INSIDE OREGON'S FORESTS

A high school forestry curriculum

OREGON'S FOREST HERITAGE

STUDENT PAGES

Oregon Forest Resources Institute

STUDENT PAGE

LESSON 1

NAME(S): _____

Oregon Forests – True or False?

First, for each statement underline whether you think it is true or false. Then look for evidence in *Oregon Forest Facts* to verify or refute each statement. Circle the correct answer based on your findings.

True or False?	Statement	Supporting Evidence and Page Number
T F	1. About half of Oregon's land area is forest.	
T F	2. The forest industry accounts for tens of thousands of jobs in Oregon.	
T F	3. The amount of forestland in Oregon has shrunk dramatically since 1950.	
T F	4. Oregon was the first state in the country to pass a law regulating forestry practices on all its forestland.	
T F	5. Private property owners control most of the forestland in Oregon.	
T F	6. Three-fourths of the timber harvested in Oregon comes from federal land.	
T F	7. All forests in Oregon are managed in the same way for the same objectives.	
T F	8. Oregon is one of the top lumber-producing states in the U.S.	
T F	9. Wood from Oregon forests is used only for making paper and lumber.	
T F	10. Forest owners in Oregon may clearcut (log all or most of the trees) on their own land without any restrictions.	
T F	11. Oregon landowners must replant forest trees after harvesting them.	
T F	12. A high amount of forest growth has led to a greater fire risk for much of Oregon's forests.	
T F	13. In Oregon, logging is restricted near waterways to protect fish and water quality.	
T F	14. More than 4 million acres of Oregon forest are certified by a sustainable forest certification system.	

Western Perspectives on Forests

The history of forestry in the United States has been shaped by our nation's changing ideas about forests. Three Western individuals from the late 1800s to early 1900s greatly influenced those ideas through their work and their writing. Each cared deeply about America's forests, but had differing views on the value of forests and how to "conserve" or maintain them.

John Muir

John Muir was born in Scotland in 1838, and immigrated to Wisconsin with his family when he was 11 years old. As an adult he became devoted to learning about a world unchanged by humans or machines. He walked from Indiana to Florida, sailed to Cuba, New York and Panama, and eventually made his way to California, where he continued his walking explorations in the Sierra Nevada mountains.

Starting in the 1870s, Muir became known for his newspaper articles and essays, in which he wrote in poetic and spiritual terms about the natural world. He believed wilderness is important for its sheer beauty and its ability to renew the spirit. He also believed nature has value whether or not people can derive a direct benefit from it. For Muir, conservation meant leaving areas untouched by human hands.

Muir fought to preserve areas of pristine forest and keep them from human destruction. He wrote a series of essays pushing for the establishment of Yosemite National Park, which was eventually created in 1890. He also worked to create Grand Canyon and Sequoia national parks. In 1892 he co-founded and became the first president of the Sierra Club, an environmental preservation organization.

Quotes from Muir's writings:

- *"Everybody needs beauty as well as bread, places to play in and pray in, where nature may heal and give strength to body and soul alike."*
- *"It took more than three thousand years to make some of the trees in these Western woods—trees that are still standing in perfect strength and beauty, waving and singing in the mighty forests of the Sierra. Through all the wonderful, eventful centuries since Christ's time—and long before that—God has cared for these trees, saved them from drought, disease, avalanches, and a thousand straining, leveling tempests and floods; but he cannot save them from fools—only Uncle Sam can do that."*

Gifford Pinchot

Gifford Pinchot (PIN-show) was the first professionally trained forester in the United States. He was born in 1865 in Simsbury, Connecticut, to an upper-class family. When he entered Yale University, his father suggested he become a forester since he had always loved being in the woods. At that time, no university offered a degree or even a course in forestry, so Pinchot decided to study forestry in France after graduating.

When he returned to the United States, he worked as a resident forester for George Vanderbilt's Biltmore Forest Estate. In 1889 he became head of the U.S. Division of Forestry. In 1900 he founded the Society of American Foresters (SAF), a professional organization aimed at bringing high standards to the new field of forestry. In 1905 he was named Chief Forester of the newly formed U.S. Forest Service under President Theodore Roosevelt. Under his leadership, the Forest Service grew from 60 national forests covering 56 million acres to 150 national forests covering 172 million acres.

For Pinchot, the term conservation meant the efficient use of natural resources, and he held a utilitarian, or practical, view of forests. He believed forests are for people to use, but he also stressed their "wise use." His view was that natural resources should be managed by considering the "greatest good" for the greatest number of people over time.

Quotes from Pinchot's writings:

- *"Conservation is the foresighted utilization, preservation and/or renewal of forests, waters, lands and minerals, for the greatest good of the greatest number for the longest time."*
- *"Without natural resources life itself is impossible. From birth to death, natural resources, transformed for human use, feed, clothe, shelter, and transport us. Upon them we depend for every material necessity, comfort, convenience, and protection in our lives. Without abundant resources prosperity is out of reach."*

Aldo Leopold

Aldo Leopold was born in 1887 in Burlington, Iowa. After graduating from the Yale Forest School in 1909, he pursued a career in forestry, working for more than 20 years with the U.S. Forest Service in New Mexico and Arizona.

In 1933 he published the very first textbook about wildlife management. Later that year he became a professor of game management at the University of Wisconsin. In 1935 he and his

family began restoring a worn-out farm along the Wisconsin River, which further informed and inspired his understanding of the natural world.

Leopold advanced the idea of the "land ethic," which places value on all living things as well as their interactions in the environment. To Leopold, the term conservation meant managing natural areas based on ecological principles – not just based on economics. He recorded his findings and thoughts in short essays, which were published the year after he died in 1949 as the book *A Sand County Almanac and Sketches Here and There*. His words inspired many conservationists in the 1950s and 1960s, and helped spur the environmental movement.

Quotes from Leopold's book:

- *"We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect."*
- *"Civilization has so cluttered this elemental man-earth relationship with gadgets and middlemen that awareness of it is growing dim. We fancy that industry supports us, forgetting what supports industry."*

Questions

1. Compare the three views of conservation held by Muir, Pinchot and Leopold. In what ways were they similar? In what ways were they different?

2. Choose one of the quotes to analyze more carefully. What does this quote tell you about the person's beliefs about forestland and natural resources?

3. Name one way each person's views helped define our nation's current relationship with forests.

4. Each of these three people spent a lot of time outdoors and in nature. Do you think going outdoors is necessary to develop beliefs about the protection or use of the environment?

Indigenous Perspectives on Forests[1]

Following are excerpts from the article "Native American Forestry Combines Traditional Wisdom with Modern Science" by Gail Wells, describing some perspectives held about forests by Oregon tribal members:

- Ten thousand years ago, ancestors of today's Coquille Indians lived along the southern Oregon coast from Coos Bay to Cape Blanco, and along the inland valleys of the Coquille River drainage. A common misconception among European Americans is that Indians lived passively within their environment, "at one with nature." On the contrary, aboriginal peoples actively managed their landscape for their own objectives, using the technologies available to them. For coastal tribes and others, the key management tool was fire. The people regularly set fire to meadows and valleys to maintain grassy cover, keep brush at bay, improve habitat for deer and elk, and cultivate fire-adapted plants that were important sources of food and fiber. Hence, the land the first Euro-Americans took to be a pristine, park-like wilderness was in fact the product of thousands of years of Indigenous land management.

- "There's a tendency in today's culture," says Tim Vredenburg [head forester for the Coquille Indian Tribe in Oregon], "to fixate on a particular set of values within a forest, or an ecosystem: jobs, or timber receipts, or old growth or fish habitat – you name it, there's a position. The tribe's position is to value all of it. The idea of reserves, of drawing a line around a forest to keep people out, doesn't make sense to the Coquilles. But neither does the idea of taking everything away and leaving nothing for future generations."

- "We get many things from the forest – canoes, baskets, clothes, shelter, fir, cedar, spruce, beargrass, camas – and we use all of these things," explains Coquille tribal chief Ken Tanner. "But they also have a spiritual value which we honor as we honor our ancestors. What we take, we try to give back. What we don't need, we try not to take."

- One important reason for burning was to prevent the vigorous Douglas-fir from invading clearings. "The Douglas-fir timber they say has always encroached on the open prairies and crowded out the other timber," recalled Lucy Thompson (Che-nawah Weitch-ah-wah),

[1] Excerpted from: Wells, Gail. "Native American Forestry Combines Traditional Wisdom with Modern Science." February 22, 2016. *Solutions Journal*, thesolutionsjournal.com.

a Yurok woman of northern California, in 1991. “Therefore they have continuously burned it and have done all they could to keep it from covering the open lands.”

- In the Siletz language, the word for Earth may be translated roughly as “made for you.” People who depend on the land learn to pay attention to cycles of birth and death, of plenty and scarcity. Over many generations, the Indians of the Oregon coast learned where the best beargrass patches were and how to keep them flourishing, when to burn the high meadows of the summer campground to attract the elk and to keep the Douglas-fir at bay, and how to harvest and process the inner bark of the Port Orford cedar for making blankets.

- “I come from a people who did not have a word for preservation, or for the environment, or for ecology,” says Esther Stutzman, a storyteller of the Komema Kalapuya people of western Oregon and a member of the Confederated Tribes of Siletz. “The word they had was *respect*.”

Questions

1. How are the Indigenous perspectives of forests described in the article similar to and different from the Western perspectives represented by Muir, Pinchot and Leopold?

2. What are the underlying beliefs or values in each viewpoint?

3. Who or what is left out or missing from each?

Tracing Oregon's Timber Culture[2]

As Oregonians, we often encounter references to forestry in our everyday lives. Many place names, local sports teams and brands use forestry terms and aesthetics to reinforce their Oregon origin. This article from the World Forestry Center in Portland summarizes our state's complex forestry history.

When did Oregon and forestry become synonymous?

Before white settlers arrived in Oregon, it was home to over 20 Indigenous tribes whose people lived symbiotically with the land, maintained the forests, and worked to preserve the environment around them.

As a territory, Oregon was shaped through manipulation of land by the United States government. The Donation Land Act of 1850 dispossessed Indigenous Peoples and pushed white settlers into the territory. White males and married white women were each allotted a 320-acre plot of land in Oregon. Conflict erupted between these white settlers and Native Peoples; many tribes did not survive the wars. In 1854, U.S. army troops forcibly relocated most surviving tribal bands to a newly established coastal reservation. The Act expired in 1855, but resulted in a huge increase in Oregon's population of white settlers.

Today, there are only nine federally recognized tribes within the state. However, they continue to play a crucial role in the maintenance of forested lands and passing on Indigenous knowledge to other state residents.

The timber industry in Oregon grew alongside the California Gold Rush of the 1800s. As more white settlers moved west hoping to strike it rich, the need for lumber increased. When rail lines were extended into Oregon in the 1870–80s, the Ponderosa Pines of Eastern Oregon and the forested areas of the Western Cascades were there to meet the need. Between the 1880s and 1911, more railways were

[2] Source: "Tracing Oregon's Forestry Culture." World Forestry Center. Reprinted with permission from the World Forestry Center.

added and logging boomed. By 1938, Oregon was the nation's leading producer of wood. To this day, Oregon produces more wood building materials than any other state.

As Oregon, and its largest city, Portland, grew in the mid-1800s, more trees were cut to build homes. Because it was easier to leave the stumps instead of removing them, the city of Portland became known as Stumptown. Stumptown Coffee and the numerous other brands that use this moniker pay homage to Portland's early logging history.

Other brands and organizations have also embraced the city's logging history. The Portland Timbers was established in 1975 as part of the North American Soccer League (NASL). In 2011, the team earned a spot within Major League Soccer. Timbers' fans, proudly called the "army," celebrate their team with lumberjack-inspired apparel. Players' jerseys sport an axe-shaped logo and the team's woodsman mascot, Timber Joey, cuts rings from a Victory Log after every home goal.

Race and Forestry

Oregon's constitution originally included a racist provision that excluded free Black Americans from the state. It read that "No free Negro, or Mulatto, not residing in this state at the time of the adoption of this constitution, shall come, reside, or be within this state, or hold any real estate, or make any contracts, or maintain any suit therein." The constitutional provision was only repealed in 1926.

This racist provision meant that most of Oregon's early population and loggers were white. However, despite this prejudiced history, Black Americans and other people of color played a key part in our state's logging industry.

Maxville, Oregon in Wallowa County was a home base for Oregon's black logging population, as well as Greek, Japanese, and other loggers of color. Though the town and recreational activities were segregated, Black and white men worked side by side. Maxville was home to a vibrant logging community until the early-1930s, when lumber companies cut their holdings there and most families moved away. In the mid-1940s Maxville was destroyed by a storm.

An Evolving Economy

Oregon has been at the forefront of the development of logging practices since the very beginning. The state continues to lead the field. Originally loggers used the steam donkey engine to increase productivity, eventually trading it for electric tools.

Around 1925, when California's demand for lumber fell, Oregon's loggers began to suffer; mill closures and employee layoffs became commonplace by the beginning of the 1930s.

After World War II, however, Oregon's logging industry boomed once again. The post-war increase in production brought a second wave of logging prosperity. New technology, specifically the modern chainsaw, further increased efficiency.

Timber Today

Logging still accounts for a significant portion of Oregon's annual revenue. In the five-year period from 2017 to 2021, Oregon timber harvest averaged around 3.8 billion board feet per year.[3] Today, more than 61,000 Oregonians are employed in the forestry industry, and nearly half (47%) of the state is considered forestland. The state is the top U.S. producer of both softwood lumber and plywood. And, more recently, Oregon has become a leader in manufacturing innovative "mass timber" engineered wood products such as cross-laminated timber (CLT) and Mass Plywood Panels (MPP).

Forestry has shaped the state in countless other, more subtle ways. Portland's thriving arts, cultural and nonprofit organizations are indirectly supported by the timber industry, as many of the state's largest philanthropic donors have financial roots in forestry.

So, the next time that you see a new craft beer with a lumberjack on the logo, know that you have Oregon's timber history to thank.

Questions

1. What are five key events that shaped Oregon's forest industry?

2. The article lists several logos and organization names that show the importance of Oregon's forest industry. What are some locations, companies or brand names in your community that reflect the importance of forests and forestry?

[3] Source: Oregon Forest Facts and Figures, 2023-2024. Oregon Forest Resources Institute, learnforests.org.

STUDENT PAGE
LESSON 2

NAME(S): _____

Creating a Timeline of Oregon Forestry History

Events

Donation Land Act of 1850

Endangered Species Act

Homestead Act of 1862

Lewis and Clark Expedition in Oregon

National Environmental Protection Act

National Forest Management Act

Northern spotted owl listed as a threatened species

Northwest Forest Plan

Oregon became a state

Oregon became the nation's leading producer of wood

Oregon Forest Practices Act

Oregon Private Forest Accord

Oregon's first sawmill

Oregon State University College of Forestry established

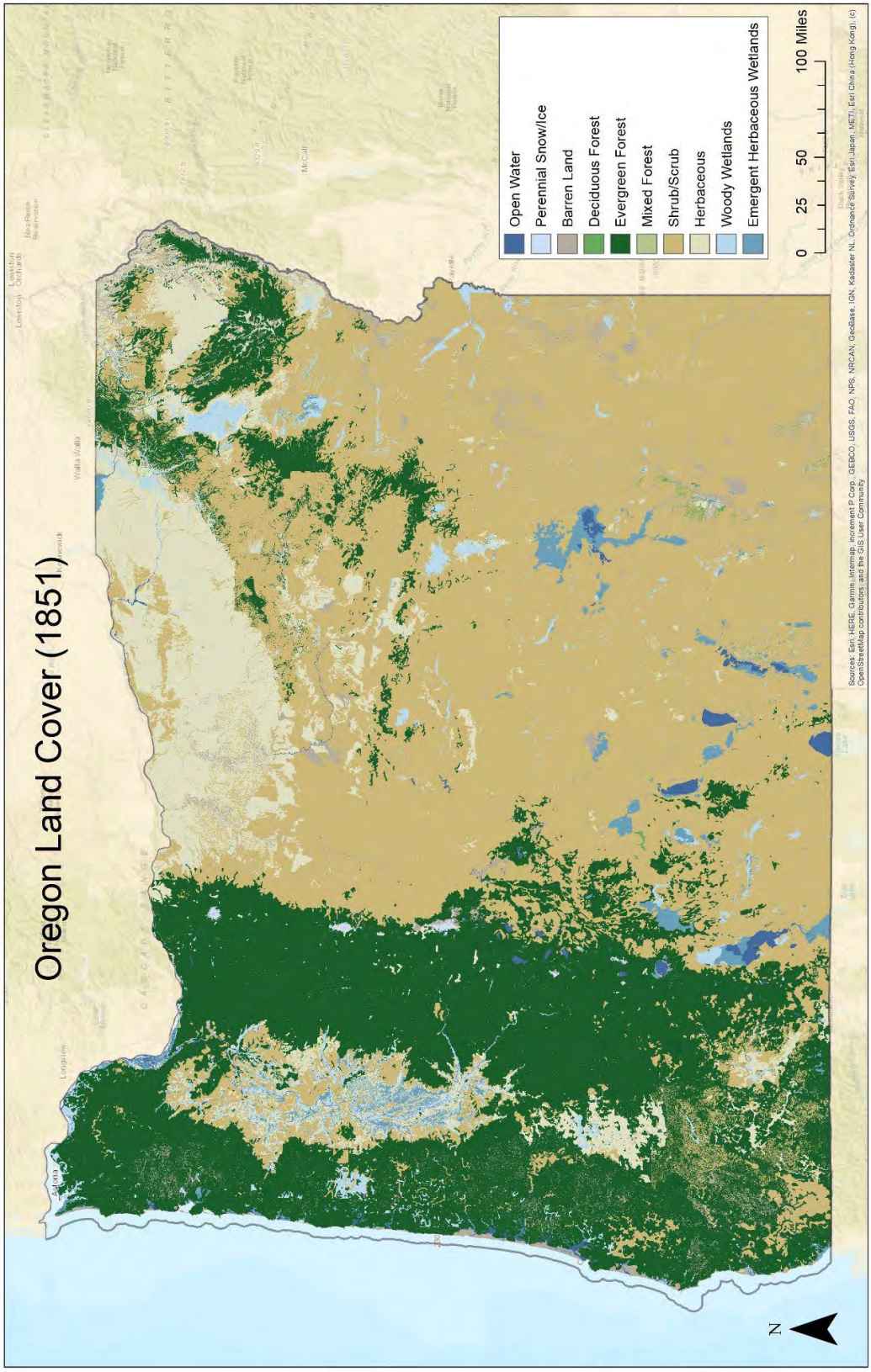
The Oregon Trail

Transcontinental railroad completed

Directions

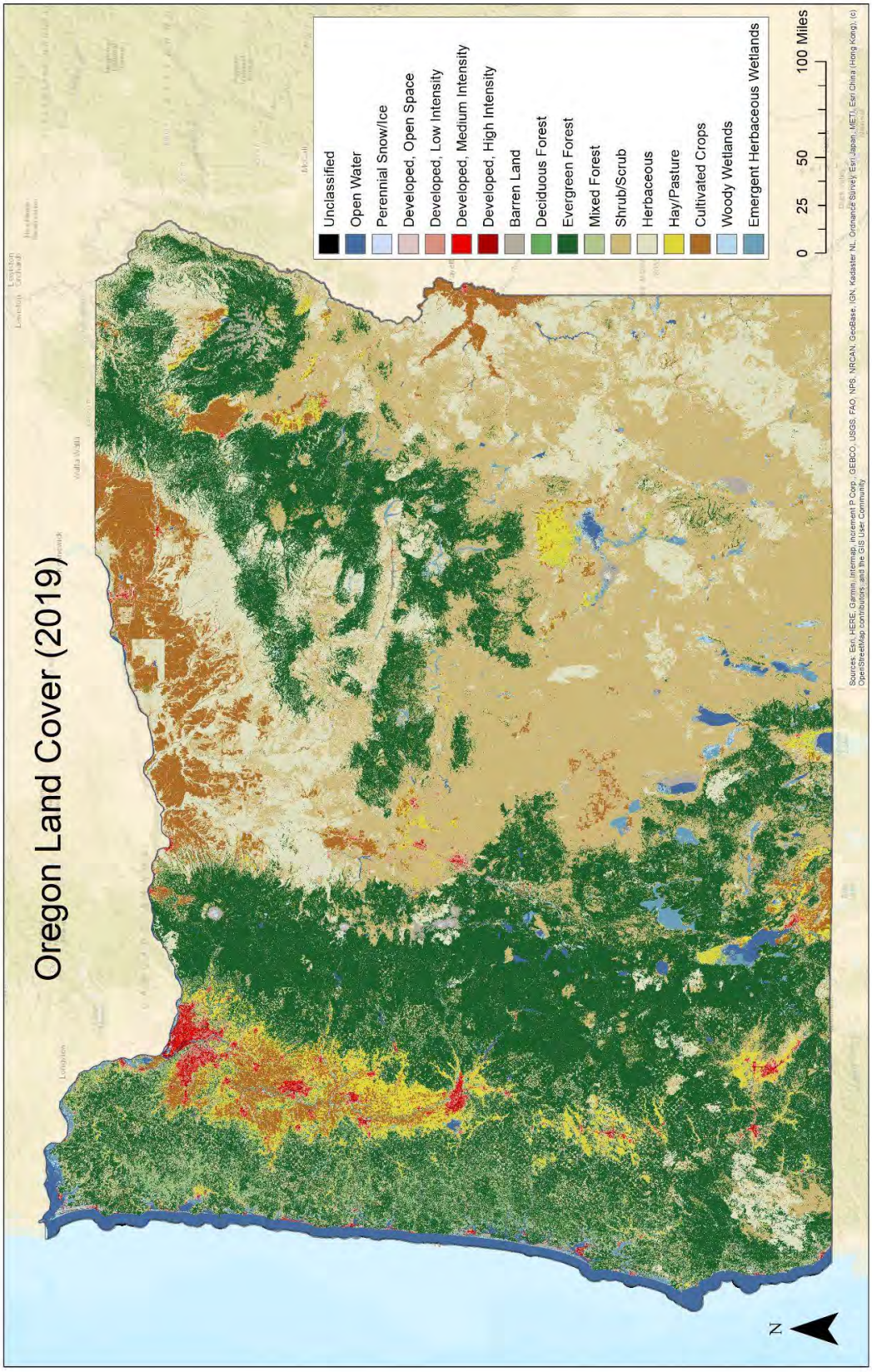
1. Divide up the list of events above so all the members of your group have about the same number to research.
2. For each, find out the following:
    a. When did this event occur?
    b. What was this event? (Describe it in one or two sentences.)
    c. How did this event affect Oregon forests or forestry? (Describe the effect in one or two sentences.)
    d. What sources did you use to learn about this event? (Cite the title, author, date and web page, if any, for each source.)
3. Write the information for each event on separate index cards or pages.
4. Sort all the cards or pages into chronological order.
5. Determine the earliest and the latest dates, and use these to decide on units of time for your timeline (1 year, 5 years, decades, etc.).
6. Decide how you will mark and label the dates and other information on your timeline.
7. Create the frame for your timeline, and then add the dates and other information for each event.

Oregon Land Cover – 1851[6]



[6] Source: Map downloaded from Historic Oregon Land Use and Land Cover 1851 (Generalized). Oregon Explorer Map Viewer, oregonexplorer.info.

Oregon Land Cover – 2019[7]



[7] Source: Map downloaded from National Land Cover Database (NLCD) 2019. Oregon Explorer Map Viewer, oregonexplorer.info.

NAME(S): _____

Oregon Land Cover Definitions[8]

Perennial Ice/Snow—Areas characterized by a perennial cover of ice and/or snow, generally greater than 25% of total cover.

Developed, Open Space—Areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20% of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses and vegetation planted in developed settings for recreation, erosion control or aesthetic purposes.

Developed, Low Intensity—Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20% to 49% percent of total cover. These areas most commonly include single-family housing units.

Developed, Medium Intensity—Areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50% to 79% of the total cover. These areas most commonly include single-family housing units.

Developed High Intensity—Highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80% to 100% of the total cover.

Barren Land—Areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.

Deciduous Forest—Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species shed foliage simultaneously in response to seasonal change.

[8] Source: National Land Cover Database Class Legend and Description. Multi-Resolution Land Characteristics (MRLC) Consortium, mrlc.gov.

Evergreen Forest—Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75% of the tree species maintain their leaves all year. Canopy is never without green foliage.

Mixed Forest—Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75% of total tree cover.

Shrub/Scrub—Areas dominated by shrubs less than 5 meters tall, with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.

Herbaceous—Areas dominated by gramanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.

Hay/Pasture—Areas of grasses, legumes or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20% of total vegetation.

Cultivated Crops—Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20% of total vegetation. This class also includes all land being actively tilled.

Woody Wetlands—Areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Emergent Herbaceous Wetlands—Areas where perennial herbaceous vegetation accounts for greater than 80% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

NAME(S): _____

Oregon Land Cover Changes

Feature	Changes	Impacts
Perennial snow/ice		
Developed (open space, low intensity)		
Developed (medium intensity, high intensity)		
Forest (deciduous, evergreen, mixed forest)		
Shrub/scrub and herbaceous		
Hay/pasture		
Cultivated crops		
Wetlands (woody and emergent herbaceous)		

STUDENT PAGE
LESSON 4

Oregon's Forest Resources[9]

Introduction

A forest is a living, complexly interrelated community of trees and associated plants and animals. Forests help provide the earth with oxygen necessary for life. Green plants take in energy from the sun and use that energy in their cells to transform water and carbon dioxide into oxygen and glucose, a carbon-based molecule. This process is called photosynthesis. High levels of carbon dioxide and other gases in the atmosphere contribute to global warming. Forests help cool and regulate the earth's climate by removing carbon dioxide from the atmosphere. The carbon-based molecules that result from photosynthesis are stored in trees' trunks, stems and leaves.

Trees take moisture and nutrients from the soil, and with the aid of sunlight they grow wood and other natural products used by humans. Oregon's forests are very diverse, ranging from mixed-species, old-growth trees in roadless wilderness areas to single-species, intensively managed industrial forests. To better understand forestry in Oregon, it's important to understand some of the basic facts that shape Oregon's forests.

Oregon's Forest Heritage

Of the 62 million acres of land in Oregon, some 30 million acres, or 47 percent, are classified as forestland. Over the past four centuries, the amount of forestland in the state has remained fairly constant, with about 1 percent having been lost to human development (agriculture, urban growth, highways, electric transmission lines and other infrastructure) since Europeans first visited the Northwest. While the amount of forestland has not changed considerably, its composition has changed, as much of the state's virgin forests were harvested for timber during the 19th and 20th centuries.

Forest Sustainability

The ecological, social and economic benefits of forests are all important to Oregon's citizens. Using our forests sustainably, so they continue to provide these important benefits far into the future, requires us to recognize the interdependent relationships among these various uses and acknowledge the need for balance among them.

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[9] Source: *Exploration of Oregon Forests: Module 1 – Oregon's Forest Heritage*. Developed by Julie Woodward based on the Oregon State University Forestry Extension's *Basic Forestry Short Course*.

- **Ecological Value:** The forest floor provides food, shelter and habitat for animals, from the simplest worm to the biggest bear. Tree roots help stabilize the soil and prevent erosion. The top portion of the forest, called the "canopy," helps regulate forest temperature and moisture. Forests also capture carbon dioxide (a greenhouse gas), produce oxygen and filter water to keep it clean. These are all important ecological functions, also known as ecosystem services, forests provide.
- **Social Value:** Forests provide places for people to relax, rejuvenate, seek food and have fun. Each year, thousands of Oregonians visit our forests to go hiking, biking, camping, hunting, fishing, foraging, off-roading and wildlife watching. Another reason forests are important to society is that they provide the raw materials for all the wood products that we use on a daily basis, such as housing, furniture, newspaper, books and cardboard.
- **Economic Value:** Oregon harvests more conifers (cone-bearing evergreens) than any other state, and is the leading producer of softwood lumber in the nation. Tens of thousands of people in Oregon earn a living by working directly with the state's forest sector. Forestry is especially important to rural economies, with most forestry-related jobs located in communities outside the Portland metropolitan area.

Oregon Forest Practices Act

All private and state forestland is protected under the rules of the Oregon Forest Practices Act (OFPA), the nation's oldest and one of the most comprehensive sets of laws and rules governing harvest practices and other forest management operations. Although US Forest Service and Bureau of Land Management (BLM) lands are not regulated by the OFPA, these federal agencies have agreed to meet or exceed many of its requirements. Oregon's landmark land-use laws offer further protection by tightly restricting the conversion of forests to other uses, attempting to ensure that future generations will have ample forest resources.

OFPA includes laws that:

- **Require Prompt Reforestation.** On average, more than 40 million new trees are planted each year in Oregon's forests. Reforestation is required any time forest density drops below established standards following harvest.
- **Require Written Plans.** The Oregon Department of Forestry must be notified of all harvesting operations and be provided site maps for review. In addition, some planned actions require that the landowner or timber operator submit a written plan that documents how the operation will meet the OFPA. In general, harvesting, road

construction or other operations conducted near streams or wetlands require a written plan.[10]

- **Protect Water Resources.** To protect water resources in forests, particularly where fish and domestic water supplies are involved, harvest operations are restricted within a certain distance from the banks of streams and water bodies.
- **Protect Wildlife Habitat.** Landowners must be responsive to the nesting and feeding needs of a wide variety of forest wildlife. For example, they must ensure that snags (standing, dead trees), fallen logs or standing green trees are present to provide nesting sites and other habitat for many birds, mammals and other animals.
- **Limit Clearcuts.** Clearcutting is when most or all the trees in an area are cut down. The OFPA limits the size and location of clearcuts.
- **Regulate Road Construction and Maintenance.** Strict regulations govern the location, construction, maintenance and repair of roads on both state and private forestland. Roads must avoid marshes, meadows, drainage channels, riparian areas and, when possible, steep terrain.

Oregon's Wood Products

Different types of trees lend themselves to different kinds of wood products. "Hardwood" broadleaf trees such as oak, cherry and walnut provide dense, durable wood – the kind commonly used to make flooring and furniture. "Softwood" cone- and needle-bearing trees such as pine, fir, spruce and cedar produce lumber that is less dense and lighter in weight. It is often used in construction and papermaking.

Beyond the "hardwood" and "softwood" distinction, the different characteristics of dozens of tree species, such as flexibility, straightness and tightness of grain, make for a wide range of applications.

Wood is a component in 5,000 different products, many of them not as easily recognizable as a baseball bat or table. While some products are made directly from hardwood or softwood lumber, many engineered wood products are made of combinations of sawdust, shavings and other waste materials. A wide range of products comes from wood pulp and plant chemicals extracted from wood pulp.

Oregon's wood and paper products are sold in all 50 states and some 40 foreign countries. They include lumber, door and window frames, fencing material, plywood, newsprint, printer and

[10] Source: "Forest Management Planning." Oregon State University, oregonstate.edu.

photocopy paper, egg cartons, food containers, glues, packing material, furniture, toys, playground equipment, pencil stock, cabinets, cosmetics and more.

Wood Use in a Global Context

U.S. wood consumption per person has increased 40% since 1960. Much of this demand has been met by imports from around the world. Across the globe, about 50% of all forests have been converted to other land uses (compared with 33 percent in the U.S. and 8% in Oregon). Timber harvests in countries without strong forest practice laws often destroy critical habitat such as tropical rainforests, and affect endangered species. Individual consumer choices help shape forests, ecosystems and communities, not only in Oregon, but across the United States and around the globe.

A Career in Forestry

A career in forestry or wood products offers an exciting chance to benefit Oregon's people, environment and economy. Forestry professionals are engaged in the practice of creating, managing, using and conserving forests and wood products in a sustainable manner to meet the needs, goals and values of forestland owners. They care for trees and other forest resources, including soils, water and wildlife, and make innovative products. Some people are drawn to forestry because they want to work outdoors. Many forest sector careers involve working in the forest, but there are other forest-related jobs that might surprise you: writing policy papers, managing timber investments, using satellite mapping technology, managing product quality and educating the public are just a few examples.

Types of job responsibilities among Oregon's forest sector professionals include:

- Growing trees for wood products
- Managing water quality
- Protecting endangered wildlife
- Ensuring healthy forests
- Planning recreational uses
- Researching tree genetics
- Planning and supervising timber harvests
- Developing mill technologies
- Creating new wood products
- Researching global markets
- Producing renewable biomass energy

NAME: _____

Oregon's Forest Resources – Questions[11]

1. How do forests help combat global climate change?

2. Over the last four centuries, what percentage of forestland has Oregon lost?

3. How do Oregon's forests contribute to the ecological, social and economic well-being of the state and beyond?

4. What factors are included when we talk about the sustainability of Oregon forests?

5. Describe the Oregon Forest Practices Act (OFPA).

6. What everyday products are made of wood or wood byproducts from Oregon trees?

7. How do consumer choices affect Oregon's forests?

8. Which forest-related job responsibility sounds the most interesting to you?

[11] Source: *Exploration of Oregon Forests: Module 1 – Oregon's Forest Heritage*. Developed by Julie Woodward based on the Oregon State University Forestry Extension's *Basic Forestry Short Course*.

STUDENT PAGE
LESSON 5

NAME(S): _____

Oregon's Forest Landowners

Ecoregion researched: _____

1. Using the map on your ecoregion's overview, draw the boundaries of your ecoregion on the *Who Owns the Forests?* map.

2. Looking at the *Who Owns the Forests?* map, what patterns of forest ownership do you notice in this ecoregion?

3. Estimate the percentage of forestland owned by each of the following entities in this ecoregion. In addition to your answer, explain the method you used to estimate it.

    a. The federal government (including Bureau of Land Management, National Park and National Forest lands)

    b. Private industrial companies

    c. Families and individuals

    d. Tribal governments

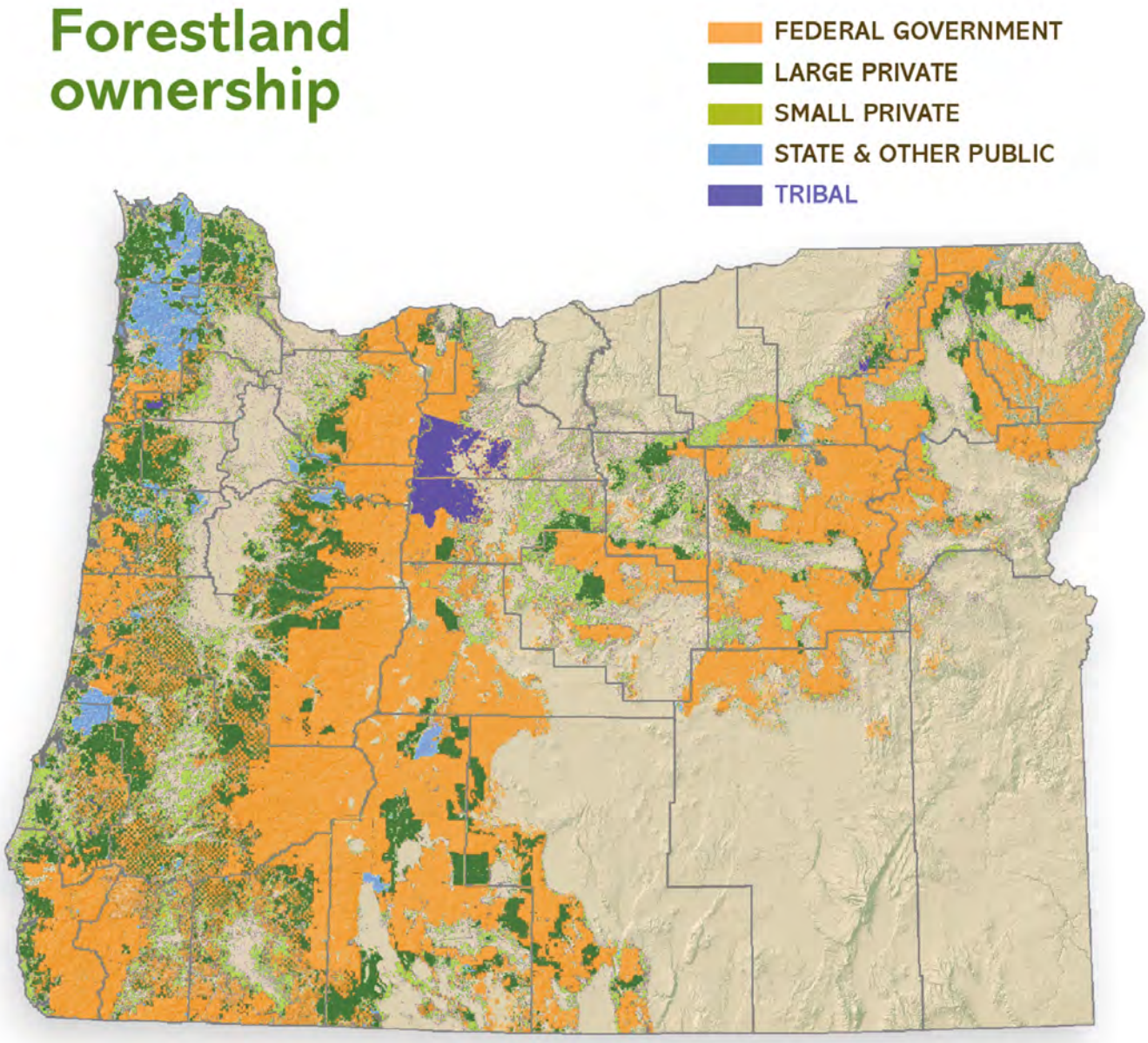
    e. Oregon state government

4. Using the *Oregon's Forests* poster, identify which forest types are most prevalent in this ecoregion. Why do you think these types are most prevalent here?

5. Using your ecoregion's overview or other sources, identify possible challenges forest owners in this ecoregion face.

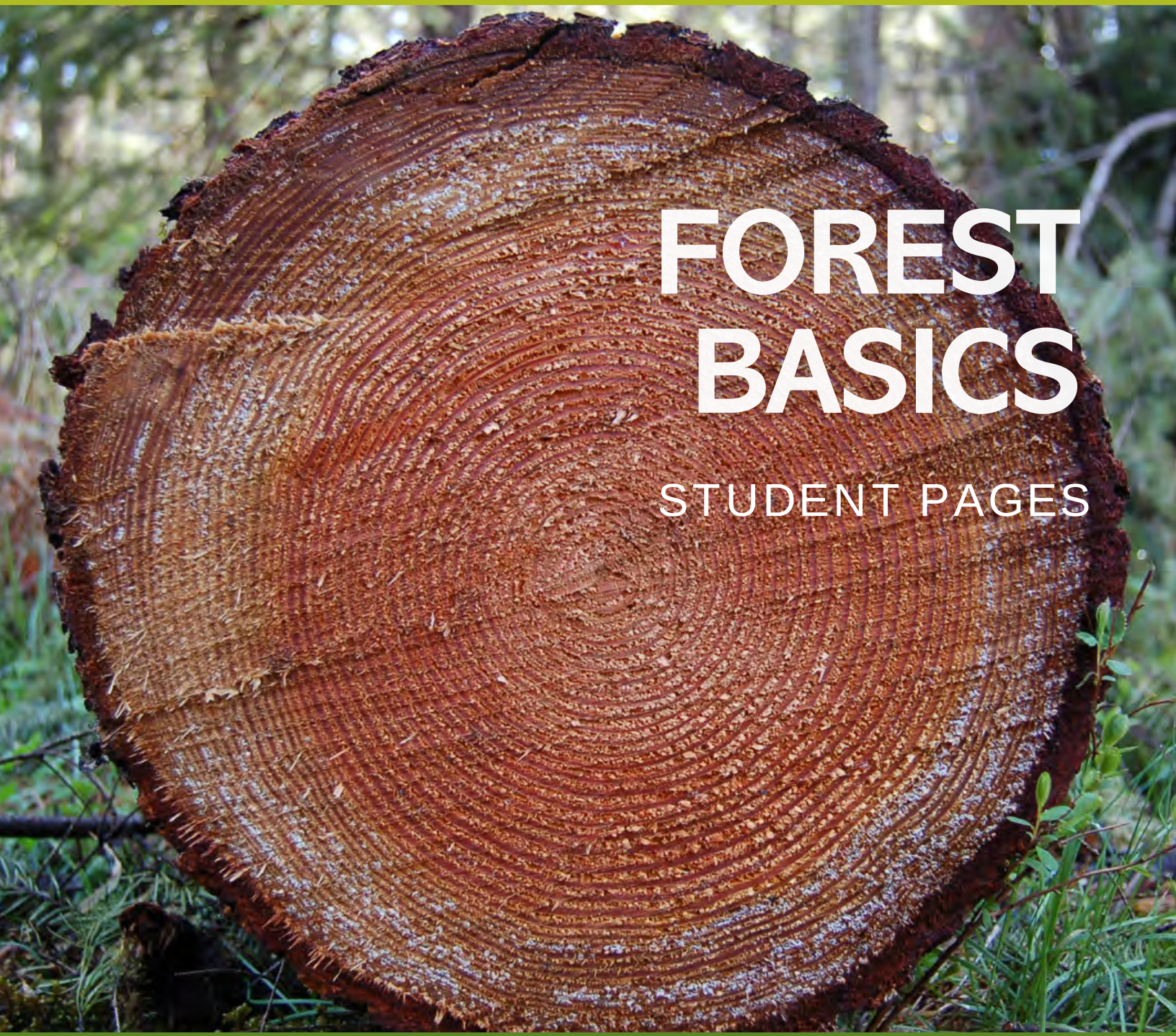
NAME(S): _____

Who Owns the Forests?



INSIDE OREGON'S FORESTS

A high school forestry curriculum



FOREST BASICS

STUDENT PAGES

Oregon Forest Resources Institute

STUDENT PAGE
LESSON 1

Basic Tree Biology[1]

Introduction

Plants are complex organisms that differ greatly in structure. While studying plants, you may discover trees, shrubs, flowering herbs, mosses, lichens and ferns, all of which share some common characteristics.

A **tree** is usually the tallest organism in the ecosystem (usually greater than 20 feet at maturity) and usually has a single stem, which is also known as the trunk. **Shrubs**, on the other hand, generally have multiple stems and relatively short statures.

A tree is a long-lived species. Some species live 1,000 years or more, so they must be able to meet the most severe conditions for long periods of time, including cold and hot temperatures, high winds, drought, rain and fire.

Trees cannot move to a new location if they do not like where they are located, so they must be well adapted to their site in order to thrive. A variety of factors including climate, geology and topography (the shape of the land) determine the tree species found in an ecosystem.

Trees serve many useful purposes to humans such as providing food, shelter, clothing, fuel, clean air, clean water, shade and medicine. Trees also provide food and shelter for many other living organisms such as squirrels, woodpeckers, insects, fungi, lichens and other plants.

Fun Facts

- Oregon's most common tree is the Douglas-fir, which is also the state tree. West of the Cascades, if you looked at any evergreen tree and guessed it to be a Douglas-fir, you would be right eight out of 10 times.
- The largest tree in Oregon is a 329-foot-tall Douglas-fir located in Coos County's Brummet Creek. It is taller than a 28-story building!
- Oregon's oldest known living tree is a Douglas-fir called "Grandma Tree," located in the Coos County Coast Range and estimated to be about 1,100 years old.

[1] Source: *Exploration of Oregon Forests: Module 2 – Tree Biology*. Developed by Julie Woodward based on the Oregon State University Forestry Extension's *Basic Forestry Short Course*.

Tree Structures and Their Functions

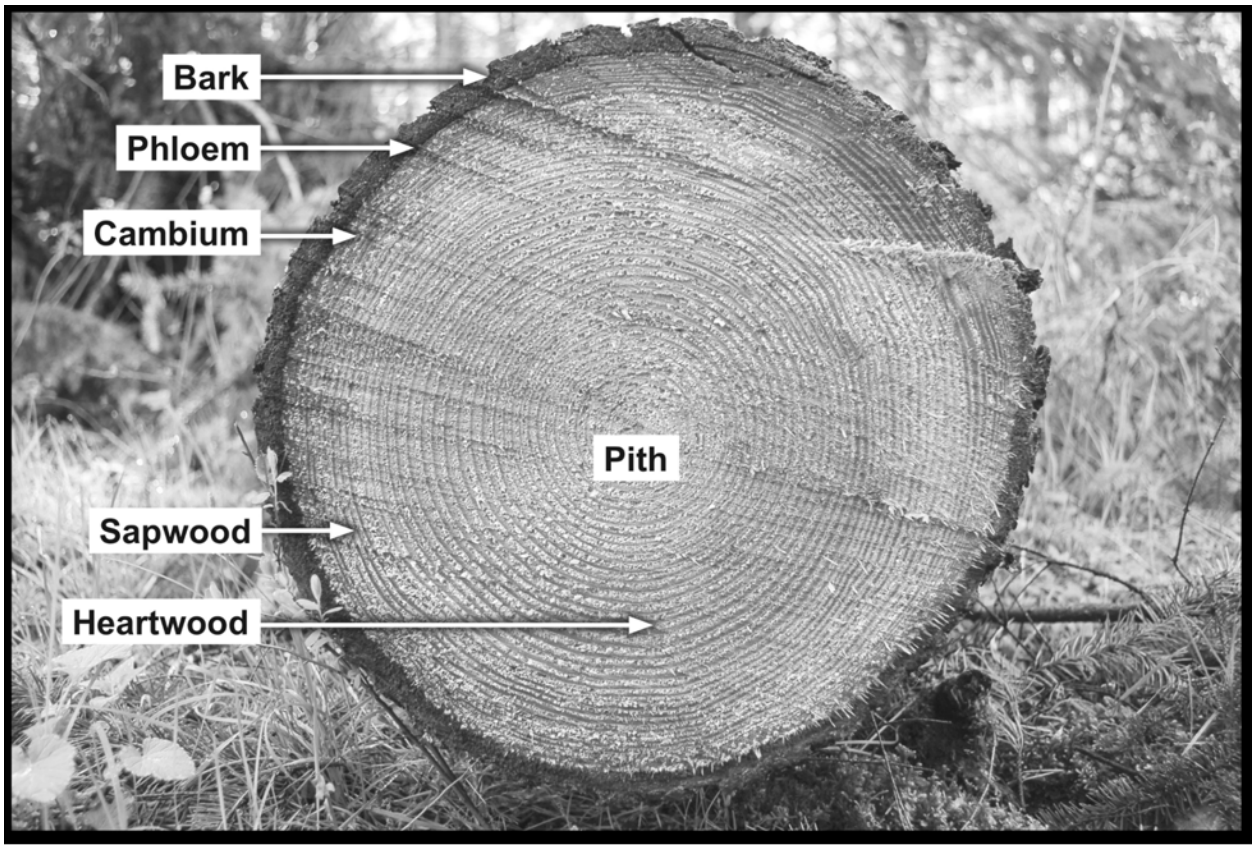
Trees have specialized parts that enable them to meet their basic needs. Following are a few of these parts:

- **Leaves**. Leaves capture sunlight and produce food in a process called photosynthesis. They are an important component of the tree's transport system, releasing water to the air and drawing in carbon dioxide.
- **Branches**. Branches support the leaves and extend them into sunlit areas. They transport water and nutrients to leaves, and nutrients from leaves to the rest of the tree.
- **Stem**. The stem, or trunk, holds the tree's branches high above competing vegetation, and transports food and water.
- **Woody roots**. Woody roots secure the tree to the soil and transport water and nutrients.
- **Fine roots**. Fine roots are responsible for much of the tree's uptake of water and nutrients.

A tree's stem, or trunk, also contains several layers, each of which serves a different function. Moving from the outside of the trunk toward the inside, you will find these layers:

- **Bark**. Bark provides the outer covering of a tree, which can be very thick (Douglas-fir) or thin (western hemlock). Bark protects against fire, disease, extreme temperatures and mechanical damage.
- **Phloem**. Phloem is a layer of living tissue just inside the protective outer bark. Phloem serves as the primary mechanism by which food is transported within the tree, and it is a favorite treat for bears in the spring.
- **Cambium**. Cambium is composed of living cells that actively divide and result in diameter growth. Cells on the outside of the cambium become phloem, while those on the inside become xylem.
- **Sapwood (xylem)**. Sapwood, or xylem, is recently formed cells capable of water transport. They serve as the primary mechanism by which water and nutrients are moved from the roots to the leaves.
- **Heartwood (xylem)**. Heartwood, also a form of xylem, is the nonfunctioning wood cells that used to be sapwood. They no longer transport water but still provide support. They may have a distinctive color and enhanced decay resistance depending on species and age. The heartwood is the part that shows annual rings. These are produced when the sapwood cells grow rapidly in the spring and are followed by the slower-growing, denser cells of summerwood. The main function of heartwood is to support the tree.

- **Pith**. Pith is found in the center core of the tree trunk and is made of air-filled cells with a distinctive dark color. The pith is a remnant of the first year's growth in the tree, and its main function is to store nutrients.



Cross-section of a tree's trunk.

Leaf Functions

Leaves release oxygen into the atmosphere through small holes called stomata, which are usually located on the underside of the leaf. They can open and close to control movement of water and air. When they are open, water vapor escapes and carbon dioxide (CO_2) can enter the leaf. If there is a drought or high summer temperatures, the tree may close its stomata to conserve water. A lack of carbon in the leaf then limits photosynthesis. Drought-adapted species have found ways to keep stomata open even when water in the soil is limited.

Photosynthesis

Photosynthesis is a natural process by which green trees and plants use energy from the sun to transform water, carbon dioxide and minerals into organic compounds for their growth. Photosynthesis begins when green plants absorb water through roots and carry it to needles or leaves. At the same time, needles and leaves absorb carbon dioxide from the air. The carbon

dioxide then flows to plant cells called chloroplasts, which contain chlorophyll. Chlorophyll uses sunlight as energy to transform carbon dioxide and water into oxygen and carbon-based compounds such as glucose (sugar). These carbon-based compounds provide energy as well as the building blocks for growth and tissue repair. As the plant grows, it releases oxygen into the atmosphere.

The elements needed for photosynthesis to take place:

- Sunlight
- Carbon dioxide (CO_2)
- Nutrient-rich water from the soil

Photosynthesis produces sugars, which are needed for many things. Since it can only produce a limited amount of food, a tree must budget the sugars created through photosynthesis to satisfy the following priorities:

- Root growth
- Reproduction (flowers, cones, etc.)
- Growth so the tree can compete with other vegetation for light and maintain strength
- Food storage to help with spring growth and maintain the tree when photosynthesis is not possible
- Defensive compounds, which protect the tree against insects, rot and disease. If a tree is weak and not producing enough sugars, then it is more likely to be a target for disease-causing germs, or pathogens.

If sunlight, CO_2, water or nutrients are limited, then photosynthesis is reduced and not as much food is produced.

Tree Growth

Trees grow both in height and diameter. We call this primary growth and secondary growth, respectively. Primary growth starts at the top, or tip, of the tree and branches. Primary growth results in more leaf area, height and increased access to sunlight. Secondary growth increases the diameter of the stem or trunk, branches and roots. Secondary growth provides support to increase the numbers of leaves or needles.

Root growth and shoot growth occur at different times of the year. In the Pacific Northwest, we plant trees in the winter because this is when they are most fully dormant and least likely to become stressed by transplanting.

Trees respond directly to light, water, nutrients, humidity, temperature and other physical factors in the ecosystem. When these conditions are sufficient for a particular species, tree height and diameter may significantly increase with age. Drought, severe heat, early frost and other physical stresses, as well as interactions with other organisms, can slow tree growth. Each year, a tree increases in diameter as the cambium divides and a ring of xylem cells is laid down.

Close examination of a tree's cross-section reveals that each ring is made of two bands. The first band is a lighter-colored area of large, thin-walled cells (springwood). The second band is a darker-colored area of small, dense, heavy-walled cells (summerwood). By counting these rings outward from the center, it is possible to determine the age of a tree. In the tropical regions of the world, there is not a definite growing season. Therefore, determining the age of a tropical tree is more difficult.

Annual rings result from defined seasons of growth and dormancy. Most trees in North America have annual rings. Annual rings vary in width, and the width of tree rings tells the story of the growth conditions of a tree. Wider rings usually indicate a fast growth rate. If a tree is stressed by less-than-optimal conditions in its environment, tree rings are often narrow.

Fun Fact

Dendrochronology is the study of growth rings. Using dendrochronology, a scientist can estimate climate variation and other past events through the comparison of successive annual growth rings. Tree ring analysis provides insights into a variety of abiotic and biotic factors such as climate, disease, disturbance, management activity, competition and forest productivity. Using this information in conjunction with observations from the rest of the ecosystem, researchers can hypothesize about the causes of changes in tree growth.

Broadleaf vs. Conifer

Trees are generally classified as either broadleaf (or deciduous) trees or conifers.

Broadleaf trees usually have wide, flat leaves and bear seeds inside fruits, nuts or flowers. Most broadleaf trees are deciduous – that is, they drop their leaves in winter – but a few are evergreen. All broadleaf trees are referred to as hardwoods because their wood generally is harder than that of conifers. That's because, unlike conifers, they don't photosynthesize in the winter months. A few, however, such as cottonwoods and balsa, have very soft wood.

Conifers have needlelike or scalelike leaves and usually bear seeds inside woody cones. Conifers are often called evergreens because most hold their leaves all year long. There are, however, some deciduous conifers, such as the larch, that drop their leaves in winter. All conifers are also called softwoods because their wood is relatively soft when compared with that of broadleaf (hardwood) trees.

Tree Reproduction

There are two processes by which trees reproduce: seed reproduction and vegetative reproduction (sprouting, suckering and layering). Broadleaf trees usually sprout profusely from cut stems, or by sending up shoots from underground roots (suckering), or when lower branches of a tree touch the ground and the branch tips become covered and eventually a new tree grows from the branch tips (layering).

Conifer trees typically reproduce by seed production. For example, pine seeds are produced on the scales of the carpellate (female) cones. In the spring, the pine produces clusters of staminate pollen-bearing cones, or strobili. Upon ripening, they disperse their pollen and fall to the ground. Female cones are produced on the tree at about the same time, and are usually greater in number and located on the outside of the crown. Once the female cones have been pollinated, they grow rapidly with developing seeds. Most pines require two years for the seeds to mature. At that time, the cone dries out, the scales open up, and the winged seeds are dispersed (usually by wind). In general, about 85 percent of the seeds fall within 125 feet of the parent tree.

Summary

A tree is the tallest organism in the ecosystem and usually has a single stem, which is also known as the trunk. Shrubs, on the other hand, generally have multiple stems and are relatively short. A tree is a long-lived species that must be well adapted to its site in order to prosper. Trees serve many useful purposes such as providing food, shelter, clothing, fuel and medicine.

Through the use of specialized parts, a tree provides itself with its basic biological requirements. The following are a few of these parts: leaves, branches, the stem, woody roots and fine roots. A tree cross-section highlights additional specialized parts of a tree: bark, cambium, phloem, xylem and heartwood.

Trees can actually clean water by absorbing contaminated water through their roots and releasing clean water through their leaves. In addition, leaves release oxygen into the atmosphere through small vapor holes called stomata, which are located on the undersides of

leaves. They open and close to control movement of water and air. Chlorophyll in leaves converts sunlight to energy that plants use to produce food. This process is known as photosynthesis.

Trees grow both in height (primary growth) and diameter (secondary growth). Root and shoot growth occurs at different times of the year. Trees respond directly to light, water, nutrients, humidity, temperature and other physical factors in the ecosystem. Annual rings are created by defined seasons of growth and dormancy. Most trees in North America have annual rings. Tropical trees generally do not have annual rings, because there is no dormant season.

Trees can be divided into two main categories: broadleaf and conifer. Broadleaf trees are often referred to as hardwoods, because their wood is generally harder than conifers (softwoods). Broadleaf trees reproduce by seeds inside fruits, nuts or flowers, and typically drop their leaves in winter. Conifers reproduce with seeds in woody cones and hold their needles all year long.

STUDENT PAGE NAME(S): _____

LESSON 1

Tree Biology – Questions[2]

1. What's the difference between a tree and a shrub?

2. Name five specialized parts of a tree. Describe the function of each.

3. Name the different parts of a tree cross-section. Identify the function of each.

4. What special cells do leaves have? What exits and enters leaves through these cells?

5. Define photosynthesis and then draw a diagram of the process.

6. Explain the difference between primary and secondary growth.

7. During what months are root and shoot growth most active?

8. How does a tree increase in diameter?

9. List the characteristics of broadleaf trees and coniferous trees.
   Broadleaf Coniferous

10. What types of wood do broadleaf and coniferous trees have?

11. What are the two methods by which trees reproduce?

[2] *Source: Exploration of Oregon Forests: Module 2 – Tree Biology*. Developed by Julie Woodward based on the Oregon State University Forestry Extension's *Basic Forestry Short Course*.

STUDENT PAGE
LESSON 2

NAME(S): _____

Oregon Forests Compared

Use the *Oregon's Forests* poster to answer the following questions:

1. Which forest type do you live in (or which is closest to your community)?

2. What patterns do you notice about the forest types in Oregon? Identify at least seven different patterns.

3. How does each of these patterns relate to what you understand about Oregon's geography?

4. What might cause these patterns?

Choose three different forest types shown on the *Oregon's Forests* poster. Using the information on the "Oregon Forest Types" student page, compare and contrast the three forest types.

	Forest Type 1:	Forest Type 2:	Forest Type 3:
Ecology			
Climate			
Elevation range			
Precipitation range			

Oregon Forest Types[4]

Douglas-Fir Forest

Ecology: Douglas-fir forests are the most extensive in Oregon; they're also the most important for timber production. Although Douglas-fir is the dominant forest tree west of the crest of the Cascades, it is also an important component of eastside forests.

West of the Cascades, Douglas-fir often forms vast, nearly pure stands, a result of both natural conditions and human management. Common associates include western hemlock (the climax species for much of this region), western redcedar, noble fir, bigleaf maple and red alder (the most common early successional species for most of this region).

East of the Cascades, common associates include incense-cedar, sugar pine, western white pine, ponderosa pine, grand fir, white fir and western larch, depending on moisture and stand history. Understories vary from dense to sparse depending on the availability of moisture, but are generally rich in shrubs and herbs. Douglas-fir is a long-lived, early- to mid-successional species. This means it can colonize recently disturbed sites, and continue to dominate them for hundreds of years.

Climate: Douglas-fir forests grow under a wide variety of conditions. The climate of westside Douglas-fir forests range from wet and mild in the north to drier and warmer in the south. Eastside Douglas-fir forests are drier than those of southwestern Oregon and have more extreme temperature fluctuations, both daily and seasonally.

Elevation: Douglas-fir forests can range from sea level up to 5,000 feet in elevation.

Precipitation: The climate of Douglas-fir forests is varied; therefore, the precipitation range varies from a minimum of 35 inches to more than 160 inches of rain in the Coast Range.

[4] Source: Forest type information adapted from "Forests of Oregon," Oregon State University, College of Forestry. www.cof.orst.edu. Site inactive January 2022.

Hardwood Forest

Ecology: Oregon has many species of broadleaf trees (hardwoods), but generally they occur as individuals and in small stands, rather than in expansive forests as they do in the eastern United States. As a result, hardwood forests in Oregon are not uniform, but vary by location, environment and stand history.

Oak-dominated woodlands are the principal hardwood type in Oregon, and they once spread across the Willamette, Umpqua and Rogue River valleys. Oregon white oak is the principal species in the north, and is joined by California black oak and canyon live oak farther south. Other common species include Pacific madrone and bigleaf maple. Historically these occurred as open woodlands, but with decades of fire suppression many stands have been invaded by more shade-tolerant conifers like Douglas-fir and incense-cedar. When this happens, the conifers commonly outgrow and shade-out the oaks.

Oregon ash, red alder, bigleaf maple and black cottonwood are common throughout much of Oregon. Along the southern coast, Oregon-myrtle and golden chinkapin join the mix.

East of the Cascades, birches, willows and cottonwoods are common. Oregon ash commonly dominates bottomlands where water stands during the winter, while cottonwoods prefer gravelly stream banks where water drains more effectively. Oregon's riparian forests are getting more attention as their vital contributions to water quality and fish habitat are better understood.

Climate: The climates in which hardwood forests occur vary dramatically, from the wet, mild weather of northwestern Oregon to the warmer, drier weather of southwestern Oregon to the highly variable seasonality of eastern Oregon. Different species of hardwoods are adapted to different environmental conditions.

Elevation: Each hardwood species has a range of elevation it is native to. Oregon white oak is usually found at lower elevations in the interior valleys. It grows from sea level to 3,800 feet in the north and at elevations of up to 7,500 feet at the southern end of its range.

Precipitation: Hardwood forests and species are found from climate areas with less than 10 inches of precipitation in the high desert areas of Oregon, to areas with more than 160 inches of precipitation.

Klamath Mixed Conifer Forest

Ecology: The Siskiyou and Cascade mountains of southwestern Oregon are occupied by a complex mix of forest types. Forests near the coast are dominated by conifers in the upper portion of the overstory and hardwoods in the lower portion of the overstory, while forests nearer the Cascades are dominated by conifers, with fewer hardwoods. There are relatively few pure stands of any single species. Because conifers are the commercially important species, these forests are often lumped together as "mixed conifer" forests.

Elevation, distance from the ocean, fire history and past management practices all influence these forests. Near the coast, Douglas-fir and tanoak are the most important species. Golden chinkapin, Pacific madrone and canyon live oak are secondary hardwoods, while sugar pine, ponderosa pine and incense-cedar are secondary conifers. Port-Orford-cedar and bigleaf maple occur on moist sites, while Jeffrey pine is common on serpentine soils (high in magnesium). With increasing elevation, hardwoods become less common, and grand fir and white fir join the mix of conifers. Near the Cascades, forests are dominated by mixed stands of Douglas-fir, ponderosa pine, sugar pine, incense-cedar and white fir. This is the northernmost extension of the mixed conifer forests that dominate the Sierra Nevada Mountains of California. Throughout the mixed conifer forests, understories are sparse and shrubby with lots of poison oak.

Climate: Climates range from cool and moist near the coast to hot and dry in the interior. Complex topography creates a variety of microclimates that support such diverse forests.

Elevation: The geography of mixed conifer forests is diverse, and elevation ranges from 450 to 6,000 feet.

Precipitation: The average precipitation ranges from 15 to 80 inches, depending on the elevation and microclimate.

Lodgepole Pine Forest

Ecology: Pure and nearly pure stands of lodgepole pine are found throughout central and eastern Oregon. Lodgepole pine is a pioneer species that rapidly colonizes disturbed sites and often gives way to more shade-tolerant species like ponderosa pine. Most lodgepole pine stands develop after fire or logging; however, they may form climax forests on sites with deep pumice and volcanic ash.

Lodgepole pine forests grow in dense stands with lots of dead trees. They are very susceptible to insect attacks, especially mountain pine beetles, and are frequently in danger from fire.

Climate: Lodgepole pine is an adaptable species that often flourishes where other trees cannot. Lodgepole forests are found in climates with short, dry summers and snowy winters. They commonly occur in frost pockets and on both excessively wet and dry soils.

Elevation: Lodgepole pines will grow from sea level to 11,000 feet elevation. The lodgepole pine forests in Eastern Oregon are generally below 6,000 feet.

Precipitation: Precipitation levels range from less than 10 inches up to possibly 35 inches, with some variability.

Ponderosa Pine Forest

Ecology: Ponderosa pine forests are widely distributed in eastern Oregon, ranging in elevation from 2,500 to 6,000 feet. Ponderosa pine occurs in pure stands or may be mixed with lodgepole pine, grand fir, Douglas-fir, western larch, western white pine, incense-cedar, white fir and quaking aspen. Volcanic pumice soils often support pure stands of ponderosa pine. Ponderosa pine is also an important component of the mixed conifer forests of southwestern Oregon, but does not form pure stands there. The Willamette Valley of western Oregon also supports a native population of ponderosa pine.

Climate: Ponderosa pine forests are the second-driest forests in Oregon; they thrive in climates with short, dry summers and cold, snowy winters. The range of these forests is closely tied to soil moisture.

Elevation: Ponderosa pines will grow from sea level to about 9,000 feet.

Precipitation: Ponderosa pines thrive in the dry climates of the high desert, ranging from less than 10 inches to around 35 inches of precipitation.

Sitka Spruce/Western Hemlock Forest

Ecology: Forests dominated by western hemlock and Sitka spruce hug the fog belt along the Oregon coast, seldom reaching more than a few miles inland or a few hundred feet above sea level. Both species are shade-tolerant, but Sitka spruce is more resistant to salt spray. Sitka spruce sometimes grows in pure stands but is more commonly mixed with western hemlock,

western redcedar, Douglas-fir, red alder and lodgepole pine (commonly called shore pine along the coast).

Near the California border, Port-Orford-cedar, Oregon-myrtle (also called California-laurel) and coast redwood join the mix. The understory is typically dense with shrubs, ferns, herbs and epiphytes. Hemlock and spruce seedlings often establish on rotting tree logs called "nurse logs." Straight lines of trees originally established on the same log are commonly seen.

Climate: The climate of this zone is wet and mild. Frequent and dense summer fog helps limit the evaporative power of the sun, while "fog drip" that condenses on tree crowns adds to soil moisture.

Elevation: This forest starts near sea level and extends up to approximately 2,000 feet.

Precipitation: Being located near the coastline, western hemlock and Sitka spruce forest precipitation is high, ranging from 65 to 165 inches.

Subalpine Fir Forest

Ecology: Subalpine forests are a combination of several forest types, all occurring above 4,500 feet in the Cascade, Siskiyou and Wallowa mountains. These forests vary widely depending on stand age, fire history and local conditions. Common trees include Pacific silver fir, California red fir, noble fir, white fir, subalpine fir, western hemlock, mountain hemlock, Douglas-fir, Alaska-cedar, incense-cedar, lodgepole pine, western white pine, Engelmann spruce and quaking aspen. Many species of huckleberries occur in the understory.

Climate: These forests occur in cold climates with heavy winter snowpacks and short growing seasons. At their upper limit, they form open park-like forests and merge with alpine meadows.

Elevation: These forests start at 4,500 feet and extend up to the end of forest zones on the alpine level.

Precipitation: These forests are covered in snow for several months. Precipitation is usually over 100 inches per year.

Western Juniper Forest

Ecology: Western juniper "forests" are the driest forests in the Pacific Northwest. In Oregon they're found primarily east of the Cascades, although they also grow on hot, dry, low-elevation sites in southwestern Oregon. Due to intense competition for water and an extreme aversion to shade, western junipers grow in open, park-like stands. The widely spaced juniper trees are typically surrounded by big sagebrush, bitterbrush and grasses.

Juniper trees grow on rocky outcrops in eastern Oregon. Ponderosa pines often occupy canyons and moist, north-facing slopes within these forests. Western junipers also occupy shallow-soil areas within other eastside forest types. Prior to European settlement and fire suppression, western juniper forests were primarily limited to shallow soils and rimrock, where vegetation was too sparse to carry fire. Fire suppression has permitted western juniper to expand rapidly into traditional rangeland, where it competes with native grasses for water and nutrients.

Climate: Western juniper forests are found in climates with hot, dry summers and cold, dry winters. Most precipitation falls during the winter.

Elevation: Western junipers can grow from 500 to over 10,000 feet in elevation. Most of the forests are found in the high desert areas of Oregon.

Precipitation: The western juniper tree is a large consumer of water, but often grows in areas with precipitation of less than 30 inches per year.

Western Larch Forest

Ecology: The western larch, one of the world's few deciduous conifers, is noted for its brilliant golden autumn colors. Rather than forming extensive forests, stands of western larch commonly develop within Douglas-fir, grand fir and ponderosa pine forests following fire or major disturbance from wind, soil movement or logging. Without periodic disturbance, larch stands will eventually be taken over by Douglas-fir on drier sites or grand fir on milder sites. Lodgepole pine, western hemlock, western white pine and Engelmann spruce also occur in this forest type.

Climate: Western larch prefers cool, moist sites and depends on frequent disturbance.

Elevation: Western larch grows primarily on the east side, at elevations up to 6,000 feet.

Precipitation: The climates of western larch forests vary and depend on location in Eastern Oregon. Precipitation ranges from 15 to 65 inches per year.

Urban Forest

Ecology: By definition, urban forests occur near or within urban boundaries. Although they sometimes include remnant stands of native forests, more often they're a mix of native and introduced trees that have been planted along streets and in parks for recreational and landscaping purposes. Without careful tending urban forests would perish, or be overrun by native forests. As communities grow in area and population, urban forests will play an increasingly significant role in the lives of Oregonians.

Climate: With appropriate care, urban forests can be maintained in almost any climate. Rather than being a product of the climate in which they occur, they are often valued for the climate they help create. Their canopies reduce air pollution, filter rainwater and create shade that cools city temperatures.

Elevation: The elevation of urban forests varies by each area. Many are close to sea level or just a few hundred feet above sea level.

Precipitation: Most urban areas within the Willamette Valley have precipitation of 35 to 65 inches per year on average.

STUDENT PAGE

LESSON 3

NAME(S): _____

Tree Survey

Tree Number	Tree Identification	Tree Characteristics

Measuring Trees

One of the most important things foresters need to know about trees is their size. Knowing trees' diameter and height enables foresters to monitor tree growth, calculate tree volume in a given forest area, and make informed management decisions. Foresters often use tree measurements to estimate the amount of marketable timber that could be harvested from a forest stand – a process that is called timber cruising.

The diameter is the distance from one side of a circle, passing through the center, to the other side. A tree's diameter is basically the width of its trunk. A tree's height is how tall it is from the ground to its very top.

Determining Tree Diameter

Because tree trunks can be wider or narrower at the base, foresters measure tree diameter at a standard height above ground level. Known as "diameter at breast height," or DBH, this measurement is taken at a height of four and a half feet above ground level. If the tree is on a slope, it is measured on the uphill side of the tree.

When foresters need an accurate DBH measurement, they may use calipers or a special diameter tape that, when placed around the tree, shows the conversion of tree circumference to diameter. Following are two different methods you can use to measure diameter.

Woodland Stick Method

A convenient way to measure the diameter is with a special stick, called a woodland stick or Biltmore stick, which contains built-in formulas for measuring diameter. While not the most accurate method, it does provide a good, quick estimate.

1. To use the woodland stick, hold it against the tree 4.5 feet above the ground. Stand so that your eye is 25 inches from the stick.
2. Without moving your head, line up the zero end of the stick with one edge of the tree, then read the tree's diameter at the other edge of the tree using the scale printed on the stick.

String Method

Another way to measure the diameter involves string and a tape measure or ruler. For this method, you first find the tree's circumference (the distance around the trunk).

1. Take the string and wrap it around the tree at 4.5 feet above the ground, making sure that the string stays level all the way around the tree.
2. Hold or mark the place where the string matches up with the beginning end of the string, then use a tape measure or ruler to determine the inches of circumference.
3. Divide this number by 3.14 (or π) to find the tree's diameter.

(Note: You may also measure the circumference directly using a tape measure. A diameter tape or D-tape measures circumference and reads it out as diameter.)

Determining Tree Height

It's surprisingly difficult to accurately measure the height of a tree, particularly when it is on a slope or surrounded by other trees or objects. The most accurate way involves climbing to the top of the tree and dropping a measuring tape to the ground. This method is used primarily by professional tree researchers or arborists, especially to measure the height of record-breaking trees. (Safety note: This method should be used only by experienced professionals with the relevant training and equipment. Do not attempt this method yourself!)

Professionals may also use laser rangefinders and other digital equipment to estimate tree height. A couple lower-tech options involve a woodland stick or a simple pencil.

Woodland Stick Method

The woodland stick or Biltmore stick contains lines and formulas for helping you determine tree height.

1. Using a woodland stick, position yourself 100 feet from the tree with your eye approximately level with the bottom of the tree.
2. Hold the stick 25 inches from your eye and align the bottom of the stick with the bottom of the tree.
3. Without moving the stick or your head, read the measurement that lines up with the top of the tree.

Pencil Method

An easy way to estimate tree height uses a pencil and a measuring tape.

1. Working with a partner, take a pencil and stand away from the tree.
2. Outstretch your arm and hold the pencil so that you can line it up with the trunk of the tree.
3. Close one eye and move the pencil until one end looks even with the top of the tree.
4. Place your thumb on the pencil where it matches the base of the tree.
5. Turn the pencil by 90 degrees, keeping your thumb in place.
6. Direct your partner to mark the place on the ground where it looks like the end of the pencil lies.
7. Use a measuring tape to measure the distance from that point to the tree. This is the approximate height of the tree.

INSIDE OREGON'S FORESTS

A high school forestry curriculum

ENVIRONMENTAL IMPORTANCE OF OREGON'S FORESTS

STUDENT PAGES

Oregon Forest Resources Institute

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LESSON 1

NAME(S): _____

Soil Filtration Investigation

Identify which substrates were used for each model and the amount of water added. Then record the results.

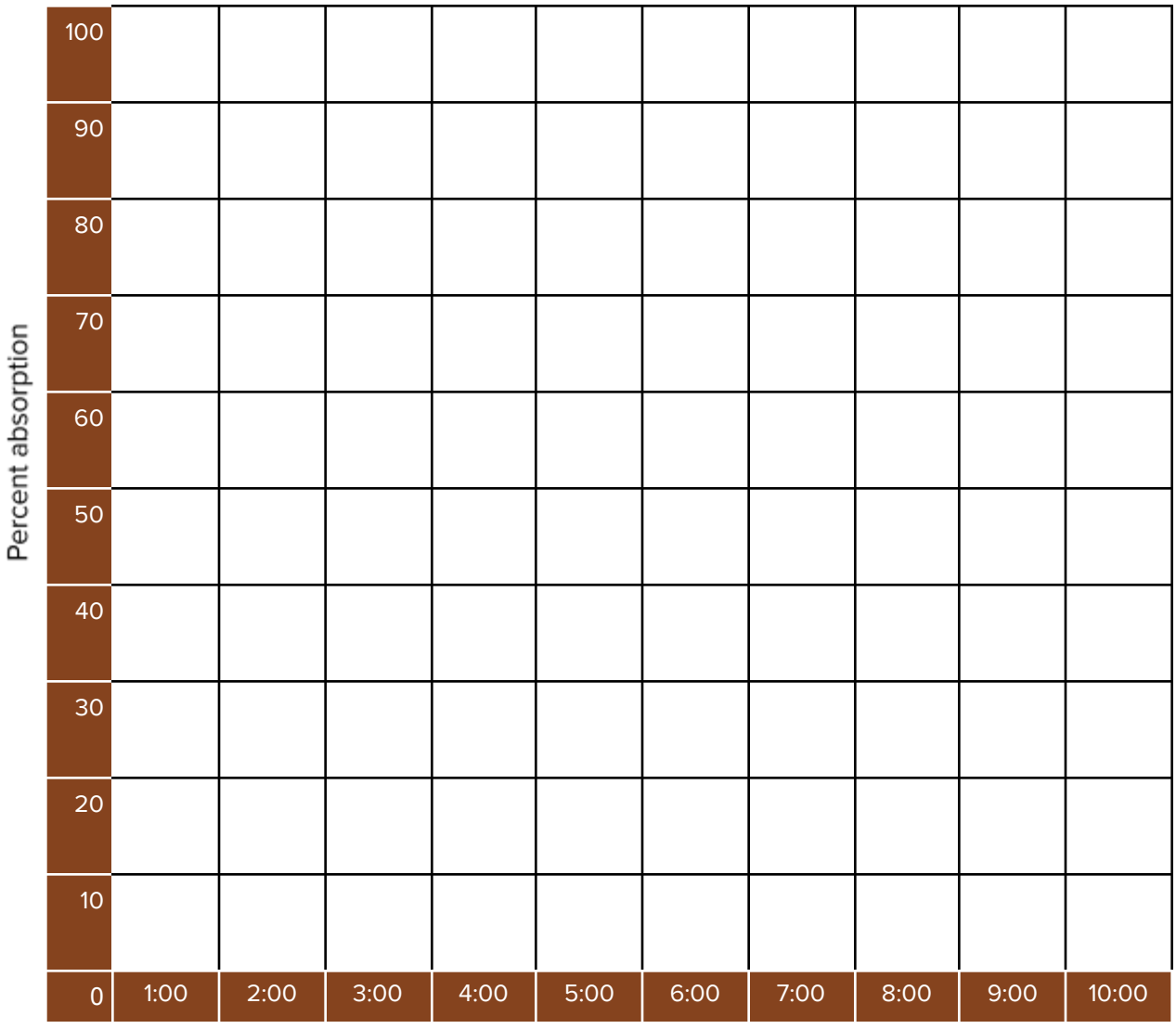
Model #	Soil Material	Water Added (in ml)	Amount of Runoff (in ml)	Percent Runoff	Percent Absorption	Absorption Time	Water Clarity (10=clear, 0=opaque)
Example	*Clay with leaf cover*	*150*	*85*	*57%*	*43%*	*4:25 minutes*	*6*

Percent Runoff = Water Added (in ml) – Amount of Runoff (in ml) x 100%

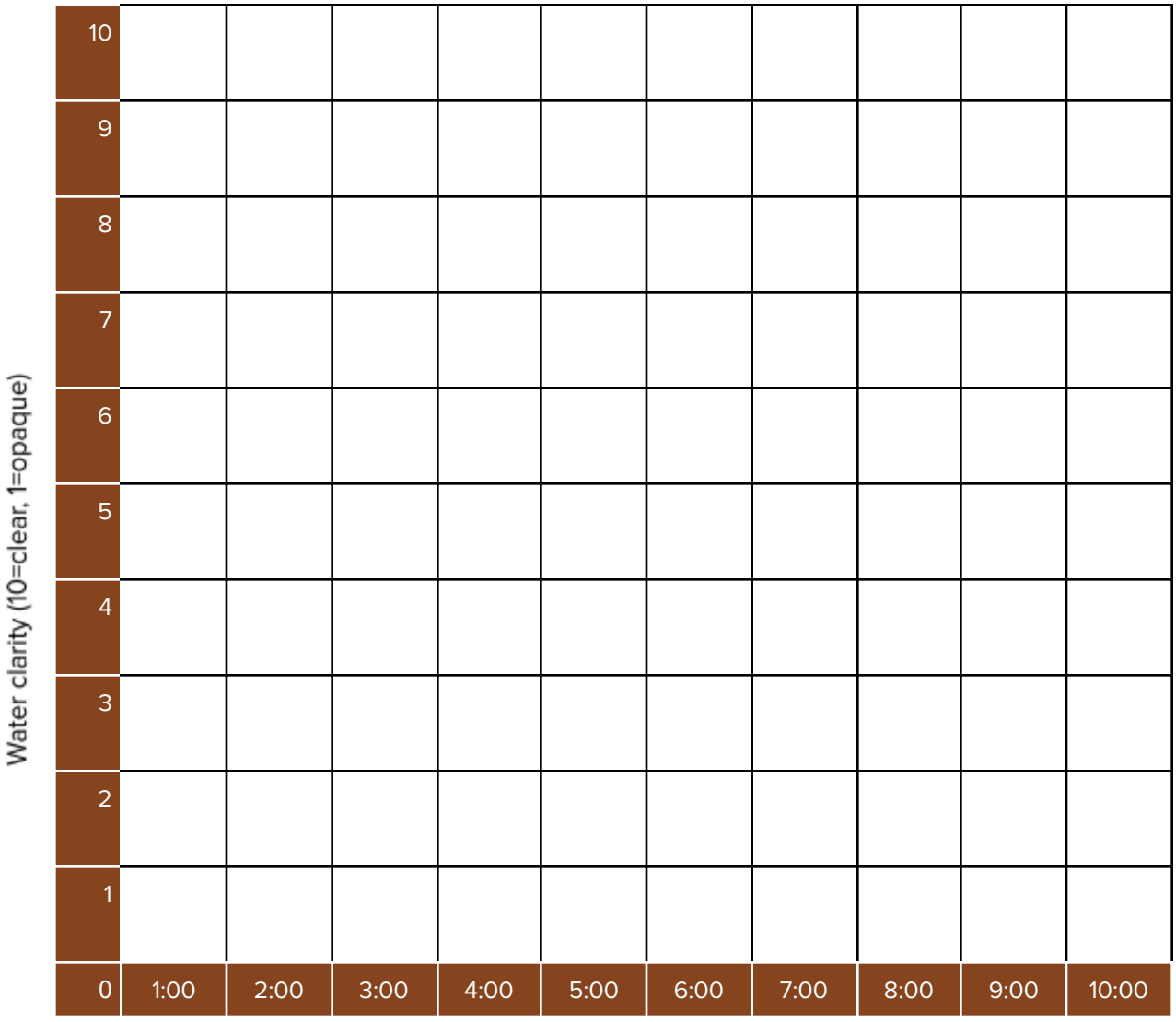
Percent Absorption = 100% – Percent Runoff

Percent Absorption Over Time

Plot the results of the experiment from all the models.



Water Clarity Over Time



What patterns do you notice?

NAME(S): _____

Online Watershed Survey[6]

- Using the mapping program, either follow the coordinates provided by your teacher or enter the name of the river you'll be studying.

- To become familiar with the watershed you'll be studying, follow the river from its source to its entry into a major river, bay or the ocean. What types of landscapes do you encounter along the way?

- Use the "rotation" and "tilt" features to get various three-dimensional views of the watershed. Try changing the elevation exaggeration (under "tools" and "options") from the default setting of "1" to "2" or "3". This feature will exaggerate elevation changes and help you visualize the shape of the watershed. Try navigating through the watershed by moving uphill from the river. The watershed boundaries will appear as ridge tops. With careful observation, you should be able to determine the watershed's approximate boundaries.

- Draw the approximate shape of the watershed boundaries on a blank sheet of paper. Include the river in your drawing.

- Look for the following major land uses along the length of the river you're studying:
    - forest (F)
    - agricultural (A)
    - urban (U)
    - residential (R)
    - industrial (I)
    - disturbed (for example, clearcut, mine or new excavation) (D)

- Closely examine the entire course of the river under study, and indicate in your drawing for step 4 which type of land use borders the river where. (You may use the initials F, A, etc. to indicate the various land uses.)

- Estimate the percentage of the river that is bordered by each of the land uses you have identified in step 6. For this activity, consider only lands immediately adjacent to the river.

[6] Source: Adapted from "Impact of Land Use on Water Quality," in *Watershed Evaluation* by Dr. Wynn Cudmore. Northwest Center for Sustainable Resources, Chemeketa Community College.

- For each land use, predict the potential impacts on the water quality of the river by entering one of the following values in each cell. See below for a description of the different land uses identified in the table.

0 = no negative impact
1 = minor impact
2 = moderate impact
3 = major impact
X = unable to determine

Potential Impacts of Various Land Uses on Water Quality

	% of River	Heated Effluent	Volume Extraction	Solid Waste Dumping	Industrial Effluent	Increased Temperature	Stream Channelization	Fertilizer or Pesticide Runoff	Livestock Manure Runoff	Sediment Runoff
Forest										
Agricultural										
Urban										
Residential										
Industrial										
Disturbed										

Description of land uses (in table):

- Heated Effluent – waste water released from a pipe or ditch at a higher temperature than ambient water temperature.
- Volume Extraction – removal of water from a river for irrigation, industrial or residential use.
- Solid Waste Dumping – deposits of usually nontoxic materials (such as tires or old appliances).
- Industrial Effluent – discharge from any industrial facility (such as a sewage treatment or chemical plant).
- Increased Temperature – inferred from removal of shading.
- Stream Channelization – straightening of stream by excavation or levees.

- Fertilizer or Pesticide Runoff – observed/inferred runoff from agricultural or residential lands.
- Livestock Manure Runoff – observed/inferred runoff from agricultural lands used for grazing livestock (or livestock access to a river).
- Sediment Runoff – observed/inferred runoff from disturbed lands resulting in decreased clarity.

Wildlife in Oregon's Forests[7]

Many species of wildlife depend on Oregon's forests. As in all ecosystems, animals in forest ecosystems have four basic needs:

- food
- shelter or cover
- water
- space

An animal's habitat is a place where the arrangement of food, water, shelter or cover, and space are suitable for the animal's needs.

Food Requirements

The food requirements for different wildlife depend in large part on whether they are plant eaters or meat eaters.

Herbivores are plant eaters. If you think about a forest, plants are everywhere. Given this abundant resource, herbivores are generally not limited by the amount of food available. Rather, herbivores have problems with the quality of food. Plants in general are low in protein and difficult to digest. In general, protein content and digestibility are highest when a plant is actively growing, and lowest during the winter months when the plant is dormant. The availability of plant foods can also change. For example, shrubs can grow out of reach of herbivores or heavy snowfall can cover grasses.

Carnivores are meat eaters. Everything a carnivore eats (other animals) is high in protein and is highly digestible – and so is high in quality. For carnivores, the trick is getting enough food. That means that they are limited by the quantity of food available.

Shelter or Cover

Shelter or cover is a basic habitat requirement that protects animals from excessive heat, cold or predation.

[7] Source: Adapted from *Exploration of Oregon Forests: Module 6 – Woodland Wildlife*. Developed by Julie Woodward based on the Oregon State University Forestry Extension's *Basic Forestry Short Course*.

Biologists often characterize cover according to the way an animal uses it. For example, thermal cover protects animals from energy loss associated with extreme temperatures. Hiding cover shelters an animal from being seen by a predator, while nesting cover refers to vegetation, rocks and so on where an animal (usually a bird) hides its nest.

Most people think of vegetation (including trees) as providing cover for wildlife. However, cover or shelter can also be provided by the topography of the land or by isolation. For example, in hilly terrain, wildlife can seek shelter by dropping down behind a small ridge. For species that are hunted, such as deer or elk, finding a spot that is a long way from a road may provide sufficient isolation to protect them.

Water

All wildlife species need water in one form or another. Wildlife can meet their water needs in three ways:

- Some wildlife, especially those that hibernate, can use metabolic water. When fat is used or metabolized, water is produced as a byproduct. So a hibernating bear can meet its water needs by burning fat.
- Most animals get some water in their diets. Many foods are high in water content, and this preformed water may be all they need. This is fairly common in desert-adapted animals.
- Free water includes all the sources we normally associate with wildlife, from puddles to lakes and rivers.

Space

Space is a basic wildlife need. Each species has minimum space requirements for obtaining food, cover and water, and raising young. Animals living in areas with abundant resources generally require less space than animals living in more inhospitable habitats.

Two additional generalizations can be made about the amount of space a species requires. First, because carnivores are limited by the quantity of food available, they have much larger space requirements than herbivores of the same size. And second, larger animals need more space than smaller animals.

Structural Components of Habitat

Another attribute that forest stands provide for wildlife is habitat structure. For example, logs and snags are structural components that up to one-half of all wildlife species use at some time. A snag is a standing dead tree or part of a dead tree from which at least the smaller branches have

fallen. Snags can be used for cover, shelter, feeding areas, places to rear young and a host of other needs.

Stand density and tree size also influence a forest's suitability as wildlife habitat. Dense stands with smaller trees may provide valuable cover to songbirds and a host of mammals. Open stands with larger trees provide access for birds of prey and other predators, and tend to have significantly more vegetation available for mammals such as deer and elk.

Forest Age and Wildlife Habitat

In Oregon, about 300 species of native vertebrates use some sort of forest cover for breeding, but forest habitat is not uniform. Disturbance over time has produced a mosaic of forest age classes, each with unique habitat features. While some species thrive in the habitat provided by younger stands or clearings, others need features such as snags and logs provided by older forests.

As forests go through natural cycles of growth, death and regeneration, species may inhabit or be absent from a given area partly in response to natural changes in the structure of trees and other plants.

Different forest types attract different species of wildlife based on their specific habitat needs. Following are descriptions of three different-age forests and some of the wildlife associated with them.

Young Open Stands

This condition occurs within a short time (two to 10 years) after a disturbance such as wind, fire or logging has removed most of the larger trees. This stage is characterized by young trees or saplings and a variety of smaller herbs and shrubs. Species that prefer this stand type include the deer mouse, striped skunk, common nighthawk and American goldfinch.

Middle-Age Stands

This forest structure occurs after young stands have grown trees to a point where natural crowding has eliminated smaller and weaker trees and the forest has opened up enough to allow ground vegetation. Many species use this type of structure, though none exclusively. Some of the animals that gravitate to this type of habitat include the marten, black-tailed deer, common garter snake and Pacific tree frog.

Older Forest Stands

This structure is distinguished by larger trees, trees of mixed ages, and more logs and snags. Species that prefer this habitat include the marbled murrelet, red tree vole and Oregon slender salamander.

Summary

Wildlife animals are very dependent on forests for food, shelter, water and space. These are the four basic needs all animals have regardless of their habitat. There are different nutritional demands for each species, season, sex or age class. Carnivores need to find enough food, while herbivores need to find quality food.

Animals use cover in extreme temperatures to hide and for nesting. From a wildlife management standpoint, vegetation is the cover attribute we typically manipulate. However, there are many other attributes of the landscape that wildlife use for cover. Water is also an important aspect. Wildlife can meet their needs for water in several different ways: metabolic, preformed and free water.

Forest wildlife species also need appropriate amounts and arrangements of space. Larger animals and carnivores need more space than smaller animals and herbivores.

Another obvious attribute that forest stands provide for wildlife is habitat structure. Forest age also influences habitat and the species that live there. The diversity of animal species in an area depends on the existence of different habitats in the system.

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LESSON 3

Wildlife in Oregon's Forests – Questions[8]

1. What are the four basic needs of wildlife?

2. What is the main issue for a carnivore related to its food supply?

3. Explain the challenges of an herbivore's diet.

4. A snowshoe hare is hiding due to a winter storm. What type of cover does it use?

5. How do bears meet their need for water when they hibernate?

6. Do carnivores or herbivores typically have larger space requirements? Why?

7. Describe an example of habitat structure that affects wildlife.

8. Name three species of animals associated with young, open stands.

9. Give three examples of the type of animal species older forests attract.

[8] Source: *Exploration of Oregon Forests: Module 6 – Woodland Wildlife*. Developed by Julie Woodward based on the Oregon State University Forestry Extension's *Basic Forestry Short Course*.

STUDENT PAGE
LESSON 3

NAME: _____

Wildlife Signs

Animal Species:

Describe this species' preferred forest habitat.

Describe the following possible signs that might indicate this species' presence in a habitat. Include illustrations where appropriate.

Sounds
(song, call, screech, chirp or other sound)

Track or print

Scat (feces)

Eggs or egg cases

Gnaw or claw marks

Other signs:

STUDENT PAGE
LESSON 3

NAME: _____

Wildlife Inventory[9]

Inventory beginning time _____ a.m./p.m. Ending time _____ a.m./p.m.

Current temperature_____

Current weather (check all that apply):

- ☐ clear
- ☐ scattered clouds
- ☐ complete cloud cover
- ☐ rain

Wind:

- ☐ calm
- ☐ breezy
- ☐ gusty
- ☐ windy

[9] Source: Data sheet adapted from "Schoolyard Biodiversity Wildlife Survey," *Schoolyard Biodiversity Investigation Education Guide*, Association of Fish & Wildlife Agencies, 2011.

Wildlife Seen or Heard

Type	Species (if known)	Description of Animal's Activity (passing through, eating, hanging out, etc.)	Number Observed
Birds			
Mammals			
Reptiles or amphibians			
Invertebrates (insects, spiders, etc.)			
Other			

Signs of Wildlife

Sign	Species (if known)	Description (What does it look like? Where was it found? Other observations?)	Number Observed
Scat			
Tracks			
Feathers			
Fur			
Nests			
Chewed leaves, branches, etc.			
Other			

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LESSON 4

NAME: _____

Edge Effect – Designing Your Investigation

In this activity, you will design and carry out an investigation to learn more about the effect of edges on forest habitats. Meet with your group to identify the following.

I. Investigation Question

Your investigation will help determine the extent to which an ecological edge impacts the physical characteristics of two habitats. A testable question guides an investigation. State the specific question you will investigate.

Investigation question:

II. Hypothesis and Rationale

Hypotheses are "educated guesses" based on prior knowledge that provide a possible answer to a question. Clearly state your hypothesis and describe the rationale you've used to make this prediction.

Hypothesis:

Rationale:

III. Experimental Design

A. Independent and Dependent Variables

An independent variable is the variable that is changed in a scientific investigation. In the case of a transect line, it is the distance along the line.

A dependent variable is the variable being tested in a scientific investigation. The dependent variable is "dependent" on the independent variable: As the investigator changes the independent variable, the change in the dependent variable is observed and recorded.

Independent variable(s):

Dependent variable(s):

B. Equipment Needed

List all equipment you'll need to carry out the procedure you outline below.

1.

2.

3.

4.

5.

6.

7.

8.

C. Procedure

Briefly describe or diagram what your investigation procedure will look like at the study site. Include such information as length of transect line, number of sampling stations, distance between stations and so on. Also describe exactly how you'll measure each variable in the field. All measurements should be in metric units.

D. Data Sheet Design

You've decided what information your group will collect and how you'll measure it. Now design a data sheet that will easily accommodate this information.

NAME: _____

Edge Effect – Data Analysis

1. What conclusions can you draw from the information you've collected? (Extract as much information from your graphs and tables as possible.)

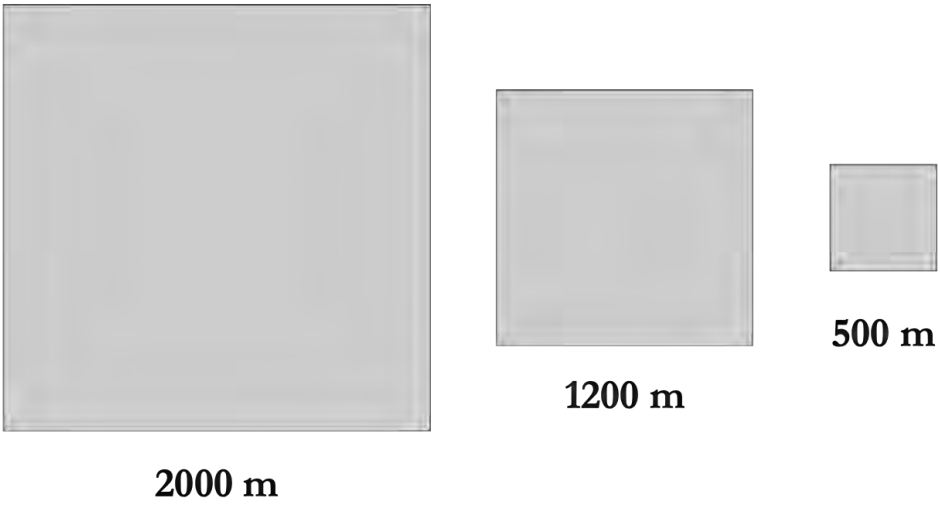
2. Is your hypothesis supported by the data?

3. If you were to repeat this study, what changes would you make?

4. Based on your measurements, does it appear that the transect line was long enough to reach the true "interior habitat" of either of the habitats? What evidence supports your answer?

5. Assuming that you did sample true "interior habitat," what is the approximate width of the edge in the habitats sampled? How did you arrive at this number?

6. For the forested stands below, assume that each is surrounded by clearcuts, and the "edge effect" penetrates 200 meters into the interior forest. For each stand, calculate the total area of edge habitat and the percent of total area in edge.



7. What conclusions can you draw?

8. Overall, does the edge effect have a positive or negative influence on ecosystem health and stability? Explain.

NAME: _____

Plant Food[14]

1. All living things need food to survive. How would you define food? How is it the same for plants as it is for animals? How is it different?

2. Which of the following do trees use as food?

- ☐ Sunlight
- ☐ Sugar
- ☐ Carbon dioxide
- ☐ Fertilizer
- ☐ Soil
- ☐ Water
- ☐ Chlorophyll
- ☐ Minerals

Explain your thinking.

[14] Source: Adapted from Keeley, Page, et al. "Is It Food for Plants?" from *Uncovering Students Ideas in Science*, Volume 2. National Science Teachers Association, 2007.

STUDENT PAGE

LESSON 5

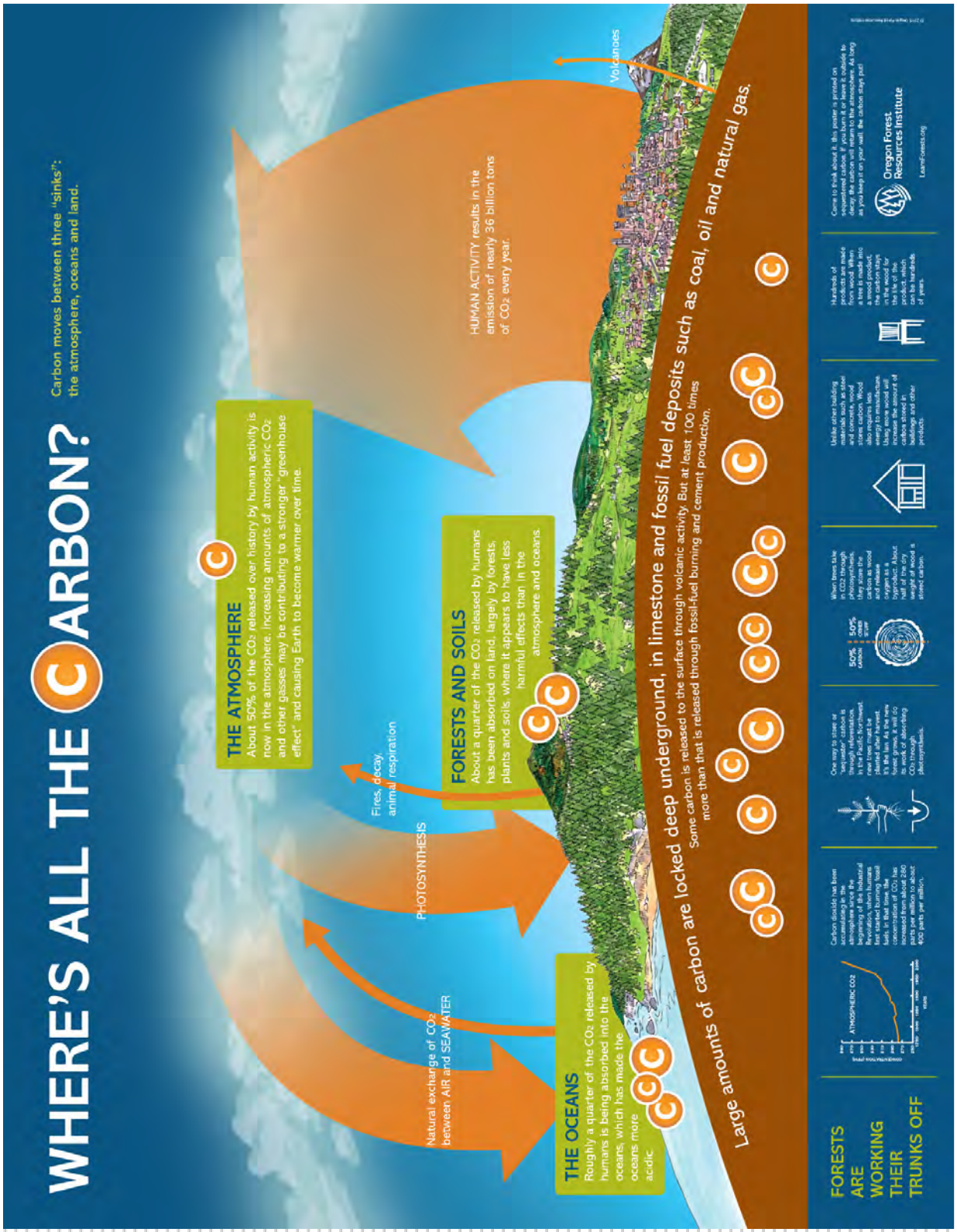
NAME: _____

How Much Carbon?

1. Identify five trees to measure using the Tree Carbon Tape.
2. Determine the circumference of each tree: Hold the tape at chest height (about 4.5 feet, or 1.4 meters) from the ground and wrap it once around the tree trunk. Find the measurement to the nearest 3 inches, and record the result below.
3. Use the tape to find the approximate carbon dioxide equivalent (CO_2e) contained in each tree. Record below.
4. Use the tape to find the approximate number of miles in a car that would emit the same amount of carbon as there is stored in the tree. In growing to that size, the tree can "offset" the emissions from driving that number of miles.

Tree location	Circumference at chest height (in inches)	Approximate carbon dioxide equivalent of tree (pounds CO_2e)	Approximate car miles offset by tree

The Carbon Cycle Poster



INSIDE OREGON'S FORESTS

A high school forestry curriculum

ECONOMIC IMPORTANCE OF OREGON'S FORESTS

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Oregon Forest Resources Institute

Oregon's Forest Economy[1]

Oregon's forestlands are some of the most productive in the world. The state's mild climate, deep soils and abundant rainfall make it one of the best places to grow trees. A strong social climate helps support our forestlands as well.

As Oregonians, we enjoy:

- Widespread public support for the economic, environmental and social contributions of a stable forest sector.
- Solid educational and research institutions, such as the Oregon State University College of Forestry and the USDA Pacific Northwest Research Station, which keep the sector at the vanguard of best practices.
- Strong forest protection laws under the Oregon Forest Practices Act that ensure landowners employ sound forest management practices.

As a result, by internationally recognized standards of sustainability Oregon is a world leader in timber production, wood product manufacturing and sustainable forestry.

Jobs and Community

According to 2021 data, forestry products and services employ about 62,000 people in Oregon. These jobs are particularly critical to rural communities, where wood product manufacturing can account for more than 50% of all manufacturing jobs.

Oregon's forest sector provides:

- About 62,000 Oregon jobs.
- 3% of all jobs in Oregon.
- An average yearly wage of $68,200.

Growing Oregon's Forests

The total acreage of Oregon's forestland has remained mostly unchanged – at about 30 million acres – for nearly 100 years. It's estimated to have been about 30 million acres in the 1600s, as

[1] Sources: *Oregon Forest Facts, 2023-24*, Oregon Forest Resources Institute, oregonforests.org. "Christmas Trees." Oregon Agriculture in the Classroom, oregonaitc.org.

well. Yet since 1953, Oregon has produced more than 450 billion board feet of timber, without a reduction in the size and volume of the state's forestland.

Oregon forests grow about 2.8 billion cubic feet of new wood each year. Overall, about 39% is harvested, 25% is in trees that end up dying from natural causes, and 36% adds to growing trees, which means Oregon grows more wood per year than it harvests.

Today, approximately 76% of Oregon's timber production comes from forestlands owned by companies, families and Native American tribes. On private forestland, the harvest represents about 77% of the new growth being added to the forests each year; on federal forestland, the harvest represents only about 8% of new growth.

Oregon leads the nation in:

- softwood lumber production
- plywood production
- engineered wood product development

Deck the Halls with Oregon Christmas Trees

In addition to growing timber for wood and paper products, more than 1,000 tree farms around the state have made Oregon the country's leading producer of Christmas trees. Each year, Oregon tree farmers harvest more than 4 million Christmas trees — nearly twice as many as any other state, and about 31% of the country's total. In 2020, Christmas tree farms contributed $107 million to Oregon's economy.

Some 92% of all Oregon Christmas trees are exported out of the region, bringing holiday cheer to California, Hawaii, Alaska and other states, and to foreign markets including Mexico, China, Japan and the Philippines.

Tourism: Oregon's Natural Attraction

Oregon attracts tourists from around the world, and many of them come to enjoy the natural beauty of our forests and abundant recreational opportunities in the outdoors. A survey by the US Forest Service estimated that more than 11 million recreational tourists visit Oregon's national forests each year, sustaining nearly 15,000 jobs and contributing an estimated $440 million to the economy.

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LESSON 1

Analyzing County Economic Fact Sheets

Using the County Economic Fact Sheets and the "Forestry & Wood Products in Oregon" fact sheet at the beginning of the collection, answer the following questions to assess the economic importance of Oregon's forests. Compare your county to the statewide information, and then compare your county to another county in another part of the state. Provide evidence for your responses from the fact sheets.

Your county: _____

1. How does the forestland ownership in your county compare to Oregon's overall forestland ownership?

2. How does the timber harvest in your county compare to Oregon's overall timber harvest?

3. How significant are forest sector jobs in your county?

4. How many wood processing facilities does your county have? What percentage of the state's overall wood processing facilities does this represent?

Other county analyzed: _____

5. How does this county compare to your county in terms of forestland, timber harvest, forest sector jobs and wood processing facilities?

6. What conclusions can you draw from your findings?

STUDENT PAGE
LESSON 2

NAME(S): _____

Wood Products Made from Oregon Trees

Lumber
- Dimensional lumber
- Solid beams
- Laminated beams
- Joists
- Laminated veneer lumber
- Finger-jointed lumber

Plywood

Reconstituted Wood
- Particleboard
- Hardboard
- Fiberboard
- Heating pellets

Posts, poles and timbers
- Utility poles
- House logs
- Fence posts
- Pilings
- Treated timbers, cross-arms and railroad ties

Pulp and paper products
- Packaging
- Printing paper
- Newsprint
- Tissue
- Paper towels
- Absorbents
- Adhesives
- Fluff pulp

Cellulose products
- Rayon
- Cellophane
- Food additives
- Pharmaceuticals
- Biomass energy

Millwork

Lumber for products
- Doors
- Windows
- Cabinets
- Furniture
- Siding
- Flooring
- Moldings
- Fencing
- Pallets
- Lath
- Pencils
- Musical instruments

Cross-laminated timber (CLT)

Task

As directed by your teacher, select a number of items from the list of wood products. For each product, research and answer the following.

- ☐ Product: _____
- ☐ What is it? How would you define it?
- ☐ What is it used for?
- ☐ How is it made? What raw materials are required to make it?
- ☐ What are the potential environmental, economic and social impacts of this product for Oregon?
- ☐ What sources did you consult?

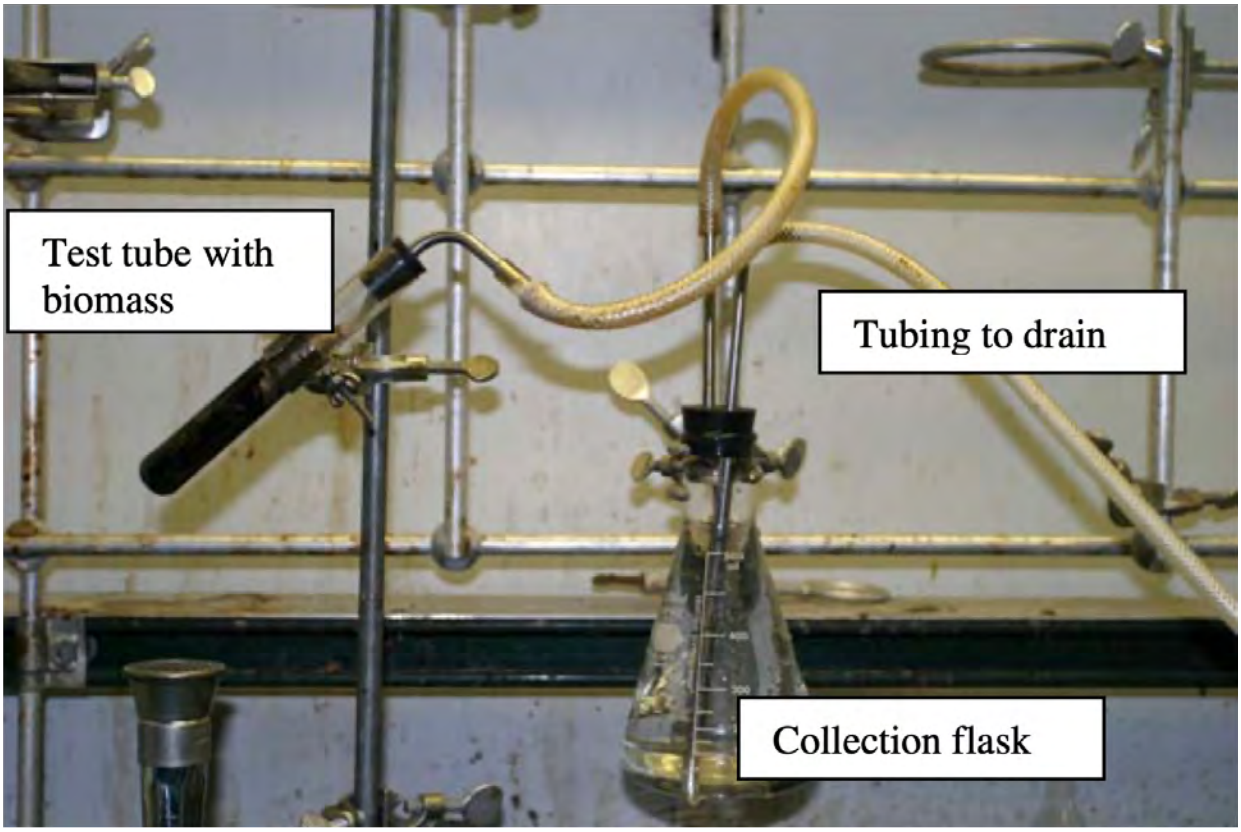
NAME(S): _____

Syngas Lab[6]

Procedure

1. Fill test tube 3/4 full with wood pellets.
2. Clamp the test tube to the ring stand using the metal clamp. Adjust the height of the tube relative to the Bunsen burner. The bottom of the test tube should be at least 3 centimeters above where the flame will be.
3. Insert the one-hole stopper with tubing into the test tube.
4. Attach the rubber tubing to one of the tubes in the two-hole stopper. The rubber tubing should come from the bottom of the stopper.
5. Fill the Erlenmeyer flask full of water and insert the two-hole stopper with the tubing going into the water. The tube should almost touch the bottom of the flask.
6. Connect the test tube and the Erlenmeyer flask with the piece of rubber tubing from step 3.
7. Connect the last piece of rubber tubing to the top of the two-hole stopper and place the other end into the sink. Check the figure to ensure your setup is correct.
8. Light the Bunsen burner and begin heating the test tube. Make sure the flame is at least 3 centimeters away from the test tube so the tube does not melt.
9. Record observations while the tube is being heated.
10. After a few minutes gas will be evolved and will begin to displace the water in the Erlenmeyer flask. Continue heating until all the water has been displaced.
11. At this point have your teacher disconnect the hot test tube tubing from the Erlenmeyer flask and move the hot test tube out of the way.
12. Connect the drain tubing to the faucet.
13. Slowly turn on the water and light the gas flowing from the end of the glass tubing. Adjust water flow rate to maintain a constant flame.
14. Roast a marshmallow on the flame (but don't eat it, as it may have a little tar on it). Record your observations below.

[6] Source: "Investigating and Using Biomass Gases" by Eric Benson and Melissa Highfill. National Renewable Energy Laboratory, U.S. Department of Energy.



Equipment setup for syngas lab.

Observations

Lab Step	Time	Observations
Heating test tube		
Turning on water		
Lighting gas		
Roasting marshmallow		

NAME: _____

What Does It Take?

For each forest-related career, identify what education, skills, experience and personal qualities are required. Then, write a paragraph telling whether that career appeals to you and why (or why not).

Job Title:

Job description:

Education:

Skills:

Experience:

Personal qualities:

Does this career appeal to you? Explain why or why not.

Job Title:

Job description:

Education:

Skills:

Experience:

Personal qualities:

Does this career appeal to you? Explain why or why not.

Job Title:

Job description:

Education:

Skills:

Experience:

Personal qualities:

Does this career appeal to you? Explain why or why not.

INSIDE OREGON'S FORESTS

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FOREST MANAGEMENT

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Oregon Forest Resources Institute

STUDENT PAGE

LESSON 1

NAME(S): _____

Managing Forests for Specific Goals

Imagine that your group owns and manages 100 acres of forest that consists primarily of same-age conifer trees.

1. What is your goal for this forest?

2. How would you know that your goal is being met?

3. What natural forest processes can you build on to meet your goal?

4. What things might you do in the short term to further your goal?

5. What things might you do in the long term to further your goal?

6. What management activities, assessments and strategies might you undertake to ensure that your forest remains healthy and vigorous in the long run, while also meeting your goal?

STUDENT PAGE
LESSON 2

NAME: _____

Pacing[3]

Pacing is a useful skill for measuring forest stands or other distances in the field. It involves using your natural walking pace to estimate a distance. For this exercise, count two steps as one pace: that is, from the heel of one foot striking the ground to the heel of that same foot striking the ground again.

1. To determine your pace, walk a measured course, counting the number of paces you take. Then, divide the length of the course by that number. For accuracy in the field, find your average pace on both smooth and uneven surfaces.

Smooth Surface

Trial 1:

Course Length: _____

Number of Paces in Course: _____

Pace Length = Course Length ÷ Number of Paces: _____

Trial 2:

Course Length: _____

Number of Paces in Course: _____

Pace Length = Course Length ÷ Number of Paces: _____

[3] Source: Adapted from *Forest Surveying and Silviculture* by Dr. Wynn Cudmore. Northwest Center for Sustainable Resources. Chemeketa Community College.

Uneven Surface

Trial 3:

Course Length: _____

Number of Paces in Course: _____

Pace Length = Course Length ÷ Number of Paces: _____

Trial 4:

Course Length: _____

Number of Paces in Course: _____

Pace Length = Course Length ÷ Number of Paces: _____

Average Pace Length = (Trial 1 Pace Length + Trial 2 Pace Length + Trial 3 Pace Length + Trial 4 Pace Length) ÷ 4 = _____

2. Use your average pace length to measure unknown distances.

Mystery Course A

Number of Paces in Course: _____

Course Length = Average Pace Length x Number of Paces in Course = _____

Mystery Course B

Number of Paces in Course: _____

Course Length = Average Pace Length x Number of Paces in Course = _____

Compass and Pacing Instruction Cards[4]

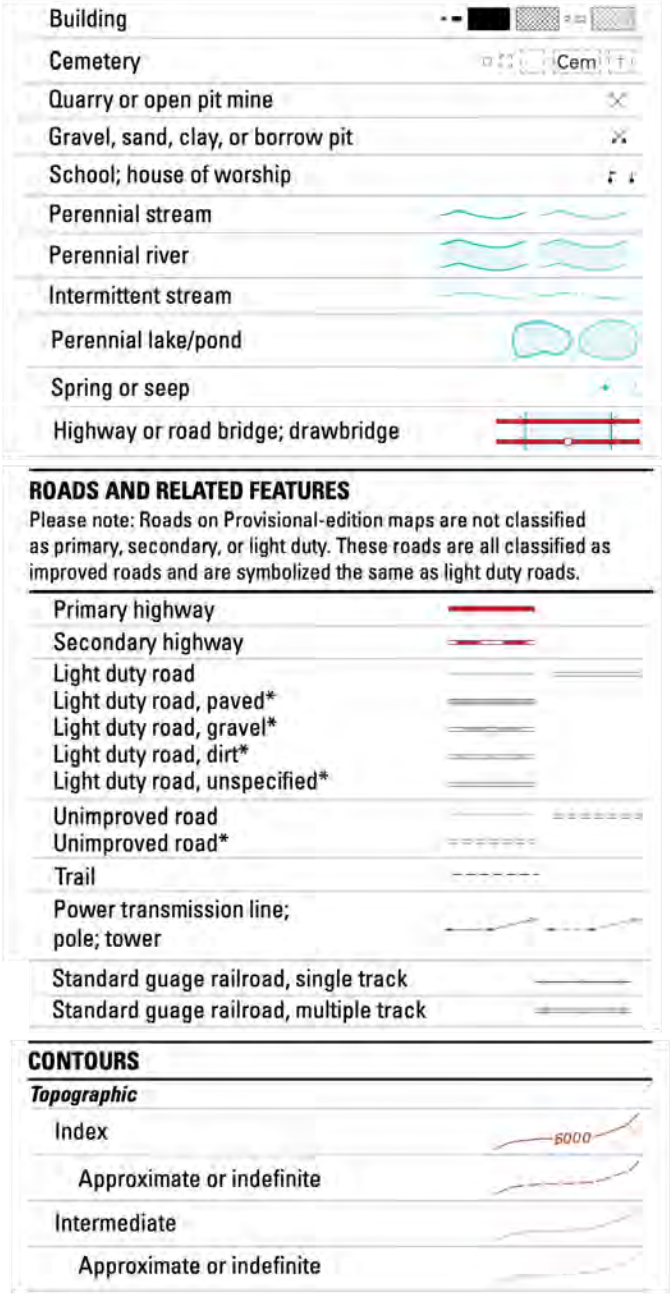
(Copy and cut cards apart)

Starting Point: 1 Go 36 degrees for 122 feet Then 149 degrees for 58 feet Then 235 degrees for 86 feet Destination number: _____	Starting Point: 6 Go 03 degrees for 100 feet Then 132 degrees for 74 feet Then 225 degrees for 69 feet Destination number: _____
Starting Point: 2 Go 17 degrees for 104 feet Then 150 degrees for 52 feet Then 142 degrees for 64 feet Destination number: _____	Starting Point: 7 Go 34 degrees for 119 feet Then 186 degrees for 50 feet Then 228 degrees for 74 feet Destination number: _____
Starting Point: 3 Go 38 degrees for 125 feet Then 237 degrees for 90 feet Then 186 degrees for 50 feet Destination number: _____	Starting Point: 8 Go 346 degrees for 102 feet Then 129 degrees for 78 feet Then 211 degrees for 58 feet Destination number: _____
Starting Point: 4 Go 36 degrees for 122 feet Then 174 degrees for 50 feet Then 228 degrees for 74 feet Destination number: _____	Starting Point: 9 Go 346 degrees for 102 feet Then 129 degrees for 78 feet Then 186 degrees for 50 feet Destination number: _____
Starting Point: 5 Go 22 degrees for 107 feet Then 158 degrees for 54 feet Then 186 degrees for 50 feet Destination number: _____	Starting Point: 10 Go 343 degrees for 104 feet Then 141 degrees for 64 feet Then 145 degrees for 61 feet Destination number: _____

[4] Source: *Forest Surveying and Silviculture* by Dr. Wynn Cudmore. Northwest Center for Sustainable Resources, Chemeketa Community College.

Topographic Map Symbols[5]

Map symbols are an important part of map reading. They can depict various features including roads, boundaries, buildings, landmarks, places of interest, water supplies and mines. Following is a list of some common symbols used in topographic maps.



[5] Symbols adapted from "Topographic Map Symbols." US Geological Survey, pubs.usgs.gov.

STUDENT PAGE
LESSON 3

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Soil Lab Procedures[7]

Safety Note: Wear goggles during this lab, and follow any other safety instructions provided by your teacher.

Organic Content

Organic material increases the water-holding ability and aeration of soil. As decaying plants decompose, they add important nutrients and influence the soil's pH. Thus, the amount of organic material in soil is an important consideration.

Organic matter burns at high temperature and decomposes to CO_2 and H20. In general, the inorganic components of the soil do not decompose at high temperatures. Therefore the loss in weight of a soil sample after burning can be used to estimate organic content.

Procedure

1. Weigh a glazed porcelain crucible (without the cover) to the nearest 0.01 gram: _____.
2. Fill the crucible approximately two-thirds full with an oven-dried sample of soil.
3. Reweigh the sample plus the crucible to the nearest 0.01 gram: _____.
4. Subtract the weight of the crucible. This is the "dry sample weight": _____.
5. Place the uncovered crucible over a flame (Bunsen burner) and cook for 15 minutes. While cooking, stir with a probe, but be careful not to remove any soil in the process.
6. Ask the teacher to use tongs and asbestos gloves to remove the crucible from the flame. Cover it and allow it to cool on a heat-proof pad.
7. After about 5 minutes, when it's cool enough to weigh, remove the cover and reweigh the sample to the nearest 0.01 gram. This is the "cooked sample weight": _____.
8. Calculate the percent (%) of organic matter in the soil sample using the formula: Percent Organic Matter = (Dry Sample Weight – Cooked Sample Weight) x 100 Dry Sample Weight
9. Record the percent of organic matter for your sample on the data sheet.

[7] Source: Adapted from "Soils: Physical and Biological Analysis," in *Environmental Science II* by Dr. Wynn Cudmore. Northwest Center for Sustainable Resources, Chemeketa Community College.

pH

A soil's pH is a measure of its acidity. The pH scale runs from 0 to 14, with 7 being neutral. Values below 7 are progressively more and more acidic, while values above 7 are progressively more and more alkaline, or basic.

Plants often have specific soil pH requirements. Crops such as blueberries and strawberries, for example, prefer more acidic soils, while most vegetable crops require somewhat more alkaline soils. Soils closely associated with Douglas-fir and other cone-bearing trees are often acidic. That's because tannic acid accumulates as a result of decomposition of conifer needles and branches.

Interpretation of Soil pH Levels

pH 4.0 – strongly acidic

pH 5.0 – moderate to strong acidity

pH 6.0 – slight to moderate acidity

pH 7.0 – neutral (neither acidic nor alkaline)

pH 8.0 – slight to moderate alkalinity

pH 9.0 – moderate to strong alkalinity

Procedure

1. Use soil from your soil core sample.
2. Follow the instructions that come with the soil test kit to determine the soil's pH.
3. Record your measurements on the data sheet.
4. Clean and dry the soil kit components and pack them neatly back in the case.

Macronutrients

Macronutrients are chemical elements that plants need for growth and development. Three primary macronutrients in soil that plants use are nitrogen (N), phosphorus (P) and potassium (K). A measure of these three components provides a good picture of soil fertility. Most commercial fertilizers contain varying amounts of these three macronutrients, which are often shown on fertilizer labels. A label of "15-30-10," for example, indicates 15 percent by weight for N, 30 percent for P and 10 percent for K.

Procedure

1. Use soil from your soil core sample.
2. Follow the instructions that come with the soil test kit to determine the soil's nitrate-nitrogen level.
3. Follow the instructions to determine the phosphorus level.
4. Follow the instructions to determine the potassium level.
5. Record all the values for soil macronutrients on the data sheet.
6. Clean and dry the soil kit components and pack them neatly back in the case.

Soil Texture

Soil texture is a physical property determined by the size of mineral particles in the soil. Soils are generally made up of larger fragments of sand or gravel embedded in microscopic silt or clay particles. Soil texture is very important, because it affects a plant's ability to get nutrients, water and air at the root level.

Mineral Particles in Soil

Gravels – 2.0 mm in diameter or greater

Sands – 0.02 mm – 2.0 mm in diameter

Silts – 0.002 mm – 0.02 mm in diameter

Clays – less than 0.002 mm in diameter

Most soils contain a mixture of sand, silt and clay. Soils that are predominantly sand have few nutrients, don't hold water and are prone to drought. Soils that are predominantly clay contain nutrients and hold water well, but do not allow movement of air or water, and don't drain well. The best soils for most plants contain a relatively even mixture of sand, silt and clay, and are called loam.

Procedure

Conduct a simple field test using the sense of touch to approximate soil texture:

- Place a small handful of dry soil (about the size of a marble) on the palm of your hand.
- Add a few drops of water to moisten it to the point that it can be worked with the fingers.

- Knead the soil between your thumb and fingers, breaking up clumps. Remove any sticks, gravel or pebbles.
- Squeeze the soil between your thumb and fingers. Use the following chart to determine the approximate soil type.
- Record your findings on the data sheet.

Soil Type	Characteristics of Squeezed Moist Soil[8]
Sand	Feels gritty and does not hold a ball shape.
Sandy Loam	Can be molded into a ball, but the ball breaks up easily.
Silt	Has silkiness like flour (not gritty; can be molded into a ball, but is easily deformed).
Loam	Can be molded into a ball that can be handled without breaking or deforming.
Clay Loam	Can be formed into a long thin "ribbon" that easily breaks.
Clay	Feels sticky, and can easily be formed into a long thin "ribbon."

Soil Invertebrates

Soil invertebrates play critical roles in the long-term stability and fertility of soils. Their activities aerate the soil, speed up decomposition of organic materials and distribute important nutrients.

Procedure

1. With your leaf litter in a large tray, use tweezers to collect any invertebrates you see, placing them in a vial.
2. Use the "Key to Soil and Leaf Invertebrates" page to identify the organisms you found.
3. Record your findings on the data sheet.

[8] Adapted from Project Learning Tree, "Monitoring Forest Health" in *Exploring Environmental Issues: Focus on Forests.*

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LESSON 3

NAME: _____

Soil Lab Data Sheet

Soil Characteristics

	Site #1	Site #2	Site #3	Site #4
% Organic matter				
pH				
Nitrate N (lbs/acre)				
Phosphorus P (lbs/acre)				
Potassium K (lbs/acre)				
Soil texture				

Soil Invertebrates

	Site #1	Site #2	Site #3	Site #4
Springtails				
Earthworms				
Roundworms				
Beetles				
Beetle larvae				
Slugs				
Snails				
Flies				
Fly larvae				
Millipedes				
Proturans				
Pseudoscorpions				
Spiders				
Sowbugs				
Mites				
Ants				
Caterpillars				
True bugs				
Harvestmen				
Other: _____				
Other: _____				
Miscellaneous				
Total # Individuals				
Total # Species				

Key to Soil and Leaf Litter Invertebrates[9]

For each organism you find, start with #1 and, depending on whether legs are present or not, go to the question number indicated. Continue until you determine the type of organism. Please note that some immature insects such as fly larvae, beetle larvae and moth larvae may not be accurately identified with this key.

1	Legs present	4
	Legs absent	2
2	Body spindle-shaped, smooth, unsegmented, slender, usually light-colored, minute (approx. 0.5-1.5 mm long)	**Phylum Nematoda** (roundworms)
	Body not spindle-shaped, or if spindle-shaped, animal is segmented, usually darker in color and 1.5 mm long	3
3	Body distinctly segmented and worm-like, shell absent	**Phylum Annelida** (earthworms)
	Body not segmented, soft and smooth, with or without shell	**Phylum Mollusca** (snails and slugs)
4	Three pairs of legs present	5
	More than three pairs of legs present	14
5	With functional wings	6
	Without functional wings	10
6	With only one pair of wings; second pair of wings replaced by a pair of short, pin-like structures (halteres)	**Order Diptera** (flies)
	With two pairs of wings	7
7	Front and hind wings similar in texture and thickness	8
	Front and hind wings unlike in texture; front wings may be horny or leathery	9

[9] Source: "Soils: Physical and Biological Analysis" in *Environmental Science II* by Dr. Wynn Cudmore. Northwest Center for Sustainable Resources. Chemeketa Community College.

8	Wings usually covered with scales; sucking mouthparts	**Order Lepidoptera** (moths and butterflies)
	Wings transparent; chewing or sucking mouthparts	**Order Hymenoptera** (wasps)
9	Front wings horny or leathery and usually meeting in a straight line down the back, forming a veinless sheath over the abdomen; hind wings folded under front wings when not in use; chewing mouthparts	**Order Coleoptera** (beetles)
	Front wings thickened and leathery at base and membranous at tip; mouthparts, a piercing-sucking beak arising from the anterior portion of the head	**Order Hemiptera** (true bugs)
10	Abdomen terminating in two or three tail-like appendages (cerci); long antennae, chewing mouthparts	**Order Thysanura** (silverfish)
	No cerci at end of abdomen or, if cerci-like appendages are present, they are pointed in an anterior direction (i.e., the springs of springtails)	11
11	Narrow-waisted; chewing mouthparts	**Order Hymenoptera** (ants)
	Not narrow-waisted	12
12	Ant-like, but broad-waisted and usually light-colored	**Order Isoptera** (termites)
	Not ant-like	13
13	Small, delicate insects with long, usually double appendages on underside of abdomen; chewing mouthparts (very common in litter samples!)	**Class Collembola** (springtails)
	Small, soft-bodied, plump insects with two short tubes at end of abdomen; piercing mouthparts in a beak that arises from back of head	**Order Homoptera** (aphids)
14	Four pairs of walking legs present; head and thorax fused to form cephalothorax (Class Arachnida)	15
	More than four pairs of walking legs present	18
15	First pair of appendages (pedipalps) with large pincer-like claws; abdomen distinctly segmented; generally less than 10 mm long	**Order Pseudoscorpionida** (pseudoscorpions)
	First pair of appendages not usually highly modified; abdomen not distinctly segmented; length variable	16
16	Tiny, total length less than 2 mm; body generally oval or shield-like	**Order Acari** (mites)
	Larger, total length greater than 2 mm; body shape variable	17

17	Cephalothorax distinct from abdomen; leg length less than 3x body length	**Order Aranae** (spiders)
	Cephalothorax not distinct from abdomen; leg length greater than 3x body length	**Order Opiliones** (harvestmen, daddy-long-legs)
18	Two pairs of appendages per abdominal segment	**Class Diplopoda** (millipedes)
	One pair of appendages per abdominal segment	19
19	Thorax composed of eight overlapping segments, abdomen composed of six segments; seven pairs of legs plus one pair of maxillipeds (anterior)	**Order Isopoda** (sowbugs)
	Thorax and abdomen variable; more than seven pairs of legs	20
20	Antennae with three distinct prongs, nine pairs of legs	**Class Pauropoda**
	Antennae not as above, more than nine pairs of legs	21
21	Minute, total length less than 10 mm; 10 to 12 pairs of legs, poison claws absent on first trunk segment	**Class Symphyla**
	Larger, total length generally more than 10 mm; generally more than 12 pairs of legs, poison claws present on first trunk segment	**Class Chilopoda** (centipedes)

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LESSON 4

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Determining Stand Density

Use Lego® bricks to model a forest stand, with each brick size representing a different size Douglas-fir tree and the 16x16-stud baseplate representing a quarter acre.

Stand 1: Place "trees" on the 16x16 baseplate in any array you choose. Then determine the Trees per Acre (TPA), Stand Density Index (SDI) and Relative Density (RD) for your stand, using the table below.

Brick Size	Comparable Tree Size (DBH)	Stand Density Index (SDI) per Tree	Number of Trees in Size Class (N)	SDI for Size Class (SDI x N)
1-stud	6.5 in	0.5	i:	a:
2-stud	10.0 in	1	ii:	b:
4-stud	15.4 in	2	iii:	c:
6-stud	19.9 in	3	iv:	d:
8-stud	23.8 in	4	v:	e:

TPA (sum of i-v above) x 4:	
Stand SDI (sum of a-e above):	f:
Stand SDI per Acre (f x 4):	g:
Relative Density (RD) = Stand SDI per Acre ÷ Maximum Stand SDI (g ÷ 512)	h:

Stand 2: Place trees on the 16x16 baseplate to build a forest stand with a Stand SDI of 240 per acre, the optimal density for Douglas-fir trees growing in the Coast Range. Be careful not to crowd trees (crowding is when one brick touches another brick at more than one stud).

Brick Size	Comparable Tree Size (DBH)	Stand Density Index (SDI) per Tree	Number of Trees in Size Class (N)	SDI for Size Class (SDI x N)
1-stud	6.5 in	0.5	i:	a:
2-stud	10.0 in	1	ii:	b:
4-stud	15.4 in	2	iii:	c:
6-stud	19.9 in	3	iv:	d:
8-stud	23.8 in	4	v:	e:

TPA (sum of i-v above) x 4:	
Stand SDI (sum of a-e above):	f:
Stand SDI per Acre (f x 4):	g:
Relative Density (RD) = Stand SDI per Acre ÷ Maximum Stand SDI (g ÷ 512)	h:

Stand 3: Create a mixed-age stand with a Relative Density of .35 per acre by choosing three or more different tree sizes and placing enough of each in the stand so that the total SDIs for each size class are about the same. Be careful not to crowd trees.

Brick Size	Comparable Tree Size (DBH)	Stand Density Index (SDI) per Tree	Number of Trees in Size Class (N)	SDI for Size Class (SDI x N)
1-stud	6.5 in	0.5	i:	a:
2-stud	10.0 in	1	ii:	b:
4-stud	15.4 in	2	iii:	c:
6-stud	19.9 in	3	iv:	d:
8-stud	23.8 in	4	v:	e:

TPA (sum of i-v above) x 4:	
Stand SDI (sum of a-e above):	f:
Stand SDI per Acre (f x 4):	g:
Relative Density (RD) = Stand SDI per Acre ÷ Maximum Stand SDI (g ÷ 512)	h:

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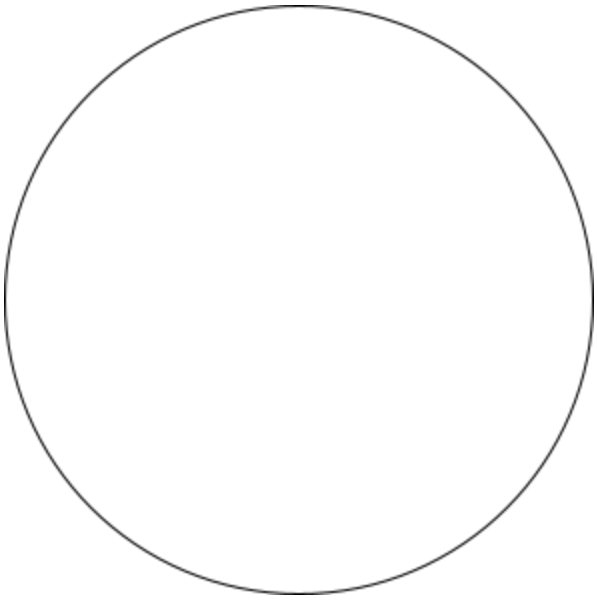
LESSON 5

NAME(S): _____

Forest Thinning Tally Sheet[18]

1. Mark in the circle the locations of each of the trees in the circle plot. Give each tree a number.



2. For each tree in your circle plot, determine the following.

Tree Number	Species	DBH	Height	Live Crown Ratio	Health	Thin?

[18] Source: Adapted from *Forest Surveying and Silviculture* by Dr. Wynn Cudmore. Northwest Center for Sustainable Resources, Chemeketa Community College.

3. Calculate the plot density (in trees per acre) using the following formula.

   Plot Size: 0.05 acres (1/20 of an acre)

   Number of Trees (larger than 2"diameter at breast height) in Plot: _____

   Plot Density = Number of Trees in Plot x 20 = _____ Trees per Acre

4. Determine the thinning requirement for the plot by finding the difference between the Plot Density and the Target Density.

   Target Density (trees per acre): _____

   Plot Density (trees per acre): _____

   Difference between Target Density and Plot Density: _____

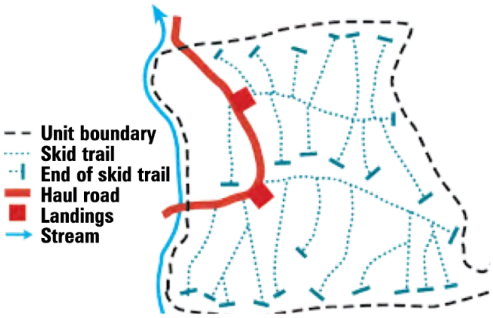
   Number of Trees to Thin = Difference in Density x Plot Size = _____

Timber Harvest System: Conventional Chainsaw and Tractor/Skidder Harvest

Hand-operated chainsaws are used to cut, delimb and buck trees into logs at the stumps. Skidders or crawler tractors (dozers) drag the logs to landings, where they are loaded onto trucks.

Tree felling, limbing and bucking are done with chainsaws.

Typical harvest layout. Skid trails should be planned and marked in advance. They often follow parallel branching patterns as shown (see Page 60). By winching logs across greater distances, skid trails can be located farther apart, reducing the area of skid trails and soil impacts from vehicle traffic.



Advantages

- adaptable to smaller harvest locations
- generally less costly equipment

Equipment used

- chainsaw
- log skidder or crawler tractor (dozer)
- log loader or self-loading log truck

Topography considerations

- normally restricted to slopes less than 35 percent
- haul roads usually located at the bottom of the logging unit

Soil considerations

- use of designated skid trails keeps machines on planned routes to help reduce soil disturbance
- on weaker soils, heavy traffic may result in trail ruts that require more water bars after logging
- soil disturbance can be reduced with widely spaced trails and pulling a winch line farther to logs – synthetic lines and other equipment features can make this task easier
- tractors and skidders should lift the front end of logs to reduce soil gouging

Forest stand considerations

- provides much flexibility with a variety of stand management goals

Slash disposal considerations

- lop and scatter possible with light accumulations of slash
- pile and burn is an option but requires additional steps and costs
- chipping and biomass energy utilization may be possible

Reforestation considerations

- yarding traffic or post-logging treatment can scarify ground and create areas for natural regeneration or hand-planting
- some advance regeneration may be lost or damaged by vehicle traffic

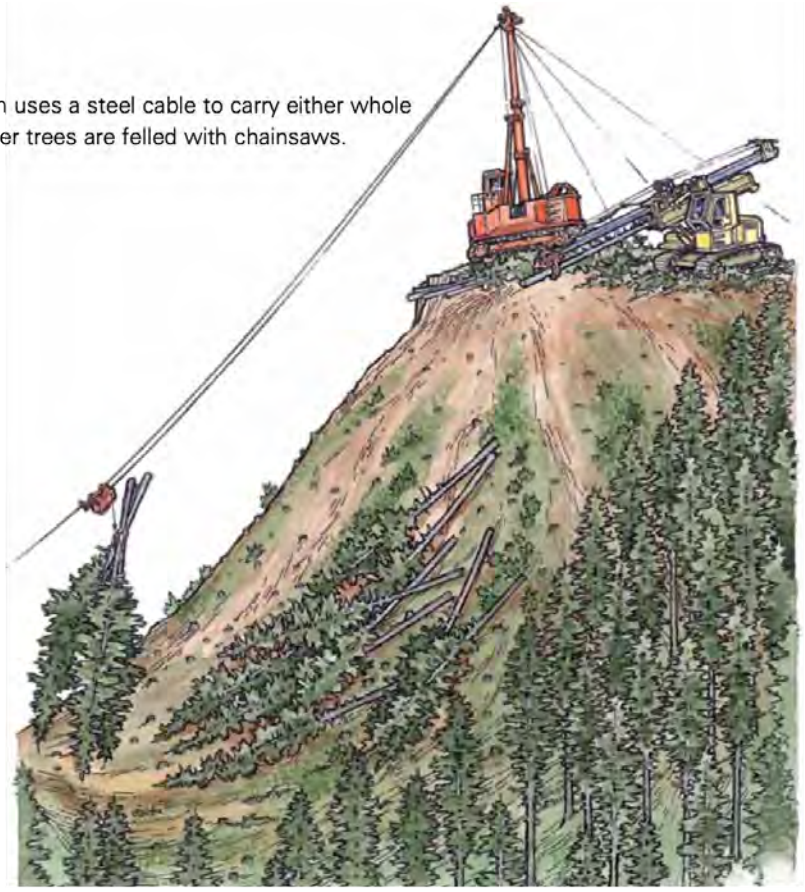
Economic considerations

- often more labor intensive
- generally, more roads are necessary
- least expensive method if road construction is not needed or is budgeted separately

Left: Skidders or dozers drag logs from the forest to the log landing. To reduce soil disturbance, rubber-tired skidders or crawler tractors are kept on skid trails. Winch line and chokers pull logs to the machine. Right: At the landing, a log loader moves logs onto trucks for delivery to the mill.

Timber Harvest System: Cable Logging

On steep terrain, this system uses a steel cable to carry either whole trees or logs to a landing after trees are felled with chainsaws.



Cable yarding systems can reach out 2,500 feet or more, especially with intermediate cable supports. This can help limit road construction needs.

Advantages

- allows for harvesting on steep ground and other sensitive terrain
- eliminates the need for skid trails
- can reduce construction and less favorable locations of roads

Equipment used

- chainsaw
- cable yarder
- delimber and log loader

Topography considerations

- well-suited for slopes of 35 percent and greater
- concave slopes allow more cable deflection and greater system efficiency
- intermediate supports allow for log lift in uneven terrain
- haul roads usually located at the top of the logging unit

Soil considerations

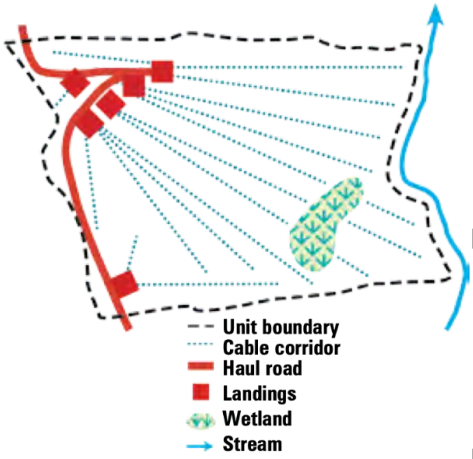
- can significantly reduce soil compaction and disturbance if logs are properly lifted
- heavy equipment is confined to roads and landings

Forest stand considerations

- primarily used with clearcuts and some partial cuts
- a more difficult method for thinning, with potential damage to residual stems

Slash disposal considerations

- if whole trees are brought to the landing, in-unit slash is minimized



Typical cable harvest layout. Generally logs are pulled uphill, but can also be moved downhill. With a strategic layout, logs can be lifted over streams, wetlands and canyons (see page 63).

- heavy slash piles at the landing must be treated or utilized
- if whole tree yarding is not used, prescribed burning of slash may be needed (see pages 69-72)

Reforestation considerations

- may expose fewer spots for easier planting or natural seeding
- brush control needs also may be greater when scarification is reduced

Economic considerations

- can be more costly and specialized than ground-based systems
- small-scale systems can be competitive in some situations

Timber Harvest System: Shovel Logging

This ground-based harvest system uses a log loader (also called a shovel) to move logs rather than a skidder, tractor or forwarder. The shovel moves logs across the unit to locations near the road where they can be loaded onto log trucks. Logs are often picked up and moved ("swung") several times before reaching the road.

The shovel starts at the nearest access point and moves logs until they are within reach of the road. From there they can be loaded on trucks.

Advantages

- requires few people and machines
- few or no skid trails needed; existing roads may be adequate
- brush can be piled during harvest operations.

Equipment used

- chainsaw
- tracked excavator equipped with a grapple to grip and move logs

Topography considerations

- limited by slope due to machine instability on steep side hills
- may allow for harvest of some sensitive areas, with less disturbance than other systems

Below: Excavators equipped with grapples are common choices for handling logs and doing other useful tasks.

Soil considerations

- less compaction and disturbance if machine passes are limited

Forest stand considerations

- used primarily in clearcuts or partial cuts
- requires clearing of roadsides for log decks

Slash disposal considerations

- while moving logs, the excavator can pile heavy concentrations of slash for burning, chipping or other utilization

Reforestation considerations

- while or after moving logs or slash, the excavator can prepare the site for planting or seeding

Economic considerations

- small crew size
- one machine for multiple tasks can reduce costs
- efficiency improves with shorter yarding distances

Timber Harvest System: Cut-to-Length Harvesting

This ground-based system uses a mechanized harvester (tree processor) and a forwarder. The harvester severs, de-limbs and cuts each tree into logs and stacks them in the forest. The forwarder follows, picking up the logs and carrying loads to log trucks. It is also called a harvester-forwarder system.

A single grip processor can reach out 30 feet, cut a tree, strip the limbs, cut the stem into pre-programmed lengths and lay the logs on the ground, all in less than a minute. Ideally, they travel over the tree tops and limbs they leave.

A forwarder follows the harvester, picking up logs and delivering them to log trucks. They can travel long distances, reducing the need for log truck roads.

Logs are offloaded from the forwarder directly to log trucks.

Advantages

- leaves slash (tree branches and tops) in the forest
- reduces the need for log landings and access roads

Equipment used

- harvester/processor (tracked or wheeled)
- forwarder (often wheeled)

Topography considerations

- normally limited to slopes less than 35 percent

Soil considerations

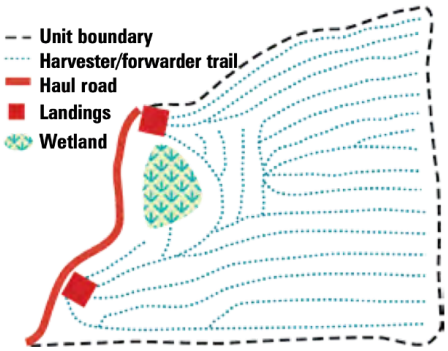
- can reduce compaction and disturbance, especially if the processor moves over duff and slash and if forwarders stay on slash-covered, designated skid trails
- slash left in the harvest unit will recycle nutrients and organic matter

Forest stand considerations

- an efficient method for commercial thinning
- typically used to move short logs out of the forest rather than long logs
- processor efficiency in dense stands is useful for forest health and fuels treatments

Slash disposal considerations

- by traveling over and compacting the slash, the system can reduce wildfire hazards and may meet slash hazard control requirements with no further treatment
- equipment can be used for slash piling for burning, chipping or other utilization



Typical harvest layout. Designated harvester/forwarder trails are about 60 feet apart and often follow parallel patterns across the harvest units.

Reforestation considerations

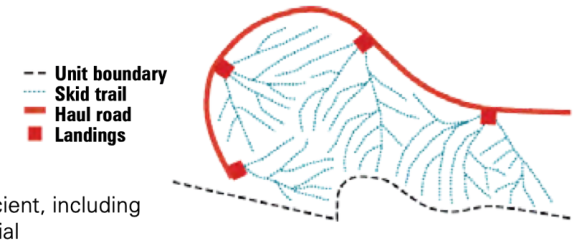
- common for thinnings where residual stocking does not trigger reforestation requirements
- if used for heavier cuts and slash loads, extra steps could create spots for planting or seeding

Economic considerations

- may not require new or improved roads
- relatively expensive and specialized machinery and operators
- may require larger volumes or higher quality timber for efficient use

Timber Harvest System: Whole-Tree Harvesting

This harvest system brings the entire tree, limbs and tops attached, to the landing or roadside. It can be used for both ground-based and cable applications. When used in ground applications, a feller-buncher often is used to cut and pile bundles of trees in the forest. Then a tractor or skidder drags the tree bundles to the landing or roadside. Finally, a delimber converts the trees to logs.



Typical harvest layout. The feller-buncher and grapple skidder travel over most of the unit. Confining multiple trips to primary skid trails can reduce soil disturbance.

Advantages

- can be relatively efficient, including use of smaller material
- slash is brought to the landing or roadside where it can be burned, chipped or otherwise utilized

Equipment used

- feller-buncher
- crawler tractor or skidder with grapple
- stroke-boom delimber
- log loader

Topography considerations

- normally limited to slopes less than 35 percent
- with ground-based harvest, haul roads are usually at the bottom of the logging area

Soil considerations

- vehicles travel over a larger portion of the area as they cut, stack, gather and drag whole trees
- potential for more soil disturbance and compaction than other ground-based systems
- removal of tops and limbs does not recycle nutrients and organic matter near its source

Forest stand considerations

- efficient harvest and stand conversion when using a clearcut,
- can be used when thinning, but damage to remaining trees can be a problem.

A feller-buncher severs trees and lays them in bunches with limbs and tops attached. Bunches are oriented with tree trunks facing downhill.

Slash disposal considerations

- slash can be piled and later burned, chipped or otherwise utilized
- slash returned to the harvest area can recycle nutrients and organic matter (see pages 67-69)

Reforestation considerations

- widespread traffic and large tree bundles may damage advance regeneration
- dragging tree bundles can expose areas for planting or seeding

Economic considerations

- costs can increase on steeper ground or with longer skid distances
- bunching trees can help reduce the cost of handling small diameter trees.

A crawler tractor or skidder with a grapple picks up bunched trees and drags them to a landing or roadside. Some grapples can swing 180 degrees, making it easier to operate in tight spaces.

The stroke-boom delimber operates at the landing or roadside, removing tree limbs and top, cutting the stem into logs and stacking them.

The loader serves two needs: loading trucks and piling tops, branches and log chunks for later burning, chipping or other utilization.

Timber Harvest System: Helicopter Harvesting

This harvest system was once used exclusively for large, high-value timber. Helicopter harvest remains a higher-cost alternative, but it can be used for smaller logs when timber volumes and quality are adequate.

Advantages

- can harvest visually sensitive, inaccessible or other areas where other systems are unsuitable
- useful option for locations with high recreational use, special wildlife habitat, riparian/wetlands or geologic hazards
- may reduce or avoid new road construction, including hazardous/sensitive locations

Equipment used

- chainsaw
- logging helicopter
- helicopter maintenance and fueling equipment
- log loader

Topography considerations

- can be used on any type of terrain with suitable landing and helicopter service area locations (i.e., adequate size, safety and efficiency)

Soil considerations

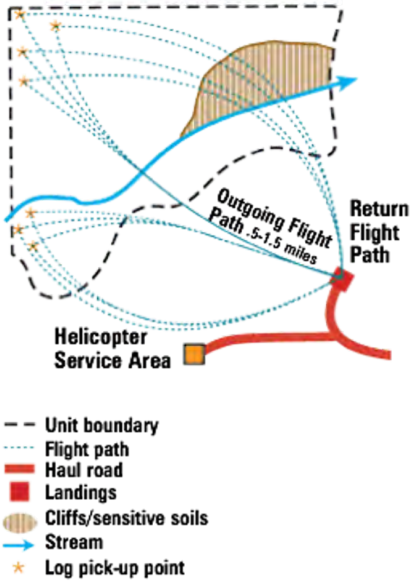
- minimizes in-unit soil disturbance and compaction because logs are fully suspended
- large landings and service areas may require extra drainage or other treatment

Forest stand considerations

- offers efficient, but costly method for commercial thinning
- large landings and service areas can locally impact forest stands.

This helicopter has a payload capacity of 6,000 pounds. Flight distances are kept to one-half to 1.5 miles. Longer distances are more costly. Planning to achieve optimum payloads for each trip helps make the operation economic.

Typical harvest layout



Slash disposal considerations

- lop-and-scatter methods typically are used to reduce fire hazards
- if further treatment is needed, it can be costly where road access is limited

Reforestation considerations

- slash left on-site and limited yarding disturbance result in fewer exposed spots for easy planting or natural seeding

Economic considerations

- typically the most expensive logging system
- equipment and crew needs can result in costs three to four times those of ground-based systems
- reduced road construction needs may help offset high costs
- without adequate volume of higher value logs, harvest costs may exceed timber revenues

STUDENT PAGE

LESSON 6

NAME: _____

Timber Harvest Systems Compared

Good for...	Conventional Chainsaw and Tractor/Skidder Harvest	Cable Logging	Shovel Logging	Cut-to-Length Harvesting	Whole-Tree Harvesting	Helicopter Harvesting
Smaller harvest or thinning?						
Clearcuts or partial cuts?						
Level land (less than 35% slope)?						
Sloped land (35% slope or greater)?						
Minimizing the number of skid trails needed?						
Areas with special wildlife habitat?						
Minimizing soil disturbance?						
Minimizing cost?						

Reforestation in Oregon[21]

Replanting a forest after it has been harvested, known as reforestation, is important. For one thing, it's the law in Oregon. Beyond the law, however, reforesting makes good sense for the environment and for the economy. Since nearly half of the state's land area grows trees, forests can provide multiple benefits, including wood products, watershed protection, fish and wildlife habitat, and recreational opportunities. Our forests can even make an impact beyond our borders, since trees provide cool shade and absorb greenhouse gases that contribute to climate change.

Oregon was the first state in the nation to pass laws to ensure continuous harvest of timber on private lands while safeguarding soil, air, fish and wildlife resources. In 1971, Oregon enacted the Oregon Forest Practices Act, which regulates many activities conducted on forestland, including reforestation. Oregon law requires reforestation when timber harvesting reduces the number of trees below specific stocking levels. Landowners must complete reforestation within 24 months after harvesting. Depending on site productivity, at least 100 to 200 seedlings per acre must be established. However, most landowners plant 300 to 400 trees per acre.

Today, about 40 million trees are planted every winter and spring in Oregon. These tree seedlings are carefully planted on public, industrial and family forestlands. It takes good planning and follow-through to ensure success in this labor-intensive and expensive work.

Planting is the most common way to ensure a fully stocked young forest. This is known as artificial regeneration and is often used in heavily managed stands. Advantages to artificial reforestation include quick, uniform regeneration, less susceptibility to environmental factors (e.g., natural seed dispersal, poor seed years, etc.), a head start over brush and selecting seedlings from superior genetic stock. Natural regeneration, by comparison, may take longer and result in spotty regeneration.

[21] Source: *Exploration of Oregon Forests: Module 4 – Forest Management 1 – Cycles and Reforestation*. Developed by Julie Woodward based on the Oregon State University Forestry Extension's *Basic Forestry Short Course*.

The Five Steps to Reforestation:

STEP 1:

Carefully plan, evaluate and prepare the site. Consider the condition of the planting site: vegetation present, soil type, aspect (direction the slope faces), wildlife and pests. Site characteristics affect critical site resources necessary for seedling survival and growth, including water, sunlight, temperature and nutrients.

STEP 2:

Choose an appropriate site preparation method or combination of methods. Several methods are available to prepare sites for planting. These methods include mechanical, manual and chemical. Costs depend on site conditions, methods used, existing vegetation and the amount of logging debris or slash.

STEP 3:

Select the proper species and seedling stock-type for the site. Different tree species are adapted to different site conditions. Choose seedlings specifically for the seed zone and elevation. Obtain tree seedlings by encouraging natural seeding, by transplanting seedlings growing in the wild or by purchasing nursery-grown seedlings.

STEP 4:

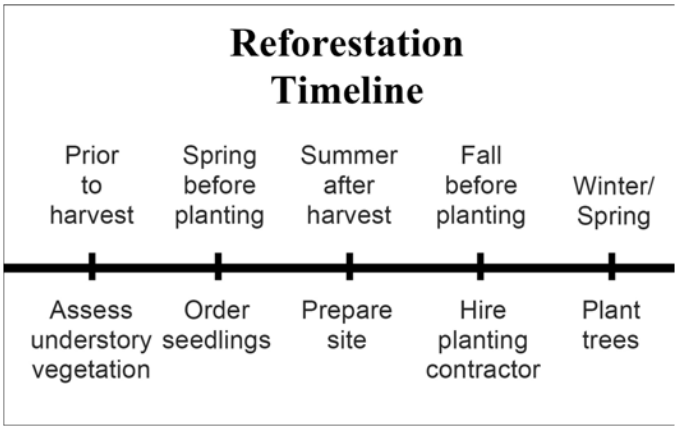
Plant conifer seedlings in western Oregon from January through March. In higher elevations or in eastern Oregon, plant as soon as possible after snow melts and the ground thaws, generally late March through April. Keep seedlings cool (34 to 40 degrees F) and moist, and handle them gently at all times. Site conditions dictate the spacing and density of trees. In western Oregon, typical spacing is 10' x 10'. In eastern Oregon, trees are generally spaced at 12' x 12'. Select good planting spots such as areas of exposed mineral soil that are free of weeds.

STEP 5:

Once seedlings are planted, additional maintenance often is needed to ensure their continued survival and growth. The first two years following planting are critical for survival. New seedlings may require protection from animals, weeds or drought. According to Oregon laws, by the sixth year, the new stand must be “free to grow” (able to out-compete surrounding grasses and brush).

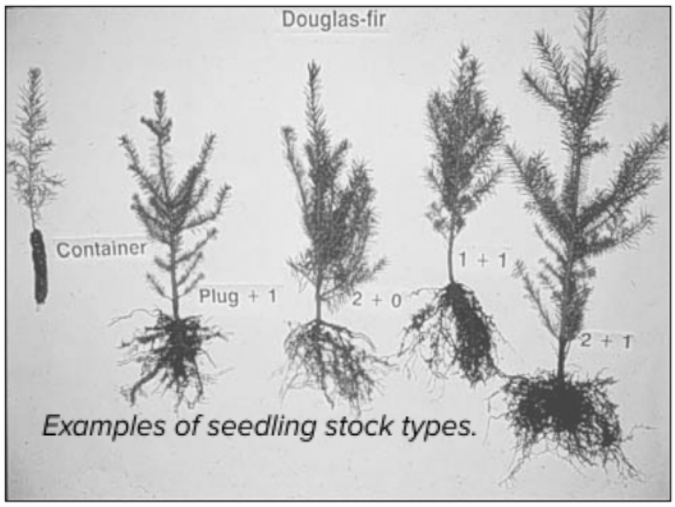
Timing

Although planting is only done in winter and early spring, reforestation is an effort that takes place year-round for most landowners. The figure to the right outlines typical reforestation timeline.



Nursery Stock

Nursery stock used for planting includes bare root and container stock. Bare root is just as it sounds: the trees are packaged, usually in bags, but their roots are exposed. Bare root seedlings are usually less expensive than container stock. Container stock comes in a container, usually made of Styrofoam. Although it is usually more expensive, this method avoids the damage associated with uprooting the trees before transport, as the seedlings are planted along with the soil from the container.



Examples of seedling stock types.

The following figure illustrates examples of seedling stock types. The names can be a bit confusing, but the numbers are associated with how many years the tree spent in a container and in the ground as a bare root. For example, “Plug + 1” means that the tree spent one year in a container, or “plug,” and one year in the ground as a bare root.

Planting Seedlings

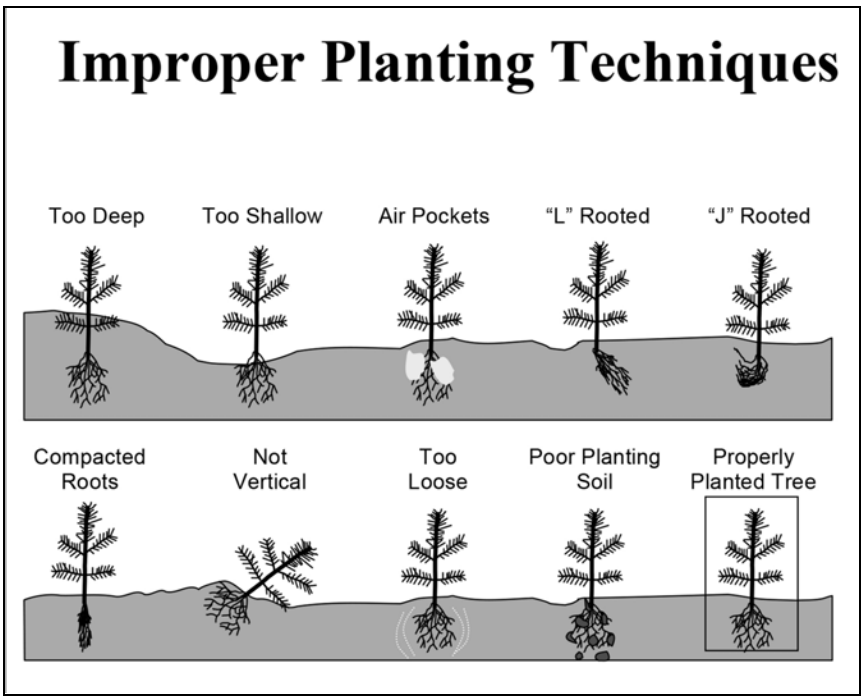
Planting should occur when the seedlings are dormant and the soil is moist, and when subsequent rains will water the plants. This generally means mid-December to mid-March.

Matching Species to Site

Species	Shade	Wet Soil	Drought	Frost	Browse
Alder	1	4	1	2	2
P. Pine	1	4	5	5	4
Douglas-fir	2	2	2-3	4	2
Grand Fir	4	3	2	3	4
W. Hemlock	5	3	1	1	4
W. Redcedar	5	4	1	2	1

(1=not tolerant, 5=tolerant)

Species of seedlings to plant should be determined by soil type, native species and existing vegetation, and seeds must be from the correct seed zone.



When planting seedlings, it is also important to ensure trees have enough space to grow and meet the landowner's long-term objectives. Another important component is properly matching tree species with site conditions. The figure above briefly summarizes common Oregon tree species and their tolerance to specific site conditions.

Tree planting requires time and practice. Proper tree planting techniques are important to successful reforestation and long-term tree survival. See the diagram "Improper Planting Techniques" at right for conditions that often lead to seedlings dying.

Summary

Replanting trees after harvest, or reforestation, is required by the Oregon Forest Practices Act. Beyond the letter of the law, replanting also makes environmental and economic sense. But this labor-intensive and expensive work requires good planning and follow-through, including the choice of timing, nursery stock, tree species and planting technique. Today, about 40 million trees are planted every winter and spring in Oregon on public, industrial and family forestlands.

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LESSON 7

Reforestation in Oregon – Questions[22]

1. Why is reforestation important?

2. What steps are involved in reforesting an area?

3. Explain the differences between bare root and container seedlings.

4. Name an Oregon tree species that tolerates drought conditions well.

5. Name an Oregon tree species that tolerates shade well.

6. Describe a properly planted seedling.

[22] Source: *Exploration of Oregon Forests: Module 4 – Forest Management 1 – Cycles and Reforestation*. Developed by Julie Woodward based on the Oregon State University Forestry Extension's *Basic Forestry Short Course*.

STUDENT PAGE
LESSON 8

NAME: _____

Silviculture in Practice

While on the field trip, find out as many of the following items as you can:

Ownership and personnel

- ☐ Who is the landowner?
- ☐ Who decides what management activities will be done?
- ☐ Who actually implements the activities done to this forest?

Management objectives

- ☐ What are the main management objectives for this forest?
- ☐ What "rules of thumb" are used to determine management strategies?
- ☐ What other planning tools are used (such as density diagrams, cost/benefit analysis or other)?

Information about the forest

- ☐ What pressures or impacts does this forest face?
- ☐ What wildlife habitat does it support?
- ☐ What opportunities does this forest offer for the future?

Management activities

What methods are used for:

- ☐ Thinning?
- ☐ Pruning?
- ☐ Planting?
- ☐ Fertilizing?
- ☐ Converting species?
- ☐ What challenges do these activities present?

INSIDE OREGON'S FORESTS

A high school forestry curriculum

FOREST MANAGEMENT ISSUES

STUDENT PAGES

Oregon Forest Resources Institute

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LESSON 1

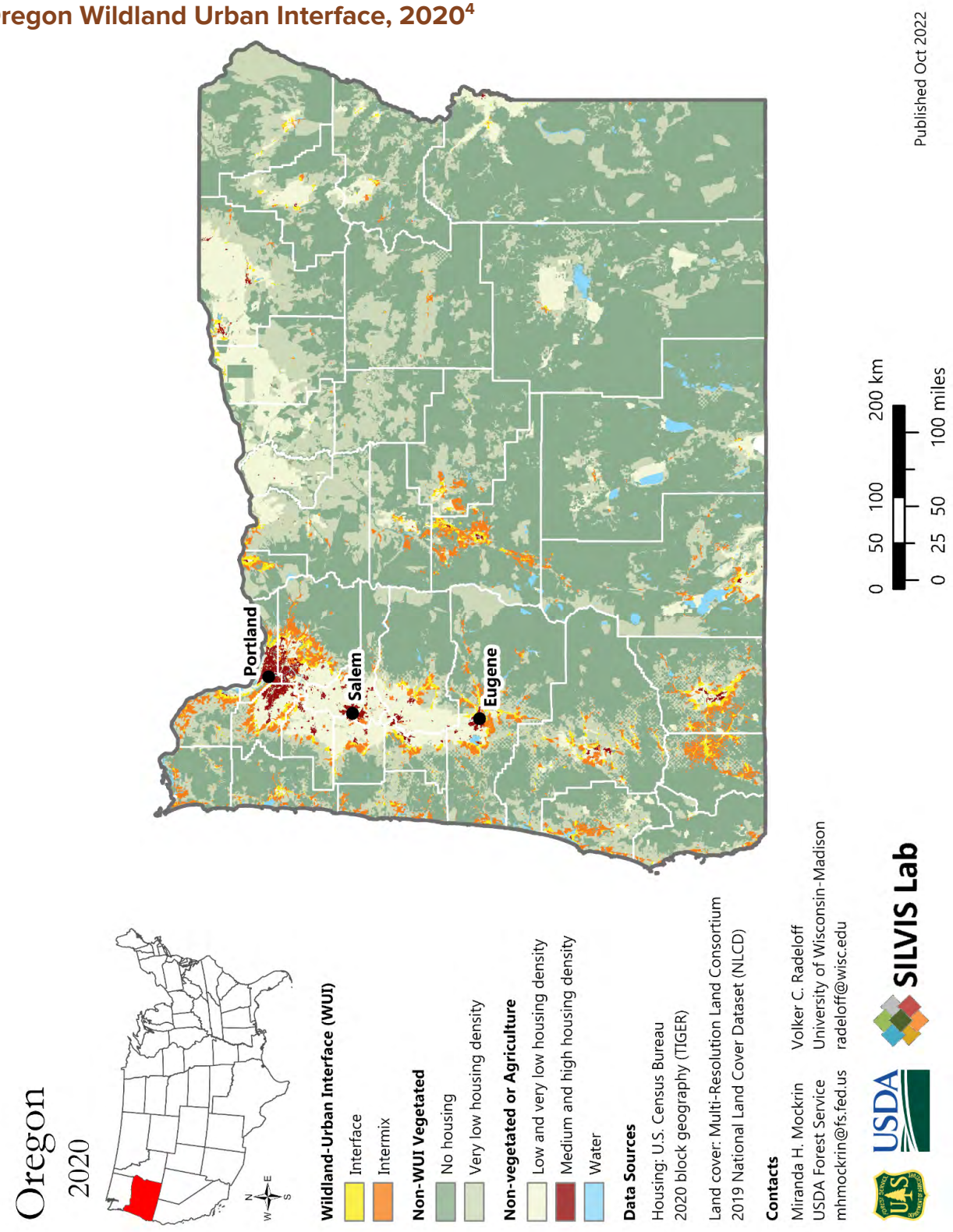
NAME: _____

Fire: Comparing Oregon Forests

Describe the differences related to fire among Oregon's broad forest types.

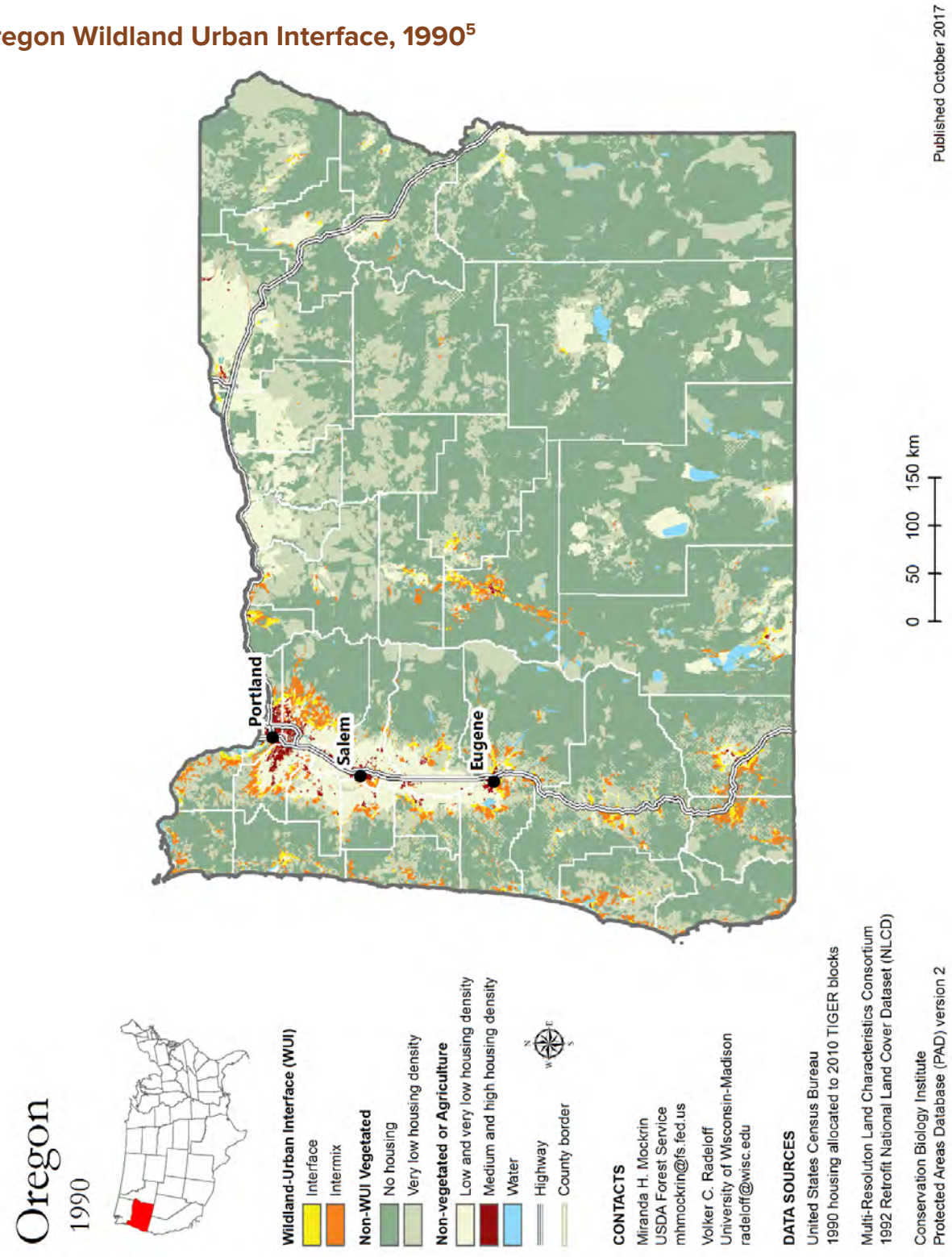
	Western Oregon	Eastern Oregon	Southwestern Oregon
Climate			
Forest Type			
Land Ownership			
Historical Fire Frequency			
Historical Fire Intensity			
Recent Fire History			
Management Solutions			

Oregon Wildland Urban Interface, 2020[4]



[4] Source of map: "Wildland Urban Interface Change: 1990-2020." SILVIS Lab (Spatial Analysis for Conservation and Sustainability). University of Wisconsin, Madison, silvis.forest.wisc.edu.

Oregon Wildland Urban Interface, 1990[5]



[5] Source of map: "The Wildland Urban Interface." SILVIS Lab (Spatial Analysis for Conservation and Sustainability). University of Wisconsin, Madison, silvis.forest.wisc.edu.

STUDENT PAGE
LESSON 2

NAME: _____

Wildfire Safety Checklist[6]

Wildfires are part of the Oregon landscape, and may even help maintain healthy forest ecosystems. There are many things you can do to make sure your property is more likely to survive a wildfire. Assess your home or school now and throughout the year to keep it wildfire-safe.

Around the Building

- ☐ Remove all flammable materials (firewood stacks, propane tanks, dry vegetation or construction materials) within 30 feet of any structure, including garages or sheds.
- ☐ Place any firewood stacks and propane tanks uphill of structures.
- ☐ Clear any flammable vegetation at least 10 feet away from wood piles or tanks.
- ☐ If there is a deck, clear all vegetation underneath it.
- ☐ For a deck or mobile home, provide a skirting or wire mesh all around to keep flammable materials from accumulating underneath.

The Roof

- ☐ Keep the roof and gutters free of all dead leaves and needles.
- ☐ Remove any dead branches overhanging the roof or within 10 feet of the chimney.
- ☐ Place a fire-proof screen with 1/4-inch or smaller mesh on chimney and stove pipe outlets.
- ☐ Check to make sure there are no loose or missing roof tiles.
- ☐ Cover any exterior attic and under-eave vents with metal mesh to prevent ember entry.

Vegetation and Landscaping

- ☐ Prune trees so that the lowest branches are 10 feet from the ground.
- ☐ Keep the lawn watered and maintained (or, if brown, cut it close to the ground).
- ☐ Wherever possible, use fire-resistant plants in the landscaping.

Emergency Access and Preparedness

- ☐ Identify at least two exit routes from the neighborhood.
- ☐ Make sure the property address is easily visible from the road.
- ☐ Make sure all road signs are clearly visible.
- ☐ Discuss and develop an escape plan with family members.
- ☐ Have a fire extinguisher, a ladder and tools such as rakes, shovels and axes available.

[6] Sources: Adapted from "Prevent Wildfires at Home." Keep Oregon Green, keeporegongreen.org. And from "How to Prepare Your Home for Wildfires." Firewise, firewise.org.

Analyzing the Reporting of a Forest Topic[9]

Articles, reports and stories on forest topics can come from a variety of sources with a range of viewpoints. As you study a topic, it's important to know the source of the information, as well as to analyze how it's presented. The following questions will help you evaluate the credibility of a particular report.

Where was the report published or presented?

Try to get as close to the original source of information as possible. Although environmental information reaches the general public through many pathways, a common sequence is:

A scientific study appears in a peer-reviewed science journal (e.g., *Journal of Forestry*, *Science*, *Nature*). This information is usually reliable, but often inaccessible to the general public because of the technical writing style and the need for a subscription to read it.

A summary of the scientific study is prepared by a science writer and appears in a journal designed for and accessible to a more general readership (e.g., *Science News*, *Discover*, *Environment, Scientific American*). This information is usually reliable but less detailed, and is usually more accessible to the average reader.

Accounts of scientific findings are written by journalists for newspapers or popular magazine articles, or for TV news programs (e.g., *The New York Times*, *Newsweek*, or *Frontline*). The writers may or may not be experts on the topic, and may project their own interpretation on the findings. Also, limited space or time often means the findings are shortened and perhaps oversimplified. As a result, reliability may be somewhat diminished.

A radio show, podcast, website or other medium uses accounts from newspapers, magazines or news programs to share with their readers, listeners or viewers. For all the reasons indicated above, reliability may be further compromised.

Selected information from any of the above is used to produce an article that supports a particular agenda or viewpoint. Only information that supports that view is reported, and conflicting information is omitted or discredited. This report may take the form of an editorial, a promotional brochure or a tabloid article.

Note that the reliability of information fades as one gets further from the original source.

[9] Source: "Media Coverage" by Dr. Wynn Cudmore. Northwest Center for Sustainable Resources, Chemeketa Community College.

Evaluating Online Sources

- Domain names (the suffix of the URL) give some indication of the source of information and the motive for posting the information. Educational (.edu) and governmental (.gov) sites, for example, generally provide more reliable information than commercial (.com) sites, which may have a motivation other than providing useful information. Websites sponsored by organizations (.org) are a mixed bag. Many are excellent sources of unbiased information, while others clearly have an "agenda."

- To be sure you're not getting outdated information, examine the "last updated or modified" note at the bottom of the first page.

- The appearance of poor grammar, misspellings and other errors should be seen as an indication of lack of editorial control. Thus, any sites that exhibit these characteristics should be looked upon with suspicion.

What type of information was used to prepare the report?

Check whether the report includes complete and reliable information. Consider where the information came from and whether the author cites their sources. If only selected information that supports a particular point of view is presented, the claims should be looked upon with suspicion.

Also, be aware of the way the information is presented. A common strategy used by writers is to present data using only the extremes. Phrases such as "as many as" or "as few as" should serve as red flags, indicating that the writer is reporting extreme values to make a point. A more credible report would report numbers as a mean or average, with some indication of variation around that mean (i.e., range, standard deviation or confidence interval).

How credible is the "evidence" presented?

Different types of evidence carry with them different levels of credibility. In general, the following list ranks sources of evidence from most to least credible:

MOST CREDIBLE

- group of independent studies
- single scientific study
- collection of anecdotes
- single anecdote
- opinion

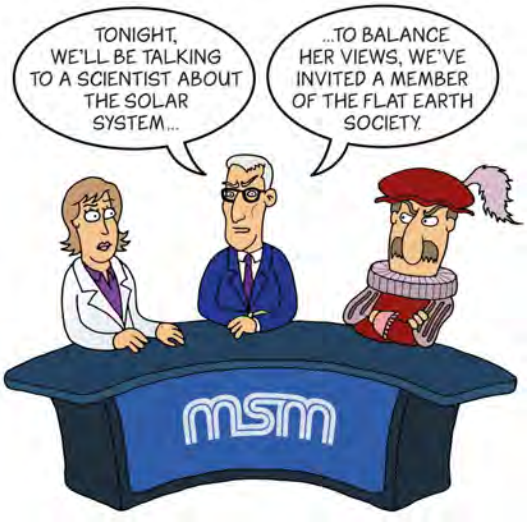
LEAST CREDIBLE

A peer-reviewed (or "refereed") article is one that has been scrutinized by experts in the field prior to publication. As a result, such articles carry more weight than one that has not been peer-reviewed. Reliability also may be influenced by factors such as sample size, length of the study and even researcher bias. A claim gains credibility when it is confirmed by several independent studies.

Although many people rely solely on anecdotal information to formulate opinions, single accounts of isolated incidents are inherently unreliable.

Does the article present a "false balance"?

Journalists - unlike scientists - are trained to present both sides of a contentious issue. They will often include viewpoints of different sides in an effort to present a "fair and balanced" account. This may be done even when the preponderance of scientific evidence supports one viewpoint over another, or when a person presenting one of the viewpoints lacks suitable expertise. Often in these situations, viewpoints rather than evidence are emphasized, and the uninformed reader or listener may be left with the understanding that there is a legitimate debate when, in fact, little or none exists. This "false balance" is frequently seen in reports on environmental issues.



Skeptical Science, John Cook, CC BY-SA 3.0, via Wikimedia Commons

Evaluating Wikipedia Articles

Wikipedia is a popular online encyclopedia that provides a huge amount of information. But be aware that:

- anyone can write or edit Wikipedia articles, so there's no assurance that they're accurate.
- Wikipedia authors are anonymous, so you can't verify their credibility.

Wikipedia is not appropriate for scholarly work. However, it can be a good starting point for learning basic background about a topic and finding more appropriate sources of information.

To evaluate the credibility of a Wikipedia article:

- Look at the article itself to:
    - Check if it contains any "template messages" about issues with the article, such as a lack of references and sources, or the presence of unreliable information.
    - See if it cites sources that are authoritative and appropriate for the topic.
    - Determine if it is written in an unbiased way.
- Look at the article's Talk page to:
    - Check the article's quality grade. Many Wikipedia articles are graded according to the WikiProject Article Quality Grading Scheme.
    - See whether there have been discussions about the article's validity, or whether it appears controversial.
- Look at the article's History page to:
    - Check the article's creation date and revision dates to assess whether the information is up to date.
    - See how many editors have contributed to the article - just one or two individuals, or many working collaboratively.
    - Find out whether the article has been subject to vandalism.

Do the conclusions or claims follow logically from the evidence?

Check whether the connection between "the evidence" and "the conclusions" (or "claims") is logical and straightforward. If the connection is convoluted or illogical, less credibility should be assigned to the claims.

Reporters will sometimes provide anecdotes or stories as evidence. But be aware that one or two stories are not usually sufficient evidence for broad generalizations. For example, even though your friend's grandfather smoked a pack of cigarettes a day and lived to be 100, that's not sufficient evidence to say that smoking has no effect on health.

What bias or hidden agenda may be at play?

Bias is a leaning either in favor of or against an idea, person or thing, usually in a way that is prejudicial or unfair. When we exhibit bias, our conclusions are based on preconceived notions rather than on a critical evaluation of the evidence.

Reporters may exhibit bias through their emphasis, perspective, word choice or tone. To illustrate, here are two different headlines for the Three Little Pigs story, which give very different impressions of the story:

- Hungry Wolf Denied Dinner by Three Deceitful Pigs
- Three Brave Pigs Take a Stand Against Aggressive Wolf

To help determine whether there might be bias in a report, consider the source of the information. What individual or organization is responsible for producing the information? Are they credible and qualified to produce it? Why was it produced? Is the author trying to promote an idea or sell a product?

STUDENT PAGE
LESSON 3

NAME: _____

Article Analysis[10]

Analyze a current news story, article or report on a topic related to Oregon forests, using the following questions.

1. Different media carry with them different degrees of credibility. In what type of media does your report appear?

2. Is the author of the report given? Who is it? Is it an individual or an organization? If it's an individual, does the report say where they work?

3. If an organization has produced the report, what is the mission of the organization? If an individual has produced the report, what credentials or affiliations do they have?

4. Does the report attempt to persuade, advocate or inform? Explain.

5. What information was used to prepare the report? Check those that were used, and add others if necessary. Some possibilities include:
   - ☐ observation of actual occurrences
   - ☐ consultation with experts
   - ☐ discussion with non-experts
   - ☐ reports in scientific journals
   - ☐ reports or findings from a particular organization (scientific or other)
   - ☐ sources are not stated in article

[10] Source: Adapted from "Media Coverage" by Dr. Wynn Cudmore. Northwest Center for Sustainable Resources, Chemeketa Community College.

6. Is this information properly referenced so you can check it out if you want to?

7. What is the date of publication? Is the information in the report (or the report itself) reasonably up to date? The importance of having recent information will vary with the topic under consideration.

8. Claims are positions or conclusions that are stated in the article. They should be supported by some kind of evidence – specific observations or data. What claims are made in your article? What evidence is used to support those claims? List the claims and the specific evidence supporting them in the space below:

Claim	Evidence

9. Do the claims in the report follow logically from the evidence given, or are "leaps in logic" required to reach the same conclusions as the author(s)? Could alternative claims be made from the same evidence?

10. Is there a basis for suspecting bias on the part of the sources, the author of the report or yourself? If so, check those you detect from the list of common biases below. For each of the biases you have detected, explain where in the article it appears.

    ☐ The author or source has a clear stake in the issue and will benefit in some way from the claims that are being made.

    ☐ Only selected information is being reported. (Are you aware of other information that would refute the claims being made?)

    ☐ You reject the claims of the article because you disagree with them, or you accept them because the claim happens to agree with your opinion.

    ☐ The publication has a well-known or suspected position on the issue.

11. Does the report appear to be objective, or does there appear to be a particular agenda being promoted? Explain.

12. Is there anything in the article you consider to be unnecessarily sensationalized to make a point or stimulate some emotion? Examples may include misleading or exaggerated titles, phrases that are meant to appeal to our emotions, or accompanying photographs.

Damaging Forest Pests[11]

A healthy forest is a balanced system of interacting and interdependent components. Defining forest health is difficult, because it means different things to different people. For those who see forests mainly for their economic benefit, a healthy forest is one that produces the most tangible goods. For those who mostly value their environmental benefit, a healthy forest may be one that is high in biodiversity and other measurements.

The Society of American Forests describes forest health as "the perceived condition of a forest derived from concerns about such factors as its age, structure, composition, function, vigor, presence of unusual levels of insects or disease, and resilience to disturbance."

In addition to fire, a multitude of insects, diseases and mammals affect trees and forest health. Many are part of a natural forest cycle – and may even be beneficial. In fact, damage and decay are essential components of healthy forests. Insects that feed on trees become, in turn, food for other animals. And fungi that rot away trees also replenish the soil with essential nutrients that would otherwise be locked up in the wood.

At low levels, insects, diseases and other organisms may contribute to forest health. When levels are high enough to weaken or kill trees, they diminish forest health.

Insects

Insects constitute 90 percent of the species found in the animal kingdom. Many insects help forests thrive. For example, they are an important food source for forest birds and other animals, and may also help decompose dead wood and return nutrients to the soil.

But harmful insects, present at too high a level, destroy more timber in the United States than any other factor. Insects cause damage in various ways, depending on the type of insect. In addition to killing trees, insects may also cause limb and leaf dieback and stunt growth.

Defoliators attack the needles and leaves of trees. Their chewing mouthparts are designed to eat leaves, and they may completely remove all the leaves in a stand. Deciduous trees can

[11] Source: Adapted from "Forest Damage" online course draft, which was adapted for high school students by Rod Bardell from the Oregon State University Forestry Extension's *Basic Forestry Short Course*.

usually withstand three consecutive years of attack without serious harm. Evergreen trees will often die after being defoliated just once.

Bark beetles enter trees through the bark and are considered more destructive than defoliators, posing a serious threat to timber trees. Although their life histories vary, most follow a similar pattern. First, a few attacking insects enter a tree. A healthy tree produces resinous pitch to drown and flush out (pitch out) the beetles that attempt to enter. If the tree is stressed or cannot resist the attack, the invading insect sends out a chemical message (pheromone) to attract neighboring bark beetles. Then thousands of bark beetles attack the tree, creating tunnels, called galleries, that destroy the cambium layer. Female beetles lay eggs in the galleries, and when they hatch the larvae "mine" their way out, killing the tree from within. Generally, the insects spend the winter in one host tree and start the process over in the spring.

Besides defoliating insects and bark beetles, there are a number of other insects that impact trees and forests in different ways. **Sucking insects** attack both foliage and stems. Their sucking mouthparts pierce tissues and siphon fluid from trees. **Wood borers** use abandoned tunnels and usually damage timber after the tree has been felled but before it has been harvested. **Terminal feeders** usually damage seedlings, which is very serious in nurseries and plantations, while **root feeders** attack young trees. **Gall makers** deposit larvae on a tree limb, causing a tree growth called a gall to form around them that provides protection and food for the growing insects. Galls are usually not harmful to trees.

Controlling Insect Pests

Forest managers can choose among many different methods for controlling insect pests and minimizing their damage. These include silvicultural controls, biological controls, chemical controls and integrated pest management.

Silvicultural controls aim to create unfavorable conditions for potential pests. Knowing the natural history of the invader (such as the host species, season of emergence, key predators and tolerance of extreme temperatures) can determine control measures. Forest managers may try:

- Selecting the "right tree for the right place." That means knowing what insects are present and avoiding planting host trees, or planting trees that are resistant to the insects.
- Maintaining tree health by thinning.
- Performing sanitation or cutting to remove damaged or susceptible trees from a stand, and to reduce spread to other trees.
- Creating multiple-age stands, which are less susceptible to some insect attacks than even-age stands.

Biological controls work by either introducing known predators or through disturbing growth or reproductive cycles. Fungi, bacteria, viruses, parasites and predators (other insects, small mammals, reptiles, birds, etc.) are all biological control agents. Since exotic species from abroad can become invasive without natural predators in their new "home," introducing natural predators from their native habitat may be the only way to control the invading insects.

Chemical controls (insecticides) are the most common and most controversial method of controlling insects, because they can have unintended consequences on the ecosystem. They are best used as treatment to control epidemic outbreaks.

Integrated pest management (IPM) uses a combination of controls (silvicultural, biological and chemical) to manage outbreaks. This method recognizes that insects are a natural and necessary part of the ecosystem, and focuses on keeping populations in check rather than on complete eradication.

Forest Diseases

Many diseases and disorders can also affect forests in Oregon. Some of these are abiotic diseases, which are caused by physical conditions of the forests, and some are biotic, which are caused by living organisms.

Abiotic diseases are growth problems that come from poor soil, drought, extreme climatic conditions or other environmental stresses. Some of the problems are caused by human activity, including increased urbanization, soil compaction, air and water pollution, or incorrect species selection.

Biotic diseases are caused by living organisms, usually from a fungal attack. Most are specific to a certain type of host tree. Examples in Oregon include heart and root rots, white pine blister, Swiss needle cast, wilts and dieback, blights and stains.

Dwarf mistletoe, a relative of the harmless "Christmas" mistletoe, is a very serious pest in Western coniferous forests. It is a parasitic, leafless seed plant whose roots (called sinkers) invade the bark of the host plant and its sapwood, draining the tree of water and nutrients.

Mammals

Deer and elk can seriously hamper reforestation projects by browsing or eating new growth, which damages seedlings and saplings. Deer are the most common browsers in Oregon, eating

young shoots and leaves until the tree reaches a height of 5 feet. They also damage bark when they rub their antlers against the trunk. Elk will sometimes pull recently planted seedlings out of the ground.

Bears consume a tree's cambium layer by tearing or biting the outer bark. Pole-sized trees are particularly susceptible due their thinner bark that allows for easier access.

Other woodland mammals can affect trees and forest health. Rabbits cause damage by eating all the way around (girdling) young tree shoots. Porcupines eat bark, exposing the cambium to insect attack and disease. Beavers cut down trees for food, lodges and dam construction. Squirrels, chipmunk and mice eat the seed crop. Pocket gophers and voles girdle seedlings, hampering replanting efforts.

Domestic mammals, particularly grazing and range animals, cause significant damage to planting sites. Cattle, sheep, goats and other grazers eat young shoots, seedlings, bark and seeds, interfering with regeneration as well as weakening or killing trees. Soil compaction and trampling by horses are also major problems, damaging young root systems and hampering regeneration.

Humans and their various activities can affect forests in many far-reaching ways. Although humans are not usually considered "pests," forest managers must often consider ways to reduce human impact on forest ecosystems. Damaging contact with the forest may include vandalism, drug labs and marijuana plantations, use of ATVs and off-road vehicles, and illegal dumping, as well as the broader effects of roads, homes and other development, air pollution and increased carbon dioxide emissions from burning fossil fuels.

STUDENT PAGE
LESSON 4

NAME: _____

Pest Report

Forest pest:

Pest species:

How it affects trees and forests:

What trees it affects most:

How it reproduces:

Under what conditions it thrives:

What people do to control it or reduce its impact:

Photo or illustration of pest:

Photo showing its effect on a tree or forest:

Sources of your information:

Key Resources on Climate Change and Oregon's Forests

2021 Oregon State Agency Climate Change Adaptation Framework. Oregon Department of Land Conservation and Development (in collaboration with other agencies), oregon.gov/lcd. Recommendations for helping the state of Oregon plan for and respond to the impacts of climate change.

2020 Biennial Report to the Legislature. Oregon Global Warming Commission, keeporegoncool.org. Recommended actions to help Oregon meet its climate mitigation goals.

Carbon in Oregon's Managed Forests: Summary Report. Oregon Forest Resources Institute, oregonforests.org. A summary report on carbon sequestration and storage in Oregon's forests, including information on managing forests to increase their carbon storage and potential carbon markets.

Climate Change and Carbon Plan. Oregon Department of Forestry, oregon.gov/odf. A plan for using Oregon's forests as part of the climate mitigation and adaptation solution.

Climate Change Impacts on Forests. U.S. Environmental Protection Agency, epa.gov/climateimpacts. Summary of the impacts of climate change on U.S. forests.

Oregon Climate Action Plan. Oregon Environmental Council, oeconline. Overview of the governor's 2020 executive order to address the climate crisis, directing state agencies to reduce greenhouse gas emissions in Oregon by at least 80% below 1990 levels by the year 2050. See also periodic progress reports (such as Oregon Climate Action Plan Two-Year Progress Report).

Oregon Climate Assessments. Oregon Climate Change Research Institute, oregonstate.edu. A biennial assessment of climate change science and the likely effects on Oregon. In the 2023 assessment, the "Natural Resources" chapter describes effects on forests and other ecosystems, including increased incidence of wildfire.

Oregon's Climate Protection Program. Oregon Department of Environmental Quality, oregon.gov/deq. Overview of the Climate Protection Program, which will set limits on greenhouse gas emissions from significant sources.

Reducing Carbon Emissions. Oregon Department of Energy, oregon.gov/energy. An overview of the actions the department is taking to reduce carbon emissions.

There's Carbon in Them Thar Hills. U.S. Forest Service Research and Development, usda.gov. Summary of a study to calculate the carbon flux in the forests of Oregon and Washington.

See Climate Change Resources for additional resources on climate change in Oregon: oregon.gov/lcd.

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LESSON 6

NAME: _____

Research on Climate Change and Forests

Look for answers to the following questions using information from at least two resources.

Resources used: _____

_____

1. What are three ways the changing climate has affected Oregon's forests?

2. What are three impacts from climate change Oregon's forests might face in the future?

3. What is one way Oregons's forests can help reduce the effects of climate change?

4. What are three strategies foresters and other Oregonians have proposed (or are already doing) to either reduce climate change's effect on forests or to increase forests' ability to slow climate change?

5. What is something else Oregonians could or should do in relation to Oregon's forests to respond to climate change?

NAME: _____

Climate Change Infographic

Create an infographic showing how climate change is affecting Oregon's forests, how Oregon's forests can help to slow climate change, and what Oregonians are doing. Your infographic should include the following elements, and visually represent the relationships between them.

- Air temperature
- Carbon in the atmosphere
- Carbon in trees and soil
- Length of growing season
- Oregon's forests
- Pests and disease
- Precipitation
- Storms
- Tree growth
- Wildfire

Add and label the forest management strategies from your research that foresters and other Oregonians have proposed. Show how each strategy affects the other elements in your infographic.

Add and label your idea for something else Oregonians could or should be doing, and show how it would affect the other elements in your infographic.

STUDENT PAGE
LESSON 6

NAME: _____

Sample Forest Management Opinion Survey

1. How familiar are you with the forests in our area?

Not at All Familiar				Very Familiar
1	2	3	4	5

2. In your opinion, what are the three most important things that you and others gain from Oregon's forests?

- ☐ Carbon storage
- ☐ Clean air
- ☐ Clean water
- ☐ Green spaces
- ☐ Jobs
- ☐ Recreation
- ☐ Solitude
- ☐ Spiritual renewal
- ☐ Wilderness
- ☐ Wood products

3. Clearcutting is a practice foresters sometimes use to harvest trees for wood products. It involves removing most of the trees in an area and then replanting seedlings over the whole area, and must follow Oregon laws. What is your opinion of clearcutting in Oregon? Please choose the best response.

- ☐ I am unfamiliar with clearcutting and do not have an opinion at this time.
- ☐ I don't see a problem with clearcutting and think forest owners should use it whenever they like, within the law.
- ☐ I think clearcutting has its place, but forest owners should use it only after considering other options.
- ☐ I don't think clearcutting should ever be used.

4. In Oregon, 60 percent of the forestland is owned by the federal government and 34 percent is privately owned. But 75 percent of Oregon's harvested timber comes from privately owned lands. What conclusion do you draw from this information?

5. According to a report by the Oregon Climate Change Research Institute, global climate change is already affecting Oregon forests and will continue to have profound effects on them. These impacts include changes in where and how trees grow, and increases in forest fires and pest outbreaks. How concerned are you about the effects of climate change on our forests?

Not at All Concerned				Very Concerned
1	2	3	4	5

6. What do you think is the most pressing issue facing Oregon forests today?

INSIDE OREGON'S FORESTS

A high school forestry curriculum

OUR RESPONSIBILITY TO OREGON'S FORESTS

STUDENT PAGES

Oregon Forest Resources Institute

STUDENT PAGE NAME: _____

LESSON 1

Forest Certification Systems Compared

Follow the steps below to compare the standards and principles from the three forest certification systems commonly used in Oregon:

- Sustainable Forestry Initiative (SFI), forests.org
- American Tree Farm Certification System (ATFS), treefarmsystem.org
- Forest Stewardship Council (FSC), us.fsc.org

Note that in addition to the standards and principles, all three certification systems include detailed criteria and indicators to show whether a standard is met. Check the website for each system to learn more.

Directions

1. For each standard or principle, mark whether it focuses on environmental (EN), economic (EC) or social (SO) aspects of sustainable forestry.
2. Looking at the three different systems, use colored markers to color-code the standards and principles that are the same or similar.
3. In what ways are the goals of the three systems the same, and how do they differ?

4. What other differences do you note among the three systems?

5. What are the strengths and weaknesses (or pros and cons) of each system?

6. Why might someone choose one certification over another?

Sustainable Forestry Initiative (SFI) Principles[4]

Goal: To ensure that forestry practices are environmentally responsible, socially beneficial and economically viable.

Certificated organizations must implement and achieve the following forest management principles:

Principle 1: Sustainable Forestry. To practice sustainable forestry means meeting the needs of the present while promoting the ability of future generations to meet their own needs by practicing a land stewardship ethic that integrates reforestation and the managing, growing, nurturing and harvesting of trees for useful products, and for the provision of ecosystem services such as the conservation of soil, air and water quality and quantity, climate change adaptation and mitigation, biological diversity, wildlife and aquatic habitats, recreation and aesthetics.

Principle 2: Forest Productivity and Health. To provide for regeneration after harvest, maintain the health and productive capacity of the forest land base, and to protect and maintain long-term soil health and productivity. In addition, to protect forests from economically, environmentally or socially undesirable impacts of wildfire, pests, diseases, invasive species and other damaging agents, and thus maintain and improve long-term forest health and productivity.

Principle 3: Protection of Water Resources. To protect and maintain the water quality and quantity of water bodies and riparian areas, and to conform with forestry best management practices to protect water quality, to meet the needs of both human communities and ecological systems.

Principle 4: Protection of Biological Diversity. To manage forests in ways that protect and promote biological diversity, including animal and plant species, wildlife habitats, ecologically and culturally important species, threatened and endangered species (i.e., Forest with Exceptional Conservation Values) and native forest cover types at multiple scales.

Principle 5: Aesthetics and Recreation. To manage the visual impacts of forest operations, and to provide recreational opportunities for the public.

Principle 6: Protection of Special Sites. To manage lands that are geologically or culturally important in a manner that takes into account their unique qualities.

Principle 7: Legal Compliance. To comply with applicable federal, provincial, state, and local forestry and related environmental laws, statutes and regulations.

[4] Source: SFI 2022 Forest Management Standard. Sustainable Forestry Initiative, forests.org.

Principle 8: Research. To support advances in sustainable forest management through research, science and technology.

Principle 9: Training and Education. To improve the practice of sustainable forestry through training and education programs.

Principle 10: Community Involvement and Social Responsibility, and Respect for Indigenous Rights. To broaden the practice of sustainable forestry on all lands through community involvement and socially responsible practices, and through recognition and respect of Indigenous Peoples' rights and traditional forest-related knowledge.

Principle 11: Transparency. To broaden the understanding of forest certification to the Forest Management Standard by documenting certification audits and making the findings publicly available.

Principle 12: Continual Improvement. To continually improve the practice of forest management, and to monitor, measure and report performance in achieving the commitment to sustainable forestry.

Principle 13: Responsible Fiber Sourcing. To use and promote sustainable forestry across a diversity of ownership and management types in the United States and Canada that is both scientifically credible and socially, environmentally and economically responsible, and to avoid sourcing from controversial sources both domestically and internationally.

American Tree Farm System (ATFS) Standards of Sustainability[5]

Goal: To sustain forests, watershed and healthy wildlife habitats through the power of private stewardship by offering affordable forest certification for family forest landowners in the United States.

Forest landowners must demonstrate compliance with the following standards:

Standard 1: Commitment to Practicing Sustainable Forestry. Landowner demonstrates commitment to forest health and sustainability by developing a forest management plan, implementing sustainable practices, and seeking opportunities to expand their knowledge and understanding of sustainable forest management.

Standard 2: Compliance with Laws. Forest management activities comply with all relevant federal, state and local laws, regulations and ordinances.

Standard 3: Reforestation and Afforestation. Landowner completes timely restocking of desired species of trees on a regeneration harvest site and nonstocked areas where tree growing is consistent with land use practices and the landowner's objectives.

Standard 4: Air, Water and Soil Protection. Forest management practices maintain or enhance the ecosystems and ecosystem services provided by the forest, including air, water, soil and site quality.

Standard 5: Fish, Wildlife, Biodiversity and Forest Health. Forest management activities contribute to the conservation of biodiversity.

Standard 6: Forest Aesthetics. Forest management activities recognize the value of forest aesthetics.

Standard 7: Protect Special Sites. Special sites are managed in ways that recognize their unique historical, archeological, cultural, geological, biological or ecological characteristics.

Standard 8: Forest Product Harvests and Other Activities. Forest product harvests and other management activities are conducted in accordance with the landowner's objectives and consider other forest values.

[5] Source: 2021 Standards of Sustainability. American Forest Foundation, treefarmsystem.org.

Forest Stewardship Council (FSC) Principles[6]

Goal: To promote environmentally sound, socially beneficial and economically prosperous management of the world's forests.

The following principles apply to all FSC-certified forests around the world:

Principle 1: Compliance with Laws and FSC Principles. Forest management shall respect all applicable laws of the country in which they occur, and international treaties and agreements to which the country is a signatory, and comply with all FSC Principles and Criteria.

Principle 2: Tenure and Use Rights and Responsibilities. Long-term tenure and use rights to the land and forest resources shall be clearly defined, documented and legally established.

Principle 3: Indigenous Peoples' Rights. The legal and customary rights of indigenous peoples to own, use and manage their lands, territories and resources shall be recognized and respected.

Principle 4: Community Relations and Workers' Rights. Forest management operations shall maintain or enhance the long-term social and economic well-being of forest workers and local communities.

Principle 5: Benefits from the Forest. Forest management operations shall encourage the efficient use of the forest's multiple products and services to ensure economic viability and a wide range of environmental and social benefits.

Principle 6: Environmental Impact. Forest management shall conserve biological diversity and its associated values, water resources, soils, and unique and fragile ecosystems and landscapes, and, by so doing, maintain the ecological functions and the integrity of the forest.

Principle 7: Management Plan. A management plan — appropriate to the scale and intensity of the operations — shall be written, implemented and kept up to date. The long-term objectives of management, and the means of achieving them, shall be clearly stated.

Principle 8: Monitoring and Assessment. Monitoring shall be conducted — appropriate to the scale and intensity of forest management — to assess the condition of the forest, yields of forest products, chain of custody, management activities, and their social and environmental impacts.

Principle 9: Maintenance of High Conservation Value Forests. Management activities in high conservation value forests shall maintain or enhance the attributes which define such forests.

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[6] Source: "Mission and Vision." Forest Stewardship Council, us.fsc.org.

Decisions regarding high conservation value forests shall always be considered in the context of a precautionary approach.

Principle 10: Plantations. Plantations shall be planned and managed in accordance with Principles and Criteria 1-9, and Principle 10 and its Criteria. While plantations can provide an array of social and economic benefits, and can contribute to satisfying the world's needs for forest products, they should complement the management of, reduce pressures on, and promote the restoration and conservation of natural forests.

NAME(S): _____

Forest Landowner Interview[8]

Forest Landowner's Name:_____

1. Describe the forestland you own: Where is it located? What types of trees, water, resources and built structures does it have? What is the surrounding area like?

2. How long have you owned this land? How did you acquire it?

3. Why do you own this forestland? What do you value most about it?

4. How do you use this land?

5. How do you make decisions about managing this forestland?

6. What are the biggest challenges you face in managing this forestland?

[8] Source: Adapted from "Who Owns America's Forests?" *Exploring Environmental Issues: Focus on Forests, Secondary Environmental Education Module.* Project Learning Tree.

7. How has this forestland changed over the past 10, 20 or 50 years? In what ways has it stayed the same?

8. What do you see happening to this land in the next 10, 20 or 50 years?

9. What are your biggest concerns about the future of this land?

10. What actions, if any, are you taking to ensure the long-term sustainability of your forestland?

Service-Learning Planning Template

Forest-related project idea:

_____

Service

Community need:

_____

Learning

Connections to curriculum, Oregon Standards and Conceptual Framework

- ☐ Arts:
- ☐ English/Language Arts:
- ☐ Mathematics:
- ☐ Science:
- ☐ Social Sciences:
- ☐ Other:

Concept Development

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

Skill Development

- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

Project Plan

Timeline:

Preparation:

Action:

Reflection:

Demonstration of learning:

Community resources:

Books, other resources:

Notes:

Sample Service-Learning Projects

Forest Stream Monitoring. Students monitor a nearby forest stream and riparian zone for the local watershed council. They map the area using GPS units, take ongoing water quality samples, keep photo journals, analyze their results and develop a multimedia presentation of their findings.

Invasive Species Removal. Students remove invasive plants from a nearby forest area, after assessing the prevalence of invasive species. They learn about the impact of invasive species on forest ecosystems, practice identifying some of the most prevalent invasive species, learn the best methods for removal, document the effectiveness of the treatment and communicate with others in the community about the problem of invasive species.

Forest Interpretive Trail. Students develop an interpretive trail for the community that goes through a local forest. Students learn about the local ecosystem, research interesting facts about plants, animals or historical figures, work with government agencies and businesses, and create signs or a brochure for the trail.

Forest Species Living Lab. Students design an outdoor forest species living lab for their school community. They research Oregon native plants and what they need to thrive, organize fundraising efforts for suitable plants and needed supplies, create planning maps of the lab site, and then plant and care for the plants.

Forest Field Day. Students plan and carry out a field day to teach elementary students about the local forest ecosystem. They research topic areas, plan activities and demonstrations, practice teaching their lessons and present them to elementary students.

Tree Planting and Monitoring. Students work with a local park or government agency to plant trees and then monitor the trees' development over time. They plan what, where and how many trees to plant, organize fundraising efforts to buy the trees, and carry out their planting plan. Then, over time, they collect data on the newly planted trees to monitor their growth and impact.