*East Cascades Oak Systems*

# Disturbance Monitoring Protocol

## *Field Instructions*[1]

*Version:* V2.071624

Version changes: V2 changed snag protocol inventory from ≥5" to ≥12"; added survey version field to page 1

[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.

*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.**

Being familiar with it before you go will save time, and help you be prepared when you get to your field location. 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 | GPS unit (Garmin or GPS enhanced smart phone/pad) *extra batteries recommended |
| 1 | Rangefinder/Hypsometer *extra batteries recommended |
| 4 | Chaining pins |
| 1 | DBH tape (10$^{th}$ inches diameter) |
| 3 | 50-foot reel measuring tapes (standard units - feet and inches) |
| 1 | 1m$^2$ quadrat (if completing oak understory module) |
| 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 (3" ideal) to mark DBH measuring height on each tree >5" DBH in plot, if approved at site |
| varies | Aluminum nails (3" ideal) and tree ID tags to mark trees, if approved at site |
| 1 per plot | Plot markers (large nails or **12" rebar** and plot number markers) (**recommended**) |
| 1 | Hammer to pound in rebar |
| Optional | Wire to affix metal plot number markers to 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 |

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

### 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. ECOP has pre-assigned plot locations across the entire eastside oak landscape that can be shared using ArcGIS. 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.

Examples:

- Mt Hood National Forest Barlow District, Rocky project area, plot number 1, would be labeled: MHBD_RCKY_001.
- Mary Bushman, Forest Health, plot number 1, MJBB_FOHE_001

**1.6 Download the Survey123 Form on your device:**

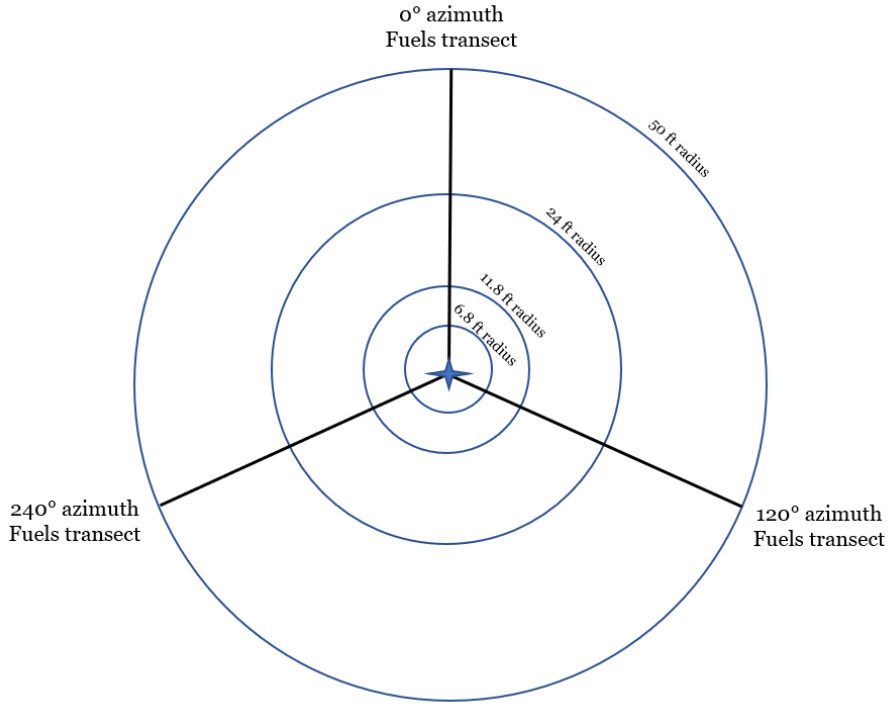
1. If you do not have the Survey123 app on your tablet or smartphone, you can download it from any app store for free. It is an ESRI product that coordinates with ArcGIS products. You do not need a license to use it. You can download it without logging in.
2. Scan QR code to the right or follow this link to download the ECOP Oak Disturbance Monitoring Survey: https://arcg.is/1amazv1
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 11 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.

*BEGINNING OF FIELD INSTRUCTIONS - Pages 5-23 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.
- Optional: Attach a metal tag to the rebar using wire. You may use a customizable tag and write the unique Plot ID directly on it, or you may use a pre-numbered metal tag to cross reference with the Plot ID.
- 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 orange tree paint 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.
- 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

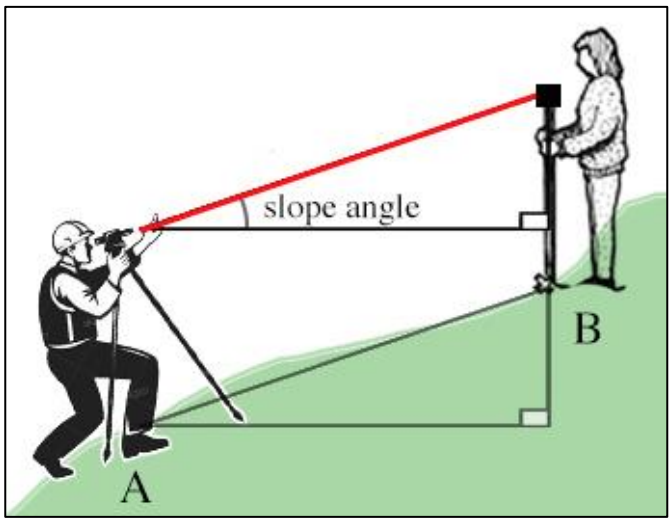
If revisiting a previously established plot, use your GPS device to navigate to the plot center. Look for the painted stake in the ground and use witness trees to help you find plot center. You can also bring a metal detector into the field to help you relocate the rebar. ECOP can generate "Relocating 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.

[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 to establish fewer transects or to change the azimuth of any of the three transects – please clearly document your decisions. Remember, Safety First!

# Begin data collection

## PLOT CHARACTERISTICS – Page 1 of Survey 123 Form

1. **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:
    - 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.
2. **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".
3. **Observer Names**: Record full names of observers.
4. **Monitoring Date**: The day you conducted monitoring for this Plot ID.
5. **Date of Plot Establishment**: If you are revisiting a plot that was previously established, enter the original plot establishment date. Make a note in the plot remarks if there are discrepancies between tags, or you if you must assign a new plot center
6. **Latitude and Longitude (Plot Center Location)**:
    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. If you must override the GPS in Survey123, note the reason for override.
    b. If you prefer to use a separate handheld GPS, record the location (NAD 83 UTM) 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.*
7. **Slope (%):** 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




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

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.

8. **Aspect (°):** 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".
9. **Elevation (ft):** Set up to automatically populate.
10. **Plot remarks**: Use this field to:
    - Describe plot location and layout to help future field crews relocate the plot.
    - Describe plot landmarks. Remember, there may be fire and management activities that would alter the vegetation (trees too). Notes such as distance to nearby road or other permanent features should be included. (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, and include new GPS coordinates.
    - Record witness tree information here (DBH, azimuth, and distance from plot center) if not recorded during tree sampling.

## 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 use a monopod or other photo taking device that helps you take consistent photos from one visit to another. Monopod should be set at 5 ft tall. 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 three

photos holding the camera at a height of about 5 feet on each transect (0°, 120°, 240°) as described below for a total of nine 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.
3. **Up/Canopy:** Position the camera device over plot center at a height of 5 feet and looking at the transect end, tilt the camera upwards approximately 45 degrees (from slope angle) towards the upper tree canopy.

## PLOT OBSERVATIONS – Page 4 of Survey123 Form

1. **Oak System Type**: 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).
    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***. [6]
3. **Land Use and Disturbance Indicators**: Note presence or absence of other disturbances that are visible on the plot.
    a. Human trails or paths: These are obviously constructed and used by people, are related to human infrastructure, or are in recreational areas frequented by people.
    b. 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.

[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.
[6] If grazing, timber management, fire or other disturbance happened within the stand but not within the plot, do not include it.

c. 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.
d. Livestock sign: This can include terracing from compaction and trail development, manure, pugging (hoof marks in the soil), or hoof tracks.
e. Soil compaction: Hard, compact soils, with shallow-rooted or weedy vegetation or no vegetation, pooling water, stunted vegetation growth.
f. 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)
g. 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.).

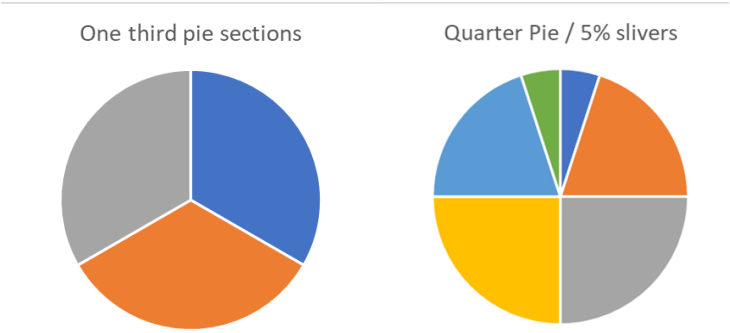
## BASIC UNDERSTORY PLOT – Page 5 of Survey123 Form

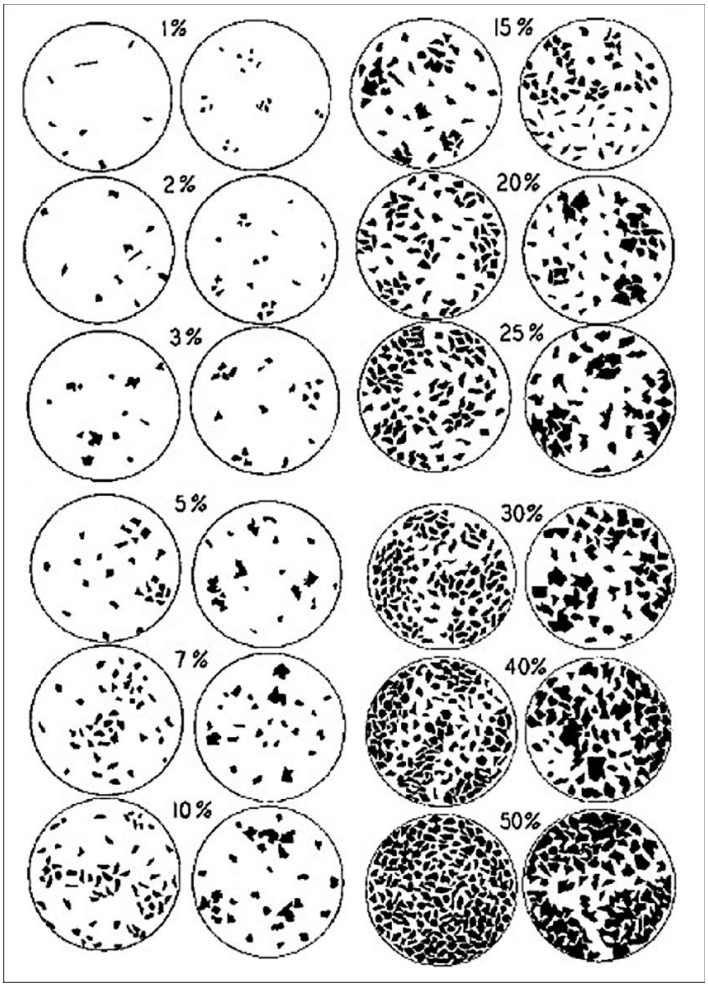
**Ground Cover Guilds - Measured within the 11.8-foot radius concentric plot**
The understory vegetation sampling plot includes all organic and inorganic materials that are not trees within the 11.8-foot radius of plot center. It may be helpful to have crew members stand facing each other at the 11.8-foot point on the transect tapes and work through the cover class of each ground cover guild together. There are 15 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
    - Climbers (vines and epiphytes)
    - Shrubs
    - Bare ground
    - Ash/charcoal
    - Trash or debris (from two legged visitors)
    - Litter (leaf litter, decomposing plant material)
    - FWD (fine woody debris)
    - CWD (coarse woody debris)
    - Rocks

- Woodchips (mechanically shredded or chipped wood)

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!

*The oak understory module is meant to 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.*

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).

## Decision point on plot marking

If you are in a project area that is primarily grassland or oak savanna with no to few trees, you can mark the 50 ft ends of each transect with a survey marking whisker (in addition to the center rebar marker). In other more treed areas, witness trees will be marked for easy plot relocation (assuming site manager permission to mark trees).

## Data fields

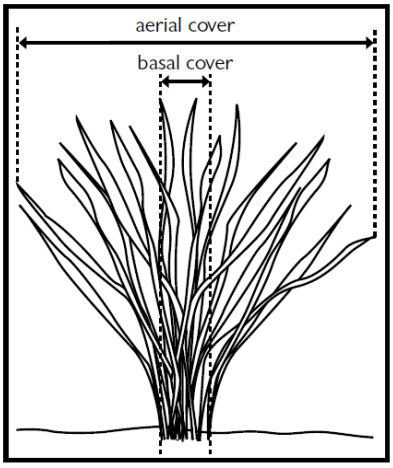
1. **Plot ID**
2. **Oak Understory Monitoring Date**
3. **Observers**
4. **General understory notes.** Record any noteworthy remarks about the herbaceous understory plant community for this plot.
5. **Understory plant species in frames.** Identify each graminoid, forb, and shrub to species that is rooted within the 1-meter square quadrat. Use the dropdown menu to search for USDA Plant Code or common name to enter plant species into the form. If unable to identify a specific plant to species, use USDA Plant Codes for the genus (typically first 5 letters of genus). If unable to identify at all, you may search for “UAG” for unknown annual grass, "UPG" for unknown perennial grass, "UAF" for unknown annual forb, "UPF" for unknown perennial forb, and "USHRUB" for unknown shrub.
    a. **USDA Plant Codes**
    b. **Cover Estimate**
6. **Diversity walk.** After completing all quadrat locations for estimating cover, walk around the entire 50 ft radius circle and record any additional graminoid, forb, and shrub species found that were NOT recorded within the quadrats. Enter each species separately using the + button. Max time is ~15 minutes.

## Estimating aerial cover

Along each 50 ft transect, starting with the 0-degree azimuth, estimate aerial cover of each live species rooted within a 1-$m^2$ quadrat (current year's growth). Place the quadrat at 11.8 ft (equivalent to 11 ft and 9.6 inches) and 38 ft on the right-hand side of the transect. Bottom left corner of quadrat should be at the specified 11.8 or 38 ft locations. Identify each graminoid, forb, and shrub to species and use the dropdown filter to select the appropriate **USDA Plant Code** and common name to enter the species into the form. Using consistent codes for plant names is essential for proper data analysis and is restricted to the list. If unable to identify a specific plant to species or it is not on the list, use USDA Plant Codes for the genus. If unable to identify at all, you may search for UAG, UPG, UAF, UPF, or USHRUB where U=unknown, A=annual, P=perennial, G=graminoid, and F=forb. Estimate cover according to the following **cover class** bins:

- Trace: 0.01-0.99%
- 1: 1-5%
- 2: 6-25%
- 3: 26-50%
- 4: 51-75%
- 5: 75-95%
- 6: 96-100%

Click the + button to add more species.



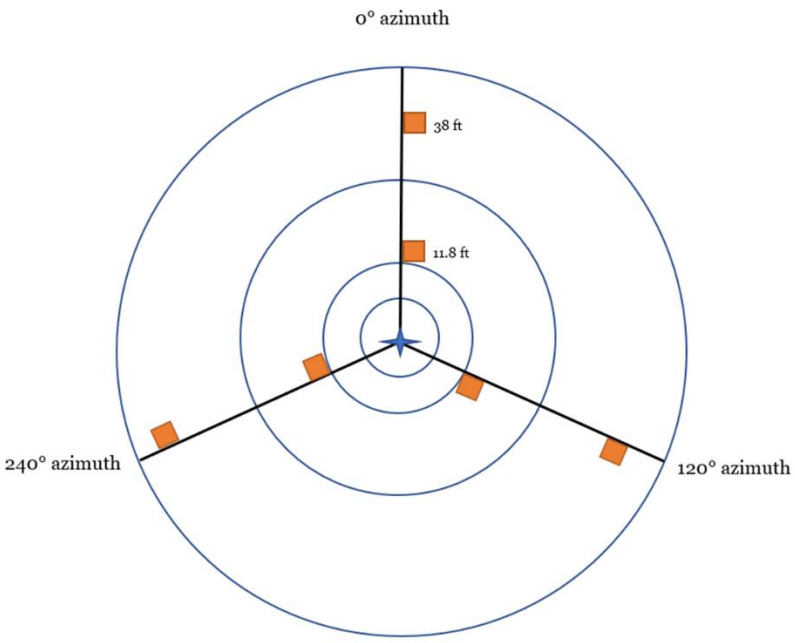

*Cover definition:* Cover is the vertical projection of vegetation from the ground as viewed from above. There are two types of cover – basal and aerial. We are focusing on aerial cover in this protocol which can be visualized by considering a bird's-eye view of the vegetation. See diagram.

*Notes*: It may be helpful to write all species present within the frame on a piece of paper first, then enter plant codes and cover classes into the Survey123 form. If a species is only partially rooted within the quadrat, only estimate cover for the portion rooted within the quadrat. Since plants overlap and vary in structure, it is acceptable for the total cover of all species to be more than 100. Only include current year's growth and not previous growing seasons (like old medusahead thatch).

## Quadrat locations

Quadrat locations can be notated as follows:

- 0 degrees, 11.8 ft= 0A
- 0 degrees, 38 ft= 0B
- 120 degrees, 11.8 ft= 120A
- 120 degrees, 38 ft= 120B
- 240 degrees, 11.8 ft= 240A
- 240 degrees, 38 ft= 240B




**Please be careful when sampling at the 11.8 ft marks since these overlap with the fuels transect. Do not trample or move fine woody debris along the tape.**

## Diversity walk

After completing all six quadrat locations for estimating cover, walk around the entire 50 ft radius circle and record any additional graminoid, forb, or shrub species found that were NOT recorded within the quadrats. Use USDA Plant Codes as before and click the + button to add more than one species. There is a section "Plants entered for diversity walk" that will list what you have entered so far. Again, be mindful not to trample along the tape lines for the fuels transects. You do not need to estimate cover. Spend ~15 minutes on this.

## Suggested plant identification resources

- Flora of the Pacific Northwest by C. Leo Hitchcock & Arthur Cronquist
- Plants of the Inland Northwest and Southern Interior British Columbia by Roberta Parish
- Wildflowers of the Pacific Northwest by Mark Turner and Phyllis Gustafson
- Field Guide to the Rare Plants of Washington by Camp & Gamon
- Field Guide to the Grasses of Oregon and Washington by Roche, Brainerd, Wilson, Otting, and Korfhage
- Washington Wildflowers (smartphone app)
- Oregon Wildflowers (smartphone app)

## OREGON WHITE OAK RESPONSES TO DISTURBANCE - Page 6 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. We are interested in documenting the presence of these features within the 50-ft radius plot. See definitions and examples below.

1. **Oak Epicormic Branching**: Present or absent.
2. **Oak Stump Sprouting**: Present or absent.
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 plot (count clumps, not number of individual stems). 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 plot. Select all that apply.
5. **Stump Sprout Condition**: Indicate the condition of sprouts including fresh, woody, failing to thrive, or recently grazed or cut/masticated. Select all that apply. These features can be detected by physical investigation.
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.

*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*

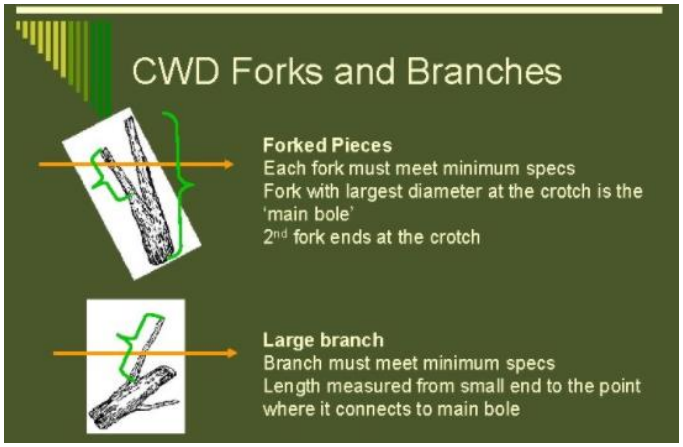
*Fresh, short shrub stump sprouts on a newly cut tree*

## FUELS TRANSECT – Page 7, 8, and 9 of Survey123 Form

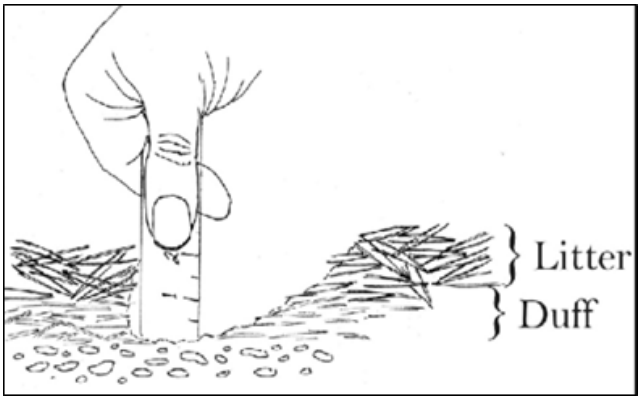
The Fine Woody Debris (FWD), Coarse Woody Debris (CWD), litter, duff, and fuelbed measurements are taken ***along all three transects*** established for the plot. Page 8= 0° transect. Page 9= 120° transect. Page 10= 240° transect.

### 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. <u>Diameter:</u> 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. <u>Decay Class:</u> 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 Fuelbed 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. **Fuelbed 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



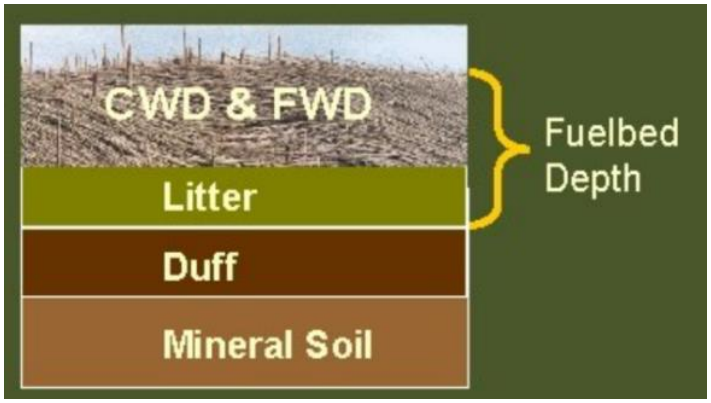
(do not include duff in this measurement) to the highest point of the fuel bed. Units of measurement are inches to the nearest tenth of an inch. Include: litter, FWD, CWD, and dead woody shrubs. Do not include dead wood hanging from trees. If the fuel crosses the tape in the air, it counts as long as 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



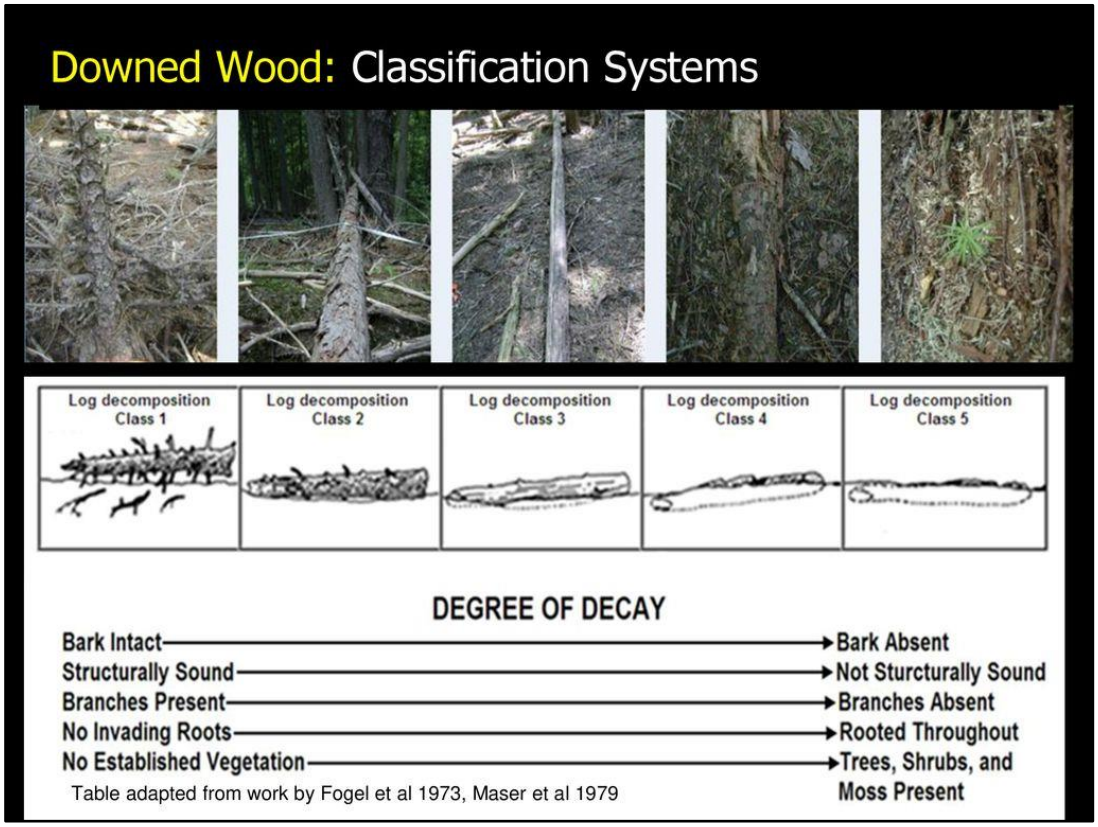

*FWD*: fine woody debris is less than 3" in diameter, is NO longer connected to a live or standing dead tree or shrub, and does not include dead foliage, needles, or bark. Could include chipped wood.
*CWD*: coarse woody debris is greater than 3" in diameter ***for at least 3.0' of its length.***
*Litter*: 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 10 of Survey123 Form

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

## SNAG SAMPLING – Page 11 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 tree 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.

Tally the number of deciduous and coniferous snags with a DBH of <12 inches. For snags ≥12" 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 12 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 the 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 (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.
    - None
    - *Quercus garryana* (Oregon white oak)
    - *Pinus ponderosa* (Ponderosa pine)
    - *Pseudotsuga menziesii* (Douglas fir)
    - *Alnus rubra* (red alder)
    - *Juniperus occidentalis* (western juniper)
    - *Populus trichocarpa* (black cottonwood)
    - *Abies grandis* (grand fir)
    - *Robinia pseudoacacia* (black locust)
    - *Prunus virginiana* (chokecherry)
    - *Taxus brevifolia* (Pacific yew; rare)
    - *Acer glabrum* (Rocky mountain maple)
    - *Acer circinatum* (vine maple)
    - *Acer macrophyllum* (bigleaf maple)
    - Unknown Tree
2. **Tree ID** (optional to install a tree tag ID number based on land manager preferences, install at base of tree with aluminum nail leaving room for tree to grow)
3. **DBH** (inches)- diameter at breast height (4.5 ft) measured on the uphill side
4. **Azimuth from Plot Center**
5. **Distance from Plot Center** (feet; measure to the nearest side of the tree)
6. **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.
7. **Tree status** (tree condition - assess living and dead branches)
8. **Crown base height** (feet; height from the ground to the lowest live branch in the tree's crown)
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.

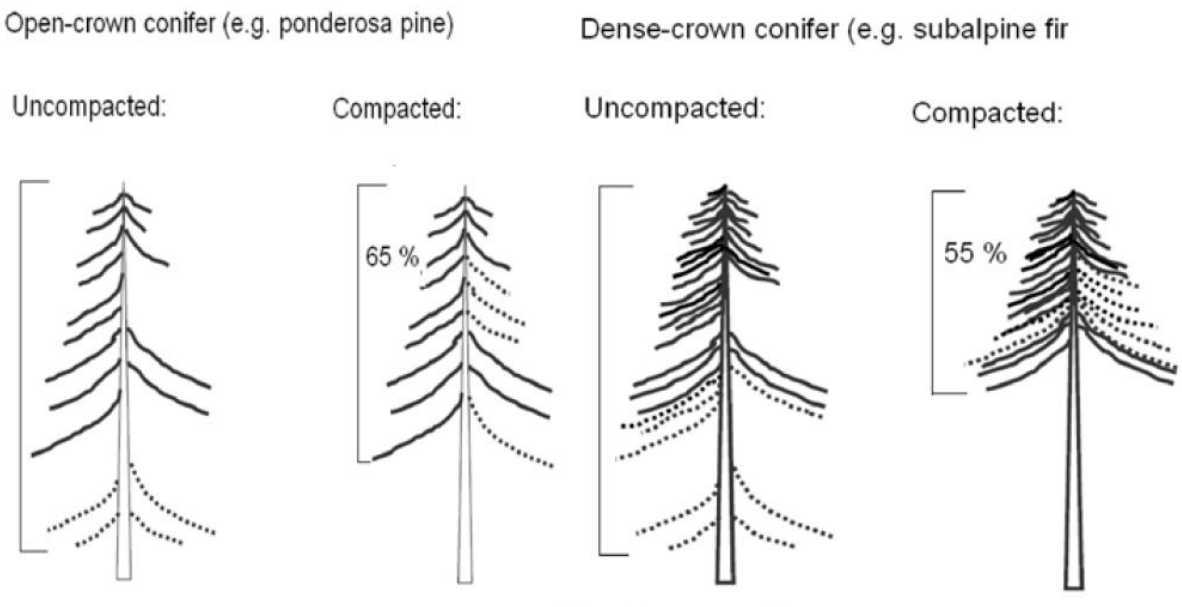



**Figure 8.45:** *Examples of COMPACTED CROWN RATIO*

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.
12. **Is this marked as a witness tree?** Yes or No. (Question shown for trees greater than 5.0-inch DBH)

As you complete the measurements for each tree, click the + button and you can enter data for the next tree as you move around the plot. This is repeated for each of the concentric plots. When you have completed the tree inventory, you can cross reference the tally on the form with the number of qualifying trees in the plot.

## 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. Refer to reference materials for pictures of oak crown shape and morphology ("Oak Structure and Morphology Graphic").

a. **Distance between ground and lowest point of the lowest attached live limb** (feet).
b. **Distance between ground and lowest point of the lowest attached dead limb** (feet).
    - **Oak crown shape** (choose one): Mushroom, Mushroom Composite, Columnar, Columnar Composite, Inverted Vase
c. **Oak morphology** (choose one)
    - 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
d. **Notes:** Include any notes or comments about trees here.