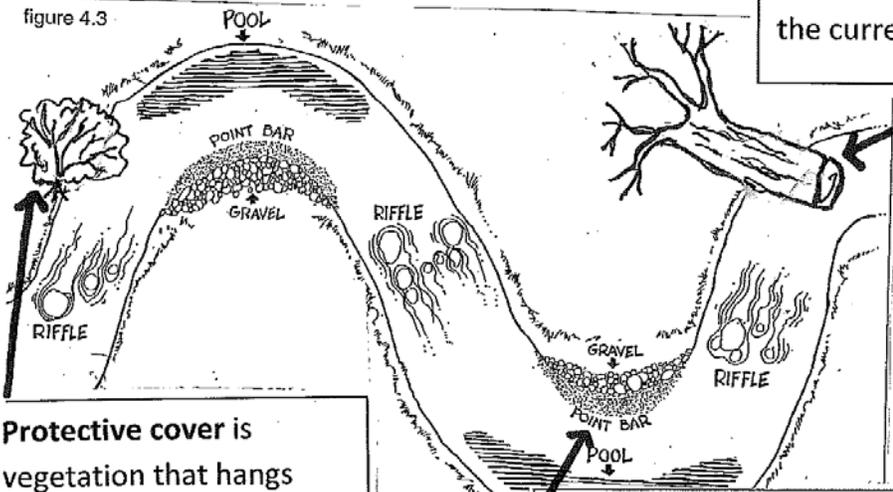
A **glide** is a relatively slow moving area of water, often coming out of a pool. Important area for fish to spawn.

A **riffle** is a shallow area of fast moving white water. Riffles provide perfect conditions for many underwater insects which are important food for fish.

A **run** is a fast flowing area of water but not shallow enough to create white water. The energy of a run helps to create pools.

A **pool** is a deeper area where water has slowed down. Pools are good hiding places for fish and give them a place to rest from the current.

figure 4.3

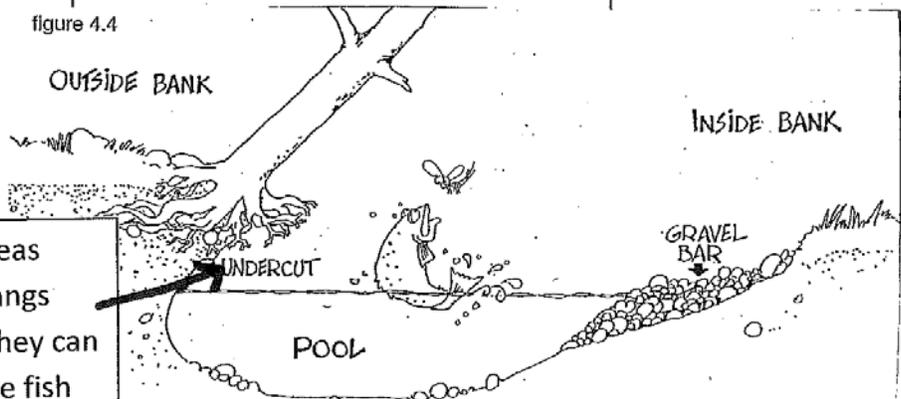


Woody debris are fallen branches and trees that are in the water. Woody debris can help create pools. It creates hiding places for fish. It also slows the stream down which helps to reduce erosion of the banks from fast-moving water.

Protective cover is vegetation that hangs over the stream banks and provides hiding places for fish. It also helps to shade the water and keep it cool. Roots from this vegetation help stabilize the banks and hold them in place.

A **point bar** is an area where gravel has been deposited. It is a wonderful habitat for ground-nesting birds, such as killdeer.

figure 4.4



Undercut banks are areas where the bank overhangs the stream. If stable they can provide good protective fish habitat and cooling shade.

HEALTHY STREAM SCAVENGER HUNT

PLEASE STAY ON THE TRAIL AT ALL TIMES

<p><i>DO YOU SEE...</i></p> <p>fish in the stream?</p>	<p><i>DO YOU SEE...</i></p> <p>plants or trees shading the stream keeping the water cool?</p>	<p><i>DO YOU SEE...</i></p> <p>plants hanging over the stream creating a place for fish to hide?</p>
<p><i>DO YOU SEE...</i></p> <p>bugs in the stream providing food for fish?</p>	<p><i>DO YOU SEE...</i></p> <p>plants or trees holding the edges of the stream in place?</p>	<p><i>DO YOU SEE...</i></p> <p>sticks or rocks in the stream that fish could hide under?</p>
<p><i>DO YOU SEE...</i></p> <p>leaves in the water for bugs to eat?</p>	<p><i>DO YOU SEE...</i></p> <p>deeper pools in the stream where fish can rest?</p>	<p><i>DO YOU SEE...</i></p> <p>garbage or anything that doesn't belong in the stream that could harm the fish?</p>



RIPARIAN AREA MAPPING DATA FORM

School: _____

Teacher: _____

Date: _____ Time: _____

Weather: _____

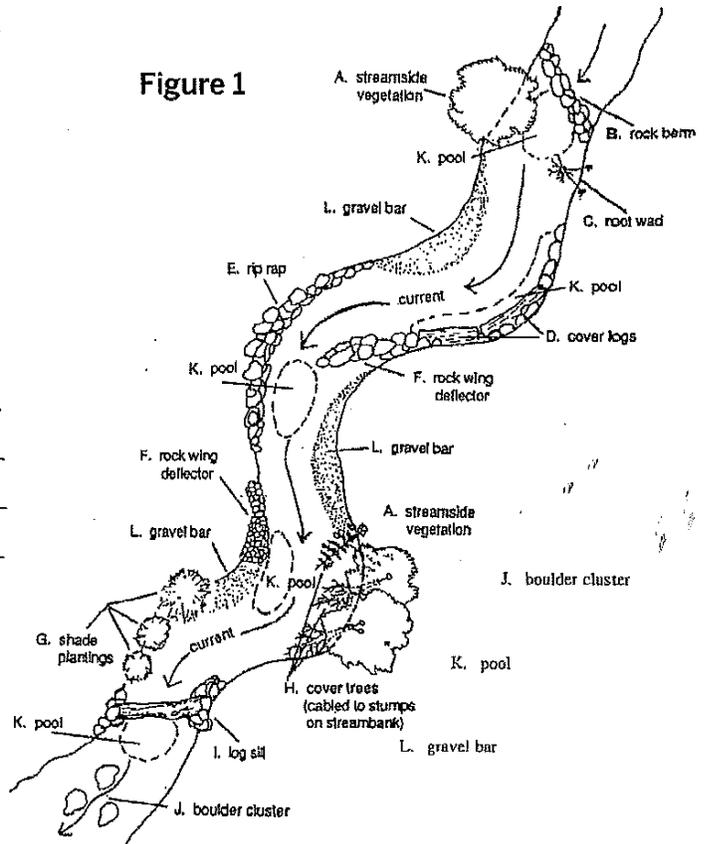
Stream/Site Name: _____

Directions: Use this space to make a map of the part of the stream that you think is important (imagine the stream from a "bird's-eye-view"). Be sure to map both the aquatic and riparian link are

important (see figure 1).

Turn over for profile activity. →

Figure 1



Grade Level: 4-5

Duration: 20-30 minutes

Time of Year/Day: Any

Ideal Location: A large open area where students can run

Materials Needed: Cones (or backpacks) to mark the boundaries of the game

Objectives:

- Students will learn about indicator species, and how scientists can study them to learn about the environment
- Students will understand that adaptation is important in determining the types of conditions that organisms can live in
- Students will learn about healthy stream conditions

Science Standards:

Oregon State Science

Standards:

4.2L.1: Describe the interactions of organisms and the environment where they live

5.2L.1: Explain the interdependence of plants, animals, and the environment, and how adaptation influences survival

Macroinvertebrate Mayhem

Rotation 3: Activity 2 of 2

Preparation:

- Create boundaries for a playing field. It should be wide enough for all students to be able to line up side by side and about 20-30m long.

Background:

Macroinvertebrates

Activity:

- If the students haven't already done the macroinvertebrate study, introduce what an aquatic macroinvertebrate is to the students. Explain that macroinvertebrates undergo a lifecycle that occurs partially in water and partially on land. The insects we find in the stream are in their larval stage, and will eventually metamorphosize into adults (usually with wings) to reproduce.
- Explain that one of the coolest things about macroinvertebrates is that they are indicator species, meaning that the types of macroinvertebrates you find tells you something about the health of the environment where they live. Some macroinvertebrates are intolerant of pollution and can only live in the cleanest of water, whereas others are tolerant and can live in water that is more polluted. Give a few examples of intolerant, somewhat tolerant, and tolerant macroinvertebrates. Explain that they will get to play a game about macroinvertebrates and how pollution affects them.
- Review with the students that pollution can also be increased temperatures or increased sediment, resulting from human impacts (like logging) or natural disasters (like fire).
- Count the group off into 3 groups – group 1 will be stoneflies (intolerant), group 2 will be dragonfly nymphs or crayfish (somewhat tolerant), and group 3 will be mosquito larvae or leeches (tolerant). Choose 1 person to be a fish or amphibian in the middle. Tell the students that they need to remember what type of macroinvertebrate they are.
- All macroinvertebrates (students) should line up on one side of the field. During the game, they will run to the other side of the field when you say “go”, trying to not get tagged or “eaten” by the fish. If they get tagged, they have to stop where they are and they become “pollution”. Pollution can't move their feet, but they can tag the macroinvertebrates as they run by.
- During the first round, there is no pollution in the stream, so all of the macroinvertebrates are healthy and fast. When you say go, all students can run to the other side of the field.
- After a couple of students get tagged and become pollution, you'll explain that for this round, because the water is getting a little polluted, our intolerant macroinvertebrates are affected. Tell them that all stoneflies have to walk for this round, while the others can run. For each round, there should be more pollution added to the stream, and you can follow this progression, or something similar:
 - Round 3: Stoneflies - hop on 1 foot, Dragonfly nymphs – walk, Mosquitos – run

- Round 4: Stoneflies – drag 1 foot behind them, Dragonfly nymphs – hop on 1 foot, Mosquitos – run
- Round 5: Stoneflies – crawl, Dragonfly nymphs – drag 1 foot behind them, Mosquitos – walk
- Continue until all of the macroinvertebrates are tagged. For each round, take a survey of how many of each type are still in the game. Hopefully you will see a pattern where there more polluted the water becomes, the fewer intolerant macroinvertebrates are left in the game.
- If you have time, repeat the game and track data for each round, recording how much pollution is in the water and the number of each type of insect. Bring it back to the classroom and have the students create graphs using the data.
- Wrap-up by asking students what are some ways that we can protect water quality for macroinvertebrates.

Science Inquiry: Interconnections (4th-5th grade) Curriculum Kit

Materials List

If you plan on doing all of the activities, listed below are the recommended materials. All materials are available through Deschutes Children's Forest. To reserve materials, email katie@deschuteschildrensforest.org.

Item	Quantity
Laminated Seed Game cards	1
Laminated Silent Hike cards	1
Whiteboard and markers	1
Transect tape (100 ft.)	4
Thermometers	4
Soil Collection Tube	2
Trowel	2
Trees to Know in Oregon (field guide)	2
Plants of the Southern Interior British Columbia and the Inland Pacific Northwest	2
Animal Tracks of Washington and Oregon	4
Compass	2
Soil thermometer	2
Soil pH probe	2
Hand lenses	14
D-nets	2
Rubber boots	8
Turkey baster	4
Plastic tub	4
Ice cube tray	4
Macroinvertebrate Identification Flashcards	1
Macroinvertebrate field guide	8
Master Copies of all data sheets, handouts, etc.	N/A