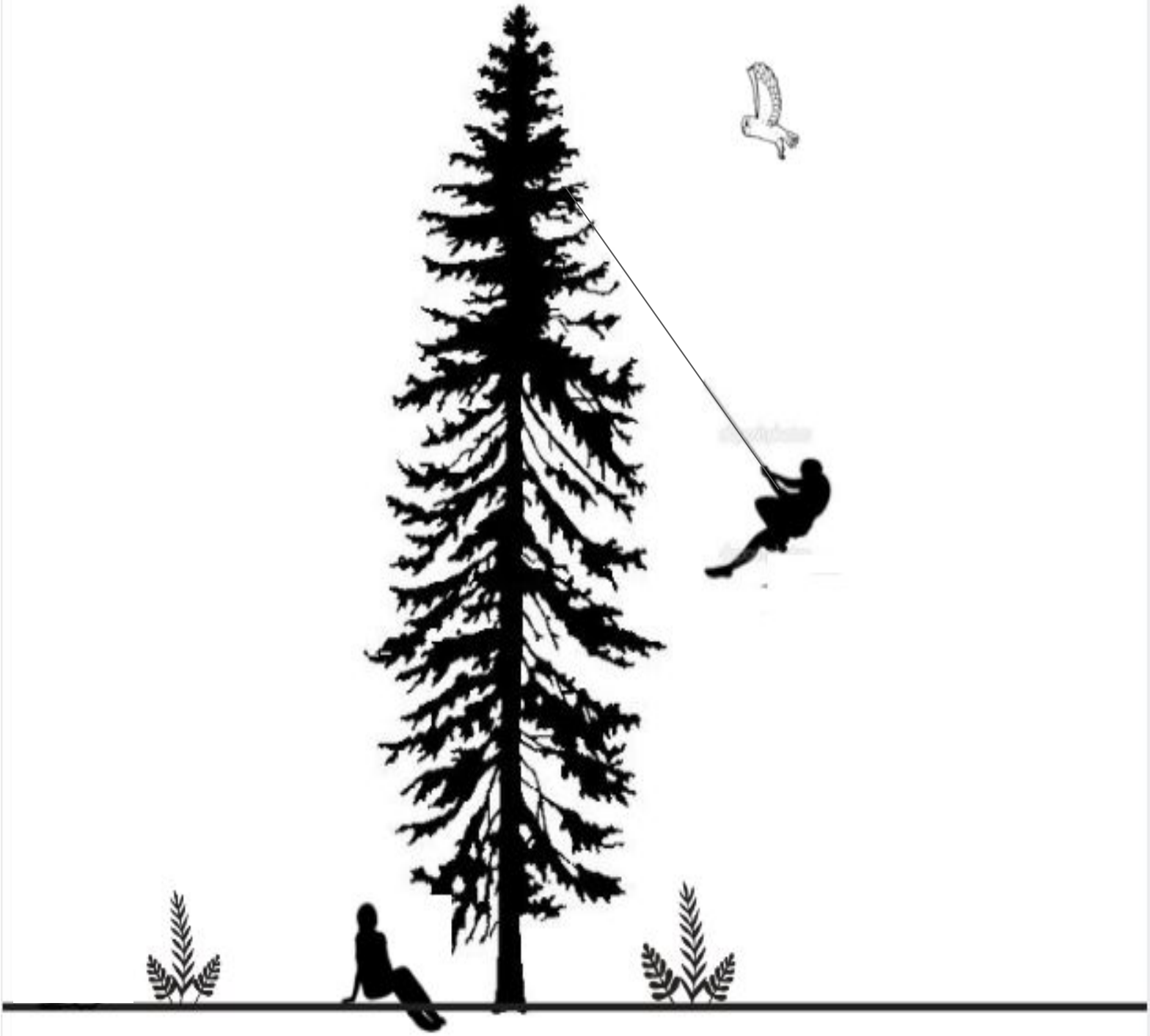
Canopy Connections 2017



Developed by: Annalise Helm, Ashley Studholme, Chaney Hart, Danielle Stein, Elizabeth Yurkov, Evan King, Jordan Morales, Sara Fatimah, Sarah Hovet

Table of Contents

Acknowledgements…….....3
Field Site Map……...4
Abstract……...……..5
Pre Trip Lesson: Sense of Place……6
a. Handout 1.1……12
b. Handout 1.2……13
c. Handout 1.3……14
d. Handout 1.4……15
Arrival and Orientation Guideline……...16
Elevating Knowledge……..18
a. Handout 1……21
b. Handout 2……22
c. HJ Andrews Discovery Trail Quest……23
d. Tree Identification Key……...25
Sacred Soils: A Place of Origin……..26
Flora and Fun-a……...31
a. Ellie's Log by Judith Li……...36
Bird's Eye View From the Canopy……37
Wrap Up…….....39

Acknowledgements

Thank you!

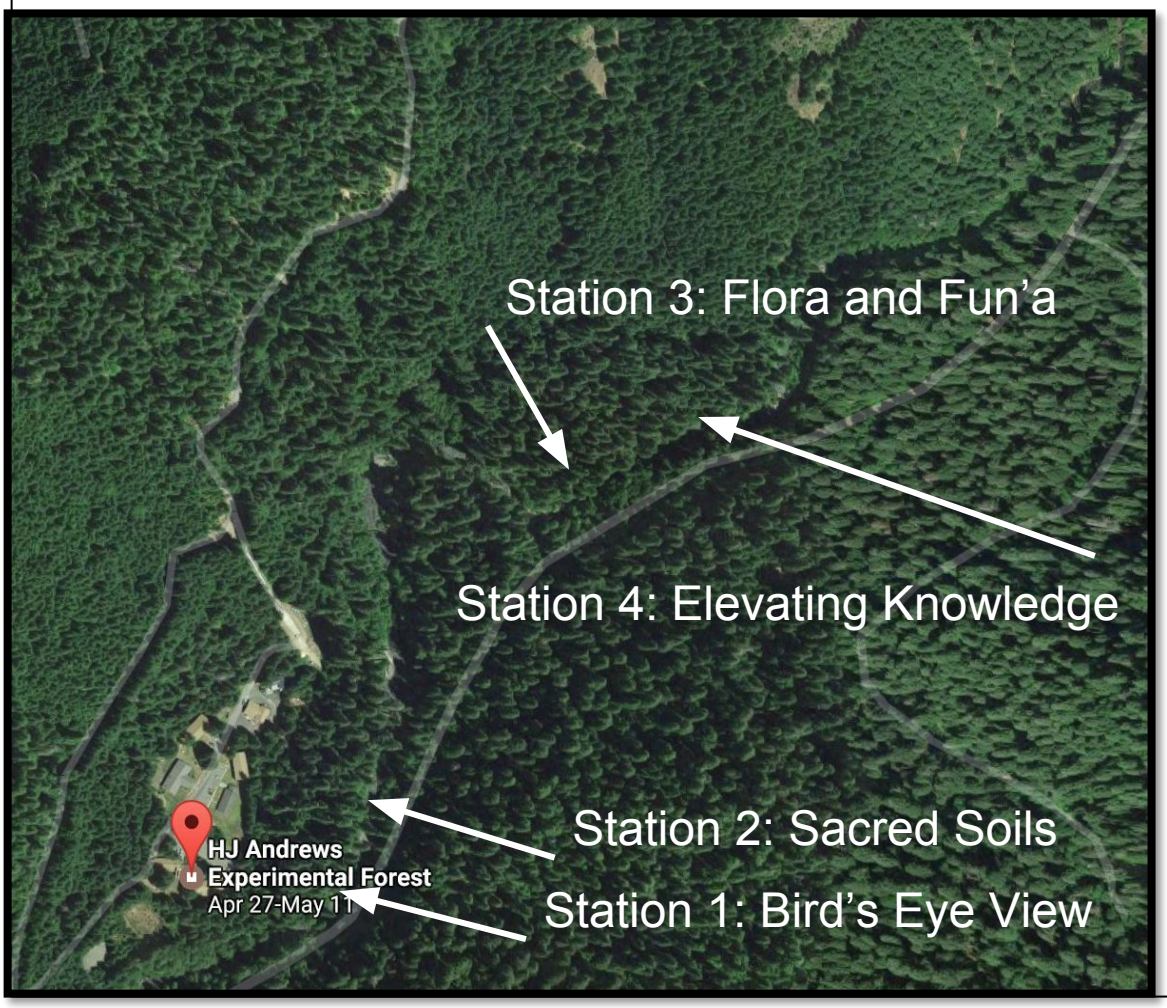
Community Partners: Pacific Tree Climbing Institute & H.J. Andrews Experimental Research Forest

Environmental Leadership Program Director: Kathryn Lynch

Project Manager: Ashley Studholme

Our Field Site: HJ Andrews Experimental Forest

HJ Andrews Experimental Forest is a pre-eminent site for research on the subject of Pacific Northwest forest ecosystems. It is located within the watershed of Lookout Creek, a tributary of Blue River.



Within HJ Andrews Experimental Forest, we operated at 4 field stations. Stations 1 and 2 were located on a trail that ran parallel to HJ headquarters alongside Lookout Creek. Stations 3 and 4 were located on the Discovery Trail located further upstream the Creek.

Abstract

Countering Nature Deficit Disorder in Eugene Middle School Students: Sense of Place at HJ Andrews Old-Growth Forest

Canopy Connections 2017

Children, especially those living in urbanized areas, are spending less time in nature than previous generations, resulting in what Richard Louv calls nature deficit disorder. The disorder contributes to higher levels of obesity, ADHD, and behavioral problems in school. Scholars suggest contact with natural spaces has a restorative effect on attention. As a service-learning project of the Environmental Leadership Program, the Canopy Connections team partnered with HJ Andrews Experimental Forest (HJA) and the Pacific Tree Climbing Institute to facilitate nine day-long field trips at HJA to connect middle schoolers with nature. We worked with 246 students from local middle schools, including underserved Fern Ridge, Prairie Mountain, and Blue River, as well as Ridgeline. We sought to strengthen the bonds between students and nature and strength their sense of place by introducing students to the unique qualities of old-growth forests and the Pacific Northwest. We developed and implemented lessons about biodiversity, soil composition, and watershed and topography, as well as facilitated climbs 90 feet into a 500-year-old Douglas fir to connect with the canopy. Throughout the winter we learned about Coyote mentoring, an approach to environmental education that focuses on awakening children's sensory awareness. We then integrated many of their activities and approaches into our field trip, including sit-spotting and journaling.We hope to create an ecologically enlightened generation of Willamette Valley residents who, through their reconnection with nature, will act to positively change the environment.

Sense of Place

Time
50 minutes

Location
Class room

Group
Middle School Students

State Standards
Interdependent Relationships in Ecosystems
https://www.nextgenscience.org/topic-arrangement/msinterdependent-relationships-ecosystems

Materials
- One flip-chart paper for each group
- 10 sheets of handout 1.1, 1.2. 1.3 and 1.4
- Invitation handout for each student
- Douglas fir needles for each group

Ruler for

Overview:

This activity introduces middle school students to the Canopy Connections Project and the theme of "Sense of Place". The agenda behind this pre-trip lesson is to give students an overview of their upcoming field trip, while also generating a sense of place by comparing their homes to those of the pileated woodpeckers, spotted owls, red tree vole and the northern squirrels.

Learning Outcomes:

By the end of this activity, students will be able to:

1. List three characteristics of a pileated woodpecker, Oregon slender salamander, northern-spotted owl and red tree vole's habitat.

2. List three basic characteristics of an old growth forest.

3. Describe how to prepare for hiking in an old-growth forest.

Rationale:

Over the past few decades, humans have developed a stewardship over the environment and have taken the role of the supervisors of nature. However, through this mentality we have completely disconnected ourselves from nature and have developed the idea of "us" versus "them." Through this lesson plan, students will compare their homes versus the homes of other species and develop a sense of place by critically analyzing why we differ ourselves from the environment so much. They will find that they have a lot more in common than they previously thought

Background:

Old Growth Forests: -

Old growth means a forest that has not undergone any major unnatural changes (such as logging) for more than 100 to 150 years, contains young, mature and standing dead trees (snags) and provides a home for a diversity of wildlife species.

(continued on next page)

The most important feature of an old-growth forest is its resilience. Old-growth stands that still contain all or most of the species of wildlife, fish and plants that are native to them are undergoing constant change. Natural events such as fire or windstorms can alter these forests, but they recover quickly.

Northern Spotted Owls (*Strix occidentalis caurina)*

The northern spotted owl is one of three subspecies of spotted owl. Like all spotted owls, the northern spotted owl lives in old-growth forests. Although it is often considered to be a medium-sized owl, the northern spotted owl ranks among the largest in North America. Northern spotted owls are primarily nocturnal hunters and eat flying squirrels, wood rats, mice and other small rodents. They are also known to eat birds, insects and reptiles.

Behavior/Range: -

Northern spotted owls are very territorial and intolerant of habitat disturbance. They prefer old-growth forests with tree canopies that are high and open enough for the owls to fly between and underneath the trees. Preferred areas have large trees with broken tops, deformed limbs or large holes used as nesting sites.

Each pair needs a large amount of land for hunting and nesting, and although they do not migrate, spotted owls may shift their ranges in response to seasonal changes, such as heavy snows, that make hunting difficult. Northern spotted owls have a distinct flight pattern, involving a series of rapid wingbeats interspersed with gliding flight. This allows them to glide silently down upon their prey.

Pileated Woodpeckers *(Hylatomus pileatus)*

The Pileated Woodpecker is one of the biggest, most striking forest birds on the continent. It's nearly the size of a crow, black with bold white stripes down the neck and a flaming-red crest. Look (and listen) for Pileated Woodpeckers whacking at dead trees and fallen logs in search of their main prey, carpenter ants, leaving unique rectangular holes in the wood. The nest holes these birds make offer crucial shelter to many species including swifts, owls, ducks, bats, and pine martens.

Behavior/Habitat: -

Pileated Woodpeckers drill distinctive rectangular-shaped holes in rotten wood to get at carpenter ants and other insects. They are loud birds with whinnying calls. They also drum on dead trees in a deep, slow, rolling pattern, and even the heavy chopping sound of foraging carries well. Their flight undulates like other woodpeckers, which helps separate them from a crow's straight flight path. Pileated Woodpeckers are forest birds that require large, standing dead trees and downed wood. Forests can be evergreen, deciduous, or mixed and are often old, particularly in the West

Red Tree Vole *(Arborimus longicaudus)*

The red tree vole is a mysterious rodent that lives in nests at the top of old-growth Douglas-fir trees. Their geographic range is restricted to mature conifer forests in the western Cascade and coastal regions of Oregon. Reddish-brown in color, red tree voles are similar in size to a common mouse, with their tails making up half their body length.

Behavior/Habitat: -

Red tree voles are highly specialized rodents, as they only live in tall, old-growth Douglas-firs, and the trees' needles are their only source of food. The moist conditions of their habitat make for a reliable water source for the voles in the form of dew on the needles. This species is thought to have a very limited dispersal capability (Thomas *et al.* 1993). Predators include spotted owls, raccoons, etc. Red tree voles feed on Douglas-fir needles. They also eat grand or lowland white fir, Sitka spruce, and western hemlock needles. It may eat tender bark of twigs as well as the pithy center. They usually feed inside or on top of their nest. It is nocturnal.

Oregon Slender Salamander: - *Batrachoseps wright)*

This species occurs in north-central Oregon. This is a small, slender, long-tailed species with a narrow head and short limbs relative to other species in its range. Its hands and feet are small and digits short; there are only four toes. There are 15 (rare) to 17 costal grooves. For a member of its genus it is relatively robust with moderately long limbs.

(continued on next page)

It is a dark animal with an almost black or blackish-brown ground color and an irregular dorsal band or stripe that is typically reddish brown. The sides are covered with a rich speckling of small white spots which become increasingly large ventrolaterally. The venter is covered with large separated white spots that give it a distinctive appearance.
Behavior/Habitat: -

It can be found in moist Douglas fir and mixed maple, hemlock and red cedar woodlands; it is dependent on mature and old-growth stands, commonly in large downed logs. This species also occurs in the recent lava flows near the crest of the Cascades and in second-growth forest. It is found under rocks, log, bark and moss; also found in rotting logs, in holes and crevices in the ground, and in termite burrows. Nests that have been located were found under bark and in rotten logs. It probably also lays eggs underground.

Time
10 minutes

Location
Class room

Configuration

Students will stand in a straight line

Activity 1.1:

Step 1. Introductions

- Share your name and introduce the Environmental Leadership Program at the University of Oregon and Canopy Connections to the students.
- Tell the students that in the next couple of days (Insert exact date) they will be taken up to the HJ Andrews Old growth experimental Forest. Where they will spend their day learning all about the forest, its in habitants and they will get to climb a 100+ft tall tree.
- Ask how many of them are excited?

Step 2. When were we first given a place on this planet?

- One facilitator will lead the following activity
- Students are asked to line themselves according to their birthdays without communicating verbally.
- Give an example to the class: -
  - E.g. the student born on 1st January will stand at the beginning of the line, next to that student will be a student born on 22nd January and next to them will be a student born on February 3rd and so on.
- Once students have lined up, each facilitator calls on the students that have already been put into groups by the teacher.
- There should be a total of 4 groups.
- Each group is led by the facilitator and taken into a corner of the classroom.

Time
25 mins

Location
Classroom

Configuration
4 groups

Materials
- One flip chart for each group
- One ruler for each group
- Douglas fir needles for each group
- Handout 1,1 for each student in group 1
- Handout 1.2 for each student in group 2
- Handout 1.3 for each student in group 3
- Handout 1.4 for each student in group 4

Activity 1.2: Building an Ideal Habitat

Group 1: - Pileated Woodpeckers Do not disclose their group name/ mascot (pileated woodpeckers) to the group.

- The facilitator should tell students that we will be drawing an ideal habitat for our group.
- Ask students. "How would you build your ideal human habitat?" Answers should include:

§ (Food, shelter, water, space) more over good location, size to accommodate all our needs, accessible to resources (food, bank, mail, hospital etc.), plenty of windows for sunlight, community members?...

- While students brain storm, draw a picture on the top half of the flip chart.
- Hand out handout **1.1** to each student and reveal the team mascot (Pileated Woodpeckers)
- Go around circle and ask each student to read a bullet point on handout 1.1.
- Ask students "What is the ideal habitat of a pileated woodpecker?"

Ideas include (food, shelter, water, space):

§ Large old Douglas fir trees with enough space for nesting, insects such as carpenter ants, water (nearby streams and channels).

§ Stimulate a discussion on the ecological interconnectedness of the old growth forests where pileated woodpeckers live.

- Ask students to draw a picture of an ideal habitat for the pileated woodpeckers on the bottom half of the flip chart (preferably, a picture of an old tree with a stream nearby and other insects and mammals drawn)
- Ask what our habitats and the habitats of pileated woodpeckers have in common?
- Ask students to collectively list three features of a pileated woodpecker's habitat.

§ Old growth forests

§ Large diameter snags or decaying trees for nesting

§ A dense canopy

- Reconvene with the rest of the class.

Group 2: - Spotted Owls

- Do not disclose their group name/ mascot (spotted owls) to the group.
- The facilitator should tell students that we will be drawing an ideal habitat for our group.
- Ask students. "How would you build your ideal human habitat?" Answers should include:

§ (Food, shelter, water, space) moreover, good location, size to accommodate all our needs, accessible to resources (food, bank, mail, hospital etc.), plenty of windows for sunlight, community members?...

- While students brainstorm, draw a picture on the top half of the flip chart.
- Hand out handout **1.2** to each student and reveal the team mascot (spotted owls)
- Go around circle and ask each student to read a bullet point on handout 1.2.
- Ask students "What is the ideal habitat of a spotted owl?" Ideas include (food, shelter, water, space):

§ Snags with big enough cavities for owls to nest in, availability of food (flying squirrel, red tree voles), water (nearby streams and channels).

§ Stimulate a discussion on the ecological interconnectedness of the old growth forests where spotted owls live.

- Ask students draw a picture of an ideal habitat for the spotted owls on the bottom half of the flip chart (preferably, a picture of a snag with a stream nearby and other insects and mammals drawn)

(continued on next page)

o Ask students what our habitats and the habitats of spotted owls have in common.
o Ask students to collectively list three features of a spotted owl's habitat.
§ Old growth forests
§ Snags with large holes
§ Presence of prey (Northern flying squirrels)
o Reconvene with the rest of the class.

Group 3: - Red Tree Voles

o Do not disclose their group name/ mascot (red tree voles) to the group.
o The facilitator should tell students that we will be drawing an ideal habitat for our group.
o Ask students. "How would you build your ideal human habitat?" Answers should include:
§ (Food, shelter, water, space) moreover, good location, size to accommodate all our needs, accessible to resources (food, bank, mail, hospital etc.), plenty of windows for sunlight, community members?...
o While students brainstorm, draw a picture on the top half of the flip chart.
o Hand out handout **1.3** to each student and reveal the team mascot (Red Tree Vole)
o Go around circle and ask each student to read a bullet point on handout 1.3.
o Ask students "What is an ideal habitat for red tree voles?" Ideas include (food, shelter, water, space): -
§ Large old Douglas-fir tree, water (nearby streams and channels).
§ Stimulate a discussion on the ecological interconnectedness of the old growth forests where red tree voles live.
o Ask students to draw a picture of an ideal habitat for the red tree vole (preferably, a picture of an old tree with a stream nearby and a lot of Douglas-fir trees)
o Ask students what our habitats and the habitats of red tree voles have in common.
o Ask students to collectively list three features of a red tree vole's habitat.
§ Old growth forests
§ Douglas fir trees
§ Dense and moist forests
o Reconvene with the rest of the class.

Group 4: - Oregon Slender Salamander

o Do not disclose their group name/ mascot (Oregon Slender Salamander) to the group.
o The facilitator should tell students that we will be drawing an ideal home for our group.
o Ask students "How would you build your ideal human habitat?" Answers should include:
§ (Food, shelter, water, space) moreover, good location, size to accommodate all our needs, accessible to resources (food, bank, mail, hospital etc.), plenty of windows for sunlight, community members?...
o While students brainstorm, draw a picture on the top half of the flip chart.
o Hand out handout **1.4** to each student and reveal students their mascot (Oregon slender salamander)
o Go around circle and ask each student to read a bullet point on handout 1.3
o Ask students "Ask students what is an ideal habitat for Oregon slender salamander?" Ideas include: Ideas include (food, shelter, water, space): -
§ Old forests with fallen decaying logs (nearby streams and channels) etc.
§ Stimulate a discussion on the ecological interconnectedness of the old growth forests where northern flying squirrels live.

(continued on next page)

○Ask students to draw a picture of an ideal habitat for the Oregon slender salamander, based on the student's suggestions (preferably, a picture of a nurse log with cavities, a bird's nest, a stream nearby and other insects and mammals drawn)

○ Ask students what our habitats and the habitats of northern flying squirrels have in common.

○ Ask students to collectively list three features of a Oregon slender salamander's habitat.

§ Old growth forests

§ Decaying logs

§ Moist conditions

○ Reconvene with the rest of the class.

Time

10 minutes

Location

Classroom

Configuration

In former groups

Wrap Up

Assessing Understanding

○ All four groups will share the 3 features of their mascot's habitat with the rest of the class.

○ Students will also share what they learnt about old growth forests by exploring their mascot's habitat.

Trip Preparation: -

○ Ask the students how they should prepare for their field trip.

§ Physical things: rain coat, close toed shoes, lunch, snacks, water (demo this if possible)

§ Mental state: open mind, thirst for adventure, willingness to try something new

Additional Reading/Resources

http://www.oregonwild.org/oregon_forests/old_growth_protection/what-is-an-old-growth-forest (Old growth Forests)

http://www.oregonwild.org/wildlife/red-tree-vole (Additional Information on the Red Tree Vole)

https://www.allaboutbirds.org/guide/Pileated_Woodpecker/id (Pileated Woodpeckers, as a keystone specie)

http://www.iucnredlist.org/details/59134/0(Oregon Slender Salamander)

http://www.defenders.org/northern-spotted-owl/basic-facts (Spotted Owls)

https://www.ted.com/talks/suzanne_simard_how_trees_talk_to_each_other

Handout 1.1

Woodpecker, pileated

(Dryocopus pileatus)

Status: State (ODFW): Strategy species

Range: Older forests in the Blue Mountains, East Cascades, West Cascades, Klamath Mountains, Willamette Valley and Coast Range ecoregions.

Description: Large, 18-inches long, black and white with a white head and red crest. Males have red "moustache" extending back from the bill.

Diet: Primarily carpenter ants, also other ants, beetles, termites and some fruits and nuts. Finds insects by making large rectangular excavations, usually in large diameter dead or downed trees or logs.

Habitat: Uses older dense mixed conifer forests or deciduous stands in valley bottoms. Requires large diameter snags or decaying live trees for nesting, foraging and roosting. A dense canopy protects them from predation. Home ranges 650 acres to more than 2,000 acres.

Principal predators/threats: Susceptible to predation from large forest hawks, snakes and squirrels. Habitat loss is significant threat in Oregon. Removal of large diameter trees and snags, downed woody material and canopy cover makes habitat unsuitable for this species and makes it more vulnerable to predation.

Reproduction: Both parents excavate a nest cavity and incubate a clutch of four eggs. The pair defends a territory year round.

Did you know… The cavities excavated by this woodpecker are used by other forest species for nesting and roosting.

Forestry, Oregon Department of. Identifying Priority Plants & Animals and Their Habitats: A Guidebook for Forest Landowners. Portland, Or.: Oregon Forest Resources Institute, 2006. Print.

Handout 1.2

Owl, spotted

(Strix occidentalis)

Status: Federal (USFWS): Threatened
State (ODFW): Threatened;
Strategy species

Range: Coast Range, Klamath Mountains, West Cascades and East Cascades ecoregions.

Description: A large 18-inch dark brown owl with dark eyes and white spotting on the breast and abdomen. Looks similar to the barred owl and in some places occupy the same habitat. The barred owl has white vertical bars on the breast while the spotted owl has white spots.

Diet: Mainly small forest mammals, especially flying squirrels, woodrats and red tree voles. Occasionally small birds and insects.

Habitat: All coniferous forest types at low to mid elevations in western Oregon. Most abundant in mature to old-growth forest habitat. In younger forests, often associated with remaining older patches. Home range from 3,000 to 4,500 acres.

Principal predators/threats: Great horned owls, northern goshawk and the barred owl. The larger barred owl is often more successful at competing for limited habitat. The barred owl may also hybridize with spotted owls. Loss of older forest habitat threatens this species.

Reproduction: A clutch of two to four eggs, usually two, is laid in a cavity or on a platform. The male brings food to the incubating female and the newly hatched young. Young leave the nest about five weeks after hatching, but remain on the parents' territory until September or October. Young may not breed for several years. Many adults do not breed every year.

Did you know… Spotted owls are particularly tame and will allow humans to approach within a few feet.

33

Forestry, Oregon Department of. Identifying Priority Plants & Animals and Their Habitats: A Guidebook for Forest Landowners. Portland, Or.: Oregon Forest Resources Institute, 2006. Print.

Handout 1.3

Vole, red tree

(Arborimus longicaudus)

Status: Federal (USFWS): Species of concern
State (ODFW): Strategy species

Range: Western Oregon, including the Coast Range, West Cascades and Klamath Mountains ecoregions. Distribution is becoming increasingly discontinuous with the fragmentation of late-successional forests.

Description: This medium-sized vole is bright orange-red to cinnamon on top and silvery gray underneath. Its tail is generally more than 50 percent of the length of the body.

Diet: Feeds almost exclusively on Douglas-fir needles, but also eat needles of other conifer species and occasionally the bark or interior of twigs.

Habitat: Found in dense, moist coniferous forests that contain sufficient numbers of Douglas-fir trees. Some habitat requirements, including minimum patch size of suitable habitat to maintain colonies, are not currently known.

Principal predators/threats: Primarily owls and possibly other forest raptors. Much of its preferred habitat has been lost and continues to decline due to logging. Has disappeared from some local areas. The species disperses slowly and with limited capabilities. Early seral stage forests may be a barrier to dispersal.

Reproduction: Breed throughout year. Build nests of Douglas-fir needles about 50 feet above the ground. Relatively low reproductive rate, producing two or three young per litter.

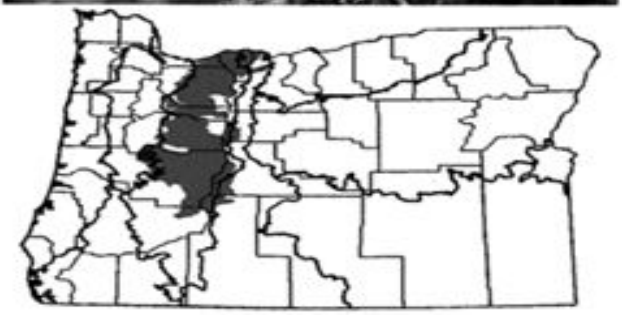
Did you know... This species spends its entire life in the tree canopy and is a major prey item of the spotted owl in some areas. Darker forms of this species (sometimes called the dusky tree vole) occur in northwestern Oregon.

Forestry, Oregon Department of. Identifying Priority Plants & Animals and Their Habitats: A Guidebook for Forest Landowners. Portland, Or.: Oregon Forest Resources Institute, 2006. Print.

Handout 1.4

Salamander, Oregon slender

(Batrachoseps wrightorum)



Status: Federal (USFWS): Species of concern
State (ODFW): Strategy species
ORNHIC/NatureServe: G2

Range: West Cascades from the Columbia River south to southern Lane County. More recent records from the East Cascades in western Wasco County

Description: A small slender long-tailed species, less than four inches long. Black or blackish-brown with an uneven-edged, reddish-brown stripe on its back.

Diet: Small invertebrates, such as spiders, mites, springtails, beetles, centipedes, snails and earthworms.

Habitat: Most commonly found under bark or moss in stable, mature second-growth and old-growth forests with many large old logs and snags. Also in talus and lava fields with abundant woody debris. Late-successional forests support approximately twice as many individuals as young forests.

Principal predators/threats: Mammals, birds and snakes. Can disappear after clear-cutting or thinning. Forests intensively managed on short harvest rotations without many large logs and snags may not support self-sustaining populations.

Reproduction: A clutch averaging six eggs is laid in spring hidden under bark or in rotten logs. The female guards the eggs until they hatch in about four months.

Did you know… When uncovered, this salamander often coils into a tight spiral and, if further disturbed, may flip about suddenly by uncoiling.

Forestry, Oregon Department of. Identifying Priority Plants & Animals and Their Habitats: A Guidebook for Forest Landowners. Portland, Or.: Oregon Forest Resources Institute, 2006. Print.

Arrival and Orientation

Time
30 minutes

Location
Parking lot pavilion

Group
All middle school students

Materials
- ❑ Hard hats in four colors
- ❑ Masking tape
- ❑ Permanent markers

Step 1: Assign Instructor Roles

- There needs to be one greeter, one bathroom coordinator, one chaperone coordinator, and one energetic leader to gather kids and entertain them until we are ready to begin. The greeter will need a walkie talkie in conjunction with another instructor to communicate if a logging truck is coming down the hill when the bus arrives at the HJ Andrews Experimental welcome sign.
- While waiting for the bus to arrive, write down the names of students on the masking tape and assign each name to a hard hat. There should be four groups (red, yellow, green, and blue) with equal number of students, about 6-9 in each group.

Step 2: Bus Arrivals

- After waiting at the welcome sign, the greeter will get onto the bus and direct the driver to the appropriate parking area. The greeter will also collect the PTCI waivers.
- All chaperones will meet with the chaperone coordinator to have introductions and a run down of expectations and guidelines.
- The greeter will direct students to put down their belongings and put on the hard hat with their name on it.
- The bathroom coordinator will gather all students who need to use the restroom and will lead the students to the facilities before gathering by the pavilion with the other students.
- For all students who do not need to use the bathroom, the greeter will direct them towards the pavilion and main lawn to meet with the energetic leader. The energetic leader will be responsible for entertaining and organizing students until everyone has gathered.

Step 3: Run Down of the Agenda

- Circle everyone up and lead them in a few deep breaths to center ourselves.
- Go over the agenda for the day:

  9:00 - 9:30 Arrive at HJA, break into four groups
  9:30 - 10:45 Rotation 1
  10:45 - 12:00 Roation 2
  12:00 - 12:30 Group Lunch (everyone brings their own)
  12:30 - 1:45 Rotation 3
  1:45 - 3:00 Rotation 4
  3:00 - 3:15 Wrap, Students leave HJA

- Introductions will be made so the students can meet the PTCI and HJ Andrews Staffers present
- Concepts for the day will be discussed- Biodiversity, Soils, Tree Climbing, and Watershed Topography

- After the agenda is shared, students will be broken up into their groups for the day

Step 4: Individual Groups

- Instructors will introduce themselves to the students they will be leading
- Guidelines and group expectations will be established-
- Guidelines and expectations include-
    - Stay on the paths
    - Stay close to your instructors and chaperones, follow their directions
    - Be respectful of each other and nature
    - Questions are encouraged, ask them if you have them
    - Once rules and introductions have been made clear, the groups are free to travel to their first station.

** In the event of early or late arriving busses, changes or additions to this blueprint will be needed on a case-by-case basis.

Elevating Knowledge

Time
75 minutes

Location
Station 4

Group
6-10 Students

Subject Areas
Natural Sciences
Social sciences

State Standards
MS-LS2-1: Interdependent Relationships in Ecosystems Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.

Concepts
Hydrology, topography, forest biology

Materials

- ❑ Laminated Topographic Activity Worksheets - 1 per Student
- ❑ Wax Crayons- 1 per Student
- ❑ Skin Safe Pens - 1 per Student
- ❑ Quest Instructions
- ❑ Tree identification guide

Overview:

This activity introduces middle schoolers to local topography and watersheds using mapping and questing activities. Following Canopy Connection's theme of "Sense of Place," students will learn about the geography of HJ Andrews, local watersheds and develop navigation skills. The quest teaches about the structure and function of old growth forests while helping students advance their use of maps and clues to navigate an area.

Learning Outcomes:

By the end of this station, students will be able to:

1. Analyze a topographic map and discern features such as slope, elevation and watershed.
2. Combine navigation skills, the ability to read a map and the ability to notice smalls details in their surrounding environment.

Rationale:

Learning the basics of reading topographic maps and understanding watersheds is valuable when developing a sense of place. An introduction to maps of HJ Andrews Experimental Forest develops an understanding of where students are during the field trip and opens up the options for middle schoolers to further their outdoor knowledge in the future. Learning navigational skills can help reduce the fear of getting lost that can keep some from trying to engage with the natural world. It is important to study the geography of HJ Andrews since it is part of the Mckenzie River watershed, which provides the water for Eugene and Springfield. When making a physical connection to the water sources that impact our everyday lives, we enhance our understanding of our environment and our responsibility to protect it.
Quests are an excellent educational tool to use on a field trip since students engage with the challenge of a treasure hunt and also learn through hands-on activities that promote critical thinking and observation skills.

Background:

Topographic maps show a 3D representation of the shape of the Earth's surface. They provide a method of analyzing factors such as slope and elevation which can influence natural factors such as water quality, biodiversity, soil composition and disturbance events such as landslides and flooding. Topographic maps are useful in assessing where human-made structures can be built in an environment, such as finding the best path for a railroad track or hiking trail. In addition, topographic maps can be used to identify areas for potential urban growth, determine environmental threats and study the physical landscape.

Watersheds are ridges of land that separate two drainage areas where water flows down to a larger body of water, such as rivers, lakes and oceans. Watersheds are important to understand for humans since water is a precious resource and knowing where water is coming from is crucial.

Activity 1. Getting Started: Introduction - 5 minutes

Instructors introduce themselves and frame upcoming activities by asking questions

- Where you are sitting right now? (In a stream bed)
- (If the stream bed is dry) How can you tell? There is sediment on the ground without vegetation, large rocks along the river bank.
- Where would the water that runs to this stream bed come from? Higher elevations above where we are sitting.
- Do you know where your water that you drink, cook and shower with at home comes from? The McKenzie River
- How long can humans live without water? 3 to 8 days

Activity 2. Topography, Watershed and Mapping Lesson - 10 minutes

- Use poster to go through lesson on both topics, having students teach you what they already know about the subjects.
- Go over the diagrams of the water cycle, show where HJA is on the maps.
- Explain how all the rain and snow melt drains into the McKenzie River, which Eugene purifies and uses as their water source.

Activity 3. Worksheet Practice - 10 minutes

- Have students work on Worksheets 1 and 2 on their own using the wax crayons.
- Go over the answers as a group and make sure each student understands why the correct answers are right.
  Handout 1 Answers: 1. B 2. E 3. D 4. C 5. F 6. A
  Handout 2 Answers: 1. B 2. B 3. 10 Feet 4. A = 40 feet, B = 50 feet 5. B

Activity 4. Topographic Map on Hands Activity - 5 minutes

Have students make a fist and notice the four ridges (knuckles) on their hand. Explain how these ridges are just like hills on a topographic map and that we will be making a topographic map of our hand. Everyone will be using their non-dominant hand as the hills, and their writing hand to draw contour lines on their hand, showing the elevation change between their hand and the top of their knuckles. Complete the activity with the students. After the students are done, have them flatten their hand to see what their own topographic map looks like. Example: Insert Own Photos

Activity 5. Exploration Activity - 10 minutes

- Have students explore their surroundings, within boundaries and on the trail, and write down or draw 10 things they found interesting or new.

Activity 6. Questing Activity - 30 minutes

- Introduction to the Quest.
- Students follow the instructions of the Quest Handout which will lead them through questions, reflections and activities. Each stage has a letter and when you put all of these letters together the quest theme is spelled out.
- Establish boundaries and ground rules for the quest.
- Talk to chaperones, tell them to be stationed at both ends of the path. If there is only one, have him or her staged at the beginning.
- Explain that kids will be staggering their starting. Tell them to wait a minute or two after the group before them has left before they go.
- Divide the students into pairs, try to find kids that complement each other well.
- Have the chaperone handout one quest and tree id guide to each pair just before they are starting.
- Students start. If there is a chaperone on either side then you can walk around and answer questions. If there is only one chaperone then you should keep an eye on the kids who are the furthest along in the trail.
- See pages 10 and 11 for the quest and tree identification guide..

- Answers for the quest (clue letter is underlined). *note on stages 6 and 9 the answers are already given and underlined within the quest handout.

Stage 1. Habitat
Stage 2. Symbiosis
Stage 3. Soil
Stage 4. Douglas fir
Stage 5. Fungi
Stage 6. Variation
Stage 7. western hemlock
Stage 8. Diverse
Stage 9. Structurally diverse
Stage 10. Disturbance
Stage 11. Thuja plicata
Stage 12. Pacific yew
Together: biodiversity

- The students should all end near the river. Either a chaperone or you yourself should be with them. In order to keep kids that have finished busy you can talk to them about the stream, retouch on the watershed. Stress that they cannot go near the stream, or onto the logs that cross the stream. This could be a time for a sit spot. The river is a nice environment for that.

Activity 7. Wrap Up - 5 minutes

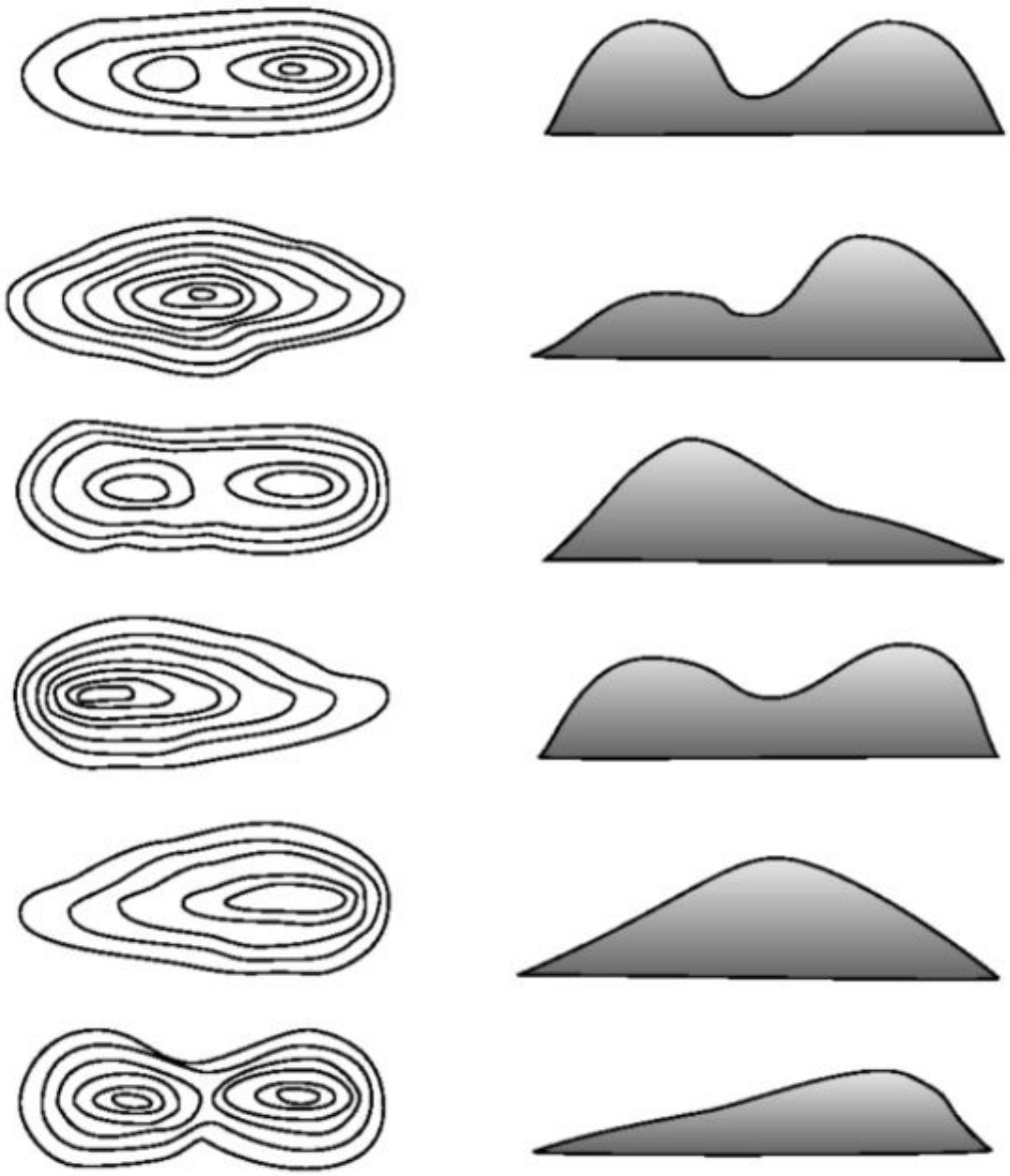
- Discuss what the experience of using a map and completing a quest was like. Open it up to their questions and comments. Example question the teacher can throw in:
- Did you notice anything new about this area that you would not have realized without using your map and exploring it?

Additional Reading/Resources

USGS has a wide variety of topographical maps as well as exercises and lesson plans that teachers can use to continue to teach about geography and watersheds.
https://education.usgs.gov/lessons/mapresources.html

Handout 1

Contour Matching Worksheet

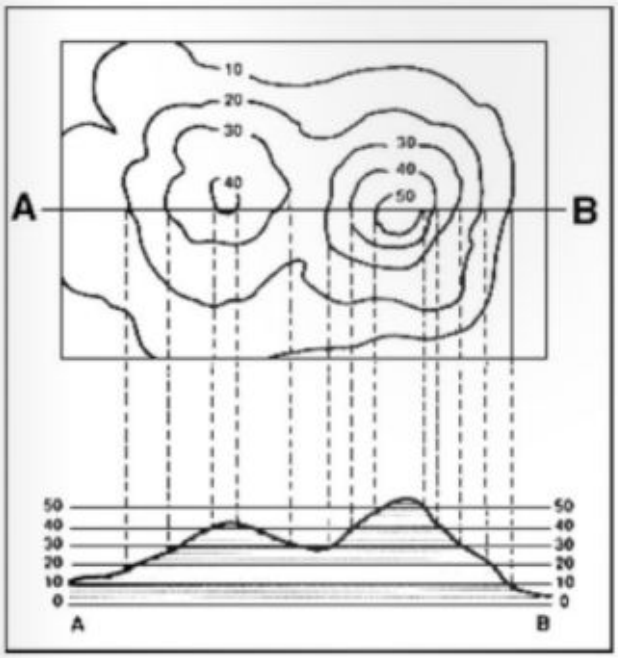


Handout 2

USGS
science for a changing world

Activity Sheet #4–How to Read a Topographic Map

One special kind of map is called a **topographic map**. It has contour lines to show the shape and elevation of the land. They are sometimes called "level lines" because they show points that are at the same level. Here's how contour lines work:



The top of this drawing is a contour map showing the hills that are illustrated at the bottom.

On this map, the vertical distance between each contour line is 10 feet.

1. Which is higher, hill A or hill B? _____

2. Which is steeper, hill A or hill B? _____

3. How many feet of elevation are there between contour lines? _____

4. How high is hill A? _____ Hill B? _____

5. Are the contour lines closer together on hill A or hill B? _____

Front of Quest Instructions

HJ Andrews Discovery Trail Quest.

Stage 1: Take a deep breath and notice how many different forms of life are around you.
For all of these organisms, this forest is called their: _____
The third letter of this word is the first clue letter.

Stage 2: The path that goes east of the washed out creek is your starting point. Walk 15-20 paces to a group of 3 conifer trees. On the forest floor is a green, rag-like lichen. This partnership between algae, fungi and bacteria is an example of this 9 letter biology term: _____
The fifth letter of this word is the second clue letter.

Stage 3: In 4 bends stop at a tree several feet in diameter that is oozing sap. Just past this giant tree, two logs are decaying. In areas like this the cyanide millipede is a crucial part of the ecosystem. By breaking down dead organisms the millipede helps replenish this living network that sustains forest life:
_____ The second letter of this word is the next clue letter.

Stage 4: Follow 2 more bends and reach another large tree with deeply grooved bark. What is this tree's common name? (hint – your key might help, look for leaves and cones on the ground nearby)
_____ The first letter of its name is the next clue letter.

Stage 5: Walk past another massive old tree and in 5 more paces you will come to a fallen tree. Upon its face are more than a dozen fleshy mounds. What kingdom do these creatures belong to?_____
The fifth letter of the kingdom name (in its plural form) is the next clue letter.

Stage 6: Walk about 30 paces. In this area find three seed cones from a Douglas fir. Notice how these cones are similar and different. This exhibits how much variation exists within one species. The first letter of this word is the next clue letter.

Stage 7: In 7-10 paces you will come to a bend in the path where two large logs meet. Investigate the small young evergreen trees that sprout from these logs. What species is this? _____
The second letter of its common name is the next clue letter. In addition, you might ponder why this species may be the most common type of tree to grow on logs like this.

Word Bank

diverse	western redcedar	protists	incense cedar	soil
symbiosis	habitat	disturbance	algae	Pacific yew
destruction	Douglas-fir	endocytosis	fungi	western hemlock

Back of Quest Instructions

Stage 8 There are millions of tiny organisms that live in these logs, from microbes, to to tiny insects, to the occasional small mammal or rough skinned newt. These logs are very _____ habitats. The third to last letter of this word is the next clue letter.

Stage 9: From here to where the trail forks observe or sketch an example of each of these characteristics. An old tree; woody debris; the canopy layer of a tree; a snag (standing but dead tree). A forest that contains all of these elements is called structurally diverse. The first letter of this phrase is the next clue letter.

Stage 10: Take a right at the fork. Within 20 paces there is a clearing where several trees have fallen. Less shade-tolerant plants and shrubs have a chance to sprout here. Do you see any? What is the general term for an event that dramatically changes the ecosystem?

_____ The second letter of this word is the clue letter.

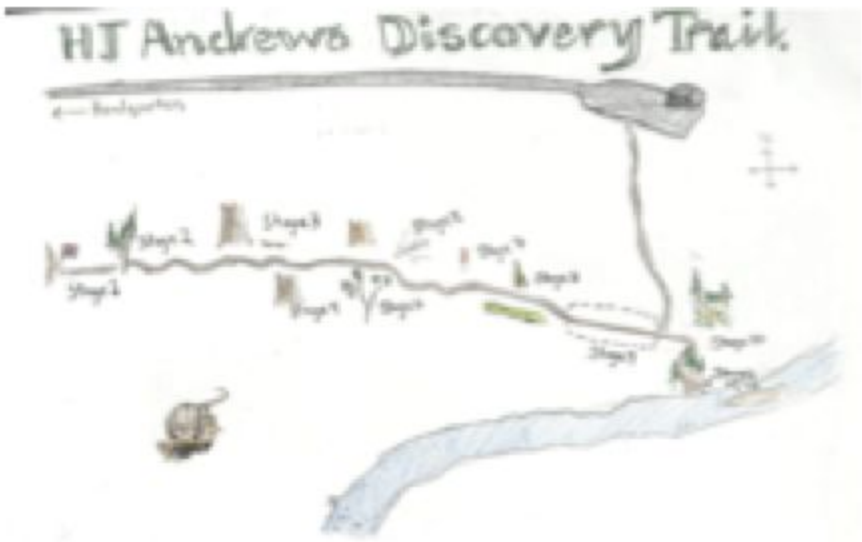
Stage 11: Round the bend and walk down the slope. Once you reach level ground stop at a tree several feet in diameter. Right before the river bank is a grove of six trees. Walk 7 paces to the tree on the far right with buttressed roots. What is the scientific name of this tree? _____

The first letter of its name is the next clue letter.

Stage 12: Take 4 paces to the northeast and stop at a tree 6-8 in in diameter with many needle-bearing shoots sprouting from its trunk. Identify this tree by its common name. The first letter in the second word of its name is the final clue letter.

You now have all of the clue letters. In order they spell out what word?

_____



Tree Identification Key

1. If the leaves are needle-shaped or scale shaped. **Go to 2.**

1. If the leaves are broad. **This is a hardwood, not what you are looking for.**

2. If the leaves scale shaped and the fruit is a cone. **Go to 3.**

If not go here.

3. If the pattern of scales looks like a braid and the cones are small and round, then you have found: **western redcedar,** *Thuja plicata*

3. If the scale pattern looks like overlapping long wineglasses and the cones are large with three distinct parts shaped like a ducks bill, then you have found:

incense cedar, *Calocedrus decurrens*

2. If the leaves are needle shaped. **Go to 4.**

4. If the leaves are in two rows, the bark is red and there aren't white stripes or marks on underside of the leaves, then you have found:

Pacific yew, *Taxus brevifolia*

If not go here

4. If the leaves are scattered around the twig or are not in two uneven rows, and the fruit is a cone. **Go to 5.**

5. If the needles are equal lengths and arranged in a circle around the stem and the cones have three-pronged bracts that look like mouse feet then you have found:

Douglas-fir *Pseudotsuga menziesii*

5. If the needles aren't all the same length and the cones are small and round then you have found:

western hemlock, *Tsuga heterophylla*

Sacred Soil: A Place of Origin

Developed by:
Jordan Morales,
Evan King

Time
75 minutes

Location
Station 2

Group
4-8 Students

Subject Areas
Natural Sciences

State Standards
MS-LS2-1: Interdependent Relationships in Ecosystems Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.

Concepts
Soil structure, plant nutrients

Materials
- ❑ Electronic pH tester for soil
- ❑ 5 Clear jars containing organic material, topsoil, subsoil, clay, and rock
- ❑ Sit pads 1 per student
- ❑ Journals
- ❑ Pencils

Overview:

This lesson introduces middle school students to the important role of soil in forest ecosystems. Our activity focuses on soil characterization which is a part of long term ecological research (LTER) projects that are ongoing at HJ Andrews Experimental Forest.

Learning Outcomes:

By the end of this activity, participants will be able to:

1. Articulate the 5 major components of soil, (air, water, minerals, organic material, and microorganisms)
2. Name the 4 macronutrients that are important for healthy soil.
3. Describe the connection between fertile soil, healthy plants, and clean air and water.

Rationale:

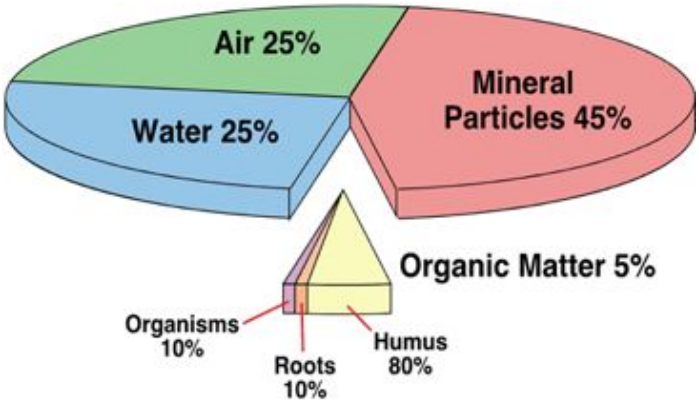
In this lesson, students will learn the physical makeup of the soil beneath their very feet! Soil is the foundation of life on land, and is the fundamental element that allows terrestrial beings to flourish. Students will gain valuable knowledge about soil nutrients and where the nutrients form in an old growth forest. Throughout the lesson students will learn why healthy soil improves the wellbeing of plants, animals, and people. Nutrient rich soil is full of microorganisms, minerals, air, water, and organic material. These five essential ingredients are responsible for the growth of the huge Douglas-fir trees found in HJ Andrews, as well as all the other plant life which thrives there. Healthy plants are able to remove toxins from the air and water by efficiently absorbing pollution. Learning about all that soil provides is a great way to form a bond between students and the places they live and visit. Forming this connection is a powerful way to encourage proper stewardship of the land we rely on so much.

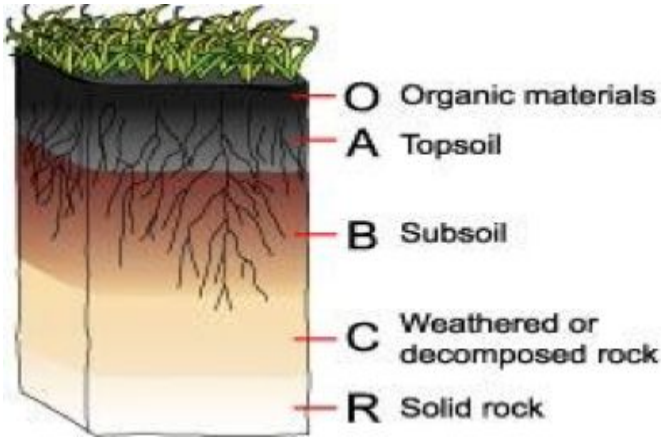
Background:

Soil contains the nutrients that plants need to grow. It has the amazing ability to anchor plant roots to the Earth, and provides a habitat for billions of microorganisms. Healthy soil that supports the most plant growth is comprised of 5 main parts, some of them organic, (living) and some of them inorganic, (non-living). The organic parts make up only 5% of the total soil volume. Organic material includes things like dead animals, leaves, sticks and microorganisms. The term humus, (Say "hew-mis") is used to describe the decomposed plant and animal matter that is rich with nutrients. The inorganic parts make up 95% of the soil volume. The inorganic parts include water, which makes up 25%, air 25%, and minerals 45%.

If we focus on the largest piece of the pie, the 45% mineral piece, we learn that it is made up of 3 potential parent minerals. These are sand, silt, and clay. A ratio of 40% sand, 40% silt, and 20% clay makes up an ideal soil mixture to support plant growth. This ideal mixture is known as loam. The important inorganic plant nutrients are formed during the decomposition of organic material and their names can be found on a periodic table of the elements! The primary macro nutrients that are important for soil fertility are Nitrogen (N), Phosphorus (P), Potassium (K), and Calcium (Ca). Nitrogen is a part of all protein and living cells.

N increases leaf area which means more photosynthesis and more succulent and dark green leaves. If there is too much nitrogen, it will delay the ripening of fruit, weaken plant stems, and make the plants more susceptible to pests. P promotes balanced healthy growth. It enhances strong root development, flower and seed formation, and promotes vigor and disease resistance. K is good for all around plant health. It balances nitrogen and phosphorous. Ca builds cell walls and promotes the growth of beneficial bacteria.





A soil profile boiled down to its basic form consists of 5 common layers denoted by the letters O, A, B, C, and R.

- **O- Organic** material aka leaf litter. This is the **uppermost layer** of soil and the one visible to the eye. This layer includes things found on the forest floor such as twigs, leaves, decaying plants and animals.
- **A- Top soil layer**. This is a layer rich in nutrients, where plant seeds germinate and begin to grow. Roots penetrate this layer.
- **B- Subsoil layer**. This layer contains a mix of broken down rocks with a small amount of organic material. Some plant roots venture into this layer because it is home to many minerals.
  - Most of the plant activity occurs in the A layer and the upper portions of the B layers, however the lower levels of soil form a foundation upon which the upper layers form.
- **C- Weathered Rock Layer** that lacks organic materials. This is a very rocky and clay like layer that is less permeable than the upper layers. Plant roots rarely will reach this deep into the soil.
- **R- Rock Layer**. this is the layer that is at the **very bottom** of soils. The bedrock layer.

A pH value is a number from 1 to 14 that describes the acidity or alkalinity of a solution or soil. A pH of **less than 7** is **acidic** and a pH of **more than 7 is alkaline**. A pH of **exactly 7 is known as neutral**. pH is important because different plants prefer different pH levels. An easy way to remember this is by thinking of people swimming in a pool. One person will most enjoy swimming in very warm water, while another may prefer it to be cooler. Similarly, plants species have a preferred pH level. Some species may prefer slightly acidic soil, while others prefer slightly alkaline. Plants are resilient and can grow well in a range of pH levels, but it is worth remembering that there is an optimal pH range for each species of plant to reach peak growing potential.

Activity 1: Build a soil profile - 35 minutes

Step 1: Gather students in a circle around the soil jars. Use the same sitting materials from the sit spots for students to sit or kneel on.

Describe the work that H.J. Andrews undertakes regarding soil. Currently their work and research consists of:

o Identifying and mapping soil types within HJA in order to produce a standard soil survey that will be placed within the US system of soil taxonomy

o Nitrogen fixing potential of soil

o Dr. Elizabeth Sulzman. Dept. of Crop and Soil Science, OSU studies the carbon storage potential of soil

o Connections between forest harvesting and erosion

*Frame the activity as doing the same work that HJA researches are performing:

o "Today we are going to examine some soil samples and describe their characteristics before they get mapped, just like the real HJA team. To do this, we are going to examine soil profiles. Soil profiles are stacked vertical layers of soil with unique characteristics"

Step 2: Examine jar 1

Open the jar and pass it around between students,

- Ask students to make an observation about the contents just from looking at the materials.
- Have the students take turns holding and smelling the materials.

Have students verbally share their observations.

Step 3: Ask these questions about jar 1.

Q: How do plants and animals at the surface interact with soils?

A: Plants and animals take up nutrients to fuel their activity, and when these organisms die they decompose so other plants and animals can use their nutrients. This nutrient cycle is important for a sustainable ecosystem where there is a balance between nutrients supplied and nutrients demanded.

Q: What type of things break down plants and animals on the forest floor?

A: Fungi, algae, lichens, microorganisms, cyanide millipedes, other insects.

· When students are finished examining materials, pour materials back into jar.

Step 4: Repeat step 2 with jar 5, then ask these questions.

Q: Where do you think the rock layers are located within soil profiles?

A: The bottom, think of Earth's crust.

Q: What role does the rock layer have in soils?

A: Rock provides parent material; when rocks erode soil forms from small pieces of the original rock. Roots of the old growth trees help to create soil by breaking up the parent material into smaller parts.

- When students are finished examining materials, pour materials back into jar.

Step 5: Repeat step 2 with jar 2, then ask these questions.
Q: This jar smells much more than the other samples, why do you think that is?
A: High organic material content.
Q: What characteristics stand out in this sample?
A: Highlight the small pieces of bark and dark color, signs of high organic material. Also highlight the fluffiness, which is important for allowing air and water through.
Q: Why does it matter if air and water can move through soil?
A: allows for roots to grow and absorb nutrients and water.
When students are finished examining materials, have students pour material back into jar.

Step 6: Repeat step 2 with jar 4, then ask these questions.
Q: How would you describe the texture from this sample?
A: This is a thick rock layer, this has to do with soil sticking together and clumping.
Q: How does thick and clumping soil affect plant growth?
A: More difficult for water and roots to pass through it, difficult to grow many healthy plants.
Q: This sample is lighter in color than the black jar, why do you think that is?
A: Lower organic material.

- When students are finished examining materials, pour materials back into jar.

Step 7: Repeat step 2 with jar 3, then ask these questions.
Q: Does this sample look familiar?
A: It should, this is called a subsoil layer that is often the middle ground between rich topsoil and very rocky clay filled soils, containing characteristics of layers on top and below it.
Q: What do you think happens in this layer?
A: Only very large and strong plants have root systems in this layer; it mostly acts as a middle ground

- When students are finished examining materials, pour materials back into jar

Step 8: Once all jars have been shown, have students balance the jars on top of each other in order to create a soil profile.

- The correct order on the tops of the jars 1-5
  - If students fail to get order correct, explain to them that soils typically have lower nutrients and air content as you go down

Step 9: Ask the students, "Do you know any other factors that influence plant growth?" Bring up the concept of pH.

- Ask for a student to define pH, (A measurement of how acidic or alkaline something is).
- Ask for a student to describe how pH might affect plant growth in soil, (Specific plants prefer a specific range of pH levels in order to maximize their growth).

Explain that pH can be tested with an electronic machine like the one we have.

- Pass around the pH testing device so all the students can examine it.
- Insert the device into the soil and wait 60 seconds for it to measure.

Have the students examine the measurement to determine if the soil is more alkaline or acidic.

Step 10: Assess understanding by,

- Have students write down the 5 essential components for a healthy soil
- Take a survey of the students who know the proper layering of a soil profile by:
  - Ask students to hold up a number between 1 and 5 on their fingers, 1 being the top most layer and 5 being the bottom.

Ask, "which layer is topsoil?" (2), "Which layer is Organic matter?" (1), "Subsoil?" (3), "Rock?" (5), "Clay?" (4).

Activity 2: Sit Spot and Journaling - 25 minutes

Adapted from: Haas, Ellen, Richard Louv, Evan McGown, and Jon Young. *Coyote's guide to connecting with nature*. Shelton, WA: OWLink Media, 2010. Print.

Step 1

- Ask students, "Who likes to wander or sit in natural places?" "Does anyone keep a journal to record things they see, hear, and smell?" Encourage students to experiment with their sense of touch and to journal about the amazing old growth forest!
- Demonstrate a crow call, explain to the students that when they hear the crow call that they are to return back to the group.
- Distribute journals if the students do not already have them; also distribute pads for students to sit on.
- Establish ground rules: don't distract one another, stay on the path, stay quiet to hear the sounds of the woods.
- Allow students to spread throughout the area so that they cannot see or hear each other.
- Take 20 minutes to sit spot, actively monitoring behavior without being a distraction. *20 minutes based on suitable weather, if weather is not conducive to sit spotting suggest standing and making observations instead.

After 20 minutes, crow call to gather the students into a group to reflect on the journaling activity, ask students to share their "story of the day"

Flora and Fun-a!

Time
75 minutes

Location
Station 3

Group
6 middle schoolers

Subject Areas
Language Arts
Natural History

State Standards
MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Concepts
Biodiversity

Materials
4 bandanas
Pens/Pencils
Journals
Ellie's Log

Overview

This lesson introduces middle schoolers to the biodiversity of the Pacific Northwest old growth forests. Through team building games, storytelling, and an exploration hike, they will gain plant identification skills and learn historical and contemporary significance.

Objectives

By the end of this activity, students will be able to:

1. Define biodiversity and why it is important
2. Identify a Douglas-fir, Sword fern, Oregon grape, and Western Red Cedar.
3. Identify red tree voles, spotted owls, pileated woodpeckers, and carpenter ants.
4. Describe at least one modern and one historical use of Douglas-firs, Sword ferns, Oregon grape, and western red cedars.

Rationale

Oregon embodies the rich, pioneering spirit of the Pacific Northwest in not just its human dwellers, but also its native flora and fauna inhabitants as well. To truly enjoy and understand the privilege in being surrounded by such breathtaking biodiversity, this lesson explores how deeper understandings of nature provide deeper connections to the environment. Keeping with the "Sense of Place" theme, this lesson will ground students and tie them directly to the forest by being able to name the plants that surround them and the interconnectivity of forest life. A student's ability to identify plants as well as their historical significance directly affects how connected they feel to those plants. Students will feel inspired to preserve and study the biodiversity of not just old growth forests, but biodiversity throughout the world as well.

Background

Alternate: an arrangement of leaves (or buds) on a stem (or twig) in which the leaves emerge from the stem one at a time. This often makes the leaves appear to alternate on the stem..
Opposite: an arrangement of leaves (or buds) on a stem (or twig) in which the leaves emerge from the stem in opposing pairs.
Palmate: (a leaf) having several lobes, emerging from a common point (like your hand)
Pinnate: (a leaf) shaped like a feather, with parts arranged symmetrically around an axis.
Scaly: having scales, like a snake, flaky.
Nurse log: a decomposing tree, usually horizontal and covered with new life
Snag: a standing dead tree.
Spore: reproductive body produced by plants, fungi, and some microorganisms and capable of development into a new individual
Biodiversity: This station should help students recognize the biodiversity of the old growth forest. We have included not just mammals and trees, but birds, insects, and leafy shrubs in our array of key species. Especially for the animals in this section, interdependence is paramount. These species rely on one another for survival and the presence of each synergistically makes a healthier environment. Each species has a role within the environment that allows it to function as a whole. Remove just one of these species and the entire system suffers. This is the importance of biodiversity.

	The **Douglas-fir** (*Pseudotsuga menziesii*) is the state tree of Oregon and is most easily recognized by its groovy bark, straight shape, and uniform needles. Historically and modernly, these trees are logged for their desirable straight wood. They might be used for housing, construction, or furniture. A tea can also be made out of young needles.
	**Oregon grape** (*Mahonia aquifolium*) is most easily identified by its leathery, dark green leaves, which have spines on the margins. These leaves are pinnate and opposite. Oregon Grape roots contain berberine, which is modernly used to treat liver disorders. The berries are bluish in color and while they are edible, they are not palatable.
	The **Sword fern** (*Polystichum munitum*) is a dark green fern characterized by its alternate blades, which have light brown spores underneath them. In the spring, sword ferns grow up out of the ground in fiddleheads, often eaten by the herbivores of the forest.
	The **Western Red Cedar** (*Thuja plicata*) is another common old growth forest species. They are recognized by their red bark, which won't give you splinters, and their scaly needles. Historically, Kalapuya Native Americans (Eugene area) used WRC to make canoes, clothing, and baskets. Modernly, some of these uses continue however most of the uses now relate to wood products.
	**Spotted Owl**. **Diet:** mainly consists of the Red-Backed Vole. **Habitat:** primarily old growth forest, and they nest either in trees or holes in snags left by woodpeckers. **ID:** light brown and white speckled breast, big brown eyes.
	**Pileated Woodpecker** **Diet:** insects and bugs like the carpenter ant **Habitat:** forests, specifically in snags. **ID:** bright red head with white stripes on face, black body.
	**Carpenter Ant** **Diet:** honeydew, a sweet liquid produced by aphids and scale insects, or dead insects' parts or plant matter. NOT WOOD. **Habitat:** Nurse logs, snags, outside a wood cabin. **ID:** six legs, dark in color, brown/black.
	**Red-Backed Vole** **Diet:** fir needles, ambrosia beetles, truffles on roots of firs. **Habitat:** Douglas-fir forests, up high in the canopy. **ID:** small rodent with reddish color.

Activity 1: Getting Started - 10 minutes

*If this is the first stop on your trail:

- Gather students into a circle and have everyone link arms. This is the "forest"
- Explain: "I will go around whispering a specific species to each of you. When I am done, I will tell a story where one of the species is wiped out. Everyone who was designated as the species will sit down, arms still linked."
- Go around and give every student the same species (red tree vole).
- Tell a short story of how the Douglas-fir needles and truffles contracted a virus that wiped out all of the red tree voles.
- All students should sit down.
- Tell everyone to stand up. Go around and give each student a different species, adding 2-3 more species (spotted owl, Pileated woodpecker, carpenter ant).
- Tell a short story of how that same virus affected the snags, which wipes out the red tree vole again. This time, the spotted owls, Pileated woodpeckers, and carpenter ants stay standing. The carpenter ants are not affected because they eat other dead insects. The Pileated woodpecker is not affected because they eat the carpenter ants. Even though the red tree vole is a main source of food for the spotted owl, they are not affected because they can eat other prey.
- The students who were designated as carpenter ants should try to sit down but should not be able to because the other species hold up the forest.
- Takeaway: Biodiversity is important maintaining a forest's health and infrastructure. The plants and animals rely on each other for food, protection, and adaptability to plights of the forest.

Activity 2: Exploration Hike - 25 minutes

- Description: We are now going on an exploration hike! We're going to stop and identify certain plants as well as look for signs of animal life (i.e. large scratches on trees from deer, scat, etc.)
    - Format: Stop at a plant or animal sign and ask for observations (1-2 per student, go around in a circle)
    - Ask questions: What do you notice? How would you describe the shape? Color? What is it close to?

· For plants:

    - Are the leaves in a pattern? Do they have a texture? Are they leaves or needles?
    - What do humans usually use plants for?
    - For each plant explain/teach these vocab words:

Oregon Grape: Make sure children observe the spines on the leaves, as well as their dark green color and leathery texture. This is an opportunity to teach the vocab words pinnate and opposite. Tell them that the rhizomes (stem of the plant that is underground, not technically roots) are used medicinally today.

Sword Fern: Make note of the spores on the underside of the leaves, and explain that- or ask if anyone knows- they can be used for treating bee stings and stinging nettle. Observe how they are shaped and that they are alternate.

Western Red Cedar: Pick up leaves/needles of this tree. Note/ask for observations on how it looks different from the Douglas-fir, pick up and compare the needles side by side. Students should see that these needles are scaly and flat. Draw attention to the tree itself. Ask if anyone knows any uses for the tree. You can then explain that Native American tribes like the Kalapuya (local Tribe whose homelands include where Eugene is now located) uses/used the bark in basket weaving (made easy by soft and flaky bark).

Douglas-fir: Compare and contrast needles with Western Red Cedar, notice how these needles are uniform in length and shape- not scaly. Ask about uses after you point out how straight the tree is- this should lead to the idea of logging. Ask students what wood is used for in their lives.

For Animal Signs:

· How did that sign get there? What does it indicate?

· What kind of relationship between plants and animals does this show?

Spotted Owl: Look for big trees that they might nest in, or woodpecker holes that they could fit in. Practice being quiet like an owl. Look for ideal perching places from which owls could hunt voles.

Red Tree Vole: Look up into the canopy; listen for any sounds of movement. Signs to look for are fungi (truffles) and Douglas fir needles. Connect to sword fern through eating fiddleheads in the spring, and connect to Douglas-fir by reminding them of the story of truffles, trees, voles, and owls.

Woodpecker: Look for snags, and then check for woodpecker holes. Discuss why woodpeckers peck at dead trees; this should lead you to insects and to the fourth animal- carpenter ants.

Carpenter Ants: Observe ground closely again and see if you see ant trails. Stop and observe a deteriorating nurse log and discuss the role of carpenter ants in decomposition while asking questions. Maybe have students form their own ant trail.

- Throughout the hike continue to ask questions to encourage critical thinking about relationships, and remember to allow time for silent observation/wandering curiosity.

Question Examples:

Q1: Why would a woodpecker peck a snag?

A: Because that is where many carpenter ants, ambrosia beetles, and termites live, which are what a woodpecker eats.

Q2: Why are there insects (like the carpenter ant) in snags and nurse logs?

A: Although carpenter ants do not eat wood, they do eat the insects that eat wood like termites and beetles. Together, they help nutrients return to the forest through decomposition.

Q3: What would happen if (X key species) disappeared?

A: (Species Y) would lose their food source/habitat or overpopulation could damage plant species (in case of spotted owl disappearing).

Q4: What examples of biodiversity do you see? Are all of the animals/plants the same?

Activity 3: Plant Concentration Game - 25 minutes

Adapted from:Haas, E., McGown, E., Young, J. *Coyote's Guide to Connecting with Nature*. Santa Cruz: Owlink Media Corporation, 2008. Print (Pg 432)

- Use Douglas fir, Western Red Cedar, Oregon grape, and Sword fern examples gathered before trip.
- Create the playing field: Ask students to turn their backs while you place your plant parts on a bandana in a deliberate pattern. Cover the plant parts with another bandana.
- Explain the challenge to the students: Divide them into two groups (A and 1). Tell the students they will have 15 seconds to look at the plant parts on your bandana. They will have to observe silently and closely, looking for details like size, shape and color. Make sure that everyone can see the bandana. They will then have 4-5 minutes to work in groups to replicate what they saw on the bandana. Remind them that they must stay on the trail.
- Uncover the bandana, allow for observation, recover the bandana, and then time out 4-5minutes for gathering.
- Have them circle up and share their replications. As each group shares integrate the ID characteristics, historical and contemporary significances you want them to learn. Do this by asking questions.
  - How did you know that this plant part was the same as mine?
  - What do you notice about this?
  - What shape does it have? Are the margins smooth or serrated?
- Identify the key species by name and have the students repeat the name.

Activity 4: Stories of the Ecosystem - 15 minutes

Adapted from: Li, Judith L. *Ellie's Log.* Corvallis: Oregon State University Press, 2013. Print

- Hand out journals and writing utensils.
- Begin with students discussing the definition of biodiversity and why it is important:
    - Biodiversity is the variety of life in a particular habitat, ecosystem, and the world. It is important because each species, no matter how small, plays a specific role in maintaining that habitat. Because each species depends on each other, it is crucial to preserve the biodiversity of every ecosystem.
- Give a brief synopsis of *Ellie's Log* (i.e. a 10 year-old girl named Ellie and her friend, Ricky, are in the midst of exploring the forest when they come upon some clues about some of the critters who live in the forest).
- Ask students to listen for and write down at least three facts about the red tree vole.
- Read aloud pages 38-41 of *Ellie's Log* by Judith L. Li.
- Have students share what they learned for no more than one minute.
- Once students have discussed facts about the red tree vole, have students share a short experience with an animal in the forest (make sure they share a fact about the animal in their story).
- Relevance: SMILE (Science and Math Investigative Learning Experiences), middle school students get to engage in LTER (long term ecological research) where they measure and collect plants, take soil samples, and observe animals like the red tree vole. Red tree voles are listed as vulnerable on the list of sensitive species because of logging and habitat fragmentation. HJ Andrews is particularly important to not only more deeply understanding the mysterious red tree vole, but also protecting its niche habitat.

Comments: Douglas firs are not actually firs! Their scientific name (*Pseudotsuga*) means "false hemlock." Although they are also called Douglas spruces and Oregon pines, they are not *any* of those types of trees. Instead, it is classified as an evergreen. Fun Fact: Out of all the *Pseudotsuga*'s, only *Pseudotsuga mensiesii* is native to Oregon and is the Oregon state tree.

Ellie's Log by Judith L. Li

Near the cabin they heard Ellie's dad walking towards them. Ellie pulled out the bag with mysterious fibers they'd found. Derek Homesly carefully pulled apart the fibers and grinned. "Aren't you lucky?" he said. "This was part of a red tree vole nest. They're mammals that only live in Douglas firs high in the canopy. Where did you find it?"

"In the branches of the fallen Great Tree," Ellie volunteered.

"The Great Tree? Nice name." Inspecting the nest again, he said, "Sometimes we can see nests like these spanning across two trees, but it's pretty hard to retrieve them so high up. This is a very interesting discovery."

Ricky remembered his calculations. Yep, he thought, our nest probably was one hundred feet high.

"See how fine these little brown fibers are?" Derek continued. "The red tree vole collects them by stripping each side of a live fir needles with its teeth. It saves the little channels on each side of a fir needle for the nest – we call them *resin duets*. Then it eats just the middle of the fir needle. Can you imagine how many fir needles it needs for one meal?"

There was lots to learn about the red tree voles. Ellie and Ricky listened intently. "The little tree voles are active only at night," Derek told them. "I've never seen one – only evidence like this nest. When a nest is new, red tree voles 'prune' the young needles nest to their nest. It's like local harvesting high in the tree. After those are gone, they scamper up and down these giant old trees to harvest the green needles in neighboring trees. Needles make nice nesting material, don't you think?"

Ricky was amazed. "That's a lot of information about a pretty secretive animal," he said. "How did all those parts of the story come together?"

"Oh to understand this story, a lot of folks climbed high into the trees and watched red tree voles for many years," Ellie's dad replied. "Probably several teams of scientists watched several families of voles grow up. Red tree voles are pretty scarce because there aren't a lot of forests with these old trees. We're finally getting enough evidence to know where they live and what they need to survive."

Ellie looked carefully at their unexpected treasure. "That was a pretty special bed of needles for young voles," she said. "Hope the red tree voles found another tree for a new nest after the storm."

Bird's Eye View From the Canopy

Time
75 minutes

Location
Station 4

Group
6 Students

Subject Areas
Natural sciences
Social sciences

State Standards
MS-LS2-1: Interdependent Relationships in Ecosystems
Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.

Concepts
Scientific method

Materials
- ❑ Extra hair ties
- ❑ Rite-in-the-Rain paper for students who cannot climb
- ❑ Pencils
- ❑ Writing prompts

Overview:

This activity introduces middle schoolers to a new perspective of HJ Andrews by allowing them to climb 90 feet into the canopy of an old-growth Douglas-fir. The Pacific Tree Climbing Institute will lead the safety talk, gear-up, climb, and gear-down, with Canopy Connections aiding with timekeeping. Students will briefly hypothesize how climbing will feel and pose a question about the tree before ascending. After taking off their gear, they will share how their findings compared to their hypotheses.

Learning Outcomes:

By the end of this station, students will be able to:

1. Formulate questions and hypotheses about the Douglas-fir tree and climb.
2. Articulate how observations during the climb influenced their hypotheses .

Rationale:

Climbing the tree comes with built-in excitement, making it a way to incorporate the scientific method that will stick in students' minds. Students ascend the tree at their own rates, making it a personal, individual experience that will build their reflective ability and independence. This activity offers unique benefits, such as adding a new dimension to the students' perspective of the Douglas-fir.

Background:

The Pacific Tree Climbing Institute has taken over 10,000 individuals climbing in the canopy of HJ Andrews. Their station is set up on one of the oldest trees in the forest, a 500-year-old Douglas-fir. The Douglas-fir (which is not a true fir) appears alongside hemlocks, cedars, and true firs. The canopies of these trees are home to Northern spotted owls, pileated woodpeckers, and red tree voles.

Activity Description

Step 1. Getting Started: Introduction - 5 minutes

Instructors introduce themselves and frame upcoming activities by asking questions

- Have students gather around the base of the Douglas-fir and prepare to put on their gearWhere would the water that runs to this stream bed come from?
- Tie the climbing into the sense of place theme: can you name the layers.
- Have the students come up with one question each about the tree.

Step 2. Climbing Safety Talk - 5 minutes

- Work in conjunction with Pacific Tree Climbing Institute (P.T.C.I) staff to ensure children are wearing gear appropriately.
- Double-check that students are not carrying extra possessions and that long hair is tied back.
- Take care of facilitating back-up activities for students who are not able to climb (depending on the logistics, adult chaperone might be prepared to facilitate backup activity). Have writing prompts and supplies available.

Step 3. Ascending the Tree and Time in Canopy - 40 minutes

- Monitorsafety regulations during ascent.
- Maintain mindful, quiet atmosphere throughout climb by distracting louder students -- use trick of lowering voice to make them listen/match volume.
- Keep an eye on time to adhere to schedule.
- Remind students to do a sensory check-in at top, but avoid any kind of groups lesson.

Step 4. Descent and Harness Removal - 15 minutes

- Remind PTCI climb leader to begin descent with 15-20 minutes before next station change.
- Have a story of the climb akin to the story of the day; compare and contrast students' expectations pre-climb to how they are feeling now.
- Ask students to state one thing they learned and three words to describe their climbing experience (take notes to contribute to word cloud).

Final Wrap

Time
15 minutes

Location
Pavilion

Group
All middle school students

Subject Areas
Natural sciences
Social sciences

Step 1: Reconvene back at the Pavilion - 5 minutes

- Retrieve all of the hardhats and place them in their appropriate places
- Return to the field (weather permitting) if raining, remain under the pavilion
- Play quick games to stall until all teams have returned and removed their helmets

Step 2: Group Discussion and Reflection - 5 minutes

- One instructor should lead a group discussion about lessons learned today
- Discuss highlights of the day
- Share the best sights or sounds of the day

Step 3: Goodbyes and Thank You's - 5 minutes

- Thank Mother Earth with a group breath in and out. Have everyone think about something they are thankful for. Have a few students and instructors share their answers.
- Thank PTCI and HJ Andrews Staffs for the opportunity to visit their labs and for all of their help
- Say goodbye to instructors and staff
- Load up the buses