East Cascades Oak Systems

Disturbance Monitoring Protocol

Field Instructions[1]

Version: V5 updated Feb 2026

[1] The data collection methodology described in this document is intended to be recorded using an ArcGIS form in Survey123. Access to the data collection software can be attained by contacting the ECOP Technical Coordinator, Stacy Simanonok at ssimanonok@columbialandtrust.org . You may also contact the ECOP Technical Coordinator for training on this protocol.

Version changes:

V2 edits: Changed snag protocol inventory from ≥5" to ≥12"; added survey version field to page 1. **V3 edits** were minor text edits. **V4 edits**: page 1 added are you revisiting a plot that had already been established? If yes, can skip date of plot establishment, slope, aspect, elevation. Removed canopy photos. Added optional dichotomous key for oak system type. Removed human trails and paths from land use and disturbance indicators. Removed climbers and trash from understory guilds and added an "other" category instead. Moved oak responses to disturbances section to after trees section. Reduced oak stump sprout density counting to 24 ft radius plot instead of 50 ft radius plot. Count saplings within 11.8 ft radius plot instead of 6.8 ft radius plot. Snags: added question for what the snag inventory cutoff was since it depends on site and project. Added "has this tree been tagged?" for medium and large trees- if yes, no need to fill in azimuth and distance from plot center. Added clarifying notes to crown base height and lowest live oak limb. "Do not include immature epicormic branches <1" diameter." Removed oak crown shape question. Added option of "single stem oak forked below DBH" for oak morphology. Removed dead limbs from tree health indicator and clarified severe drought stress. Understory module: Added optional photo points. **V5 edits:** New survey link and QR code! Added more clarifying notes to crown base height. Removed suggestion of plot center tag IDs- rebar + GPS location is sufficient. Removed oak understory module instructions and more simply linked to those instructions.

BEGINNING OF OFFICE INSTRUCTIONS - *Pages 2-5 intended for office-based preparation.*

Before you go into the field

1.1 Read the entire protocol before you go into the field.

It is highly recommended that you practice or participate in a training session before embarking on a full-scale monitoring effort. Have questions? Contact Stacy Simanonok at ssimanonok@columbialandtrust.org (971-361-6531) or Lindsay Cornelius at lindsayc@columbialandtrust.org (360-921-1073). Check with Stacy to ensure that you have the most recent version of the protocol. Field monitoring kits are available for ECOP partners to check out.

1.2 Gather and Pack Equipment[2]:

1	Smart phone/pad with Survey123 uploaded "ECOP Oak Disturbance Monitoring Survey" (instructions for accessing the application follow) *charger/backup battery recommended
1	Clinometer (smartphone clinometer apps may be used in place of clinometer)
1	Compass (**declination set to 14.5° East**)
1	Rangefinder/Hypsometer *extra batteries recommended
4	Chaining pins
1	DBH tape (10th inches diameter)
3	50-foot reel measuring tapes (standard units - feet and inches)
1	1-m^2 quadrat (if completing oak understory module)

[2] ECOP has monitoring kits available to loan that include all of the tools and materials included on this list.

1	Go/No-Go gauge for Fuels Transects
1	Clear plastic ruler that measures 1/10-inch increments
1	Small shovel to scrape aside duff and litter for measurement
1	Field Instructions (this document plus reference diagrams + plant ID resources)
varies	Aluminum nails (2-3" ideal) to mark DBH measuring height on each tree >5" DBH in plot, if approved at site
varies	Aluminum nails (2-3" ideal) and tree ID tags to mark trees, if approved at site
1	Hammer to pound in nails
1 per plot	Plot markers (large nails or **12" rebar**) (**recommended**)
1	Mallet to pound in rebar
Optional	3 survey marking whiskers and nails to attach to (for plots without witness trees)
Recommended	Permanent/tree marking paint to mark plot center and witness trees (diamond flashers an alternative option for witness trees depending on land manager)
Recommended	Flagging to tie to plot center to help with relocating
Optional	GPS unit (Garmin or GPS enhanced smart phone/pad) *extra batteries recommended

1.3 Planning out the workflow in the office

Oak and oak pine systems are fairly slow growing, but disturbance events that influence these systems happen over a variety of temporal scales – from immediate, as with wildfire, to slow as with fire suppression, grazing, and climate change. This protocol and the ECOP monitoring project are intended to document changes in oak systems across any of these temporal scales, depending on monitoring objectives. The installation of plots can achieve those goals through several methods. Permanent plots that can be revisited before and after discrete disturbance events and at random time intervals will help us collect the data needed to answer key management questions. If you need assistance with project effectiveness study design, contact ECOP's Technical Coordinator. If you design your own plot locations, please write up your technique and share it with ECOP.

The following are a few general concepts to consider:

- Take your staffing, budgetary, and project goals into consideration. You can select your plot density based on the resources available, and the type of information that you hope to analyze.
- Staffing hours needed to install each plot varies depending on the experience of the field crew and the condition of the plot. We found that the first sets of plots take more time as crew members learn how to move through the questions. Plots with higher density trees and shrubs also take more time to install. The range of time for each plot is 4 hours when crew is new to the protocol and the density of trees and understory vegetation are high, that time is reduced to 45 minutes per plot with experience and in lower veg density plots.

1.4 Gather information about the survey location

One of the first questions on the Survey123 Form will ask you to select from several future management activities that will happen on or very near your plot. Gather that data/make notes before you go to the field. You will have the option to check all that apply.

- Unknown/None
- Oak removal
- Conifer removal
- Limbing/pruning
- Hand cutting
- Mechanical cutting
- Mechanical mastication
- Prescribed fire
- Pile burning
- Coarse woody debris removal
- Snag creation
- Herbicide application to oaks
- Herbicide application to understory species
- Mechanical weed control
- Understory planting/seeding
- Grazing (provide type of animal, stocking rate, and timing in notes)
- Other

1.5 Establish the naming/numbering of your plots before you begin collecting data.

You are required to enter a unique Plot ID in the Survey123 form when you are in the field. The unique Plot ID will help us manage the data storage, make it possible to analyze the data spatially, and help us organize the photographs that are taken as part of the protocol. Prior to beginning your field work establish your unique Plot ID series. We ask that you use the following naming convention for each of the plots that you establish. If anonymity (property owner, or project) is necessary, please contact ECOP and propose another method of creating a unique Plot ID (still using the 4letters_4Letters_3numbers convention).

- Assign a 3 or 4 letter abbreviation ID for the property owner, a 3 or 4 letter/number abbreviation ID for the project (name), and a plot number between 001 and 999.
- Use an underscore to separate property owner, project name, and plot number.

Example:

- Mt Hood National Forest Barlow District, Rocky project area, plot number 1, would be labeled: MHBD_RCKY_001.

1.6 Download the Survey123 Form on your device:

1. If you do not have the Survey123 app on your tablet or smartphone, you can download it from any app store for free. It is an ESRI product that coordinates with ArcGIS products. You do not need a license to use it. You can download it without logging in.
2. Scan QR code to the right or follow this link to download the **2026 ECOP Oak Disturbance Monitoring Survey: https://arcg.is/1fPnvK2**
3. Once downloaded, go back to the main screen, My Survey123, and you'll see the survey. To collect data, click "Collect" and follow the

survey prompts. There are 12 pages. This instruction manual will walk you through the protocol step by step.

4. Before going into the field throughout the season, check that there are no updates to the form. On the My Survey123 app homepage, there will be a bar at the top that says "Updates Available" if there are any.
5. You are now ready to collect data. It is recommended that you practice using the survey form with this instruction manual. For training or questions, contact Stacy Simanonok at 971-361-6531 or ssimanonok@columbialandtrust.org.
6. Once you are done collecting data, submit data by following the prompts. You may need to do this when you are back in service (save in outbox). If you collected a large amount of data, we advise waiting until you have a Wi-Fi connection to upload data. You can request a copy of your data by emailing Stacy Simanonok at ssimanonok@columbialandtrust.org.

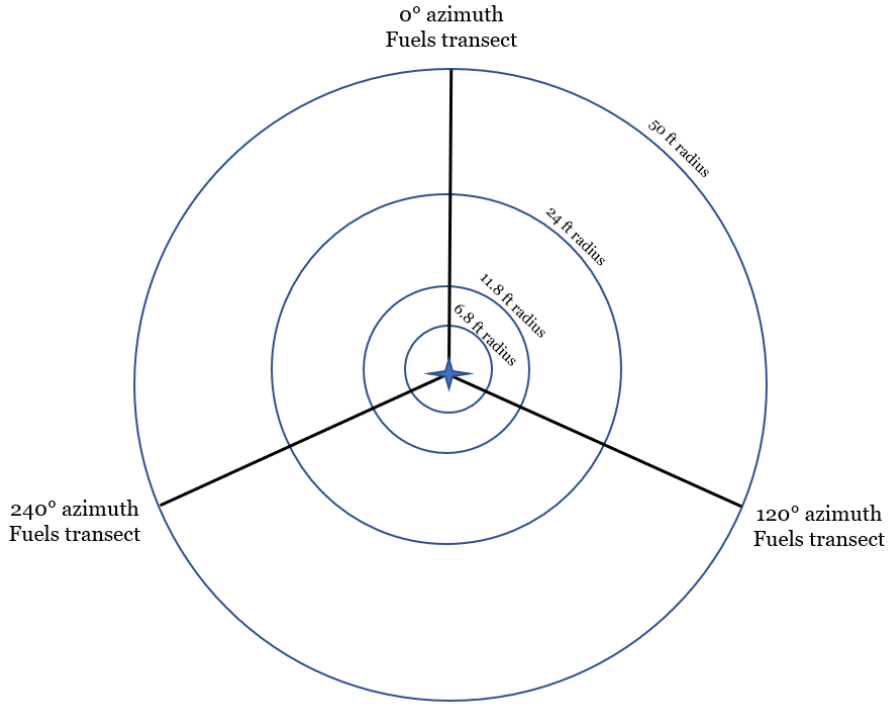
1.7 Download or print reference materials

- Oak System Types with Photos
- ECOP Tree Sampling
- Crown Position from USFS FIA
- Tree Health Indicators

BEGINNING OF FIELD INSTRUCTIONS - Pages 6-24 are intended for reference in the field. It is strongly recommended that you take a printed copy with you.

Navigate to and layout plot

The data collection design is based on a fixed plot radius of 50' with three linear transects and four concentric circular intervals at 6.8', 11.8', 24' and 50' from plot center.



2.1 Navigate to plot center

Navigate to the randomly assigned plot center using a hand-held GPS or smartphone with enabled navigation application (seeking accuracy <10m). Potential navigation applications include: ArcGIS Field Maps, Avenza, and GPS enhanced iPhone and iPad devices. Once plot center is located, leave all gear (backpacks, lunch, water bottles, dogs, etc.) not needed for layout outside of the 50-foot radius plot. Remember to step carefully while establishing the plot. It is important not to trample vegetation and fine fuels that you will measure while collecting data. The order of operations in this protocol is intentional to reduce impacts to the physical condition of the plot.

If there are no oak trees in the plot, assess the general landscape area. If the plot is in a savanna (low oak density) or the site is highly variable, it is acceptable to establish a plot where no oaks are present. Alternatively, you may opt to select another plot center from the randomly generated plot locations in your project area if the landscape surrounding the site does not include oak trees. If in doubt, ask ECOP Technical Coordinator.

2.3 Plot and Transect Layout

Mark plot center and establish three transects each radiating 50 feet in length along the following azimuths: 0°/360° (N), 120° (E/SE), and 240° (W/SW) from plot center[3] (as shown in diagram on page 7).

- Place a permanent metal rebar stake (or something you can find when returning that won't melt in a fire and can be relocated with a metal detector if necessary) into the ground at the center of the plot. Drive the stake in until it is secure. You can paint the top of the stake or pair the metal stake with a painted wooden stake for improved visibility. We recommend painting the marker at the end of data collection, so you don't get paint on you or your equipment.
- Starting at plot center, extend a tape 50' along each transect and anchor the far end with a stake or chaining pin. Be careful to place the tape as close to the soil surface as possible without disturbing the surface. Repeat for each transect if you have enough tapes.
- For relocating purposes and if approved at the site by the manager, mark 1 to 3 witness trees with tree paint (color depends on site manager preferences) or diamond flashers at eye level. These trees should help future data collectors triangulate to find plot center. Ideally, witness trees are close to plot center, 5+ inch DBH, and not a <8" DBH conifer in case that tree is removed in future conifer thinning treatments. If there are no trees within the 50 ft radius circle, you may mark a tree further outside the plot. The azimuth and distance to each witness tree from plot center will be recorded in the survey.

[3]Some site conditions may constrain the size of the plot and the location of the transects. If landscape features or safety issues (cliff, active yellow jacket nest…) limit the ability to install all three transects on the prescribed azimuths, it is permissible relocate the plot away from the undesired feature. Remember, Safety First!

- While setting up the plot, be aware of the plot conditions and take note of unique attributes or easily disturbed characteristics. You should also look for burn scars, wildlife or livestock impacts, trails or equipment impacts, etc., anything of note that will be captured in the process of collecting data.

2.2 Protocol for revisiting plots

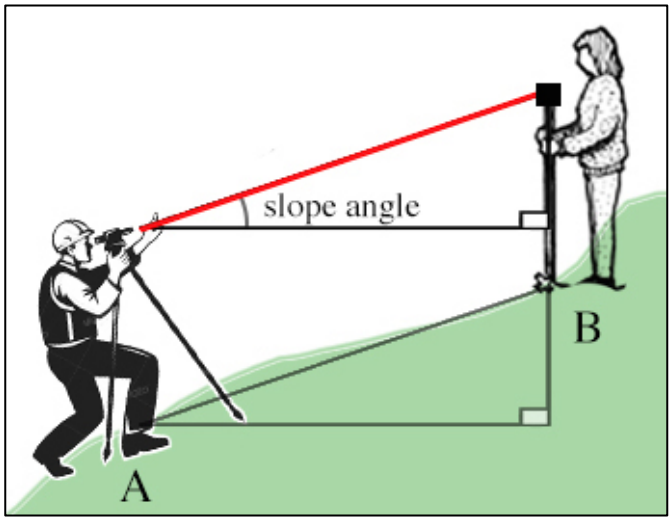
If revisiting a previously established plot, use your GPS device to navigate to the plot center. Look for the painted stake in the ground and use witness trees to help you find plot center. You can also bring a metal detector into the field to help you relocate the rebar. ECOP can generate "Relocating Plot IDs" reports that list key information to finding plot centers like the coordinates, plot remarks, and photos from each photo point. Please contact the ECOP Technical Coordinator for copies of reports you need. If you spend more than 15 minutes of time and can't find plot center, you can decide to put in a new stake where center should be based on witness trees. Remark witness trees if need be. Record information in Plot Remarks.

Begin data collection

PLOT CHARACTERISTICS – Page 1 of Survey 123 Form

1. **Plot Center Location**: Automatically populates when survey record is opened.
    a. In Survey123, tap the GPS (circle with compass lines) symbol to update the reading until you have better than 32 ft (10 m) accuracy.
    b. If you prefer to use a separate handheld GPS, record the location, projection system, and elevation (ft) at the plot center point in plot remarks.
    c. *Note: A GPS enhancement device can be added to smart phones and tablets to increase accuracy.*
2. **Survey Version:** Optional, defaults to newest version.
3. **Plot ID**: Use the naming convention from "Before you go in the field, Section 1.5" of these instructions. If you did not assign a Plot ID in advance, please follow this format:
    - 3 or 4 initials for the property owner (underscore), followed by 3 or 4 initials for the project name (underscore), followed by plot number 001-999. Example MHBD_RCKY_001. Note the underscore that separates each section.
4. **Optional Tag ID number**: If you are using pre-stamped tags, please enter the pre-stamped number to show that the plot is marked with an identifier that is not the same as the Plot ID. If the metal tag is marked with the Plot ID, type in the word "SAME".
5. **Observer Names**: Record full names of observers. Can use initials after first plot.
6. **Monitoring Date**: The day you conducted monitoring for this Plot ID.
7. **Are you revisiting a plot that has already been established?** If no, fill out questions 8-11. If yes, you will skip to plot remarks.

8. **Date of Plot Establishment**: For first time plot visit, enter current date. If you are revisiting a plot that was previously established, you won't need to do this field.
9. **Slope (%):** If you are revisiting a plot that was previously established, you won't need to do this field. Otherwise, using a clinometer[4], record the slope along the hillslope azimuth to the nearest percent (0-100) within the plot. Where there are significant variations in slope across the plot, record the average slope of two measurements and note this in the plot remarks. To measure slope: facing downslope, site your clinometer on a person, tree, or other vertical object *at a height consistent with your eye level at that location.* Slope is an infinite plane, so the object can be located any visible distance from plot center so long as there are no changes in the slope between that object and the observer. If your eyes are approximately 5 ft from the ground, site your clinometer 5 ft from the ground on an object upslope or downslope to accurately calculate percent slope.



10. **Aspect (°):** If you are revisiting a plot that was previously established, you won't need to do this field. Otherwise, point yourself in the direction water would run across the landscape surrounding the plot. Using a compass (declination set to 14.5° East), record the hillslope azimuth in degrees (0-359°). This measures whether the sample location is on a north, south, east, or west facing hillside. If the plot is on a plateau or an expansive flat plain, enter "999".
11. **Elevation (ft):** If you are revisiting a plot that was previously established, you won't need to do this field. Otherwise, it will automatically populate.
12. **Plot remarks**: Use this field to:
    - Describe plot location and layout to help future field crews relocate the plot. Optional to describe plot landmarks. (Example= Mature stand on gentle N-facing slope ca. 780 meters west of historic homestead, ca. 200 meters east of wetland basin. Some stumps in plot, oak cut long ago. Conifers decline to the west. Deer trails through plot.)
    - If plot center locations are moved, note the reason.
    - Record witness tree information here (DBH, azimuth, and distance from plot center) **if not recorded** during tree sampling.

[4] Can download a reliable clinometer app if you don't have a clinometer.

PROPOSED MANAGEMENT ACTIVITIES - Page 2 of Survey123 Form

This section is not observational, it is intended to support future data analysis by creating a relationship between management activities and changes that this protocol is intended to detect. To help us with data analysis, we ask that you use the provided list to indicate any known near-term planned management activities. Select all that apply for the **PROPOSED MANAGEMENT ACTIVITIES** section of the form. Please include any notes if more information is needed to explain management activities that will impact the plot. This section is for activities that are proposed for the site within the next 5 years. There is a selection for none or unknown if that is needed. *Note: Page 4 of this survey will ask for existing conditions in the plot and the surrounding landscape that will reflect disturbances, past management activities, or events that have already occurred.*

PHOTO POINTS – Page 3 of Survey123 Form

Photos provide the opportunity to track qualitative changes at the plot over time. They also help relocate plots for subsequent data collection. Take photos in the landscape orientation and consider using a monopod or other photo taking device that helps you take consistent photos from one visit to another. If possible, exclude people, gear, etc. from the photo. Plot ID, date, and azimuth will be recorded automatically in the file name so there is no need for a whiteboard. Standing at the plot center, take 2 photos holding the camera at a height of about 5 feet on each transect (0°, 120°, 240°) as described below for a total of 6 photos per plot:

1. **Straight forward**: Position the camera device over plot center at a height of 5 feet and aim for about 5 feet above the transect terminus. The camera should be angled if needed so that it is horizontal to the slope (as shown in diagram on page 8 of these instructions). If the ground is sloping 20 degrees, the photo should also be sloping 20 degrees such that the resulting photo is horizontal to the slope at eye level towards the transect end.
2. **Down/Ground Cover:** Position the camera device over plot center at a height of 5 feet and aim for the end of the 50 ft tape in the top of the frame. The photo should include the ground between plot center and, as much as possible, the transect end. It is roughly a 45-degree angle (from slope angle) and make sure feet are not in the photo.

PLOT OBSERVATIONS – Page 4 of Survey123 Form

1. **Oak System Type**: Optional to use the built-in key to help you determine the oak system type of the plot area. Select the oak system type according to ECOP's Oak System Classification[5]. The descriptive metrics are primarily based on CURRENT canopy structure (% cover) and tree species composition. There is a diagram with photos and oak habitat type descriptions provided in the field instructions reference materials ("Oak System Types with Photos").

[5] Generalize. We know there is a wide range of variability in oak structure but call it something. If you have experience stand-typing, or delineating polygons around areas with similar structure and species composition, exercise that experience here. You can make notes to explain your reasoning if you feel it was not obvious.

a. **Plot:** The oak system type that you choose should be representative of the stand your plot occurs within. Consider live trees.
b. **Surrounding Landscape:** If the plot tree canopy structure and species composition is significantly different from the surrounding stand, you can capture that difference here, or enter the same type as above.

2. **Land Use History**: Check all activities or disturbances you have knowledge of or can observe to have occurred within the footprint of the ***plot itself***.
3. **Land Use and Disturbance Indicators**: Note presence or absence of other disturbances that are visible on the plot. Defaulted to absent.
    a. Motorized vehicle trails or tire tracks: Are there signs of wheeled vehicles in the plot? These do not have to be actual roads or trails, but obvious sign of vehicular access (this does not include tracked equipment, which is captured below). Bike tire tracks should be included here. Please describe the nature of the tracks in the notes field.
    b. Wildlife trails or paths: These may be occasionally used by people or livestock but are characteristic of regular use by wildlife. They commonly develop around water sources, along ridges or other confined corridors.
    c. Livestock sign: This can include terracing from compaction and trail development, manure, pugging (hoof marks in the soil), or hoof tracks.
    d. Soil compaction: Hard, compact soils, with shallow-rooted or weedy vegetation or no vegetation, pooling water, stunted vegetation growth.
    e. Surface disturbance due to tracked machinery: Displacement of soil (rutting) or vegetation due to operation of tracked machinery (not ATV/truck/car but tracked machinery)
    f. Fire Evidence: Are there visible signs of fire scars or charring from prior burns? These signs can be on trees, surface fuels, etc. Please characterize the nature and extent of the charring in the notes field (e.g., extensive, one old tree trunk, fire circle, etc.).

BASIC UNDERSTORY PLOT – Page 5 of Survey123 Form

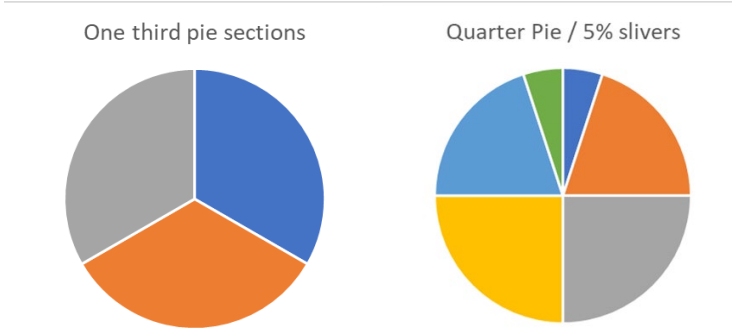
Ground Cover Guilds - Measured within the 11.8-foot radius concentric plot

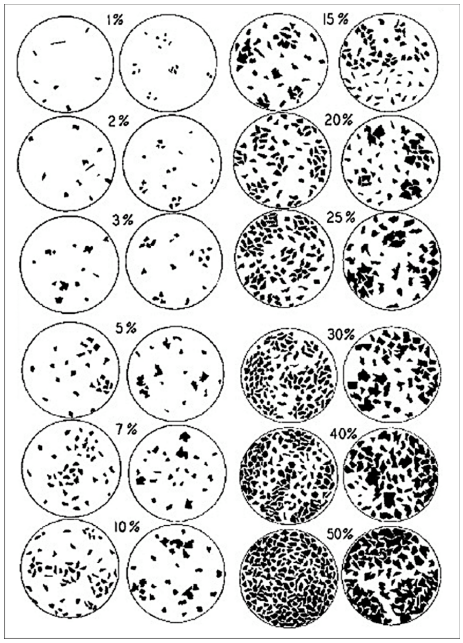
The understory vegetation sampling plot includes all organic and inorganic materials that are not trees within the 11.8-foot radius of plot center. It may be helpful to have crew members stand facing each other at the 11.8-foot point on the transect tapes and work through the cover class of each ground cover guild together. There are 14 possible guilds to evaluate**. For each guild present in the 11.8-foot radius circle, select a cover class and then click the + button to add another guild**. The "Guilds Entered" field will display guilds that have been entered so far to help you keep track. There may be multiple canopy layers present, so total percent cover may exceed 100. Any guilds without an entry will be assumed as absent/0% cover.

1. In the drop-down menu, select each present guild as follows:
    - Graminoids (grass and grass-like plants)
        - Non-native (examples include cheatgrass, ventenata, medusahead, and bulbous bluegrass)
        - Native

- Forbs (herbaceous flowering plant that is not a grass)
  - Non-native (examples include rush skeletonweed, spotted knapweed)
  - Native
- Lichens, mosses, and liverworts
- Shrubs
- Bare ground
- Ash/charcoal
- Litter (leaf litter, decomposing plant material)
- FWD (fine woody debris)
- CWD (coarse woody debris)
- Rocks
- Woodchips (mechanically shredded or chipped wood)
- Other- climbers/vines, or trash/debris

2. Using the visual aids included in the field instructions here, work with your team to establish an ocular estimate of the best fit for the cover class bin that represents the quantity of that material within the 11.8 ft radius of plot center. The area being assessed is ~437 ft^2 so 1% = 4 ft^2, 5% = ~22 ft^2 so imagine a ~5 x 4 ft rectangle. 25% = 110 ft^2. Cover class bins are as follows:
   - None
   - Trace (0.01-0.99%)
   - 1: 1-5%
   - 2: 6-25%
   - 3: 26-50%
   - 4: 51-75%
   - 5: 76-95%
   - 6: 96-100%





OAK UNDERSTORY MODULE- separate survey!

Dependent on the site, but the oak understory module can be completed in tandem with the ECOP Disturbance Monitoring Protocol, as requested by the ECOP Technical Coordinator. Not all plots will require the in-depth oak understory module. See instructions here: https://eastcascadesoakpartnership.org/wp-content/uploads/2025/03/ECOP-Understory-Monitoring-Protocol_V1.pdf

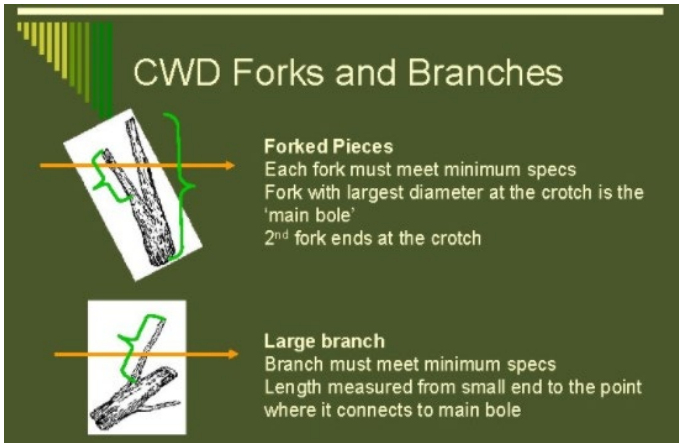
If you are instructed to conduct the oak understory module, it is ideal to conduct the module at this time, before vegetation is trampled too much in further sections of this protocol. Please complete the understory module if needed, then return to the base Disturbance Monitoring Protocol. This module was created to document any effects on the oak understory plant community that certain restoration practices may have, such as herbicide treatment for specific invasive species. Measurements focus on estimating the cover of plant species and estimating species diversity. The oak understory module is a separate survey- please download this survey on your device before going into the field (https://arcg.is/10WjWO1).

FUELS TRANSECT – Page 6-8 of Survey123 Form

The Fine Woody Debris (FWD), Coarse Woody Debris (CWD), litter, duff, and fuel bed measurements are taken ***along all three transects*** established for the plot. Page 6= 0° transect. Page 7= 120° transect. Page 8= 240° transect.

Measurements:

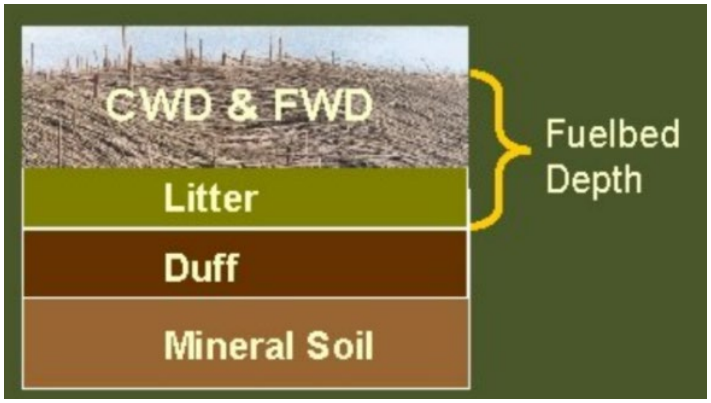
1. **Fine Woody Debris (FWD) Measurements:** See page 18 for definitions.
   a. Between 14-20 ft along the transect, use your clear ruler or Go/No-Go gauge to tally the **0.1-to-0.24-inch** diameter material that cross the transect tape.
   b. Between 14-20 ft along the transect, use your clear ruler or Go/No-Go gauge to tally the **0.25-to-0.99-inch** diameter material that cross the transect tape.
   c. Between 14-24 ft along the transect, use your clear ruler or Go/No-Go gauge to tally the **1.0-to-2.99-inch** diameter material that cross the transect tape.



2. **Coarse Woody Debris (CWD) Measurements**
   a. Diameter: Between 0 and 24 feet along the transect, note the diameter at the tape intersection of each qualifying piece (all material greater than 3" in diameter for at least 3' of its length). The piece must meet the minimum diameter requirement (3") where it intersects the tape. If a piece is forked, consider each fork separately to see if the piece qualifies. The larger fork is considered the main bole. The smaller fork must all meet minimum requirements from the fork to its terminus to be included as its own piece. If no CWD in plot, enter 0 for both diameter and decay class.

b. Decay Class: Assign a decay class (1-5) to each piece of qualifying coarse wood. See page 19 for species on wood that is decay class 5. See page 20 for decay class definitions.

3. **Litter, Duff, and Fuel bed Measurements**
   a. **Depth of Litter** and **Depth of Duff**: Measure the depth of litter and duff at the 24-foot hash mark. Using a trowel, knife or other sharp edge to expose a flat faced hole in the ground. Measure the depth of both duff and litter in inches to the tenth of an inch. When finished cover the hole.
   b. **Fuel bed Depth**: At the 24-foot mark, measure and record the height of the accumulated mass of dead woody material from the top of the duff layer (do not include duff in this measurement) to the highest point of the fuel bed. Units of measurement are inches to the nearest tenth of an inch. Include: litter, FWD, CWD, and dead woody shrubs. Do not include dead wood hanging from trees. If the fuel crosses the tape in the air, it counts as long as the fuel is attached to dead and downed woody debris (the piece is resting at a 45° angle or less erect and is not herbaceous). Only count material less than 6' from the ground.
4. Repeat measurements for Step 1 (FWD), Step 2 (CWD), and Step 3 (Litter, Duff, and Fuelbed) for each transect.



The nitty gritty of fuel transects

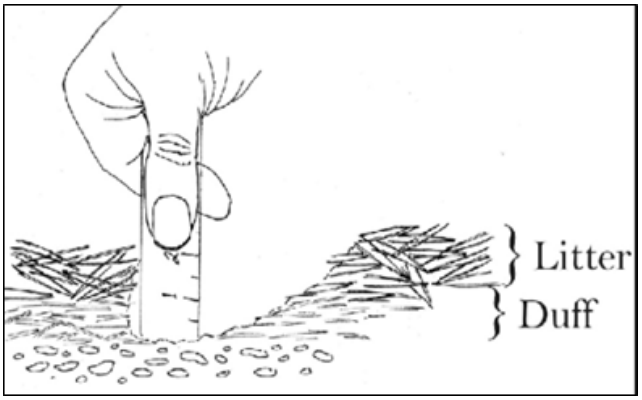
The fuels transect method used here is based on the USFS Forest Inventory and Analysis method. Understanding the woody makeup of the understory of a plot provides key insight into both organic and non-organic materials in the plot, which impact fire behavior and intensity. Data on fuels and other variables will enable users to better understand woodland and forest system/ecological response to disturbance events such as wildfire, prescribed fire, thinning, and fuels reduction.

Definitions

FWD: fine woody debris is less than 3" in diameter, is NO longer connected to a live or standing dead tree or shrub, and does not include dead foliage, needles, or bark. Could include chipped wood.

CWD: coarse woody debris is greater than 3" in diameter ***for at least 3.0' of its length.***

Litter: Mainly dead plant organic material present on top of the mineral soil surface. It is composed of debris in different stages of

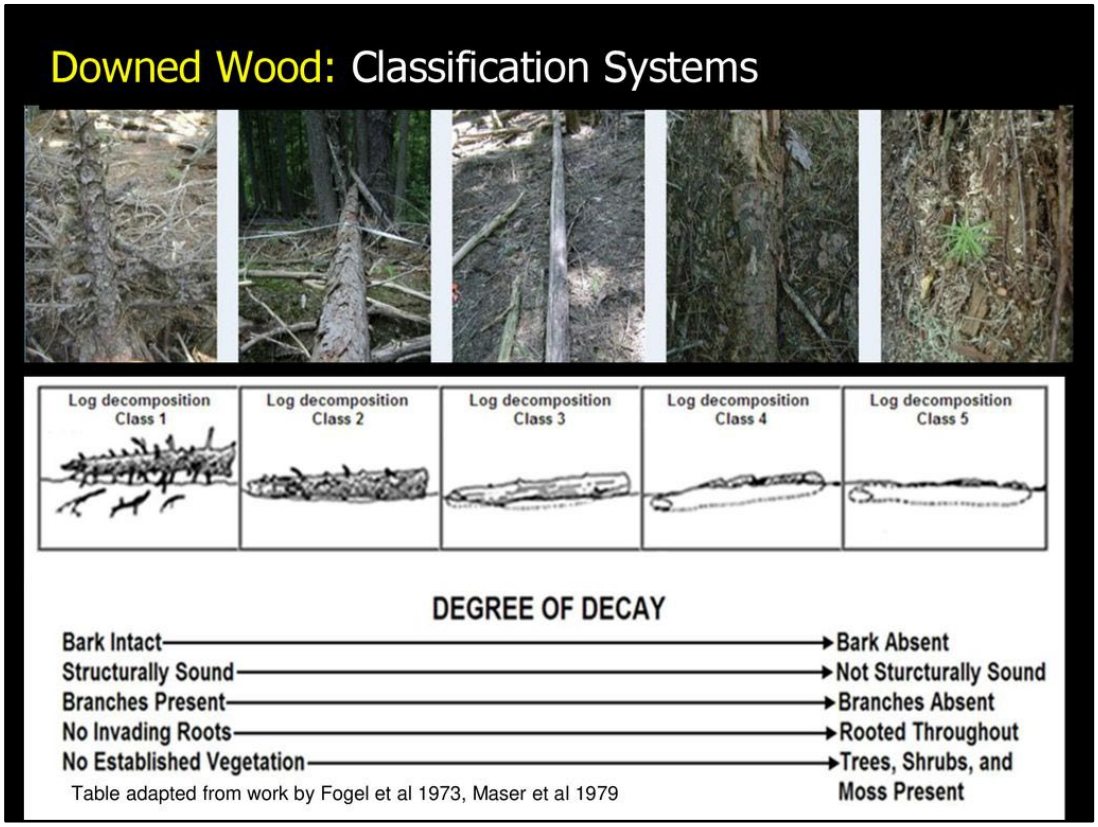


decomposition where the organic materials (twigs, leaves, pine needles, etc.) are still identifiable.
Duff: The organic material layer between the uppermost soil mineral horizon and the litter layer. It is composed of decomposing organic material to the point at which there are no identifiable organic materials (twigs, leaves, pine needles, etc.).

Assorted Details

- For all measurements: only include dead, uprooted material less than six feet from the ground and leaning more than 45° from vertical (i.e. falling or fallen over)
- Sticks that are obscured by litter where they intersect the tape should not be counted.
- Material that is counted once then bends to cross the transect again should be counted at each point it crosses the tape (one stick may be counted twice).
- All materials are counted only if the piece meets the qualifying criteria ***where it intersects the tape line.***
- Tally pieces created by natural causes (examples: natural breakage or uprooting) or by human activities such as cutting only if not systematically machine piled. Do not record pieces that are part of machine-piled slash piles or windrows, or that are part of a log "jumble" or debris jam at the bottom of a steep-sided ravine in which individual pieces are impractical to tally separately. Note the presence and size/content of these features in the notes section.
- Tally a piece if its central longitudinal axis intersects the transect. Tally dead trees and tall stumps that are leaning > 45 degrees from vertical. Do not tally live trees or standing dead trees and stumps that are still upright and leaning < 45 degrees from vertical. Most CWD will be laying on the ground. The minimum length of any tally piece is 3.0 feet. When CWD pieces are close to 3 feet total length measure the length to the nearest 0.1 foot to determine if it is >3.0 feet. CWD TOTAL LENGTH is the length of the piece that lies between the piece's recorded DIAMETER AT THE SMALL END AND DIAMETER AT THE LARGE END.
- The decay class of the piece determines whether or not the piece is tallied. **For decay classes 1 to 4:** tally a piece if it is > 3.0 inches in diameter at the point of intersection with the transect. The piece must be > 3.0 feet in length and > 3.0 inches or more in diameter along that length. If the intersect diameter is close to 3.0 inches, measure the diameter to the nearest 0.1 inch to determine if the piece qualifies. For decay class 5: tally a piece if it is > 5.0 inches in diameter at the point of intersection and > 5.0 inches high from the ground. The piece must be > 3.0 feet in length and > 5.0 inches or more in diameter along that length.
    - The reason for **treating decay class 5 pieces differently** is because they are difficult to identify, especially when heavily decomposed. Only pieces that still have some shape and log form are tallied, humps of decomposed wood that are becoming part of the duff layer are not tallied.

Decay Class	Structural Integrity	Texture of Rotten Portions	Color of Wood	Invading Roots	Branches and Twigs
1	Sound, freshly fallen, intact logs	Intact, no rot; conks of stem decay absent.	Original color	Absent	If branches are present, fine twigs are still attached and have tight bark
2	Sound	Mostly intact; sapwood partly soft (starting to decay) but can't be pulled apart by hand or sapwood absent.	Original color	Absent	If branches are present, many fine twigs and are gone and remaining fine twigs have peeling bark
3	Heartwood sound; piece supports it't own weight	Hard, large pieces; sapwood can be pulled apart by hand or sapwood absent	Reddish brown or original color	Sapwood only	Branch stubs will not pull out
4	Heartwood rotten; piece does not support it's own weight, but maintains its shape	Soft, small blocky pieces; a metal pin can ge pushed into heartwood.	Reddish or light brown	Throughout	Branch stubs pull out
5	None, piece no longer maintains it's shape, it spreads out on ground	Soft; powdery when dry	Red-brown to dark brown	Throughout	Branch stubs and pitch pockets have usually rotted down.



SEEDLINGS AND SAPLINGS- Page 9 of Survey123 Form

Within the inner 6.8 ft radius plot, complete a tally of all seedlings, by species. Seedlings are defined as <1" DBH or shorter than DBH height. Within the inner 11.8 ft radius plot, complete a tally of all saplings- defined as 1-2.49" DBH. It is not necessary to include oak stump sprouts in either tally, as they will be accounted for in the Oregon white oak observation section.

SNAG SAMPLING – Page 10 of Survey123 Form

SNAGS: Snags of any tree species with a DBH are tallied or inventoried **within the 50-foot radius plot**. A snag is defined as a standing dead tree, or what remains of a dead tree, that is at least 4.5 ft tall. Dead trees should be leaning less than 45 degrees from vertical as measured from the base of the tree to 4.5 ft. If there are any live branches, then they are inventoried as live trees and not snags. If a tree splits below DBH and one bole is alive while the other is dead, count the dead bole as a snag and the live bole as a live tree.

Enter the threshold at which you started inventorying snags- should be specific to your site's conditions. For snags smaller than the threshold, a simple tally of deciduous vs. coniferous is required. For snags ≥ your threshold DBH, record the species, DBH, azimuth and distance from plot center, height, number of cavities, and snag decay class. As you complete the measurements and assessments for each snag, click the + button and the form will provide you with the opportunity to enter data for the next snag as you move around the plot.

TREE SAMPLING – Page 11 of Survey123 Form

Using concentric plot radii (11.8, 24, and 50 feet), collect data for trees that qualify for inclusion based on the stated criteria for each concentric plot. It is strongly recommended that you use a rangefinder to take distance and height measurements. ECOP has purchased some rangefinders that can be loaned with the field monitoring kits.

Measurements of tree species
As you move through the measurements, begin at the 0-degree azimuth and move clockwise through the area, ending where you began. Do this for each concentric circle, looking for trees that meet the target DBH. This will ensure that you do not double count any trees or miss any due to confusion/disorientation. If approved by the site manager, you may install DBH nails (2-3" aluminum) at measurement height on the uphill side of each tree ≥5" DBH. This will ensure repeatable measurements in subsequent years.

Is this one tree or two (or more!)? If the tree bole splits below the 4.5-ft height where you measure DBH, then count each bole as a separate tree. If it splits above the DBH measurement point, then count that tree as one individual.

Which trees are "in"? Standing at the center of the plot, use the following guidelines for

determining if a tree should be considered "in" (not all trees within the 50' radius will qualify to be measured). Trees are measured within a range of plot sizes as described below:

- Within the **11.8 ft radius** from plot center: Trees 2.5 to 4.9-inch DBH are inventoried where at least half of the diameter of the tree stem is within the 11.8-foot plot.
- Within the **24 ft radius** from plot center: Trees 5.0 to 24-inch DBH are inventoried where at least half of the diameter of the tree stem is within the 24-foot plot.
- Within the full **50 ft radius** from plot center: Trees over 24-inch DBH are inventoried where at least half of the diameter of the tree stem is within the 50-foot plot.

DATA COLLECTION – Measurements for all species of live trees

1. **Tree Species-** Select a tree species from the drop-down list. If you select "None" then you will move on to the next size class.
2. **Tree Tagged?** For trees ≥5" DBH, check yes if tree has been tagged in previous surveys.
3. **Tree ID**- For trees ≥5" DBH and with land manager permission, install a tree tag ID at base of tree with a 2-3" aluminum nail leaving room for tree to grow.
4. **DBH** (inches)- Diameter at breast height (4.5 ft) measured on the uphill side
5. **Azimuth from Plot Center-** If first time measuring this tree, you will record azimuth from plot center to tree.
6. **Distance from Plot Center** (feet; measure to the nearest side of the tree)- If first time measuring this tree, you will record distance from plot center.
7. **Tree height** (feet)- We strongly encourage the use of a hypsometer or a rangefinder to measure tree height and crown base height. Measure height as distance from ground to highest point of tree. If tree has dead top, record height to top, live or dead.
8. **Crown base height** (feet)- Height from the ground to the lowest live branch in the tree's crown- not necessarily where the branch forks from the bole. More difficult to measure in oaks than conifers but try to measure from where the significant crown starts excluding clearly separated branches.
9. **Percent live crown ratio** (nearest 10%) – This is the percentage of the tree's stem that is occupied by live branches. You can typically calculate this by subtracting the tree's crown base height from the total height and then dividing by the total height. (Example: a 100-foot-tall tree with a 25-foot crown base height has a 75 % live crown ratio.) If there are dead branches at the top or gaps throughout the crown, ocularly transfer lower live branches to fill in large holes in the upper portion of the tree until a full, even crown is visualized. See below for examples from USFS FIA.

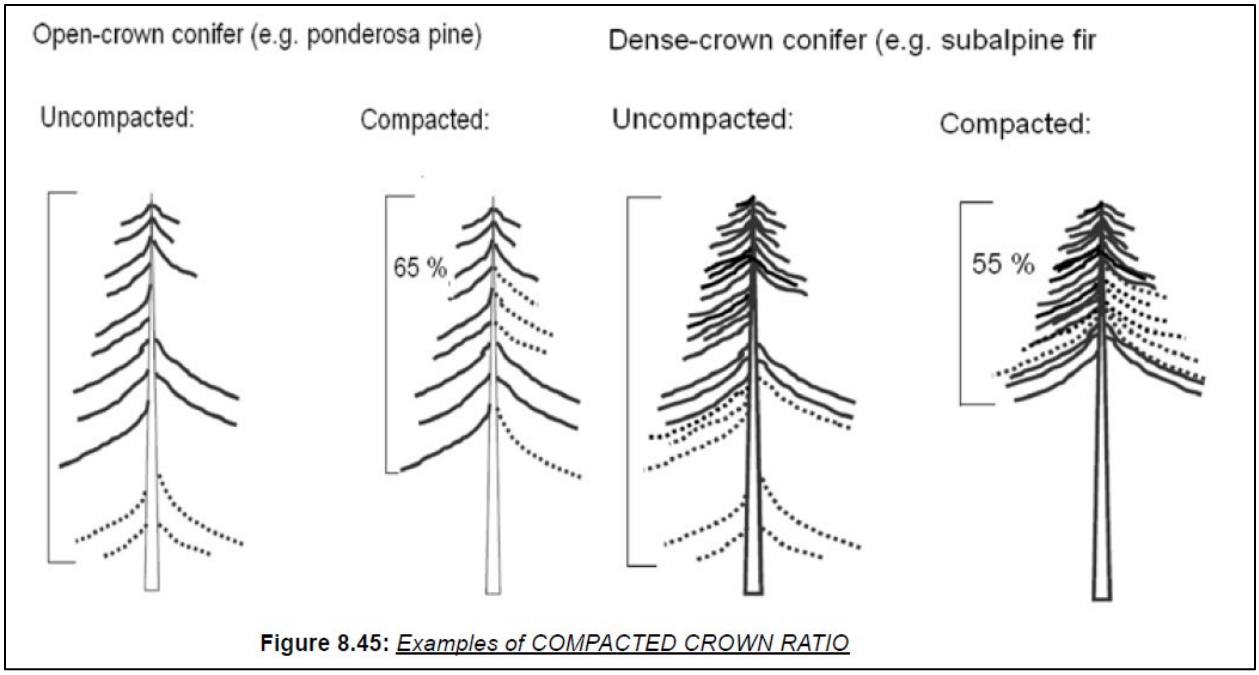


Figure 8.45: *Examples of COMPACTED CROWN RATIO*

10. **Crown position**: Select the crown position based on the descriptions in survey and reference materials ("Crown position from USFS FIA").
11. **Tree health indicators:** Select all that apply and that you can diagnose from reference materials ("Tree health indicators").
12. **Is this marked as a witness tree?** Yes or No. (Question shown for trees greater than 5.0-inch DBH)
13. **Notes.** Include any notes or comments about trees here.

As you complete the measurements for each tree, click the + button and enter data for the next tree as you move around the plot. This is repeated for each of the concentric plots.

DATA COLLECTION – Measurements specific to Oregon white oak trees

When you select Oregon white oak as the tree species, you will be asked to characterize observations specific to this species. Use reference materials for guidance ("Oak Structure and Morphology Graphic").

a. **Distance between ground and lowest point of attached live limb** (feet). This is often the same as crown base height but may be less if oak has clearly separated lower limbs. Do not include immature epicormic branches <1" diameter.
b. **Distance between ground and lowest point of attached dead limb** (feet). Enter "999" if no dead limbs (although unlikely for oaks!).
c. **Oak morphology** (choose one)
    - Clonal Oak: Stems radiate from the root collar of an old stump. Most clones are within 2 ft of each other.
    - Clump Oak: Stems emerge from densely spaced germinating acorns.
    - Single Stem Oak: Stem emerges from widely spaced germinating acorns.
    - Single Stem Oak Forked Below DBH: As described.

OREGON WHITE OAK RESPONSES TO DISTURBANCE - Page 12 of Survey123 Form

Oregon white oak will often display unique growth responses to changes in available resources such as water or light. Initial responses are seen as epicormic branching or stump sprouting. See definitions and examples below.

1. **Oak Epicormic Branching**: Present or absent within the 50 ft radius plot.
2. **Oak Stump Sprouting**: Present or absent within the 50 ft radius plot. Stump sprouts appear as numerous stems that co-contribute to a crown in the form of a shrub, sapling, or even mature tree clones.
3. **Oak Stump Density:** If oak stump sprouts are present (checked yes above), count number of oak in a clonal/sprouting morphology with stems <2.5" DBH within 24 ft radius plot. Count clumps, not number of individual stems, and only count if it is an obvious stump sprout from a cut stump or clonal oak. If the sprouts you observe are associated with a mature oak stem >2.5" DBH, do not count here.
4. **Stump Sprout Form**: Indicate the growth form of the stump sprouts or clones in the full 50-ft radius plot. Select all that apply.
5. **Stump Sprout Condition**: Indicate the condition of sprouts. Select all that apply.
6. **Stump Sprout Origins**: Look for clues about the origin of the tree stem failure that incited the stump sprouts. Select all that apply. Where there are shrubby oaks, peer or feel within to locate cut stumps, burnt stumps, rotted stumps, or no obvious origin.

Definitions:
Epicormic branches: Epicormic branches are shoots arising from adventitious or dormant buds on the trunk, stem, or branch of a woody plant. Epicormic branches look like new growth and can grow in dense clusters (reminiscent of mistletoe), or along the trunk of the tree. Epicormic branches are formed following the release of dormant buds in response to increased light, or injury.

Example of abundant epicormic branching

Stump sprouts: Stump sprouts emerge from the collar of a cut, burned or dead tree stump usually just below ground level. You will see numerous oak sprouts stemming from the root crown at the base of a tree or its residual stump. There is generally a radial pattern to the architecture of the sprouts (a circle around the old stump) that persists after the stump has rotted away.

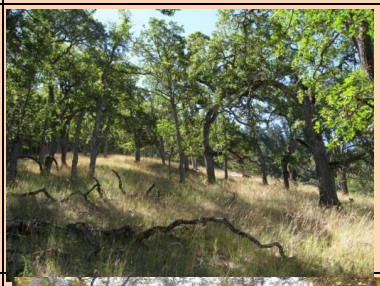
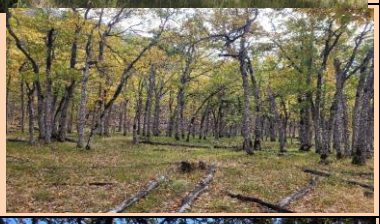
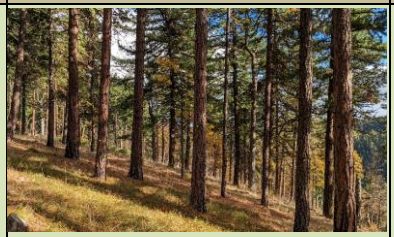
Check to be sure shrubby oaks are emerging from stumps rather than from browsed single stem seedlings and if you can't tell, make your best guess. (Note: stump sprouted oaks also experience browse).
Mature Stump Sprouts/Clones: Mature stump sprouts are greater than 2.5 inches DBH. Mature stump sprouts can grow to be massive trees, with stems sometimes merging together over time at the base. We're calling these clones (photo below). Watch for the radial aspect of their root base, and often a mound of soil where the previous stump has rotted.

Woody stump sprouts at base of tree

Mature clone stump sprouts

Fresh, short shrub stump sprouts on a newly cut tree

Oak System Types and Descriptions

	Oak System Type	Visual of System Characteristics	Oak System Characteristics	Canopy Type	Oak Cover	Conifer Cover	Understory Cover
Oak Dominated	***Savanna***		Oak savanna habitats are grasslands with scattered oak trees, with approximately 1-5 large trees, or 1-10 younger trees per acre. Oak trees in savannah are generally "open-grown" (i.e., without nearby competition for resources), which result in mushroom-shaped trees with well-developed limbs and canopies.	*<10%*	*Widely scattered oaks*	*Can include scattered pine or fir*	Grass and forb dominated understory , < 10 % shrubs
	Open Oak Woodland		Open oak woodlands have a somewhat open canopy, with about 25-50% canopy cover. Pine or fir, if present, make up a small component of the canopy.	Open Canopy (10-60% Cover)	(0-50%)	<10%	Grass and forb dominated understory, < 30% shrub cover.
	Closed Oak Woodland		Closed oak woodland is characterized by a relatively closed canopy. Pine and fir can be a smaller component.	Closed Canopy (60-75 % Cover)	(25-50%)	<10%	Grass and forb ground cover including <30% shrub cover, varies based on Mesic/Xeric soils, shade level.
	Oak Forest		Oak forest is characterized by nearly closed canopy that is dominated by oak trees. High levels of competition lead to columnar and vase shaped tree crowns with limited branching and foliar volume.	Closed Canopy (>75%)	>75%	<10%	Varies widely. Subcanopy on drier sites is devoid woody vegetation, and on mesic sites can be very densely vegetated.
Conifer or Co-Dominant	***Mixed Oak-Conifer Forest & Woodland***		Xeric sites- pine dominated woodlands with oak. Mesic sites- pine and fir dominated woodlands with oak. **Choose this type when oak and conifer is closer to co-dominant, or oaks are loosing out to the conifer canopy, s**tand is shifting/transitioning from oak to conifer.	Varies from woodland (10-60%) to forest type (60-100%) canopy.	<50%	> 50%	Varies widely. Subcanopy on drier sites often devoid woody vegetation, and on mesic sites densely vegetated.
Conifer Dominated	***Forests With Oak***		Mixed conifer stands with minor oak components. **Oaks patchy or low numbers in the understory or on balds and shallow soils that do not support conifer. Usually more mesic.**	Varies - 60% or more	< 10%	65-100%	Varies widely, dominated by shade tolerant shrubs, grasses, or forbs.
Oak Mixed with Hardwoods, and Conifer	***Riparian Oak***		Mixed stands of oak, various hardwoods, and rarely conifer located in ravines and creeks at lower elevations. Oaks in riparian stands often grow straight and tall with larger diameters than in stands of similar density on more xeric soils.	Classify as riparian when oak system is within 100' of perennial stream center. Also when oaks are in floodplain beyond 100' . Codominance and shrub cover varies by stream type, aspect, and available moisture.			

USNVC standards, forest refers to vegetation dominated by trees in a closed canopy, between 60% and 100% cover.

USNVC standards, woodland refers to vegetation dominated by trees with an open canopy, between 5% to 60% cover

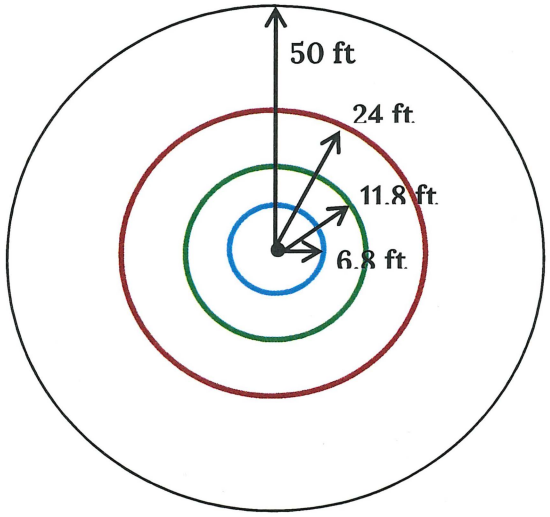
ECOP TREE SAMPLING

Every stem >2.5" DBH is a tree whether it stands alone or is part of a clone or a clump. You include the tree's measurements if the stem meets the requirements for inclusion based on its diameter and distance from plot center. For each stem you will record the following:

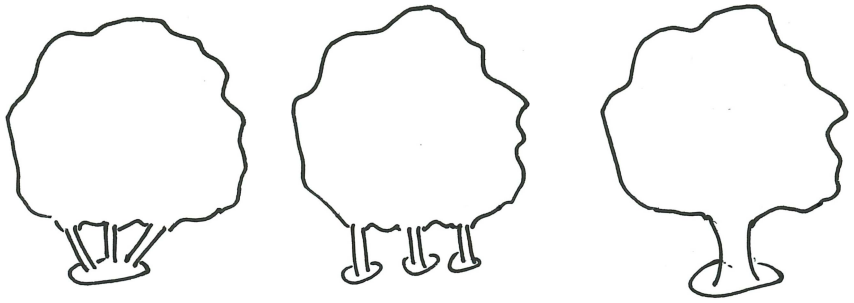
For all trees:
Species
DBH, Height
Azimuth and distance from center
Tree status
Crown base height
Percent live crown ratio
Crown position
Tree Health Indicators

For oaks only:
Distance to lowest live limb
Distance to lowest dead limb
Oak morphology (see right)

Using the following radii from plot center, collect data:



KEY TO OAK MORPHOLOGY



Clonal Oak
stems radiate from the root collar of an old stump

Clump Oak
stems emerge from densely spaced germinating acorns

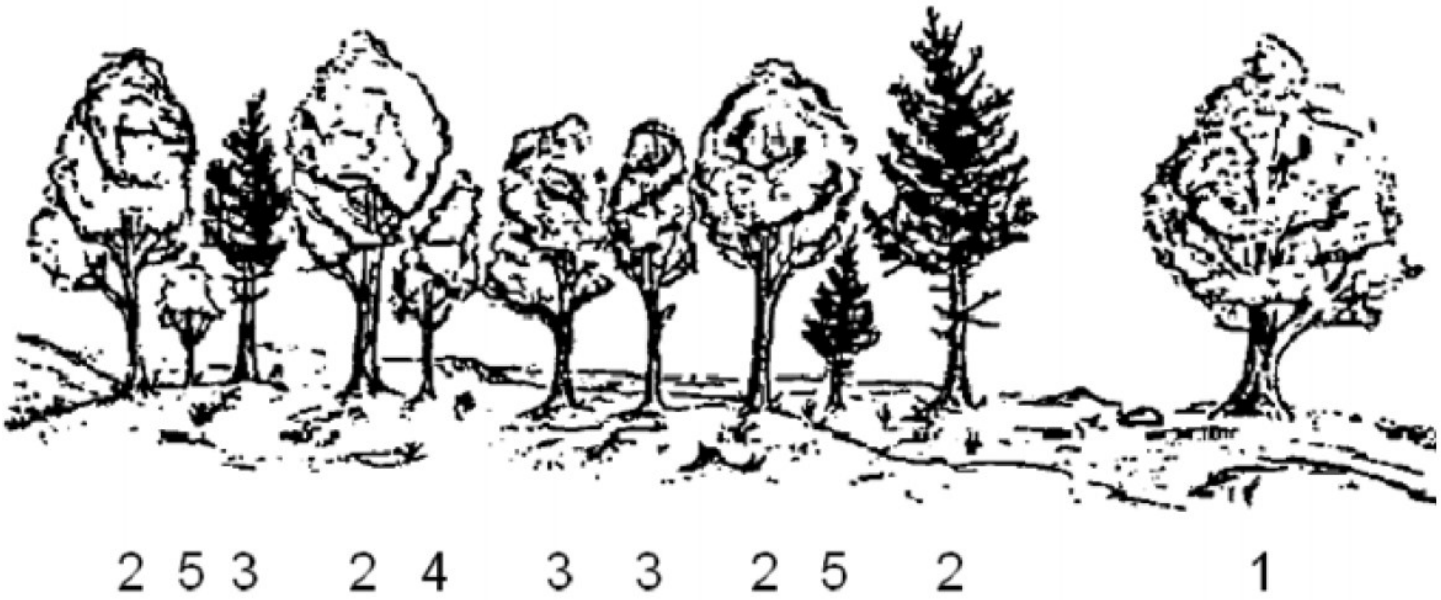
Single Stem Oak
stem emerges from widely spaced germinating acorns

Within 6.8 ft radius	Tally seedlings (<1" DBH) by species
Within 11.8 ft radius	Tally saplings (1.0-2.4" DBH) by species
Within 11.8 ft radius	Record tree data for each tree between 2.5 – 4.9" DBH
Within 11.8 ft radius	Record percent cover for ground cover guilds
Within 24 ft radius	Record tree data for each tree between 5.0 – 24" DBH
Within 50 ft radius	Record tree data for each tree more than 24" DBH

Do not include stump sprouts in your tally for seedlings.
Stump sprouts are accounted for in the oak observations section of the data form.

ECOP CROWN POSITION

(Taken from USDA Forest Service Forest Inventory and Analysis)



Code	Description
1	Open Grown – trees with crowns that received full light from above and from all sides throughout most of its life, particularly during its early developmental period.
2	Dominant – trees with crown extending above the general level of the crown canopy and receiving full light from above and partly from the sides. These trees are taller than the average trees in the stand and their crowns are well developed, but they could be somewhat crowded on the sides. Also, trees whose crowns have received full light from above and from all sides during early development and most of their life. Their crown form or shape appears to be free of influence from neighboring trees.
3	Co-dominant – trees with crowns at the general level of the crown canopy. Crowns receive full light from above but little direct sunlight penetrates their sides. Usually they have medium-sized crowns and are somewhat crowded from the sides. In stagnated stands, co-dominant trees have small-sized crowns and are crowded on the sides.
4	Intermediate – trees that are shorter than dominants and co-dominant, but their crowns extend into the canopy of co-dominant and dominant trees. They receive little direct light from above and none from the sides. As a result, intermediate trees usually have small crowns and are very crowded from the sides.
5	Overtopped – trees with crowns entirely below the general level of the crown canopy that receive no direct sunlight either from above or the sides.

Tree Health Indicators

Rot & Fungal Bodies

EAST CASCADES OAK PARTNERSHIP

lion's mane

fungal bodies

fungal bodies at base

Tree Health Indicators

Leaf Damage

oak anthracnose

jumping gall wasp

eriophyid mite damage

Tree Health Indicators

Galls & Cankers

speckled gall

oak apple gall

caused by wasp

crown gall

caused by bacterium

Tree Health Indicators

Mistletoe

oak mistletoe

dwarf mistletoe

dwarf mistletoe

Tree Health Indicators

Dead Limb Scars

Tree Health Indicators

Human Caused Damage

Tree Health Indicators

Fire Scars & Scorch

char

scorch

fire scar

Tree Health Indicators

Cavities

Tree Health Indicators

Wildlife Damage

porcupine

beaver

deer rub

Tree Health Indicators

Mild Drought Stress

mild retraction of crown (less than 50%)

conifer drought stress (red needles)

prematurely dried leaves

Tree Health Indicators

Severe Drought Stress

Tree Health Indicators

Epicormic Branching

post-wildfire

stressed

epicormic branching

Tree Health Indicators

Stump Sprouts