



Washington
Department of
**FISH and
WILDLIFE**

Measuring Forest Health

9-12th Grade

Themes: Ecology, Forest Management

Location:

This lesson's activities can be done in the classroom with student computers. If you are able, we encourage you to take a field trip to a [WDFW wildlife area](#) or a local park to view forests.

Remote learning modification: Lesson can be taught over Zoom or Google Classrooms.

Standards:

NGSS

[HS-LS2-6](#)

Evaluate claims, evidence, and reasoning that the complex interaction in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

[HS-LS4-5](#)

Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

WA OSPI

[ESE Standard 1](#)

Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, tribal, and global levels.

Modifications, Adaptations:

For COVID-19 distance learning, or other remote learning modification, look for **remote learning modifications** throughout the lesson plan.

Materials:

WDFW PowerPoint, 6 [DBH tape measure \(a tree diameter tape measure\)](#), 6 rolls of [flagging tape](#) (to mark trees), 6 [field measuring tapes](#), 6 tree/plant ID books, student notebooks/ journals to record data.

Objectives:

Students will..

1. Describe different types of disturbance and what positive and negative impacts disturbance can have on forest ecosystems.
2. Examine a plot of forest or a nearby outdoor area and record the features of that area.
3. Compare data and make hypotheses based on their data and outside research.
4. Synthesize information and develop a report on the status of the plot where they collected data.
5. Determine the value of forest management and support their reasoning in a discussion with classmates.

Vocabulary:

Anthropogenic: Human caused.

Biophysical processes: The biotic and abiotic ecosystems and processes (i.e. the water cycle) that surround an organism or population.

Disturbance: A change in environmental conditions that causes a pronounced change in an ecosystem. Disturbances often act quickly and with great effect to alter the physical structure or arrangement of biotic and abiotic elements. Disturbances can be temporary or permanent.

Ecology: The study of the relationships between living organisms and their physical environment.

Ecosystem services: Benefits people obtain from ecosystems, plants, and wildlife.

Resilience: The capacity of an ecosystem to respond to a disturbance by resisting damage and recovering quickly.

Stand: An aggregation of trees sufficiently uniform in species composition, size, age, arrangement, and condition and can be distinguished from the forest or other growth on adjoining areas.

Succession: The change in species composition as plants grow, die, and are replaced over time.

Sustainability: Avoidance of the depletion of natural resources to maintain an ecological balance and meet the needs of future generations.

Procedure:

Introduction to forest health and management practices

Before class, have students read the article, "[A Summary of Forest Succession in the Pacific Northwest](#)". The article succinctly brings up many of the topics this lesson will dive into. Ask students to write down three things they learned or found interesting. Before starting the PowerPoint, ask students to share with a partner and then with the class. Write their thoughts on a whiteboard. **Remote learning modification:** use breakout rooms and a virtual whiteboard.

Open and go through the WDFW Forest Health PowerPoint. Make sure presenter notes are on for the script for PowerPoint. The PowerPoint has two sections: one on an introduction to forest health and the other on wildlife habitat and forests restoration. We recommend doing the PowerPoint in two separate class periods. Various slides contain links to videos and articles and prompts for discussion.

Monitoring forest health

Pass out the "Monitoring Forest Health" homework assignment. This document explains why we monitor burns and has students answer questions about pre and post prescribed burn areas in the Oak Creek Wildlife area near Naches. We recommend giving students one to two days to complete this assignment.

Measuring the health and age of a forest

Take students to nearby forested area. This could be a city,



Measuring Forest Health

9-12th grade

county, or state park, [WDFW wildlife area](#), or other public land. Make sure before visiting the area you have checked into any requirements for large groups. Either on site, or before you leave, have students split up into groups of three. Tell students they are going to hypothesize on whether they believe the forest they're visiting is "healthy" (able to withstand disturbance). In their groups, students will create a hypothesis about the forest's health. They will identify species, measure the circumference of trees, and observe vegetation in the forest.

The field measuring tape is used to make circular sampling plots. Student plots will have a radius of five meters. We recommend making a plot with a couple of volunteers so students can visualize what you are talking about. Next, introduce DBH tape. This tool is used to measure a tree's Diameter at Breast Height (4.5 feet). Because we can't go directly through a tree to measure its diameter, the DBH tape does the math for us. The diameter of a tree is usually indicative of a tree's age. A larger diameter tree is usually older than a smaller diameter tree of the same species. (Although sometimes this may not be the case. For example, one tree might be in an area with limited sunlight, water, or other resources). Students will be measuring the DBH of all trees in their circular plot. This will help them determine the age of the forest.

Demonstrate how to use a DBH tape: Using the measuring tape, measure 4.5 feet up from the ground on the tree trunk. Use the DBH tape, explaining to use the metric side (cm and meters) only. Wrap the measuring tape around the tree at 4.5 foot height to find the DBH of the tree. When you finish surveying a tree, mark it with flagging tape (demonstrate) so that other group members do not sample the same tree twice.

While two to four students are measuring trees in their plot, others can identify other vegetation. They should describe the features of the plot. For example: Do you see any dead wood? Is it standing or on the ground? Any fungus? Is the vegetation dense or thin? Is it all the same type of vegetation or is there variation? Students can draw or take pictures for their final report.

Give students 30-45 minutes to measure all the trees and identify species of trees and shrubs in their five-meter plot. Make sure students remove all flagging when they are done and pack out any garbage. You may want to [review leave no trace principles](#) before going to the area, and while onsite.

After the project, students will share their data with another and then create their own final report of their plot. The report should be 3-5 pages and should include their data and supporting, peer-reviewed research. You can pass out these questions for students to think about before their field trip.

Questions to answer in report:

Students can collect data in the field and then answer these questions at home/in the classroom.

- 1) Are you in a dry or wet forest? How do you know this?
- 2) How many plant species were you able to find?
- 3) Was there a lot of vegetation or a little?
- 4) Do you think this would be considered good wildlife habitat? Why or why not?

5) What stage of succession do you think this forest is in? What evidence supports this?

6) Hypothesize...

- a) If a large and very hot fire were to come through this area, what would this area look like afterward?
- b) If a smaller, less intense fire came through, what would this area look like afterward?
- c) If insects/a fungal pathogen were to come through this area, what do you hypothesize your radius would look like afterward?

Consider: Variety of species, amount of dry vegetation, amount of precipitation.

7) a) If in a dry forest: If fires were continued to be suppressed in this area, how do you think the species composition would change? Use data from your in-field project and find and cite research that supports your answer.

b) If in a wet forest: Many of our temperate rainforests have been converted into Douglas fir plantations. How might only having one species in a forest impact the ecosystem and species who live in the ecosystem? Use data from your in-field project and find and cite research that supports your answer.

8) How did indigenous peoples of the area manage the landscape? (cite research)

9) In one to two paragraphs, explain why forest health is important socially, economically, and socially.

Remote learning modification: Students can visit a local park or wildlife area with an adult if they are able. Ask students to take pictures and try and identify the vegetation in their area (iNaturalist is a good app to recommend). Ask students to try and describe the forest and its structures as much as possible. For example, are there only tall trees or a mixed of different sized trees? What does the vegetation look like? Any animals? To the best of their ability, have students complete their report. If students are unable to visit a nearby park, have them walk around their neighborhood and complete the activity. If you live in Western Washington, you can also have them participate in the Western Red Cedar dieback community science project (see supplemental activities).

Final discussion:

After students turn in their reports, host a 20-minute small group and/or large class discussion. This can be done inside or outside. Questions to ask:


- Some feel as though forests are fine the way they are and need no management (such as thinning and burning). Do you agree with this? Why or why not?
- If forests were left on their own and not managed how would this impact current species? Would some go extinct? Would a new species evolve?
- If forests were left on their own, predict what would happen to forest meadows and open spaces. Would this be a "good" thing or a "bad" thing? Why?
- Who/what benefits from healthy forests? Why?
- Who should be responsible for forest health? What role can the community play in making sure their public lands are resilient?

Remote learning modification: This discussion can occur on Zoom. If you want to break into small groups, use breakout rooms.



Measuring Forest Health

9-12th grade

 **Idea:** Show off your students' work! Share student projects from this lesson with WDFW.
Facebook: @WashingtonFishWildlife
Instagram: @TheWDFW
Twitter: @WDFW
#WildWashington #WildWa

Did you teach this lesson? [Give us your feedback.](#)

Additional Resources :

We encourage you to use the following resources as either a supplement to this lesson, or to share the resources with students for their project.

Supplemental lessons:

[Forest Health Watch-Western Red Cedar Dieback Community Science Project](#) (Western Washington)

Have your students contribute meaningful data about the health of trees in their area. Students can collect and interact with the data and see how scientists use community science data to monitor conditions on when, where, and why Western red cedar are dying. You will need a smart phone/tablet and iNaturalist/Survey123. You could take students out as a class or have them find Western Red Cedars and complete data on their own.

[Western Red Cedar Dieback Map](#)

Other Resources:

Webpages:

- [Forest Management](#)-WDFW
- [Forest Management Story Map](#)-WDFW
- [Snags the Wildlife Tree](#)-WDFW
- [Forest Health and Resilience](#)- Washington DNR
- [Forest Health](#)-U.S. Forest Service
- [Have a CCOW](#)- Gonzaga University (resource for determining credible sources in research)

Articles:

- [Indigenous Fire Practices Once Shaped the Pacific Northwest](#)-Crosscut
- [Restoring Eastern Washington's Forests](#)- Results Washington
- [Wildfires and Fuels](#)- Woodland Fish and Wildlife
- [Creating Habitat Piles](#)- Northwest Natural Resource Group
- [A New, Old-Growth Future](#)-The Nature Conservancy
- [Dead Trees and Living Creatures](#)- Idaho Department of Fish and Game

Videos:

- [Restoring Elk Country](#)- Rocky Mountain Elk Foundation