INSIDE OREGON'S FORESTS

A high school forestry curriculum

FOREST MANAGEMENT ISSUES

1: Fire in Oregon's Forests
2: Assessing Wildfire Safety
3: Evaluating Articles on Forest Issues
4: Forest Pests
5: Climate Change and Oregon's Forests
6: Community Views on Forest Management Issues

Oregon Forest Resources Institute

Introduction

Inside Oregon's Forests is a high school curriculum developed by the Oregon Forest Resources Institute (OFRI) to help students build a deep understanding of Oregon's forests. The seven modules are loosely organized around topics and concepts from the *Oregon Forest Literacy Plan*, a forest-education conceptual framework developed by OFRI and available at learnforests.org.

Curriculum Goals and Objectives

The overall goal of this curriculum is to provide engaging, standards-based lessons that help high school students understand the environmental, economic and social importance of Oregon's forests, as well as the principles behind forest management. Through the lessons, students will be able to:

- explain basic tree biology
- identify the forest types in Oregon
- describe the environmental, economic and social benefits Oregon's forests provide
- explain scientific and economic principles involved in managing Oregon's forests
- describe current issues facing Oregon's forests
- identify actions they can take to help ensure the sustainability of our forests

Curriculum Overview

Following is a description, as well as a suggested sequence and time frame, for each of the seven modules in the curriculum.

Sequence & Time Frame	Module	Description
Weeks 1-2	Oregon's Forest Heritage	Students are introduced to Oregon forests and their history, and examine some changes in our state's forestland over time.
Week 3	Forest Basics	Students gain an understanding of both tree biology and the forest types in Oregon, and practice identifying and measuring trees.
Weeks 4-5	Environmental Importance of Oregon's Forests	Students explore the environmental importance of forests: for example, how they protect our water resources, provide habitat and store carbon.
Week 6	Economic Importance of Oregon's Forests	Students examine Oregon's forest economy, including the products, energy and jobs that come from forests.

Weeks 7-9	Forest Management	Students learn about forest management and practice forest management skills, such as surveying a forest tract, analyzing forest soil and developing a management plan.
Weeks 10-11	Forest Management Issues	Students explore the impacts of fire, forest pests and climate change on Oregon's forests, and conduct an opinion survey related to a forest management issue.
Week 12-13	Our Responsibility to Oregon's Forests	Students learn about certification as a way to achieve forest sustainability, and plan and carry out a service-learning project.

How to Use the Curriculum

The curriculum is designed to be flexible. Teachers may select modules or lessons that fit their educational goals, as each lesson can either stand alone or build on prior lessons. This curriculum may be used:

- as the basis for a 13-week or semester-long course on forestry
- to teach a single unit on forestry within other high school courses, such as agricultural science and technology, or environmental science
- to help prepare students for the FFA Career Development Event (CDE) on Forestry, or for Envirothon

Curriculum Resources

The following Resources (available at learnforests.org) support teaching the curriculum:

- Glossary
- Supplies
- OFRI Publications and Videos
- Student Pages
- Field Investigations
- Oregon Standards Connections
- Oregon Forest Literacy Plan Concepts

About OFRI

The Oregon Forest Resources Institute supports and enhances Oregon's forest products industry by advancing public understanding of forests, forest management and forest products.

FOREST MANAGEMENT ISSUES

1: Fire in Oregon's Forests

Overview

Students compare the forests of eastern and western Oregon in terms of historical fire behavior, current fire risks and approaches to fire management.

Time Considerations

Preparation: 30 minutes

Procedure: One 50-minute class period

Learning Objectives

Students will be able to:

- Explain why fires behave differently today than they did historically.
- Compare eastern and western Oregon forests in terms of fire behavior and fire risk.
- Identify solutions for making eastern and western Oregon forests more fire-resilient.

Standards Connections

Oregon Science Standards

- Disciplinary Core Idea – HS.ESS3.C. Human Impacts on Earth Systems. The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.

Oregon Forest Literacy Plan Concepts

- 3.C.3. The type and intensity of forest management, including harvest, is dependent on the purposes for which the forest is managed, as well as forest type, ownership, size and location.
- 3.C.7. Sustainable forest management takes into account environmental, economic and social dimensions of sustainability. It includes maintaining forest health, productivity and diversity, and maintaining a forested land base for the needs of present and future generations.

- 3.D.2. Forestry practices can be controversial, because of diverse perspectives as well as the complex nature of forest ecosystems.
- 3.D.4. Current issues related to forest management include the effects of timber harvest, wildfire, climate change and land uses, as well as the perception of these effects.

Materials

- Optional: *State of Fire* video (12 minutes), available at oregonforests.org
- Optional: *State of Fire* report
- Technology for showing video
- "Fire: Comparing Oregon Forests" student page

Background Information[1]

Fire is a natural part of forest ecosystems in Oregon. Historically, fires in the dry pine and mixed-conifer forests of eastern and southwestern Oregon occurred every five to 40 years. Fires in the wetter, Douglas-fir and western hemlock forests of western Oregon burned every 100 to 450 years. As humans have actively fought fire over the past century, the "housekeeping" that fire provides hasn't happened at these natural intervals. With no matching level of fuel removal, many of these forests have become unnaturally dense, particularly in Oregon's dryer forests.

Although fire can provide benefits, a wildfire or a fire that's out of control causes significant damage to forest values of timber, watersheds, wildlife habitat and homes. Treatments that can reduce fire severity and promote fire-resiliency – particularly in Oregon's dryer forests – include:

- Thinning. Thinning subordinate trees mimics natural stand mortality by removing trees that would naturally die from competition or from natural surface fires, leaving the more dominant trees and eliminating "fuel ladders." The remaining dominant and co-dominant trees are more fire-resistant, because their bark is thicker and their crowns are much higher.
- Pruning. Pruning is removing tree limbs to improve wood quality, aesthetics and fire resistance. Pruning improves fire resistance by raising the tree canopy so fire will be less likely to climb into the crowns. The branches need to be removed from the site, or burned or chipped.
- Mowing. Mowing is one tool used in central Oregon to remove flammable shrubs such as bitterbrush, which contains volatile oils that can produce flames 15 feet or higher. Mowing reduces the surface fuel and often is used adjacent to developments where prescribed burning might be risky and produce unwelcome smoke.

[1] Source: Adapted from *Forest Fact Sheet: Why Are Some Forest Fires More Intense?* Oregon Forest Resources Institute, learnforests.org.

- Prescribed fire. Prescribed fire is the purposeful and controlled application of fire to rid the understory of fuels. Prescribed fire also helps control insects and disease, improves the quality of grass for animals, prepares a seedbed for regeneration, removes undesirable older shrubs, improves access, and allows more nutrients, water and space for remaining trees. Sometimes a naturally occurring fire, such as one started by lightning, can be managed to achieve the goals of a prescribed burn.

Fire Basics[2]

Wildfires are ignited by either lightning or humans. Human activities that can cause wildfires include debris burning, campfires, equipment fires, smoking and arson.

To sustain a fire, three elements are needed: heat or an ignition source, oxygen and fuel. Together, these elements are known as the "fire triangle." Take away one of these things, and the fire will go out or won't start. For example, constructing a fire line down to the mineral soil removes fuel from the forest floor.

Fires differ in terms of how fast they spread, how high their flames are, and how hot they burn (their intensity). Once a fire ignites in forestland or rangeland, the manner in which it reacts to local conditions is known as its behavior. The "fire behavior triangle" includes three elements: the amount and arrangement of fuel, the topography and the weather conditions. A change in any one factor during the fire alters its behavior and type (whether it's a ground, surface or crown fire).

There's not much people can do about weather and topography. The one element in both of these triangles we can do something about is fuel. Fuels include grass, shrubs, litter and slash. By reducing the amount of fuel and changing its arrangement, we can influence a fire's behavior.

Key Vocabulary

fire intensity

fire suppression*

fire triangle

fuel

ignition

prescribed fire*

**included in Glossary*

[2] Source: Adapted from *Chapter 9: Fire in the Forest* 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*.

Preparation

- Plan whether you will use the *State of Fire* video or report, or both, or have students do their own research, to compare forest conditions in different parts of Oregon as they relate to wildfire.
- Plan how students will access the *State of Fire* report.
- Make copies of the student page.

Procedure

1. Explain to students that over the next few lessons they will be exploring some of the challenges and issues that face Oregon's forest managers. Ask them what they think some of those might be.
2. If they don't mention it, point out that fire is one of the topics they will explore. With a show of hands, ask students whether they think forest fires are good for forests, bad for forests, or neither good nor bad for forests. Have a few students explain their thinking.
3. Using information from the Background Information, introduce or review the fire triangle (the three elements needed for a fire to ignite or burn), as well as the fire behavior triangle (the three factors that influence the fire's rate of spread and intensity).
4. Ask students how fire might be different in western Oregon than in eastern and southwestern Oregon.
5. Have students view the *State of Fire* video, read the *State of Fire* report or conduct their own research to take notes on the "Fire: Comparing Oregon Forests" student page about the differences among western, eastern and southwestern Oregon forest fires. (Note that the film mostly discusses western and eastern Oregon forests, while the report differentiates among all three.)
6. Lead a discussion about students' findings:
    a. What role has fire played in Oregon's landscape, both historically and recently?
    b. In what ways have people's views of wildfire changed over time?
    c. What differences between eastern and western Oregon forests influence our approach to wildfires in these regions?

Assessment

Ask students to use the information from the student page to write a paragraph describing one or more fire-related issues in Oregon.

Extension Ideas

- Visit FireAmongUs.org, an illustrated microsite specifically for youth, in which characters of the forest walk them through the basics of fire science, and how to make smart choices with fire in and around a forest.
- Practice properly and safely using hand tools to construct a fuel break or trail in the field. Discuss with students the importance of gas-powered equipment operating with a spark arrester and off-road vehicles having proper exhaust systems to minimize fire hazard. You can get more information about fire prevention from Keep Oregon Green at keeporegongreen.org.
- Learn more about fire behavior using matchsticks (see box).
- Research to learn about Indigenous people's use of fire as a tool for managing Oregon's forests. One place to start is *Indians, Fire, and the Land in the Pacific Northwest*, edited by Robert T. Boyd.

Matchstick Forest Demonstration

For a very visual exploration of how slope and tree density affect fire behavior, do a classroom demonstration with "forests" made out of matchsticks. Using roasting pans or boards at different angles, or with matches placed at different densities, students can evaluate how fire behavior changes over multiple experiments. See "A Matchstick Forest" in the Bureau of Land Management's Exploring Wildland Fire Educator Guide, available at blm.gov, for a sample procedure.

STUDENT PAGE

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			

2: Assessing Wildfire Safety

Overview

Students do a wildfire safety assessment of their home or school, and make recommendations for increasing wildfire safety.

Time Considerations

Preparation: 30 minutes

Procedure: Two 50-minute class periods, with time between to conduct the assessment

Learning Objectives

Students will be able to:

- Define the term “wildland urban interface.”
- Identify strategies for reducing the risk of damage to their homes and communities from wildfire.
- Conduct a wildfire safety assessment at their home or school, or in their community, and make recommendations for increasing wildfire safety.

Standards Connections

Oregon Science Standards

- Disciplinary Core Idea – HS.ESS3.C. Human Impacts on Earth Systems. The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.
- Science and Engineering Practice – Obtaining, Evaluating, and Communicating Information. Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

Oregon Forest Literacy Plan Concepts

- 3.C.7. Sustainable forest management takes into account environmental, economic and social dimensions of sustainability. It includes maintaining forest health, productivity and

diversity, and maintaining a forested land base for the needs of present and future generations.

Materials

- "Oregon Wildland Urban Interface, 1990" teacher page
- "Oregon Wildland Urban Interface, 2020" teacher page
- Technology for sharing teacher pages
- "Wildfire Safety Checklist" student page

Background Information[3]

In Oregon, more and more people are living in what is known as the wildland urban interface — or WUI — where homes and other structures are built in or near woodlands or forests. While residents in these areas enjoy the beauty of the environment, they also face the very real danger of wildfire.

The WUI is composed of both intermix and interface communities. Intermix communities are places where housing and wildlands intermingle. In the intermix, wildland vegetation is continuous and more than 50 percent vegetation. Interface communities are next to or very near wildlands. These areas are defined as having less than 50 percent vegetation, but being within 1.5 miles of a large area with more than 75 percent vegetation.

For those fortunate enough to live nestled in or near forests, planning and preparation can help safeguard their homes and communities against catastrophic wildfire damage. This includes:

- Clearing a 30-foot perimeter of defensible space around the home
- Removing dead material
- Pruning branches in the adjacent forest to remove fuel ladders
- Creating fire-resistant landscapes with plants such as Oregon grape, holly and Pacific rhododendron

Working together, residents can make their own properties – and their neighborhoods – much safer from wildfire. In addition, land use planning helps strike a balance between growth and conserving Oregon forestlands for both humans and wildlife.

[3] Source: Adapted from "Do Your Part." Keep Oregon Green. keeporegongreen.org.
Maps and information about maps from "Wildland Urban Interface Change: 1990-2020." SILVIS Lab (Spatial Analysis for Conservation and Sustainability). University of Wisconsin, Madison, silvis.forest.wisc.edu.

Note on maps: The 2020 map was produced using different land cover datasets than the 1990 map, and should only be compared on a very general basis.

For more information, see the report *Living with Fire*, available at learnforests.org.

Key Vocabulary

defensible space

flammable

non-flammable

wildland urban interface (WUI)*

**included in Glossary*

Preparation

Make copies of the student page and set up equipment for sharing teacher pages.

Procedure

1. Ask students whether they have heard the term "wildland urban interface." Ask them what they think it means. What issues might it raise for forests and for humans?
2. If students don't mention it, point out that one issue with the wildland urban interface is an increased vulnerability to wildfire.
3. Show students the two maps of Oregon's wildland urban interface, and have them compare and contrast the maps. What Oregon communities are most at risk for wildfire? What is the wildfire risk of their own community?
4. Have students conduct an assessment of their school, home or community using the "Wildfire Safety Checklist" student page.
5. Invite students to share what they learned. Which items on the checklist have been addressed? What could students do to encourage parents or community members to tackle items that haven't been addressed?

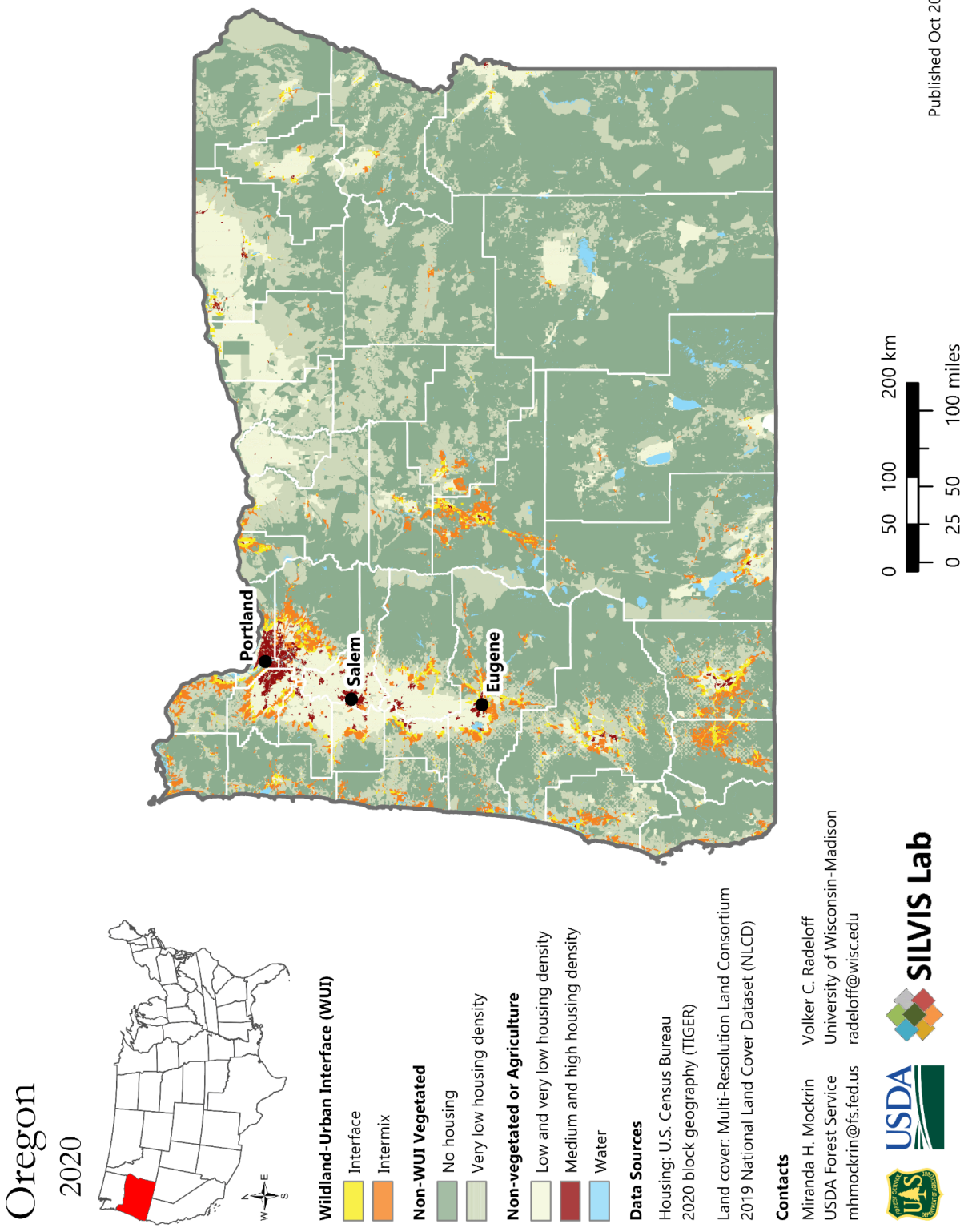
Assessment

Have students develop a recommendation plan for addressing one or more of the items on the checklist that still need attention.

Extension Ideas

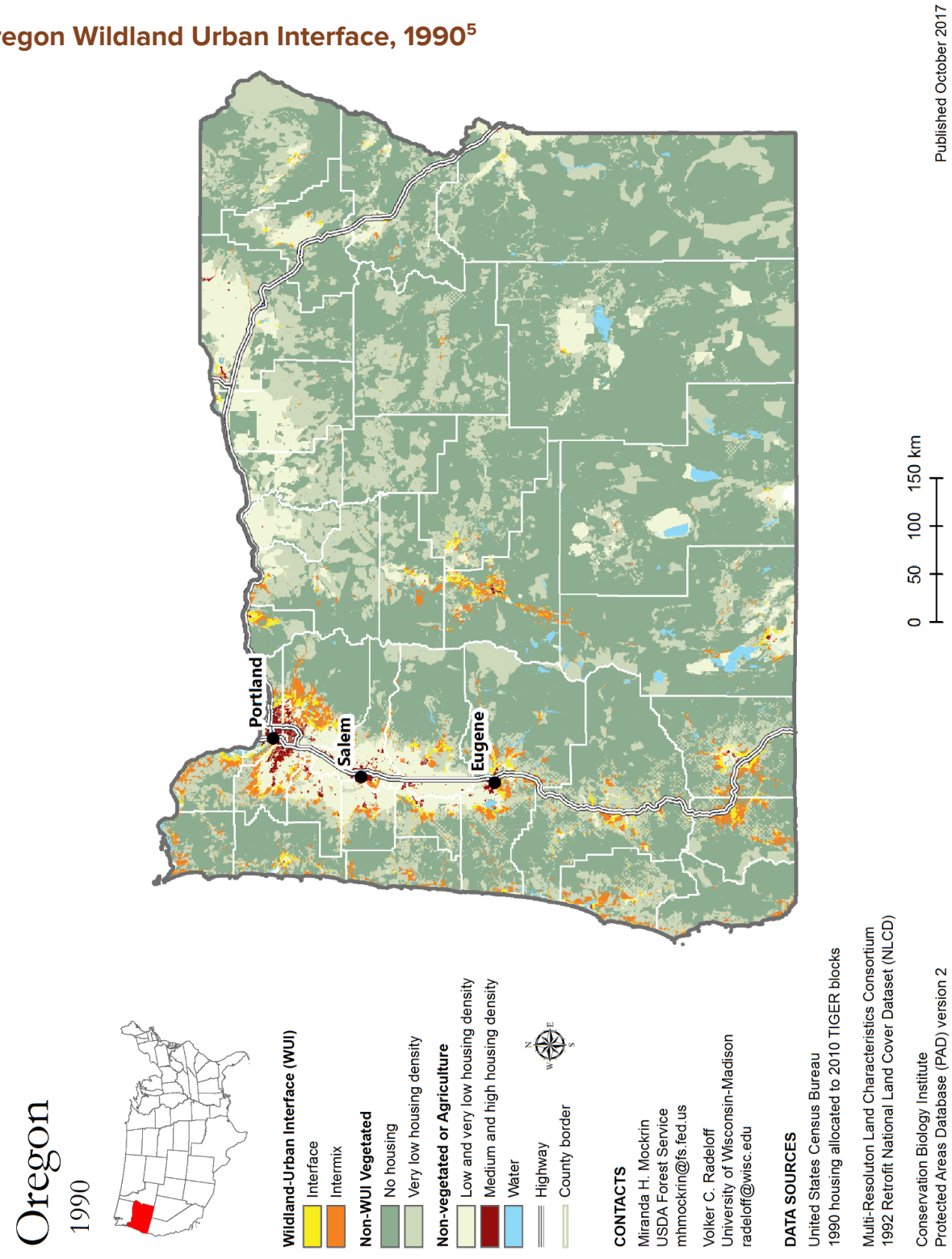
- Find out whether your community has a wildfire protection plan. (See *Community Wildfire Protection Plans* at www.oregon.gov/odf for links to some plans in Oregon.) If so, evaluate whether it is sufficient. If not, talk to community leaders about developing one.
- Challenge students to design a home or community that would exemplify living safely and responsibly in the wildland urban interface. Have them present their designs to the class. (From "The Nature of Fire," Project Learning Tree's *Exploring Environmental Issues: Focus on Forests* secondary environmental education module.)

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 NAME: _____

LESSON 2

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.

3: Evaluating Articles on Forest Issues[7]

Overview

Students select an article from print or online sources related to Oregon forests, and analyze it using a series of questions such as "What claims does the article make?" and "What is the source of the evidence?"

Time Considerations

Preparation: 30 minutes or more, depending on whether teacher or students are locating articles

Procedure: One to two 50-minute class periods

Learning Objectives

Students will be able to:

- Critically evaluate an article on a forest-related topic or issue.
- Recognize some common types of bias in an article.

Standards Connections

Oregon Science Standards

- Disciplinary Core Idea – HS.ESS3.A. Natural Resources. All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors.
- Science and Engineering Practice – Obtaining, Evaluating, and Communicating Information. Evaluate the validity and reliability of, and/or synthesize multiple claims, methods and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible.

Oregon English Language Arts Standards

- Reading Science and Technical Subjects – 11-12.RST.1. Analyze what science and technical texts say explicitly as well as inferentially, citing evidence to support the analysis,

[7] This lesson was adapted from "Media Coverage," by Dr. Wynn Cudmore. Northwest Center for Sustainable Resources, Chemeketa Community College.

attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

- Reading Science and Technical Subjects – 11-12.RST.7. Integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem.

Oregon Forest Literacy Plan Concepts

- 3.D.1. People have differing perspectives on forests and forest management, which can be affected by cultural background and personal experiences, as well as by values, politics, science and economics. Their perspectives can change over time.
- 3.D.2. Forestry practices can be controversial, because of diverse perspectives as well as the complex nature of forest ecosystems.

Materials

- "Analyzing the Reporting of a Forest Topic" student page
- "Article Analysis" student page
- News stories, articles or reports on an issue related to Oregon forests (selected by students or by teacher; see Preparation)

Background Information[8]

Forest management issues - like many environmental problems - are often very complex, because they involve many different interacting components separated by both time and space. They're often also controversial precisely because they're too complex to have clear "right" and "wrong" solutions.

While the internet gives everyone access to a tremendous number of articles, reports, opinion pieces and websites on environmental issues, it can sometimes be difficult to determine which of these sources and accounts are reliable. They may be inaccurate or biased, or exaggerate certain aspects of an issue.

Students must learn to critically evaluate information sources to fully understand the issues. This activity is designed to help them practice evaluating claims related to forestry and forest management issues.

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

Key Vocabulary

anecdote

bias

evidence

peer-reviewed

popular media

Preparation

- Decide whether students will find their own articles to analyze, or you will provide them. If you'll be selecting them, choose articles that vary in terms of their sources, perspectives and quality (such as a science journal article, a Wikipedia article, an advocacy organization webpage and an op-ed piece). If you want students to find their own articles, look for possible general sources on the chosen topic, such as organizations, government agencies and journals you can direct students to. Also decide any selection criteria you want students to follow, such as a minimum acceptable length and acceptable sources.

- Make copies of the "Analyzing the Reporting of a Forest Topic" student page, or provide on-screen access to it. Alternatively, you might prepare a brief lecture to present to students.

Procedure

1. Select a current issue related to Oregon forests for students to explore. Topics that are contentious, well-publicized and for which there is scientific uncertainty or different viewpoints would work well for this activity. Examples include the impacts of global climate change and how to address them; who should be responsible for managing wildland fires and how they should be managed; or economic pressures on the forest sector workforce.
2. Give students copies of the "Analyzing the Reporting of a Forest Topic" student page to read, or present a brief lecture on the key points of the reading.
3. Explain that students will be using this information to analyze articles related to Oregon's forests. Provide copies of the "Article Analysis" student page and one or more articles to analyze. If students will be finding their own articles, direct them to possible sources and explain any selection criteria you want them to follow.

4. Allow students time to evaluate each article by responding to the questions on the "Article Analysis" student page.
5. Have students meet in groups of three or four to discuss their evaluations.
6. Direct students to compare different articles they or another group analyzed. Challenge them to identify both strengths and weaknesses of the articles in communicating about the topic.

Assessment

Use student responses to the "Article Analysis" student page to assess their analyzing skill. Have them submit both the completed student page and a copy of the article they analyzed. Acceptable responses will depend on the article.

Extension Ideas

- Challenge students to look for examples of "false balance" in news articles. (This is when journalists present opposing viewpoints of an issue in an effort to be fair and balanced, even though the preponderance of scientific evidence supports one viewpoint over another.) Discuss how false balances such as this may influence the reader's perception of an issue.
- Encourage students to write articles or letters to the editor on a local forest-related issue.

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

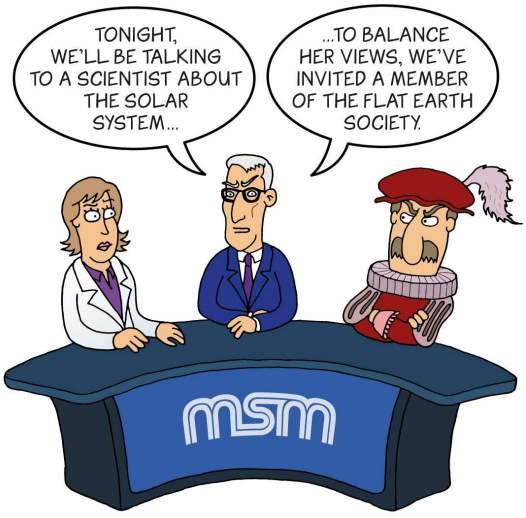
LEAST CREDIBLE

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?

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.

4: Forest Pests

Overview

Students read about the mountain pine beetle and learn how some insects and other pests can damage forests. They research specific pests and quiz each other on methods for controlling these organisms and reducing their damage.

Time Considerations

Preparation: 20 minutes

Procedure: Two to three 50-minute class periods, with time between for student research

Learning Objectives

Students will be able to:

- Identify the major insect types (defoliators, bark beetles, etc.) present in Oregon's forests.
- Describe the major diseases that can affect Oregon's forests.
- Identify the major mammal species that harm the forest, and the characteristics of the damage they cause.
- Explain the various strategies used to control and reduce damage from forest pests.

Standards Connections

Oregon Science Standards

- Disciplinary Core Idea – HS.ESS3.C. Human Impacts on Earth Systems. The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.
- Science and Engineering Practice – Constructing Explanations and Designing Solutions. Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Oregon English Language Arts Standards

- Writing History, Science, and Technical Subjects – 9-10.WHST.7 and 11-12.WHST.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when

appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Oregon Forest Literacy Plan Concepts

- 3.C.7. Sustainable forest management takes into account environmental, economic and social dimensions of sustainability. It includes maintaining forest health, productivity and diversity, and maintaining a forested land base for the needs of present and future generations.
- 3.D.4. Current issues related to forest management include the effects of timber harvest, wildfire, climate change and land uses, as well as the perception of these effects.

Materials

- "When Beetles Battle Pines, It's a Pitched Pine Beetle Battle" in *Forest Essays (Level 7-12)*, available at learnforests.org
- "Damaging Forest Pests" student page
- "Pest Report" student page
- Index cards (4x6 or other size)

Background Information

This lesson introduces some of the insects, diseases and other forest pests that can affect forest health. Students should be aware that 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 even contribute to forest health. When levels are high enough to weaken or kill trees, they diminish forest health.

See the student page "Damaging Forest Pests" for a definition of forest health and basic information about these agents. In the next lesson, students will learn how global climate change affects forest health, including forest susceptibility to insects and disease.

Possible Forest Pests for Student Research

Insects

- Defoliators: western spruce budworm, Douglas-fir tussock moth, pine butterfly, hemlock looper, gypsy moth, tent caterpillar and sawfly

- Bark beetles: Douglas-fir bark beetle, pine engraver beetle and fir engraver beetle
- Sucking insects: aphids and scale insects
- Wood borers: emerald ash borer, flatheaded borer, roundheaded borer, ambrosia beetle, wood wasp larvae, carpenter ants and termites
- Terminal feeders: Sitka spruce weevil and midges
- Root feeders: white grubs, some weevils, termites and wireworms
- Gall makers: oak wasp gall and Cooley spruce gall adelgid

Diseases

- Biotic diseases: heart rot, white pine blister rust, Swiss needle cast, Dutch elm disease, blue stain and dwarf mistletoe

Mammals

- Deer, elk, bear, rabbit, mice, porcupine, beaver and mountain beaver (or "boomer")

Key Vocabulary

abiotic*

biotic*

defoliator

disease

forest health*

gall maker

integrated pest management (IPM)

**included in Glossary*

Preparation

Make copies of the student pages, or provide on-screen access to them. (Alternatively, for the "Damaging Forest Pests" student page, you may choose to prepare a brief lecture based on the content.)

Procedure

- Ask students what they think the term "forest health" means, and ask them what factors might influence forest health.
- Give them copies of "When Beetles Battle Pines, It's a Pitched Pine Beetle Battle" forest essay. Have them read the essay and then work in groups to answer the questions provided.

- Discuss what other insects, diseases or pests might impact forest health – both positively and negatively. Have students read the "Damaging Forest Pests" student page, or present the information to them in a brief lecture.
- Assign each student a forest pest to research (see the list of possibilities in the Background Information section). Using the "Pest Report" student page as a guide, they should find out how the species or disease affects trees and forests, under what conditions it is most damaging, and the methods forest managers use to control it. When possible, students should also locate a photo or illustration of the pest and another photo showing the impact on a tree or forest.
- Make a class set of Forest Pest Cards by giving each student an index card and having them summarize their findings on one side of the card and place their photos on the other side.
- Invite students to use the cards to quiz each other on the different pests and best methods of control. They may do this similar to a spelling bee or other game format.

Assessment

Use students' "Pest Report" responses or their Forest Pest Cards to assess their learning.

Extension Ideas

- Encourage students to make a flier or poster "advertising" the hazards of one or more of the forest pests explored in the lesson.
- Develop a research project to determine the most effective method to protect seedlings or school garden plants from deer damage.
- Share the Oregon Forest Resources Institute report *Forest Threats*, available at learnforests.org. Discuss the different threats to Oregon forests identified in the report and pinpoint some of the actions people are taking to mitigate them.
- Research diseases commonly found in Oregon's forests and their impact on trees.
- Explore the topic of invasive species and how they affect Oregon's forests. Conduct research to learn about invasive organisms that threaten our forests. See the Oregon Invasive Species Council website at http://www.oregoninvasivespeciescouncil.org for information and resources.

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:

5: Climate Change and Oregon's Forests

Overview

Students research and prepare an infographic on how Oregon's forests are affected by climate change, and how the forests can be managed to help minimize the effects.

Note: See Lesson 5: Forests and Carbon in the "Environmental Importance of Oregon's Forests" module for an exploration of photosynthesis and carbon sequestration in trees.

Time Considerations

Preparation: 30 minutes

Procedure: One to two 50-minute class periods, plus time for research

Learning Objectives

Students will be able to:

- Read and understand scientific information on the effects of climate change on forest ecosystems.
- Identify ways forest managers and others are working to minimize the effects of climate change on Oregon's forests.
- Create an infographic to present the information to their peers.

Standards Connections

Oregon Science Standards

- HS.ESS3.5. Earth and Human Activity. Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
- Disciplinary Core Idea – HS.ESS3.C. Human Impacts on Earth Systems. The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.

Oregon English Language Arts Standards

- Speaking and Listening – 11-12.SL.5. Make strategic use of digital media in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
- Reading Science and Technical Subjects – 9-10.RST.1. Analyze what science and technical texts say explicitly as well as inferentially, citing evidence attending to the precise details of explanations or descriptions.

Oregon Forest Literacy Plan Concepts

- 3.C.7. Sustainable forest management takes into account environmental, economic and social dimensions of sustainability. It includes maintaining forest health, productivity and diversity, and maintaining a forested land base for the needs of present and future generations.
- 3.D.4. Current issues related to forest management include the effects of timber harvest, wildfire, climate change and land uses, as well as the perception of these effects.

Materials

- "Key Resources on Climate Change in Oregon" student page
- "Research on Climate Change and Forests" student page
- "Climate Change Infographic" student page
- Sheets of poster paper and marker pens, or access to a presentation app

Background Information[12]

Climate change amplifies the effects of forest threats, such as fire and insects. Rising temperatures and prolonged droughts in some parts of Oregon are impacting forests in a number of ways, according to researchers from Oregon State University's College of Forestry and Portland State University's School of the Environment. This includes contributing to longer, more intense fire seasons, and increased insect and disease outbreaks.

Climate change may even reshape the makeup of Oregon's forests in some areas, as conifer trees that need more moisture to live have a harder time surviving. In other regions of the state, such as northwestern Oregon, climate change models show increased moisture in the future.

[12] Source: "Climate Change and Oregon's Forests," oregonforests.org.

More intense storms and extreme weather caused by climate change could also have lasting impacts on forest health. Trees with limbs that are snapped off in storms are more prone to insect and disease outbreaks. Freshly downed trees and branches attract bark beetles and could fuel a wildfire.

The good news is that the impacts of climate change can be lessened with active management, especially through forest restoration, thinning and fuels reduction for wildfire resiliency.

Forests also serve a vital biological role in mitigating the effects of climate change, because trees absorb and store carbon through photosynthesis. This carbon continues to be sequestered even after a tree is harvested and manufactured into wood products.

Key Vocabulary

adaptation

distribution*

effect

event

global climate change*

implication

mitigation

solution

**included in Glossary*

Preparation

Look over the "Key Resources on Climate Change in Oregon" student page and, if desired, identify which resources you'd like students to focus on for their research.

Procedure

1. Introduce the lesson by posing true-or-false statements to students about climate change (without telling them the answers), such as:
    - Climate change is something that will affect future generations, but is not happening now. (False)

    - Forests will not be affected by climate change, because trees are very resilient. (False)
    - Wildfires will be more intense and more frequent in the future. (True)
    - Oregon forests may be more productive with climate change, as the trees are exposed to more CO_2 and longer growing seasons. (True)
2. Explain to students that they will do research to learn more about the ways Oregon's forests are affected by climate change, and about forest management strategies Oregonians are implementing to reduce the effects. Working in groups, they'll answer the questions on the "Research on Climate Change and Forests" student page and then create a visual presentation using the "Climate Change Infographic" student page to communicate the results of their research.
3. Give students copies of the "Key Resources on Climate Change in Oregon" student page or provide online access. Also give them copies of the "Research on Climate Change and Forests" and "Climate Change Infographic" student pages.
4. Divide the class into groups of three or four students. Provide poster paper and pens, or access to presentation software, for developing the infographic.
5. Give students time to research and prepare their presentations, and to share them with the whole class.
6. After the presentations, discuss students' findings about how the changing climate is affecting forests, and whether people could or should be doing more to reduce the effects.

Assessment

Use students' presentations to assess student learning.

Extension Ideas

- Students examine one of the references cited in one of the reports on the "Resources on Climate Change in Oregon" student page, and analyze the research underlying the conclusions presented.
- Students choose a topic related to climate change and forests and write a research paper on it.
- Students explore forest management strategies in more depth. See Project Learning Tree's activity guide *Southeastern Forests and Climate Change* for classroom activities on this topic, available at plt.org for free download. (Although it focuses on Southeastern forests, the activities in this guide are easily adapted to other forests.)

Possible Responses to the "Research on Climate Change and Forests" Student Page

1. What are three ways the changing climate has affected Oregon's forests? Answers may include: warmer, drier conditions have occurred; severe wildfires happen more often and for a longer period of time each year; extreme weather events happen more often; pests and disease are becoming more of a problem.
2. What are three impacts from climate change Oregon's forests might face in the future? Answers may include: Changes in the ranges of forest tree species; increased drought; more frequent and more intense forest fires due to greater fuel loads; stronger and more frequent storms; and greater incidence of invasive species and forest pests, which could jeopardize the health of native forest species.
3. What is one way Oregon's forests can help reduce the effects of climate change? As trees grow, they remove carbon dioxide from the atmosphere and store carbon in their wood and in the soil, which reduces the amount of carbon in the atmosphere and, thus, its effect on climate.
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? Answers may include: managing forests to reduce vulnerability to drought, insects and wildfire; altering the mix of forest tree species to better adapt to climate; using data to determine areas of forest stress; planting trees to create more forest; letting trees grow to peak carbon age; managing forests to increase their carbon storage; or using mill waste and wooden debris to produce energy.
5. What is something else Oregonians could or should do in relation to Oregon's forests to respond to climate change? Answers may vary.

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.

STUDENT PAGE
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.

6: Community Views on Forest Management Issues

Overview

Students consider the pros and cons of one forest management practice that is sometimes controversial: clearcutting. They then develop and conduct an opinion survey on forest management issues, to learn about the views of people in their community.

Time Considerations

Preparation: 20 minutes

Procedure: One to two 50-minute class periods, plus time for conducting the survey

Learning Objectives

Students will be able to:

- Articulate pros and cons of one forest management practice: clearcutting.
- Identify other forest management practices for which the public may have a variety of opinions.
- Develop an opinion survey around those practices.
- Conduct the survey and analyze the results.

Standards Connections

Oregon Science Standards

- Disciplinary Core Idea – HS.ESS3.C. Human Impacts on Earth Systems. The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.
- Science and Engineering Practice – Planning and Carrying Out Investigations. Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.

Oregon English Language Arts Standards

- Writing History, Science, and Technical Subjects – 9-10.WHST.5 and 11-12.WHST.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.

Oregon Mathematics Standards

- Number and Quantity – HS.NQ.B.3. Use reasoning to choose and interpret measurement units consistently in formulas, graphs, and data displays, as a way to understand problems and to guide the solution of multi-step problems.

Oregon Forest Literacy Plan Concepts

- 3.C.3. The type and intensity of forest management, including harvest, is dependent on the purposes for which the forest is managed, as well as forest type, ownership, size and location.
- 3.C.7. Sustainable forest management takes into account environmental, economic and social dimensions of sustainability. It includes maintaining forest health, productivity and diversity, and maintaining a forested land base for the needs of present and future generations.
- 3.D.2. Forest management can be controversial, because of diverse perspectives as well as the complex nature of forest ecosystems.
- 3.D.4. Current issues related to forest management include the effects of timber harvest, wildfire, climate change and land uses, as well as the perception of these effects.

Materials

- *Forest Fact Break: Clearcutting* video (1:51 minutes), available at learnforests.org
- Technology for sharing video
- *Forest Fact Sheet: Why Are Some Forests Clearcut?*, available at learnforests.org
- "Sample Forest Management Opinion Survey" student page (optional)
- Strips of paper (approximately 3" x 18")
- Colored marker pens
- Tape

Background Information

Managing Oregon forests is often a balancing act that requires foresters to consider the environmental, economic and social impacts of their decisions. Controversy over these decisions can sometimes arise, because stakeholders or the public may not know, understand or agree with them.

One forest management topic that most Oregonians have an opinion about is clearcutting, particularly because clearcuts are often readily visible. Many people believe clearcutting is not only unattractive, but that it actually harms the forest ecosystem and threatens water supplies. What they may not realize is that Douglas-fir seedlings, the species that predominates west of the Cascades, grow best in full sunlight, and that many of the forests seen today in western Oregon were established after clearcutting. Current Oregon laws include many measures that regulate the use of clearcutting on Oregon's private and public lands.

In this lesson, students will poll members of their community to learn what they think about various forest management issues. They may use this information as the basis for a project in Lesson 37: Service-Learning Project.

Survey Questions Compared

Question Type	Example	Advantages	Disadvantages
True/False or Yes/No	Do you enjoy visiting forests? Yes/No	• Fast and easy to complete • Easy to tally and analyze	• Only useful for items that have a yes/no or true/false response • Lacks detail and depth
Multiple Choice	Which of the following is the best way for you to learn new material? A. Lecture by teacher B. Assigned readings C. In-class videos D. In-class interactive exercises	• Easy format for respondents to understand • Allows comparison of different options	• Limited response options • May omit a respondent's preferred answer • Lacks detail and depth

Question Type	Example	Advantages	Disadvantages
Rank Order	Rank the following ice cream flavors by order of preference: __ chocolate __ vanilla __ strawberry __ cookies 'n' cream	• Enables respondents to indicate the relevant importance of choices • Allows comparison of different choices	• More difficult to answer • Limits number of response options • May omit a respondent's preferred answer
Rating Scale	How strongly do you agree or disagree with this statement: Forests are critical to Oregon's future. 1=strongly agree 2=agree 3=neutral 4=disagree 5=strongly disagree	• Respondents can give more specific information about their thoughts • Provides a more precise measure than yes/no or true/false items	• Each item must be scored separately • You have to have a specific question about each thing you want to know about • Respondents are more likely to give neutral responses
Open-ended	What is the most important issue facing Oregon today?	• Identifies issues and ideas most relevant to respondents • Generates new ideas about the topic • Clarifies respondents' positions • Provides depth and detail	• Requires more time and communication skill to complete • May generate incomplete or irrelevant data • May be difficult to analyze and summarize

Key Vocabulary

clearcutting

open-ended

rank order

rating scale

Preparation

Depending on your class's time and interest, you may choose to have students create a survey from scratch or by building onto or modifying the "Sample Forest Management Opinion Survey" student page. They may also simply use the sample survey as is.

Procedure

1. Ask students what the term “clearcutting” means. Ask students for a show of hands on whether their view of clearcutting as a forest management practice is positive, negative or neutral.
2. Show the *Forest Fact Break: Clearcutting* video or have students read the *Forest Fact Sheet: Why Are Some Forests Clearcut?* Ask students whether their opinion about clearcutting changed after watching the video or reading the fact sheet. What additional information might they need for a more informed opinion?
3. Point out that many different forest management practices require weighing trade-offs and making decisions based on a variety of factors. Forest management can sometimes be controversial, as people with different perspectives on an issue may also be affected differently.
4. Ask students what they expect the people in their community would say about clearcutting or another forest management issue.
5. Invite students to learn more about their community’s ideas about forest management practices by creating and conducting a survey. Discuss the possible topics the survey might explore and, if you like, give students copies of the “Sample Forest Management Opinion Survey” as a starting point.
6. Discuss the different question formats that surveys employ and the advantages and limitations of each, including true/false, rating scale, multiple choice and open-ended questions. (See the Background Information for a comparison.)
7. Divide the class into small groups of three or four students, assigning each group one of the topics chosen. Groups should draft three or four possible questions on their topic, using a marking pen to write each question on a strip of paper.
8. Direct the groups to tape their question strips to the board. As a class, look at the questions to remove any duplicates, combine ones that make sense to do so, revise any that may need fine-tuning, and decide on a question order, moving the strips as necessary.
9. When a draft survey is complete, have students do a dry run by answering the questions themselves in order. Make any adjustments and then ask a couple volunteers to type it up. Give students copies of the final survey to administer to friends and family members.
10. After students have conducted the survey, have them tally and analyze the results in class. Discuss:
    a. What does the survey tell us about our community’s views on forest management?
    b. How were the results the same or different from what you expected?
    c. Which of the results were particularly interesting?

d. If you were a forest manager, how might you use these results in your work?
e. Which do you think is more important in determining forest policy on forest management issues: public opinion or scientific findings? Why do you think so?
f. Is there anything we can do to further educate our community about these forest management issues?

Assessment

Ask students to write a couple paragraphs describing the survey and what they learned from it. Use their writing to assess their learning.

Extension Ideas

- Have students prepare a report about their survey and findings to present to forest managers or other decision-makers in your area.
- Explore more deeply the practice of clearcutting by having students read *Not So Clear-Cut*, available at oregonforests.org, and identify the conditions and rules for its use.

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?