Educators Guide To Charles L. Pack Experimental Forest

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Educators Guide to Charles L. Pack Experimental Forest

Purpose

The purpose of this guide is to give teachers help in planning a meaningful fieldtrip experience to Pack Forest. There are pre-trip activities designed to give students the skills and knowledge they will need to appreciate their on-site experiences. The Tour Menu gives an overview of the activities available when visiting Pack Forest. The post-trip activities offer students the opportunity to synthesize the information they gathered during their fieldtrip.

Goals of this Guide

Washington State has developed academic standards for the "basics" called Essential Academic Learning Requirements. Several seem to apply to field experiences at Pack Forest.

1 The student understands, and uses scientific concepts and principles.

1.2 Recognize the components, structure and organization of systems and the interconnections within and among them.

5. The student understands how science knowledge and skills are connected to other subject areas and real-life situations

5.4 examine the relationships among science, society, and the workplace.

In the Office of the Superintendent of Public Education's Introduction to Science they state that Learning in science depends on actively doing science. Active engagement in hands-on, minds-on science learning experiences enables students to make personal sense of the physical world and to solve problems.

This guide will help educators give students that "active engagement" and allow exploration of the EALR's by:

1. Introduction to basic principles of forest ecology
2. Showing the role forest management plays in the Nisqually River Basin.

3. Gaining understanding that our forestlands are managed for a variety of resource uses, such as wood products, wildlife habitat, recreation, watershed protection, and wilderness protection.
4. Presenting that forest managers, with the input from researchers and the public, find ways to balance multiple demands on forest resources.
5. Showing that forests are important and renewable natural resources.

What is Forest Management?

Early Beginnings

People have "managed" forests for as long as they have thought about the future. Before the beginning of recorded history, Native Americans burned their forestlands to create more productive conditions for the game they hunted and the plants and roots they collected. People from other parts of the world, such as tribes from Southeast Asia, also burned portions of the forest every year to free nutrients for their crops.

Over time, our objectives for managing forests have changed and evolved, as have the tools we use to meet those objectives. Although we are now living in an increasingly technological and more highly populated world, forest management today still involves the use of forests to meet the goals of landowners and society. All U.S. forestlands are currently "managed", whether it is for wilderness preservation, commercial timber production, etc. What differs between forests is the degree and intensity of management, and the management goals.

Regulations

All activities carried out on forest land in Washington State, public and private, are subject to certain regulations. The Forest Practices Act provides authority for state regulation of forest practices on 12.5 million acres of state and private lands. A forest practice is defined as an activity carried out on forest land which relates to the growing, harvesting, or processing of timber. Some examples include: logging, thinning, road construction, brush control and fertilization.

The Forest Practices Board, chaired by the Commissioner for Public Lands, is responsible for overseeing the Act, and establishing rules to protect public resources while maintaining a viable timber industry. Regulations are primarily designed to protect public resources by preventing erosion from roads, to protect water quality and provide fish and wildlife habit with streamside buffers, to protect wetlands and to ensure long-term supply of forests with reforestation requirements.

Forests & Fish

In May 2001, the Forest Practices Board adopted permanent rules implementing the "Forest and Fish Report" that had been passed by the Legislature in 1999. The objectives of this agreement were:

1. to provide compliance with the Endangered Species Act for aquatic and riparian-dependent species on non-federal forest lands;
2. to restore and maintain riparian habitat on non-federal forest lands to support a harvestable supply of fish;
3. to meet the requirements of the Clean Water Act for water quality on non-federal forest lands; and
4. to keep the timber industry economically viable in the State of Washington.

Forest Management Conflicts

Society today is riddled with varying ideas of how forestlands should best be used. The forests of the Nisqually River Basin, for example, are valued by many for such diverse resources as timber production, mushroom collection, fisheries habitat, wilderness reserves, recreation, and water quality protection. The demands we place on our finite forest resources are great, and many people passionately believe that some of these resource uses are not compatible. Today's forest managers face the challenge of finding ways to balance between these many goals. Achieving this balance requires gaining knowledge not only of forest ecosystems, but also of the diverse people who value and place demands on those forests and of conflict resolution methods.

About Pack Forest

Why Bring Students to Pack Forest?

We are living in a time when our forestlands, and how we use and manage them, are the subject of great controversy. Students need to study the source of these conflicts, so they are prepared to influence and make the tough decisions that will determine the future of these forestlands. Students need to understand the connections between themselves, forests, and the forest products we all use and depend on. Students need to understand the process necessary to produce these products, and how forest management influences the array of products and benefits we derive from forests.

Pack Forest is a microcosm of the Nisqually River Basin in particular and of western Washington in general. Thus, Pack Forest provides an ideal place to accomplish this learning by allowing students to experience and study a variety of forest stands. Students will be able to recognize differences between stands managed for various purposes, as well as understand why it is important to ensure we maintain a balance.

A Man and His Vision

When Charles Lathrop Pack donated $9,222 to the University of Washington on January 9, 1926, he achieved the first step of realizing his vision of creating what he called a "Show-Window Forest". An east coast lumberman and conservationist, Charles Pack saw the need to educate the public about current forest management practices. His goal was to educate through demonstration. He envisioned inviting the public to an actively managed forest to allow them to see for themselves what such a forest looks like. The public would learn about the processes used to grow the same timber which eventually finds its way into every visitor's household in the form of paper products, furniture, building materials, etc.

In his correspondence to University of Washington, College of Forestry Dean Hugo Winkenwerder, Mr. Pack outlined his idea for this forest:

"…This should be situated on one of the big highways that is much traveled. It would be our idea to have a small amount of large timber, some timber of various ages; also a place where there would be some regeneration particularly of Douglas-fir. After this forest is purchased, it should be put into shape to sell forestry…"

So as Charles Pack requested, the University purchased 334 acres of forestland off the Mount Rainier Highway, and managed it according to his vision

Three-Fold Mission

Pack Forest had a three-fold mission:

1. The forest provided an opportunity for undergraduate forestry students to spend a quarter as residents in a field study program;
2. Pack Forest, with its security, permanent staff, and long term assurance of continuity, became an ideal location for forestry research projects; and
3. By virtue of its location on the main route to Mount Rainier, Pack Forest was able to draw in large numbers of visitors who were interested in seeing and learning about forest management practices.

Pack Forest Today

Today, Pack Forest has increased its land base from the original 334 acres to 4300 acres, and is still managed according to the original three-fold mission of Education, Research and Public Demonstration. Students majoring in Forest Resources Management at the University of Washington spend one quarter in the field study program at Pack Forest.

Pack Forest has a highly developed 50-year landscape management plan using Chad Oliver's Landscape Management System (LMS). LMS simplifies and speeds up landscape management processes by combining complex growth models, visualization and inventory software.

In addition to the traditional forest-based operations, Pack Forest operates a conference center with classrooms, meeting halls, and overnight accommodations.

Pack Forest Educators Guide

Pre-Trip Activities

Introduction

Engaging in the pre-trip activities prepares students for their visit to Pack Forest. Students will be excited to be in the forest, learning new concepts and procedures can be difficult in such a stimulating environment. The activities in this section are designed to give students the skills and knowledge they will need to have on-site at Pack Forest. By participating in these few activities, your students will have a richer and more meaningful experience at Pack Forest.

Build a Tree

Adapted with permission from "Trees are Terrific", National Wildlife Federation, Naturescope, 1992

Objective

Students will demonstrate the functions of different tree parts.

Vocabulary

cambium, chlorophyll, heartwood, lateral roots, phloem, photosynthesis, sapwood, taproot

Leaves

From skinny pine needles to broad maple leaves, all tree leaves serve the same purpose: to make food for the tree. Leaves use carbon dioxide from the air, water from the roots, and the sun's energy to make sugar, or glucose, through the chemical reaction photosynthesis. Photosynthesis takes place in the presence of chlorophyll, the green pigment capable of absorbing sunlight. During photosynthesis, leaves release oxygen into the air as a by-product.

Trunk

The trunk of the tree is important for two reasons: First, it acts as a support rod, giving the tree its shape and strength. Second, it acts as the central "plumbing system" in a tree, forming a network of tubes that carries water and minerals up from the roots to the leaves, and food (sugar) from the leaves down to the branches, trunk and roots. The easiest way to see how a tree works is to look at a cross-section of the trunk. (See diagram in background section of this activity's student page.) Here are the five main layers you would see, and the function of each:

1. Bark: The outer layer of the trunk (and branches) is called the outer bark, or just the bark. Bark can be smooth, scaly, rubbery, flaky, craggy, or bumpy. Its texture, thickness, and flexibility depend on the type of tree. Although bark looks different from tree to tree, it always serves the same purpose: to protect the tree from injury and disease. Some trees (such as the Douglas-fir, a common western Washington tree) have very thick bark that helps prevent damage from fires. Others have bad-tasting chemicals in their bark that discourage hungry insects. Some bark

is even covered with spines or thorns that browsing mammals keep away.

2. Phloem: The layer next to the outer bark is called the inner bark, or the phloem (FLOW-um). The phloem is a thin layer that acts as a food supply line from the leaves to the rest of the tree. Sap (water containing dissolved sugars and nutrients) travels down from the leaves through channels in the phloem to the branches, trunk, and roots, supplying all the living parts of the tree with food. At certain times during the year the phloem also transports stored sugars up from the roots to the rest of the tree.
3. Cambium: Next to the phloem is a very thin layer called the cambium. (It is often only one or two cells thick; you need a microscope to see it.) The cambium is one of the growing layers of the tree, making new cells during the growing season that become part of the phloem, part of the sapwood (see below), or more cambium. The cambium is what makes the trunk, branches, and roots grow thicker.
4. Sapwood: The layer next to the cambium is called the xylem, or sapwood. The sapwood is made up of the youngest layers of wood. (Each year the cambium adds new layers of woody tissue.) The sapwood is a network of thick-walled cells that form a pipeline, carrying water and minerals up the tree from the roots to the leaves and other parts of the tree. The sapwood also stores nutrients and transports them across the tree from one part to another.
5. Heartwood: Most of the trunk in an old tree is dead wood, called heartwood, or just plain wood. The heartwood is old sapwood that no longer transports water and minerals up the tree. (After a few years the sapwood in most trees gets filled with resin-like material and slowly changes into heartwood. The new sapwood is the only part of the wood that works as a transport system.) The heartwood is often much darker in color than the sapwood. The heartwood gives the tree support. Sometimes it rots away, leaving a hollow living tree. Hollow trees often topple over or split apart in storms because they are so weak.
6. Roots: A tree's roots are long, underground branches that spread out to help anchor the tree and to absorb water and nutrients from the soil. Some trees have long taproots that reach straight

down 15 feet or more. Other trees have more shallow root systems that lie closer to the surface of the ground. Large taproots and lateral roots branch into smaller and smaller roots. An average tree has millions of these small rootlets, each covered with thousands of fine root hairs. The root hairs make it easier to soak up water and dissolved minerals from the soil.

Procedure

Build a Tree

Copy and pass out the "Build a Tree" background sheet to everyone in your class. Divide the class into seven groups and assign each one of the following seven tree parts:

1. Leaves
2. Bark
3. Phloem
4. Cambium
5. Sapwood
6. Heartwood
7. Roots

Give each group colored pens and a large piece of paper. Ask them to draw a picture or diagram to illustrate what their tree part does to help the tree grow. Then have each group share and explain their illustration to the rest of the class.

A Human Tree

Copy the following words onto separate slips of paper and put them in a paper bag. Adjust the number of slips you make according to the size of your class. (The following is for a class of 30)

Heartwood (1)
Sapwood (2)
Cambium (4)
Phloem (8)
Outer bark (12)
Taproot (1)
Lateral roots (2)

Take the group outside to an open area or clear a big enough space inside, and explain to the group that they will work together to "build" a tree. First

have each person pick a part to play by reaching into the paper bag and pulling out a slip of paper. Have the students practice any sounds or movements suggested for their parts. Begin to build the tree, layer by layer. Once the tree is built, have them act out their parts together.

1. Have the student playing the part of the heartwood cross their arms and stand in the center of the play area. Explain that this student represents the heartwood of the tree.
2. Have the student playing the taproot sit down at the foot of the heartwood. Explain that this person represents the deep taproot that many trees have.
3. Have the lateral roots lie on their backs, spreading out from the taproot with their feet toward the heartwood. (Have lateral roots make slurping sounds.)
4. Have the sapwood students join hands to make a ring around the heartwood. Position them so they stand between the lateral roots. They should face in toward the heartwood. (Have the sapwood pretend they are drawing water up from the roots by lowering their hands, still joined, and then raising them above their heads.)
5. Have the cambium students join hands and form a large circle around the sapwood. (Have the cambium chant, "we make new cells, we make new cells".)
6. Next have the phloem students join hands and form a larger circle around the cambium. (Have the phloem pretend they are transporting food down from the leaves by holding their arms above their heads, then lowering them and raising them again, etc.)
7. Have the outer bark students form a circle around the entire tree, facing outwards and holding hands.

Once everyone is in position, ask the students to go through their motions: the roots taking water up from the soil, the sapwood transporting the water up the trunk to the branches and leaves, the phloem carrying food down from the leaves to the trunk and roots, and the cambium chanting, "we make new cells". Afterward, lead a short discussion about the different parts of the tree to make sure everyone understands what each part does.

How Old Is That Tree?

Adapted with permission from "Tree Cookies", Project Learning Tree Activity Guide

Objective

Students will understand how a tree grows, and how to determine its age.

Vocabulary

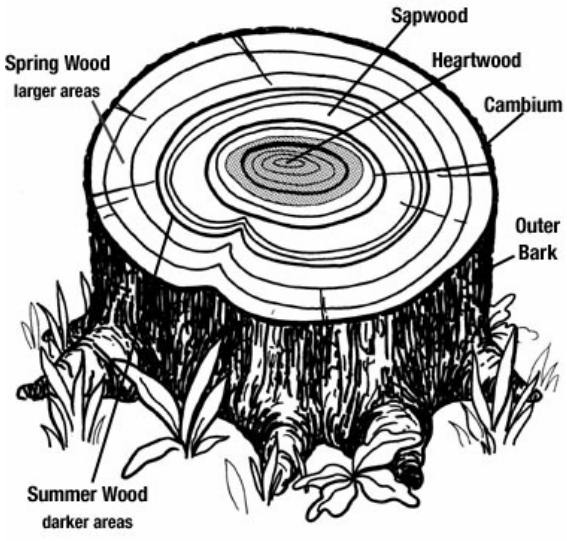
Cells, diameter, springwood, summerwood

Background

All trees grow, not only in height each year, but in diameter. Have you seen a tree stump and noticed the light and dark rings on it? These rings represent the annual growth of the tree. In the spring, when the weather is wet, trees grow more quickly than at other times during the year. This rapid growth produces thin-walled (low density) cells. This growth produces the light colored rings, and is called early wood or spring wood.

During the summer, when the weather becomes drier, growth begins to slow, and the tee produces thick-walled (higher density) cells which form the thin dark rings next to the light ones. This growth is called latewood, or summer wood. One light and one dark colored band equal one year's growth. Counting the number or growth rings on a stump will tell you how old the stump was when the tree fell or was cut down.

The pattern of the rings will also tell you something about the history of the tree's life. Rings that appear narrow and bunched together are the result of bad growing conditions, such as drought or unusually cold weather. Rings that are wider than the rest indicate better than average growing condition, such as unusually warm and wet weather, or a fertilization source added to the soil.



Procedure

Divide the class into small groups. Ask them to use the diagram of a tree cross-section to identify these parts of a tree: bark, phloem, cambium, xylem, and heartwood.

Explain how the tree's growth rings tell a story about the tree's age and weather conditions over time. By reading the rings we can see where branches have grown, and see evidence of fire and disease. Show students how to count the rings to find the age of the tree (count only the light or only the dark rings). How old was the tree when it fell or was cut? Ask them to try to find indications of past disturbances or events in the life of the tree, such as fire, insect damage, drought, or loss of a branch.

Give each student a white paper plate and crayons to create a tree cookie the same age as themselves. They can then use sticky labels to identify when important events in their lives took place, such as when they were born, started school, etc.

Extension

Another good discussion topic is how trees grow taller. While new cells are made by the cambium in the trunk of the tree, which makes the tree grow bigger around, new cells are also made in the meristematic tissue located at the tips of branches and roots. These new cells enable the tree to grow taller and the roots to penetrate the soil farther (trees grow from the top, not from the bottom up). To help illustrate this concept, have students think about what would happen if they built a fence and nailed part of it to the tree. Ask them if, after 10 years, the fence would be high in the air? Why or why not?

Build a Tree Background Sheet

Key Words

cambium	chlorophyll	heartwood	lateral roots
phloem	photosynthesis	sapwood	taproot

Background

Trees are a lot like people. They need food and water, just like you do, to survive and grow. As you read the following, you will learn how trees grow.

Leaves

From skinny pine needles to big palm tree leaves, all tree leaves serve the same purpose: to make food for the tree. Leaves use carbon dioxide from the air, water from the roots, and sunlight to make sugar. This process is called photosynthesis, which takes place with the help of a green pigment in the leaves called chlorophyll which absorbs the sun's energy. During photosynthesis, the leaves release oxygen which becomes part of the air that we breathe.

Trunk

Just like you depend on your strong bones to give your body structure (without them you would be a mushy pile on the floor), trees have a stiff woody trunk to hold them upright. This trunk acts like a plumbing system to move water (much like your own blood and other body fluids) and food through the tree to help it grow. A trunk has the following parts in it: (see the diagram on the next page)

1) Barking Up the Right Tree

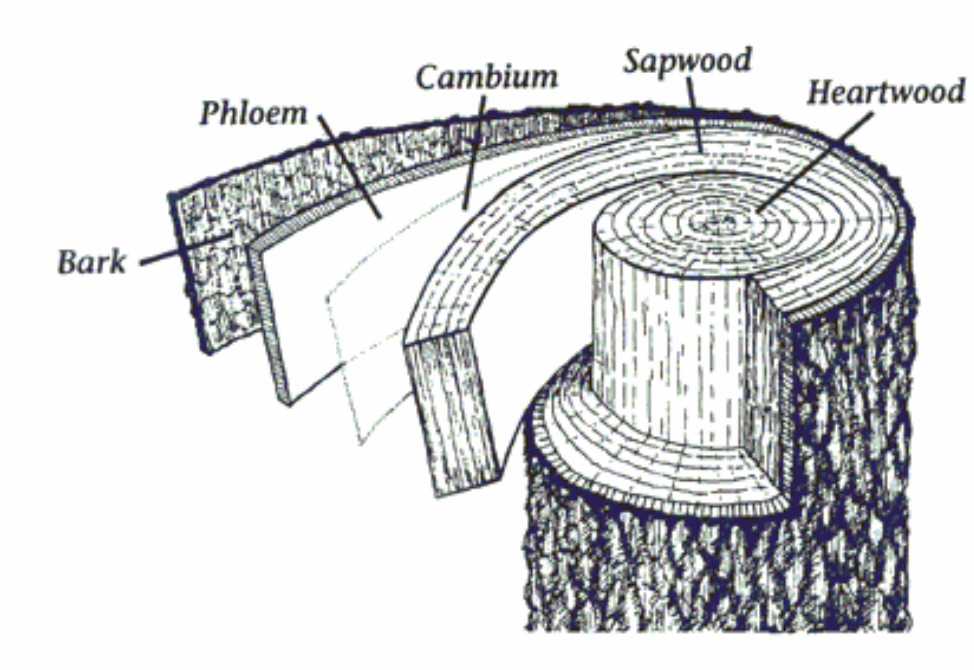
The outside layer on the trunk is the outer bark. Tree bark can be smooth, scaly, rubbery, flaky, craggy, or bumpy. The outer bark serves the same purpose for trees as skin does for humans, by protecting the tree from injury and disease. Some trees have extra thick bark to protect them from forest fires, while other trees have bad-tasting bark to discourage hungry insects.

2) Food is for Phloem

The layer next to the outer bark is called the inner bark or phloem (FLOW-um). The phloem has lots of little tubes (like your blood vessels) which carry the sticky sugar made by the leaves, called sap, from the leaves to the tree's branches and trunk.

3) Keep 'um Coming Cambium
Next to the phloem is a very thin layer (only one or two cells thick) called the cambium. The cambium is the factory which produces new cells for the other parts of the tree to use. Because of the cambium, the trunk, branches, and roots grow thicker.
4) Up, Up, and Away with Sapwood
The layer next to the cambium is the sapwood. The sapwood is a network of thick cells forming a pipeline. This pipeline carries minerals and water from the roots up to the leaves to help them make food.
5) A Dead Heart
Most of the trunk of an old tree is deadwood, called heartwood. The heartwood is old sapwood that no longer transports water and minerals up the tree.

Roots
A tree's roots are long, underground branches that spread out to help anchor the tree in the soil (so that it does not topple over). Roots also draw up water and nutrients from the soil, just as you might drink soda using a straw. Many trees have a long straight root, called a taproot that reaches down as deep as 15 feet under the ground. They also have roots that branch off to the side, called lateral roots.



Who Lives Here?

Key Words

canopy	crowns	forest floor	co-dominant	snag
dominant	sub-floor	understory	suppressed	habitat

A Forest Apartment Building

A forest is made up of trees and plants of different sizes, the soil they grow in, and a variety of animals. Not all forest animals live in one place such as up in the tree tops or down on the ground. If they did, it would get pretty crowded. Imagine if all the people in a big apartment building we crammed into one story instead of spread out between stories. The forest can be compared to an apartment building with four stories and these stories are often referred to as "forest layers".

Canopy

A tree's upper branches are called the crown. The canopy is a horizontal layer of tree crowns making up the top layer of a forest. The fast growing trees can grow taller then others around and are called dominant. Dominant trees form an upper canopy. Trees with crowns making up most of the canopy may be called co-dominant.

Understory

The understory includes the shorter trees in the forest. Some are young trees, but others are trees that are just growing slowly because they don't get much light filtering through the dense canopy. These may be called suppressed trees. The understory also has bushes and other plants, as well as snags (dead trees that are still standing).

Forest Floor

The forest floor, beneath the understory, includes leaf litter, rocks, fallen logs, stumps, small plants, moss, mushrooms, seedlings, etc.

SubfloorThe subfloor includes everything underneath the ground, including soil, rocks, roots, animal tunnels, etc.

Animal Homes

Just like people, forest animals need three basic things to survive: food, water and shelter. Many animals are able to find all these in one layer. Some animals may move from layer to layer to get what they need. An owl may nest in the canopy for shelter and hunt for mice on the forest floor.

Forest Layers

Read the Pack Forest Wildlife Cards to learn about the different types of wildlife that live in Pack Forest. List the various animals by the layer or layers where you think they find food and shelter.

Canopy

_____
_____
_____
_____
_____
_____

Understory

_____
_____
_____
_____
_____
_____
_____

Forest Floor

_____
_____
_____

Subfloor

_____
_____
_____

PACK FOREST EDUCATOR'S GUIDE

On-Site Activities

Introduction

For your field trip at Pack Forest we have a menu for you to choose from. A number of different activities have been created and may be pulled from the menu to match what your interests are. Some of them can be used on a number of different trails, while some of them are site specific. In planning your trip, travel time to and from trails should be taken into consideration. Restroom facilities are only available in the campus area and most groups will want to start with a restroom stop. Once a group is out in the forest the travel time back to campus restroom facilities is often prohibitive. Group leaders may want to bring items such as toilet paper for emergency calls of nature in the forest.

There is a covered pavilion at the main campus area that may be reserved for lunch if the weather is bad. In good weather there are several view sites that make good lunch spots.

Look at the Tour Menu and find areas of interest that match or compliment your curriculum. Using the trail matrix and Pack Forest map determine the trails that you would like to visit.

Some items on the menu are interpreter led discussions or need an interpreter to lead the group through the activity. There are self guided trails and activities that you may do alone or with the help of an interpreter. With any of these activities it is asked that you schedule at least two to three weeks in advance.

Pack Forest Tour Menu

Soil Pit Study: An elementary lab activity examining the horizons of a soil pit. Recording and interpreting color, moisture, and feel of the soil.

Soil Test: An intermediate lab activity using chemicals to determine pH and amounts of nitrogen, potassium, and phosphorus. Interpretation of lab results will be discussed.

Fallen Log Study:
Investigate a Rotting Log: an elementary short answer study concentrating on what is happening to the log.
Rotten Logs & Forest Communities: A data collection of species and number present, and their place in the food chain.

Transect Study: Beginning Plant Transect Study: A count of plants along a transect line.

Nature Scavenger Hunt: An elementary check off list of natural things found along the trail.

Spacing Study: Measuring and recording the circumference of trees growing in the Nelder spacing. Data may be plotted on a graph. Results indicate the effects of sunlight, spacing, and fertilizer on tree growth.

Habitat Study:
Who Lives Here: Listing or drawing plants and animals along a transect line at the four levels of the forest. (canopy, understory, forest floor, subfloor)
Advanced Quadrate Study: Data collection of plant type and size calculating the percent total of each species using observation in several quadrates.

Water Quality Monitoring: Chemical testing of pH, turbidity, and the amount present of dissolved oxygen, nitrates and phosphates.

Stream Flow studies: Elementary study estimating the stream channel area, determining current rate and calculating approximate stream flow.

Forest Management: Interpreter led discussion of forest resource management and current forest practices including timber, fish, wildlife, and soils.

Forest Ecology: Interpreter led discussion of the role landscape patterns and disturbances play in shaping forest structure and function.

Old Growth Ecology: Interpreter led discussion of oldgrowth structure, function, development and the importance of disturbance.

Tree Tour: Interpretative tour identifying the major tree species of Pack Forest.

Trails at Pack Forest

Biosolids Recycling Demonstration Area: Demonstration showing how treated wastewater solids (biosolids) can be used as fertilizer. A short self-guided loop shows control and fertilized plantings of several species of trees.

Changing Forest trail: A ½ mile self-guided loop covering natural and man-made disturbances in a lowland Douglas-fir forest.

Managed forest trail: Observation of the development of a forest from clear cut to a mature forest in approximately 10 year intervals. The trail includes a forested wetland being managed for wildlife habitat.

Tacoma Eastern Railroad Grade: Follows the abandoned Tacoma Eastern Railroad grade ½ mile to LaGrand.

Hugo Peak trail: 4-mile (round trip) hike gaining over 900 feet elevation traversing a wide variety of forest stand types and ages. It offers views of the Olympic Mountains, Mashel and Ohop Valleys.

Trail of the Giants: A 1-mile loop through an old growth Douglas-fir stand and a young Douglas-fir stand. A short (1/4 mile) trail may be taken through the old growth showing trees 600 to 800 years old.

Windy Ridge trail: A 1-mile (round trip) hike along the edge of a recently harvested stand (summer 1996) to an acid rain testing station.

Reservoir trail: A 2-mile (round trip) trail through an old growth stand, into a young Douglas-fir stand, and then through a naturally seeded second growth forest.

Falls trail: The trail passes through young Douglas-fir and descends into as alder stand to the Little Mashell River. The path forks, allowing you to hike to the Upper Falls, or continue down to the Middle and Lower Falls.

New Forestry loop trail: 2-mile hike through two "New Forestry" timber harvests. New forestry is an ecologically founded approach to forest management with consideration given to wildlife habitat and species diversity.

Elk Meadows trail: A short hike through mixed species stand, a grove of alder, a cedar stand, to a meadow. The trail offers a wide variety of wildlife habitat.

Riparian Management Zone: Examples of options open to small land owners to harvest next to fish bearing streams. Observation of good forestry practices in care of streams.

Regeneration trail: A short hike through shelterwood, seedtree, and planted clearcut areas.

Nelder Spacing: The Nelder is a planting study of Douglas-fir starting very close together and increasing the space between trees. It is divided into four areas with differing applications of fertilizer along with a control. A good area for data collection and graphing results.

Trails Tool Box

Trails	Hiking time	Travel time to trail	Soil Pit Study	Soil Test	Fallen Log Study	Transect Study	Nature Scavenger Hunt	Spacing Study	Habitat Study	Harvest Management	Wildlife Management	Water Quality Monitoring	Stream Flow Studies	Edible Plants	
estimated time			30 min	40min	30 min	30 min	variable	40 min	1-2 hr	Variable	Variable	40 min	30 min	Var	
Biosolid Recycling Area	10 min			*											
Changing Forest Trail	20 min		*	*	*	*	*		*					*	
Managed Forest Trail	20 min		*	*	*	*	*		*	*				*	
Tacoma Eastern Railroad Grade	30 min			*			*							*	
Hugo Peak Trail	2 1/2 hr.			*	*	*	*		*					*	
Trail of the Giants	45 min		*	*	*	*	*		*		*			*	
Windy Ridge Trail	45 min			*	*	*	*		*					*	
Reservoir Trail	1 1/2 hr		*	*	*	*	*		*			*		*	
Falls Trail	1 hr		*	*	*	*	*		*		*	*	*	*	
New Forestry Trail	1 1/2 hr		*	*	*	*	*		*	*				*	
Elk Meadow Trail	40 min		*	*	*	*	*		*		*			*	
Riparian Management Trail	15 min			*		*	*		*	*	*	*	*	*	
Regeneration Trail	20 min		*	*			*		*					*	
Nelder Spacing	5 min			*				*							

On-Site Activities

Soil is More Than Dirt

Study Site _____

Try to imagine a world without soil, and you quickly realize how important it is to all of life. It has been said that the forest is the plant expression of the soil. What do you think that means? When you see plants that are droopy, pale and dying, the answer to the problem can usually be found in the soil. Soil holds water, supplies nutrients, provides habitat for wildlife, and offers structural support to plants and trees. You will be studying some characteristics of soil to help you understand how important it is to the forest.

Characteristics of Soil

Color	soil color is affected by the type and amount of minerals, moisture, chemical reactions, weathering, decaying plant and animal material.
Structure	the shape soil takes bases on its physical and chemical properties. Soil structure affects the movement of water, air and root penetration.
Texture	texture refers to the size on the soil particles. Texture also affects the movement of water, air and root penetration.
Moisture	the ability of soil to retain moisture affects the survival of plants.
Water	protects plants from wilting, and aids in nutrient uptake.
Temperature	soil temperature affects what and how well plants grow.

Instructions

Working with a partner or a small group, you will investigate a cross-section of soil, called a soil profile. Each layer in the profile is called a horizon.

Select an area near the soil pit and sift through the top 3 inches. Record the evidence of plants and animals you observe (including roots, decomposing leaves, twigs, insects, earthworms and fungus).

_____

_____

_____

Draw a picture of your soil profile as you dig through the different soil horizons. Note these characteristics for each horizon: color of the soil, whether it was dry or moist, whether it was warm or cool.
Top Layer

Second Layer

Third Layer

Next, determine the texture of the different horizons. How does it feel when you rub it between your fingers? Does the soil feel gritty, smooth, or sticky and plastic? Can you see different sized particles (sand, silt or clay)? Does the soil squash or break easily between your fingers, or is more pressure required?
The texture of your soil was influenced by a variety of forces. Animals, such as earthworms, ingest soil particles and break them up into smaller pieces. Roots penetrating the soil also break soil particles into smaller pieces. The effects of weather over time also influence soil texture. How do you think the structure and texture of your soil affects plant growth?

_____

_____

_____

Soil temperature also influences plant growth. If the temperature gets too cold, water in the soil may freeze, slowing plant growth. On the other hand, soil that is exposed to direct sunlight can be very warm and may lose moisture to evaporation. Soil temperature differs with the seasons; it is colder during the winter months than it is during the summer months. How do you think the soil temperature of your soil profile affects plant growth?

_____

_____

_____

Soil Testing Procedure

Preparing soil

Gather a sample of soil from 2” to 6” below the surface. Avoid touching the sample with your hands. The soil should not be too wet. Crumble the soil as finely as possible. Remove solids such as stones and other debris.

pH

1. Fill test tube to the shoulder with distilled water
2. Add 1 soil pH tablet.
3. Use green test tube cap to measure and add one capful of prepared soil.
4. Cap tube, invert 10 times.
5. Let soil settle for one minute or until a clear color solution is visible above the soil layer.
6. Compare colored solution to pH color chart.

Extraction

1. Fill extraction tube to the 30ml line with distilled water.
2. Add two Floc-Ex tablets and cap tube.
3. Mix until tablets have disintegrated
4. Remove cap and add one heaping teaspoon of soil
5. Cap tube and shake for one minute
6. Let tube stand until soil settles out

Nitrogen

1. Use pipette to transfer the clear extraction solution above the soil to a test tube until it is filled to the shoulder.
2. Add one Nitrate #1 tablet and cap with the red cap.
3. Mix until the tablet disintegrates
4. Add one Nitrate #2 tablet.
5. Cap with red cap and mix until the tablet disintegrates.
6. Wait 5 minutes for color to develop.
7. Compare color to the Nitrogen color chart.

Potassium

1. Use pipette to transfer the clear extraction solution above the soil to a test tube until is filled to the shoulder.
2. Add one Potassium soil tablet and cap with white cap.
3. Mix until the tablet disintegrates.
4. Compare cloudiness of solution in test tube to Potassium color chart on box.

Phosphorus

1. Use pipette to transfer 25 drops of the clear extracted solution above the soil to a test tube.
2. Fill tube to the shoulder with distilled water
3. Add one Phosphorus tablet and cap with blue cap.
4. Mix until tablet disintegrates.
5. Wait 5 minutes for the color to develop.
6. Compare to the Phosphorus color chart.

Soil Test Results

Site name ____________________

	1	2	3
pH			
Nitrogen			
Phosphorous			
Potassium			

Site description

Trees

Ground cover

Comments

Site name ____________________

	1	2	3
pH			
Nitrogen			
Phosphorous			
Potassium			

Site description

Trees

Ground cover

Comments

Site name ____________________

	1	2	3
pH			
Nitrogen			
Phosphorous			
Potassium			

Site description

Trees

Ground cover

Comments

Site name ____________________

	1	2	3
pH			
Nitrogen			
Phosphorous			
Potassium			

Site description

Trees

Ground cover

Comments

Investigating a Rotting Log

Study Site _____

Fallen logs and snags (standing dead trees or stumps) are important members of the forest community. They provide homes and food for small animals. These small animals, in turn, are eaten by larger predators, such as birds, coyotes and snakes. The rich, organic, loose material decaying from the log provides a unique habitat where certain plants, fungi, tree seedlings, mosses and ferns can grow. (Fallen logs are often called nurse logs because they provide a relatively sheltered place for plants to take roots. They retain moisture during the dry summer months). The log eventually decays into the soil, adding nutrients and changing the soil's texture, color, depth and water holding capabilities.

Find a fairly large rotting log. Work in pairs or small groups to observe and record as much as you can. BE SURE NOT TO TEAR THE LOG APART. IF YOU LIFT UP ANY PART OF THE LOG, PLEASE BE RESPECTFUL OF THE PLANTS AND ANIMALS AND PUT THE PARTS BACK WHERE YOU FOUND THEM. The following questions will help you look more closely at your log.

1. Can you locate the stump or the tree? _____ Where is it in relation to the log?
   _____
2. Was the tree cut down or did it die naturally? _____ How can you tell?
   _____
   _____
3. Is the bark still on the log? _____ If yes, describe the condition of the bark.
   _____
   _____
4. What is the species of this tree (look at bark, wood, structure, etc)?
   _____

(If you do not know the species of tree, write down a description of what you see so you may look it up later.)

_____
_____

5. List or draw evidence of animals in or on the log (look for insect and woodpecker holes, animal dens, sawdust around the base of the log, and animals themselves).

_____
_____
_____

6. How do you think this log helps new plants to grow?

_____
_____
_____

7. What effect do you think animals have on the log?

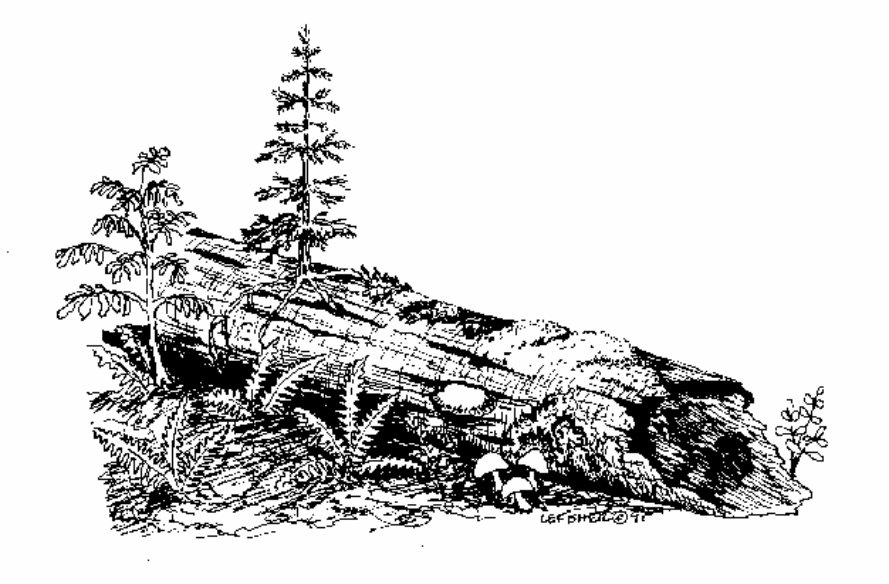
_____
_____
_____

8. What do you think will eventually happen to this log?

_____
_____
_____

9. How many years do you think it will take for this log to completely decompose into the soil?

_____



Investigating a Rotting Log (Answer sheet)

Study Site _____

Fallen logs and snags (standing dead trees or stumps) are important members of the forest community. They provide homes and food for small animals. These small animals, in turn, are eaten by larger predators, such as birds, coyotes and snakes. The rich, organic, loose material decaying from the log provides a unique habitat where certain plants, fungi, tree seedlings, mosses and ferns can grow. (Fallen logs are often called nurse logs because they provide a relatively sheltered place for plants to take roots. They retain moisture during the dry summer months). The log eventually decays into the soil, adding nutrients and changing the soil's texture, color, depth and water holding capabilities.

Find a fairly large rotting log. Work in pairs or small groups to observe and record as much as you can. BE SURE NOT TO TEAR THE LOG APART. IF YOU LIFT UP ANY PART OF THE LOG, PLEASE BE RESPECTFUL OF THE PLANTS AND ANIMALS AND PUT THE PARTS BACK WHERE YOU FOUND THEM. The following questions will help you look more closely at your log.

1. Can you locate the stump or the tree? _____ Where is it in relation to the log? _____
2. Was the tree cut down or did it die naturally? _____ How can you tell? *sawdust and smooth stumps indicate that the tree was cut, jagged stumps indicate that it fell naturally*
3. Is the bark still on the log? _____ If yes, describe the condition of the bark. *Answers may include flaky, half gone, chewed up by insects, squishy, etc.*
4. What is the species of this tree (look at bark, wood, structure, etc)? *possibly cedar, hemlock or Douglas-fir* (If you do not know the species of tree, write down a description of what you see so you may look it up later.)

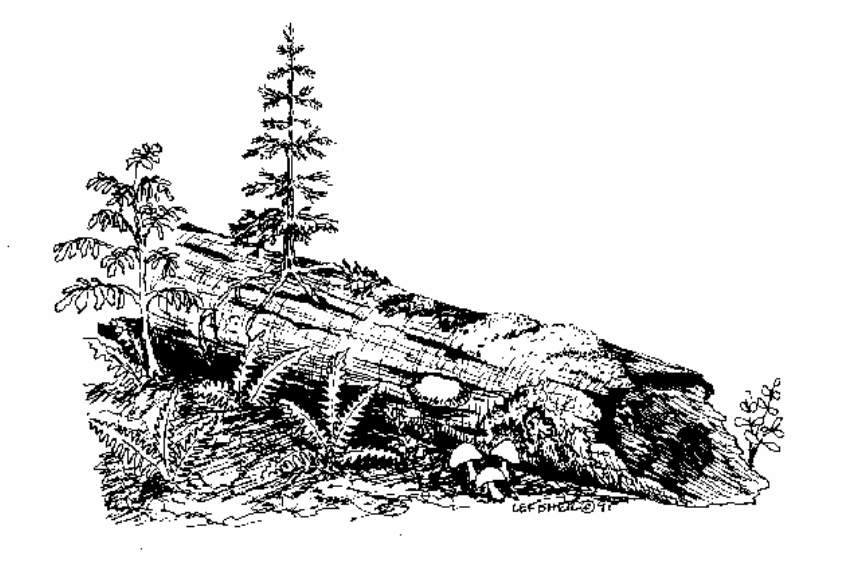
5. List or draw evidence of animals in or on the log (look for insect and woodpecker holes, animal dens, sawdust around the base of the log, and animals themselves).

   _____

   _____

   _____

6. How do you think this log helps new plants to grow? *Provides moisture and nutrients, a place for plants for take root, protection from being eaten by ground-foraging animals*
7. What effect do you think animals have on the log? *Help decompose the log, which releases stored nutrients essential for plant growth*
8. What do you think will eventually happen to this log? *It will become part of the soil.*
9. How many years do you think it will take for this log to completely decompose into the soil? *50 to 100 years, depending on size and species of tree*



Beginning Plant Transect Study

Materials:
Length of cord
Measuring tape or ruler

Procedure:

1. Identify the area you wish to study.
2. One student holds the end of the cord while another student unwinds and straightens it.
3. Count the number of plants that the string touches or passes over and record in the data sheet.
4. Measure the height of the shortest and the tallest plants on your line and record their heights. If you can not reach to the top of the tallest plant find some way to estimate its height.
5.

Area 1

The area we called _____ had _____ plants that touched or were below the string.

The tallest plant was _____.

The shortest plant was _____.

Transect studies give you information to compare several different areas. Select another area and repeat the procedures above.

Area 2

The area we called _____ had _____ plants that touched or were below the string.

The tallest plant was _____.

The shortest plant was _____.

Area 3

The area we called _____ had _____ plants that touched or were below the string.

The tallest plant was _____.

The shortest plant was _____.

Beginning Plant Transect Study Discussion Questions

1. Was there any difference in the number of plants in the areas studied?

2. Can you explain any differences you found?

3. What tests could you run on the areas to check out your answers in question 2?

4. The difference between the tallest and shortest plant is the range of height. What does it tell you about the areas?

Scavenger Hunt

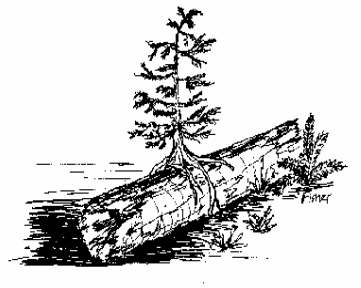
Find these things on your walk through the forest. DO NOT COLLECT THEM.
Check the items off as you see them and be ready to show them to someone if you are asked.

___ A fern that's longer that your are

___ A tree that's too big to fit your arms around

___ Something that's crawling

___ A dead log



___ A cone from an evergreen tree

___ A dead tree that is still standing (a snag)

___ Your favorite thing

___ Food for a slug

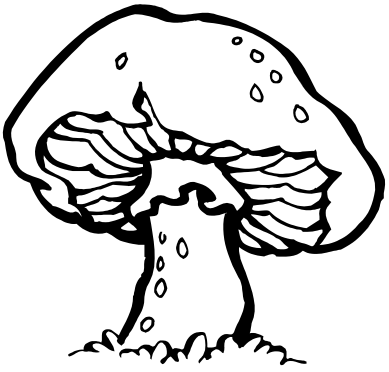
___ Something that would be good food for a deer

___ Something smooth

___ Something scratchy

___ Something an insect has been eating

___ A fungus



___ A woodpecker hole

___ A tree that you think is younger that you

___ Something perfectly round

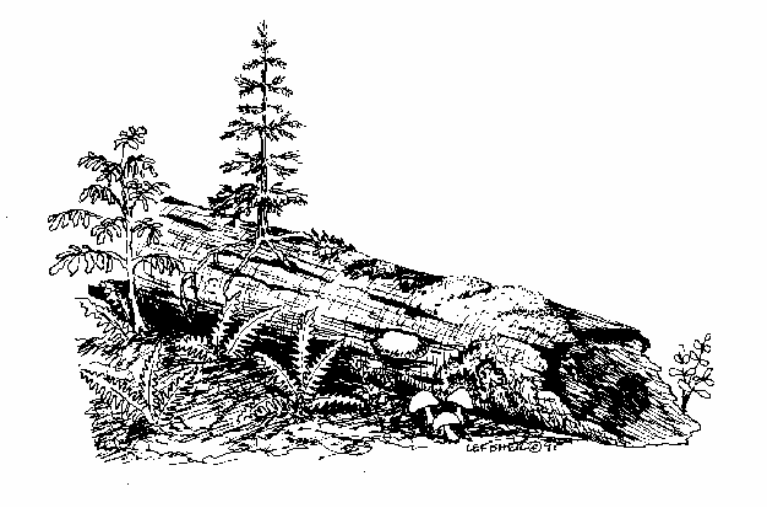
___ A flower

___ A stem with thorns

___ Something flying

ROTTEN LOG SCAVERGER HUNT

Find these things on and around a rotten log. DO NOT COLLECT THESE. Find them, check them off and be able to show them to someone if you are asked.



___ mushrooms
___ young plants
___ ferns
___ insect holes
___ wildflowers
___ moss
___ ants
___ lichen
___ algae
___ sawdust
___ spider
___ banana slug
___ squirrel midden (pile of eaten fir cones)
___ grass
___ insect eggs

trees

___ Spruce
___ Douglas-fir
___ Hemlock
___ Cedar
___ Cottonwood
___ Alder
___ Vine maple

PUT THESE IN A GARBAGE BAG IF YOU FIND THEM

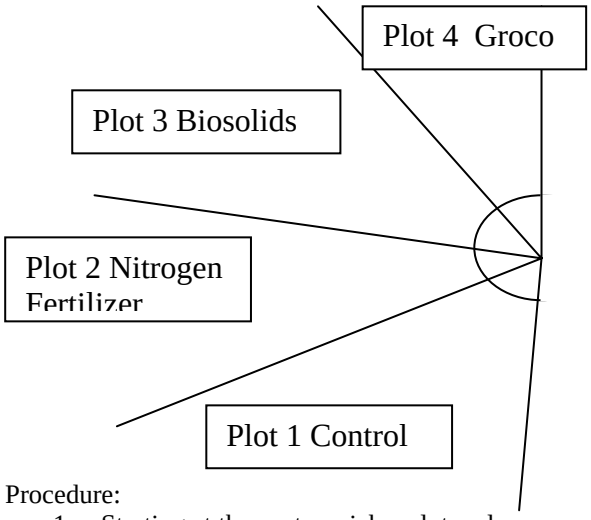
___ cans, bottles, paper
___ candy wrappers
___ old shoes
___ any thing else that does not belong in this habitat

Nelder Spacing Data Sheet Name_____

Objective: To gather, record, and analyze data from a Nelder Spacing.

Materials: measuring tapes, rulers, string, clipboards

A Nelder Spacing is a circular plot in which trees are planted close together in the center and gradually farther apart as they get farther from the center. The site you will be working with has two variations from a typical Nelder. It is not a full circle, and it is divided into four sections, which are fertilized with different materials.



Procedure:

1. Starting at the center, pick a plot and measure the circumference of a tree at a height of 12".
2. Record the circumference in the corresponding part of the data table.
3. Skip one tree and measure and record the diameter of the third tree in line of the plot.
4. Continue working outward measuring every other tree.

DATA TABLE

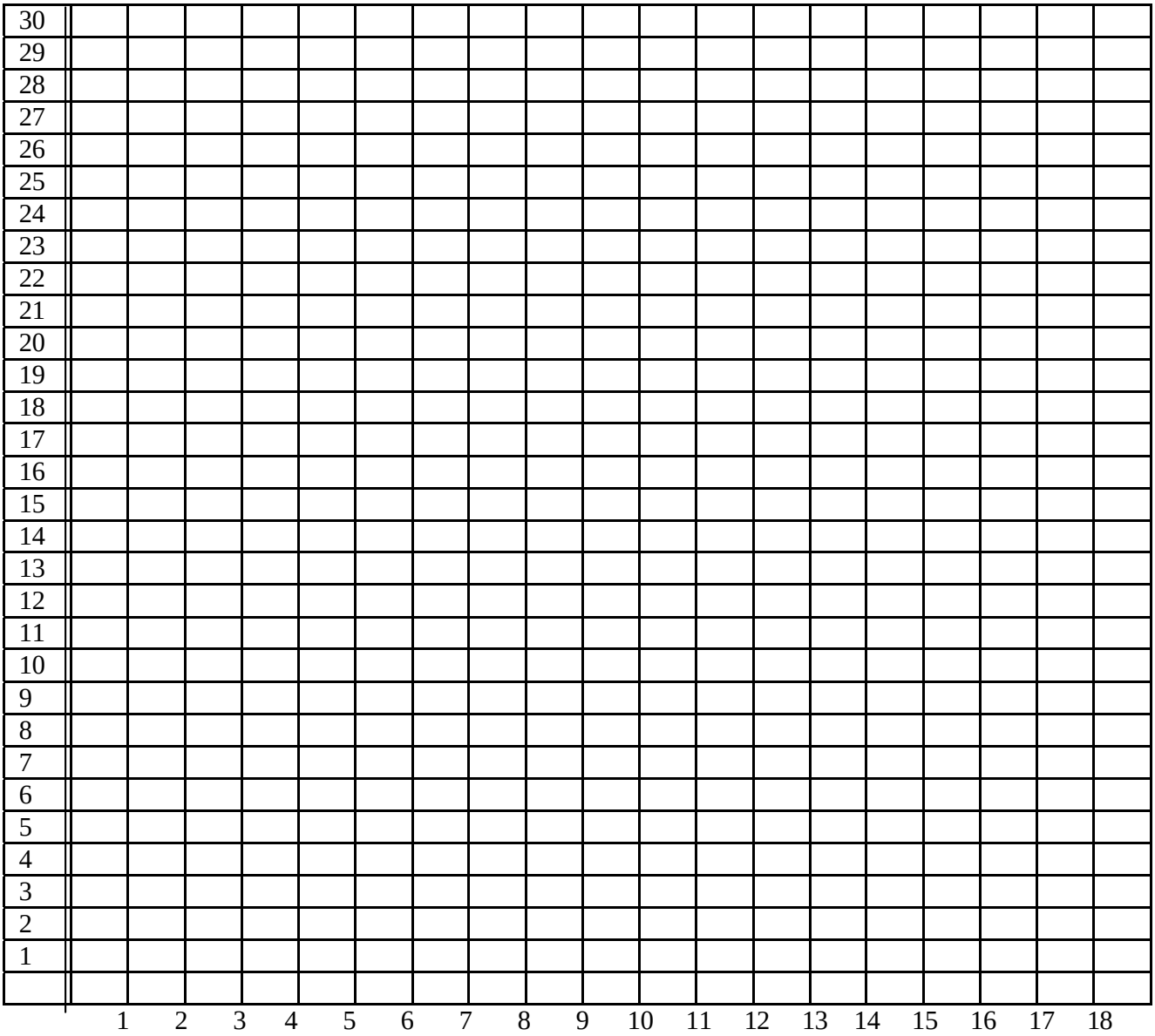
Plot number	tree 1	tree 3	tree 5	tree 7	tree 9	tree 11	tree 13	tree 15	tree 17

1. What do you notice about the tree size as you move out from the center of the hub?

2. Can you think of a reason to explain your findings?

3. Did any plot show better growth than the others? Can you think of a reason?

Nelder Spacing Graph



Tree number

Color

row 1 =	row 2 =	row 3 =	row 4 =	row 5 =	row 6 =
row 7 =	row 8 =	row 9 =	row 10 =	row 11 =	row 12 =
row 13 =	row 14 =	row 15 =	row 16 =	row 17 =	row 18 =
row 19 =	row 20 =	row 21 =	row 22 =	row 23 =	row 24 =

Habitat Study

Study site _____

Animals and plants have adapted to live in certain habitats. They survive within limits of temperature, moisture, shelter, and any number of other factors making up their environment. Some plants and animals can adapt to a wide variation of factors. Other species have a very narrow range in which they can survive. A whale clearly cannot survive in a desert, but it is just as impossible for a bluebird to survive in a dense forest.

In this study we will work with the four forest layers: subfloor, forest floor, understory and canopy. The different forest layers provide habitat needs for a variety of wildlife species. Some animals use only one forest layer, while others use all four layers to get the things they need to live. (food, shelter, and water)

When a forester or wildlife biologist wants to study a forest, it isn't always practical to study the entire forest. Instead, they choose and study a series of plots that represent the surrounding forest. You are going to take the part of a forester or wildlife biologist and choose a survey plot to study.

Without going too far into the forest, choose a spot you would like to survey. Two people in your group will mark a transect (a straight line) using your 20' length of string: one person stands still, holding onto one end of the string, while the other person holds the other end of the string and walks in a straight line, keeping the string tight. Your study plot will include the area approximately two feet on each side of the string, from the subfloor to the canopy.

Using the blank form on the next page, write down or draw pictures of your observations of the forest layers (not all study sites will have all four layers).

When studying your site, look for the following components of the forest:

*plants	*trees
*moss	*lichen
*bugs/spiders	*animals or signs of animals
*rotting logs or stumps	*roots

Habitat Study Recording Form

Study Site _____

Canopy

Understory

Forest Floor

Subfloor

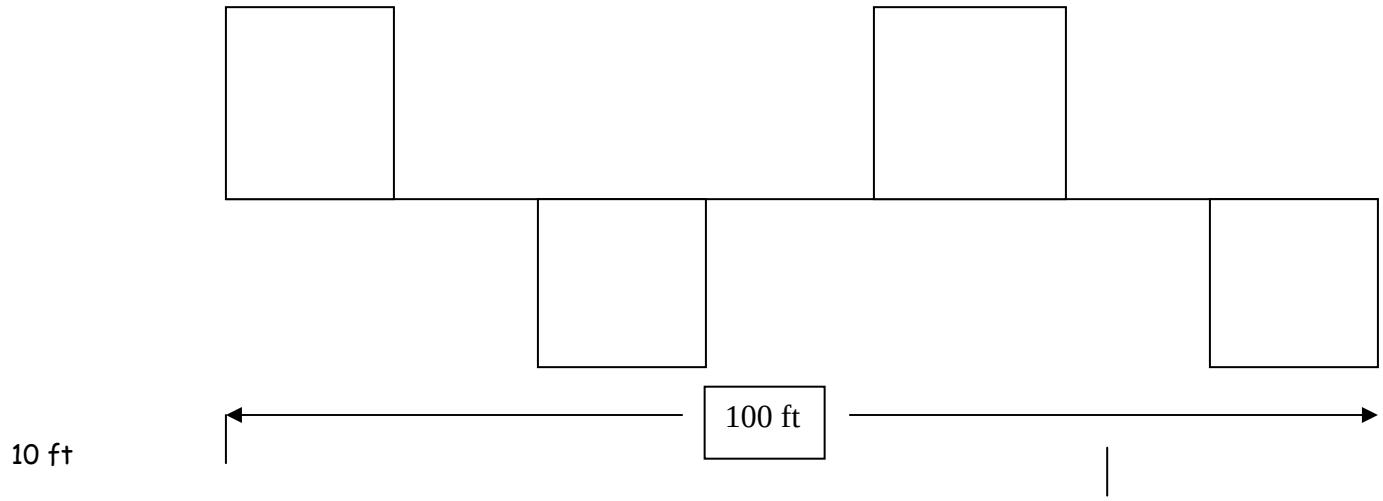
Habitat Study Using Quadrates

Habitat is the area in which an organism lives and grows. It has to offer suitable shelter, food, water, and protection for the organism to survive. In considering the habitat we will start from the ground up, literally. Soil will determine what plants will be in an area. The quality of soil will play a part in determining how dense the plant life can be. You may want to do a soil study as part of your overall habitat study.

Objectives:

1. To determine the major plant species of the area.
2. To determine the number of layers in the habitat.
3. To determine what animals might be found in this habitat.

Materials:
100 ft measuring tape
Cord or string
Flagging tape



Procedure:

1. Using the 100 foot tape set out a transect line in the area you wish to study.
2. Lay out 10 foot quadrates on alternating sides of the transect line and flag the corners.
3. Determine the species present, count them, and record the data.

Data Sheet

Quadrate number _____

Species	Number of plants	Average height

Quadrate number _____

Species	Number of plants	Average height

Quadrate number _____

Species	Number of plants	Average height

Quadrate number _____

Species	Number of plants	Average height

Questions

1. What is the major plant species of this area?

2. Which of the four forest layers, (canopy, understory, forest floor, subfloor) are present?

3. How does this area provide shelter, protection, food, and water for animals?

4. Using wildlife guides or the wildlife cards determine what animals might be found in this area.

Advanced Quadrate Study

Materials:5
Length of cord
Measuring tape or ruler
Plant field guides
Flagging tape

Procedure:

1. Select the area you wish to study.
2. Set up square using the length of cord and mark the corners with flagging tape.
3. Record the following information in the vegetation data sheet.
    a. kinds of living plants
    b. approximate plant height of different species. (measure and calculate average height)
    c. the number of each plant type

Area _____

Plant type	Average height	Number of plants	# plant types/ total # plants = % total

Area _____

Plant type	Average height	Number of plants	# plant types/ total # plants = % total

Elk Meadows Habitat Study

Stop 1: Trail head to large downed log

There are microhabitats within this given area. Small pockets where the vegetation varies from what is around it. List the microhabitat area, the plants that are different, and any physical factors that make the area different.

Description of microhabitat	Indicator plant	Physical factor

The average age of the trees in this area is 50 to 85 years old. What did the area look like 100 years ago? What clues are present?

What species of trees are present in this area? Check off the ones you find.
Circle the one that you find the most of.

___ Douglas fir ___ western red cedar ___ western hemlock

___ alder ___ cottonwood ___ vine maple

___sitka spruce ___ hawthorn ___ other

What plants are found in the understory?
___ salal ___ sword fern ___ deer fern ___ bracken fern

___salmon berry ___ blackberry ___ huckleberry ___ Oregon grape

___bedstraw ___ moss ___ other

What animals could hide in this understory?

Stop 2: Downed log to Cedar stand

What species of trees are present in this area? Check off the ones you find.
Circle the one you find the most of.

___ Douglas fir ___ western red cedar ___ western hemlock

___ alder ___ cottonwood ___ vine maple

___sitka spruce ___ hawthorn ___ other

How does the understory of this area differ from the first area?

What could explain the difference between the understories?

What differences does this area offer as a habitat to animals?

Stop 3: Cedar stand

Was this area logged? How can you tell?

What tree do you find the most of here?

What other trees are present?

___ Douglas fir ___ western red cedar ___ western hemlock

___ alder ___ cottonwood ___ vine maple

___sitka spruce ___ hawthorn ___ other

How does the understory differ from the other areas? Why?

Stop 4: Meadow

What plant species is dominant here?

What animals would use this habitat and how would they use it?

Animal	How they would use it

What animals would live here?

Could trout live here? Why or why not?

Stop 6: Cedar stand

What evidence do you see that animals live here?

Animal	Evidence

Changing Forest Activity Sheet

Stop 1) The soil in an area determines what can grow and how well it grows. Salal and Sword fern are used as indicator species of soil quality.
Place the correct name in the blank next to the picture

Sword fern indicates a better soil quality than salal.

_____ _____

Stop 2) This stump is from a tree that had a parasitic fungus called *Phellinus*. It is a root rot that attacks Douglas-fir trees. Look around the area and write down any evidence you see that may be the result of root rot. (Check the canopy, sick looking trees, and other roots)

_____

_____

_____

_____

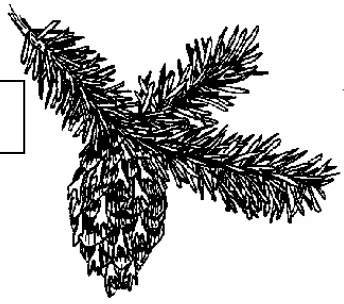
Stop 3) Identify the tree species pictured and write their names in the correct spaces. (Western Red Cedar, Douglas fir, Western Hemlock)

1. _____
2. _____
3. _____

1

2

3



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Stop 4) What species of tree is most common in this area?

_____

Stop 5) Use your detective skills at this stop and determine what happened around 80 years ago.

_____

_____

_____

Stop 6. Look at this area and tell what foresters have done to manage it. (Hint: In areas where trees grow close together, they compete for sunlight, soil, nutrients, and water.

_____

_____

_____

Tall Douglas-fir is the dominant species of the area around stop 6. What other trees do you see?

_____

_____

How did they get there?

_____

_____

How can they live in the shadow of the Douglas-fir?

_____

_____

Stop 7) Look out across the forest. What could account for the dead trees and holes in the canopy?

_____

_____

Look at those plants in the understory. What can you say about the soil?

_____

_____

Stop 8) What do you notice that is different about this area?_____

Edible Plants of Pack Forest

Common name	Scientific name	Edible parts and/or preparation
Bedstraw	Galium sp.	Young plants eaten as a cooked green
Big Leaf Maple	Acer macrophyllum	Seeds can be boiled and eaten hot. Seedlings eaten fresh or dryed
Blackberry	Rubus sp.	Fruit eaten
Bracken Fern	Pteridium aquilinum	Rhizomes roasted or boiled. Young stem (fiddle head) boiled like asparagus
Cattail	Typha latifloia	Young shoots peeled and eaten raw or cooked. Young seed heads boiled
Clover	Trifolium sp.	Flowers, leaves and roots high in protein. Best cooked
Coltsfoot	Tussilago farara	Flowers, slower stalks and young leaves eaten as a cooked vegetable
Cow parsnip	Heracleum maximum	Roots peeled and boiled. Young leaf and flower stalks peeled, raw or cooked
Dandelion	Taraxacum offincinale	Greens eaten before flowers appear. Unopened buds are edible.
Devils club	Oplopanax horridum	Roots and young stems
Dock	Rumex sp	Leaves as a cooked green
Douglas fir	Pseudotsuga menziesii	Inner bark eaten. Tips of branches boiled for tea
False Solomon's Seal	Smilacina racemosa	Berries high in vitamin C. Too many acts as a laxitive
Fireweed	Epilobium angustifolium	Young shoots boiled like asparagus
Grass	Gramineae sp.	Seeds parched and eaten as cereal or ground as flour.
Indian Plum	Oemleria cerasiformis	Berries edible. Leaves edible, at least in small amounts
Japanese Knotweed	Polygonum cuspidatum	Shoots edible in early spring
Lady Fern	Athyrium filix-femina	Rhizomes roasted or boiled
Lambs quarter	Chenopodium album	Young shoots cooked as spinach
Miners lettuce	Montia perfoliata	eaten fresh or cooked
Nettle	Urtica sp	Young leaves and stems used as cooked green
Ocean Spray	Holodiscus discolor	fruit eaten raw, cooked or dryed
Oregon grape	Bereris aquifolium	Berries edible but sour
Ox eye daisy	Chrysanthemum sp	Young leaves used as salad greens or potherb
Oxalis	Oxalis oregana	leaves used as salad green
Piggy-back	Tollmiea menziesii	Sprouts eaten raw in early spring
Plantain	Plantago lanceolata	Young leaves as salad or cooked green
Red alder	Alnus rubra	Cambium layer eaten
Red Huckleberry	Vaccinium parvifolium	Berries edible
Salal	Gaultheria shallon	Berries edible
Salmonberry	Rubus spectabilis	Berries edible
Skunk Cabbage	Lysichitum americanum	early leaves washed 2x in cold water, cooked like spinach
Sword Ferns	Polystichum munitum	Rhizomes roasted or boiled
Thistle	Cirsium sp.	peeled stem edible
Vine Maple	Acer circinatum	Seeds can be boiled and eaten hot. Seedlings eaten fresh or dryed
		eaten like corn on cob. Roots boiled or roasted or starch extracted as flour.

WRAP IT UP

Objective

Students will use observations and gathered data to illustrate four general forest layers and describe how wildlife species use different layers to meet basic needs.

Procedure

Create a Forest Mural

Divide the students into groups and explain that they will use the information they gained at Pack Forest to create a mural of a forest site. Give each group a strip of butcher paper and ask them to pick a place in the forest they studied. Have the groups draw the plants they found in the four forest sections; canopy, understory, forest floor, and sub-floor.

NOTE: If the students use a replanted clear-cut site they will not have all the layers that an older forest has.

Once the students have finished creating their vegetation layers, have them use the Pack Forest Wildlife Cards to add the animals found in the different forest layers.

Class Presentation

Hang the murals up in the classroom and ask each group to tell which site they have pictured and describe the drawing in terms of food webs, and shelter for the animals.

Class Discussion

Lead a discussion with the class asking the following questions:

1. Why didn't you see animals that you know are in these areas?
2. Which of the murals shows the best place for animals to live and why?
3. Which of the sites offer the best protection during times of bad weather? Explain why.
4. If one of the murals does not offer all three basic needs for animals, (food, water, shelter) how would an animal living in this area meet their needs?
5. Which of the sites would be most likely to provide trees for harvest to be turned into forest products? Explain why

The answers to these questions will vary from class to class depending on the sites visited and the observations made. There are no real "right" answers. The important concepts to keep in mind are:

1. A forest with stands in different stages and types of management will more closely simulate natural patterns and will likely support diverse types of wildlife.
2. Some species will use different managed sites for different purposes. (A deer will forage in a clear-cut for food and use wetland tree cover for shelter and protection.)
3. There are regulations governing clear cuts and tree harvests to protect fish and wildlife habitat.
4. A properly managed forest will have different ages of trees (seedlings, young trees, and older trees) to ensure a steady source of timber old enough to harvest and provide proper habitat for wildlife.

Activities Matched with EALR's and Benchmarks

Activity	EALR	To Meet This Standard The Student Will:	Benchmark
Soil is More Than Dirt	Understands and uses scientific concepts and principles	1.1 Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.	(1) use properties to sort natural and manufactured materials
Soil Testing	Understands and uses scientific concepts and principles	1.1 Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.	(2) use physical and chemical properties to identify and describe
Investigating a Rotting Log	Understands and uses scientific concepts and principles	1.3 Understand how interactions within and among systems cause changes in matter and energy.	(1) Recognize that living things need constant energy and substances are continually recycled
Beginning Plant Transect Study	Knows and Applies the Skills and Processes of Science and Technology	2.1 Develop abilities necessary to do scientific inquiry.	(1) record and report observations, explanations, and conclusions
Nelder Spacing	Understands and uses scientific concepts and principles	1.3 Understand how interactions within and among systems cause changes in matter and energy.	(1) Describe how an organism's behavior and ability to survive is influenced by its environment, other life forms, and availability of food and/or other resources
Who Lives Here	Understands and uses scientific concepts and principles	1.3 Understand how interactions within and among systems cause changes in matter and energy.	(1) Describe how an organism's behavior and ability to survive is influenced by its environment, other life forms, and availability of food and/or other resources. (2) Explain how organisms interact with their environment and with other organisms to acquire energy, cycle matter, influence behavior, and establish competitive or mutually beneficial relationships.
Habitat Study	Understands and uses scientific concepts and principles	1.1 Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.	(1) Distinguish living organisms from nonliving objects, and use characteristics to sort common organisms into plant and animal groups.
Advanced Quadrate Study	Understands and uses scientific concepts and principles	1.1 Use properties to identify, describe, and categorize substances, materials, and objects, and use characteristics to categorize living things.	(1) Distinguish living organisms from nonliving objects, and use characteristics to sort common organisms into plant and animal groups.
Elk Meadows Habitat Study	Knows and Applies the Skills and Processes of Science and Technology	2.1 Develop abilities necessary to do scientific inquiry.	(1) Ask questions about objects, organisms and events in the environment.
Changing Forest Activity Sheet	Knows and Applies the Skills and Processes of Science and Technology	2.1 Develop abilities necessary to do scientific inquiry.	(1) Ask questions about objects, organisms and events in the environment.

Pre-Trip Activities Matched With EALR's and Benchmarks

Activity	EALR	To Meet This Standard The Student Will:	Benchmark
Build a Tree	Understands and uses scientific concepts and principles	1.2 Recognize the components, structure, and organization of systems and the interconnections within and among them	(1) Identify the parts of a system, how the parts go together, and how they depend on each other. (2) Describe how the parts of a system interact and influence each other
How Old is That Tree	Understands and uses scientific concepts and principles	1.2 Recognize the components, structure, and organization of systems and the interconnections within and among them	(2) Know that specialized cells within multicellular organisms form different kinds of tissues, organs, and organ systems to carry out life functions.
Who Lives Here?	Understands and uses scientific concepts and principles	1.3 Understand how interactions within and among systems cause change in matter and energy.	(1) Describe how an organism's behavior and ability to survive is influenced by its environment, other life forms, and availibility of food and/or other resources. (2) Explain how organisms interact with their environment and with other organisms to acquire energy, cycle matter, influence behavior, and establish competitive or mutually beneficial relationships.

Post-Trip Activities Matched With EALR's and Benchmarks

Wrap It Up	Understands and uses scientific concepts and principles	1.3 Understand how interactions within and among systems cause change in matter and energy.	(2) Explain how organisms interact with their environment and with other organisms to acquire energy, cycle matter, influence behavior, and establish competitive or mutually beneficial relationships.