

# Pacific Northwest Permanent Sample Plot Program (PNW-PSP)

## Protocol for Tree Measurements and Mortality Assessments

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### BASIC SUPPLY LIST FOR MEASURING PERMANENT PLOTS

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|--|--|
| ___ gate keys (HJA, private, etc) + permits    | ___ cruiser's vest                               |
| ___ GPS unit + spare AA batteries              | ___ metric DBH tapes (10 m, cloth)               |
| ___ Plot/stand location map                    | ___ 15-cm d-tape strips for small trees          |
| ___ Stem maps                                  | ___ calipers for biomass measurements            |
| ___ Field protocols on Rite-in-Rain paper      | ___ compasses                                    |
| o Main protocol (this document)                | ___ laser + spare batteries (AA)                 |
| o Protocol decision tree                       | ___ hammers                                      |
| o Mortality guides                             | ___ aluminum nails (2.75" x 0.145")              |
| ___ Nomad recorders with case + spare battery  | ___ nail pouches (to protect field vest pockets) |
| ___ Data forms: Rite-in-Rain and regular paper | ___ pliers / nail pullers                        |
| o Cover sheet w/ directions                    | ___ hatchet                                      |
| o Tree remeasurement                           | ___ Tree tags (ingrowth, replacement, temp)      |
| o Ingrowth                                     | ___ flagging (blue, red)                         |
| o Tree mortality                               | ___ FS field radio                               |
| ___ clipboards                                 | ___ 2 walkie-talkies                             |
| ___ field notebooks                            | ___ First-aid kits and Epi-pens                  |
| ___ mechanical pencils (0.9 mm lead)           | ___ spare keys for vehicle                       |
| ___ extra pencil erasers + lead                | ___ rain gear, lunch, water                      |
|  | ___ camera                                       |

## COMPLETE LIST OF EQUIPMENT AND SUPPLIES FOR FIELD SEASON

- Gate keys (HJA, private, etc.)
- Spare keys for vehicle
- House/apartment key
- Permits (Ntl Parks, Exp. Forests, private)
- Nomad handheld recorders + styluses
- Nomad spare batteries
- Laptop computer
- GPS unit + spare AA batteries
- Camera + charger
- FS field radio
- 2 walkie-talkies + chargers
- Laser(s) + spare batteries (AA)
- Maps on Rite-in-Rain
  - quad map with stand location
  - plot map with bearing of x-axis
  - stem maps (a copy for each crew)
- Forest maps (HJA, WNF, GPNF, MRNP, ONP, ONF)
- Gazetteers for Oregon + Washington
- Imagery
  - aerial photos (DOQs)
  - LiDAR images of ref stand locations (HJA)
- Clear plastic map cases
- Field protocols on Rite-in-Rain paper
  - Main protocol (this document)
  - Protocol decision tree
  - Pathogen ID
- Instructions for:
  - Handheld recorders and software
  - GPS
  - Lasers
- Species list and codes on Rite-in-Rain
- Hand lenses
- Tree ID booklet
- Data sheets on Rite-in-Rain and regular paper
  - Cover sheet w/ directions
  - Tree remeasurement
  - Ingrowth
  - Tree mortality
- Clipboards + extra to keep forms dry
- Field notebooks
- Mechanical pencils + 0.9 mm lead
- Extra pencil erasers + lead
- Metric DBH tapes (10 m, cloth)
- 15-cm d-tape strips for small trees
- Calipers for biomass measurements
- Compasses set to correct declination
- Hammers
- Hammer holsters
- Aluminum nails (2.75" x 0.145")
- Nail pouches (to protect field vest pockets)
- Pliers / nail pullers
- Hatchet(s)
- Tree tags
  - ingrowth tags with numbering sequence that is specific to each stand
  - replacement (NNT) tags specific to each stand
  - write-on temporary tags
  - tag clips (shower curtain rings)
- Sharpees
- Flagging (blue, red)
- Biodegradable flagging (Ntl Parks only)
- Pin flags (for fixed-radius plots)
- Cruiser's vests
- First-aid kits and Epi-pens
- Crate and bins for gear
- Shovel
- Hand saws
- Large axe
- 5-gallon jug of water
- Boots + rain gear
- Food + water
- Camping gear

## GENERAL INFORMATION

### Design of permanent plots

- Reference stands: contiguous area, usually square, subdivided into subplots
- Watersheds and some other plot installations are sampled with a network of fixed-radius (circular) plots arranged on transects.
- A subset of high-elevation sites at HJA are sampled with fixed-radius plots arranged FIA-style.

### Types of data collected in permanent sample plots:

- Tagged trees: diameter, status, vigor, condition of main stem, rooting condition, % crown, % tree, lean.
- Ingrowth: tag, measure and map trees that now exceed the minimum dbh for the plot. Some reference stands have “detail plots” in which the minimum dbh differs from plot to plot (nested design).
- Mortality: assess condition of trees that have died since previous census and assign a cause if known.  
\*RS34 (Mack Cr) and RS38 (Lookout Cr) have annual mortality assessments (“mort checks”).
- Understory vegetation: cover and biomass are measured in some studies (described in separate protocols).

### Evening before measurement

- Assemble data sheets and tree tags for the plot(s) you’ll be measuring.
- Clean and repair essential equipment. Clean pitchy d-tapes. Replace d-tapes if not readable.
- If equipment is wet, bring it inside to dry out.
- Make sure plot data are in handheld recorder.
- Charge handheld recorders, FS radio and walkie-talkies (generally every night if possible).
- Make sure GPS coordinates of plot (and parking spot in some cases), are loaded in GPS. If not, enter them.
- Have a back-up plan (another plot) in case plot is inaccessible (road washout, road closure, fire, etc.).

### Flagging (specific colors are an attempt for consistency across plots and years)

- Blue + red: for parking spots, outer plot corners of reference stands (usually marked by PVC or metal posts), and plot centers of circular plots (usually marked by PVC posts or rebar).
- Blue alone: for flagging the route to the plot and along transect lines. Refresh any old flagging you find.
- Red alone: for plot boundaries and internal plot corners (*in densely stocked stands it really pays to take time to flag the outside boundaries before you begin measuring*).
- Use pin flags to temporarily mark boundaries of circular plots where vegetation is dense or ingrowth is common.
- In national parks, use only biodegradable flagging, and use it sparingly. In wilderness areas remove all flagging marking routes to a plot.

**Recording data on paper forms:** Please print neatly, always fill in the header information including personnel (first initial and last name), and check for completeness of the data before leaving the plot.

## LOCATING PLOTS

Before heading into the field, make sure you have (a) a topographic map with the plot location, (b) your compass set with the correct magnetic declination (15° E in 2019), (c) a handheld GPS with the plot coordinates pre-entered, (d) the **Field Work Documentation** sheet, and (e) the paper copies of the data sheets (as a backup in case the electronic recorder fails). The documentation sheet provides driving and hiking directions, GPS coordinates and lat-longs for the plot. Once you arrive at the parking spot, look for old flagging at the parking spot and along the route. However, don’t follow the flagging blindly; read the directions, set your compass azimuth, and then set off. Note that the shortest distance isn’t always the easiest. If directions are ambiguous, misleading, or have changed (e.g., road closures or washouts), record new detailed directions with mileage to intersections, new GPS coordinates, azimuth of route, etc. Flag the route to the plot so you can find your way out and the next crew can find their way in.

## MEASUREMENT STRATEGIES

1. Check the **Field Work Documentation** sheet for the minimum dbh and which plots, if any, are “detail plots.”
2. Use the data sheets and stem map (when available) to determine which tagged trees were alive at the last observation. Cross out measured trees on data sheets and/or stem maps.
3. Stick together: Measurers should work in close proximity to one another, for several reasons: (a) easier to keep track of which trees have been measured; (b) some trees require two people to position the d-tape; (c) it helps having someone nearby to check alignment of your tape; (d) it makes it easier for the recorder to hear everyone and see all the trees being measured.
4. Be systematic: Use a logical, efficient route to go from tree to tree, such as along topographic contours. Locate and measure all trees in a subplot (plot within stand) before moving to another plot. Sometimes you may want to measure trees in neighboring plots if steep ground or other obstacles such as large downed logs make it easiest to access them from the current plot.
5. The recorder should actively participate in the measurement process by directing traffic, looking at the crowns of trees being measured to check for lean angle, crown and stem condition, defects (broken tops, crooks, conks, etc.), witches brooms (hemlock, fir) and for guiding measurers with the position of their d-tapes.
6. Both recorder and measurers should keep an eye out for missed trees as you work through tag sequences. Missed trees that you have to go back and find take up a large amount of time! Sometimes trees are mismapped, but often they are lying on the ground, under another tree or log, and you have to dig around to find the tag.
7. First thing to do when you come to a tree is... look up (!) and determine if tree is still alive or now dead. Trees with any living foliage or live branches above the nail are considered alive. For stands with dense canopies it may be necessary to move around to get a better view of the tree's crown.
  - If tagged tree is alive, follow instructions below for live tagged trees.
  - If tagged tree has died since previous measurement, follow instructions for mortality.
  - If a previously “dead tree” is determined to be alive, (e.g., bad call at previous measurement, or tree has sprouted *above* tag height), then record all info for a live tree and write “alive!” in the Comments.
8. Confirm that trees recorded dead at the previous measurement are still dead.
9. Ingrowth: tagging and measuring ingrowth can be time-consuming. If a plot has a lot of ingrowth trees (>25), it can be more efficient to flag them as you measure the tagged trees, then afterward go back and measure all the ingrowth. If there aren't many ingrowth, it is usually most efficient to tag and measure as you measure the previously tagged trees so you only have to make one pass through the plot. See instructions below for ingrowth.
10. After finishing all measurements in a plot, check the data sheets or handheld recorder for completeness.

## TAG AND NAIL MAINTENANCE

Trees can grow over their tags if there is not enough space between the bark and nail head. Make sure there is at least 1” of exposed nail. To back the nail out, first tap the nail head to loosen the pitch, then pull the nail out a short ways with a claw hammer. Use a stick or piece of wood behind the hammer for leverage and to protect the tree's cambium if it's a thin-barked tree such as a true fir, hemlock, yew, red alder or any small tree.

The only exception to the 1-inch-space rule would be in old trees with very thick bark where the nail cannot be secured until it is pounded in deeper.

If the nail is difficult to extract, save time by clipping the nail head off with a pliers. Leave the nail in the tree, and reattach the tag **at the exact same height** with a new nail placed to the side of the old nail.

If a tag is missing or unreadable but the nail is still present, or if the tag and nail are being swallowed by the tree, attach a temporary write-on tag *at the same height* as the original nail.

Before attaching the temporary tag, inscribe the original tag number on it with a pencil.

To note that a temporary tag has been used, simply record “**NNT**” in the comments (“needs new tag”). This will alert the crew for the next measurement to bring a new permanent tag for that tree.

If the tag and nail are missing and you are certain which tag number it should be (from map location and past data), attach a temporary tag **at a height that is consistent with the previous dbh measurement and the growth of similarly sized trees of that species in the plot.** This tag height may or may not be 1.37 meters from the ground. Note in the Comments how you determined where to nail the tag (see comment abbreviations in Table 1).

Replace any temporary or damaged tags from the last census with the permanent replacement tags that have been supplied for that purpose (look for “NNT” in the previous Comments).

If a tagged tree is dead, pound the nail all the way in to secure the tag against the tree.

## FIELD WORK DOCUMENTATION SHEET

- Always complete the Field Work Documentation Sheet.
- Update and clarify the driving and hiking directions to the plot, as needed.
- Indicate and describe recent natural or human-caused disturbance (e.g., road construction, logging, vandalism, catastrophic windthrow, landslide, fire, etc.). If no such disturbances are apparent, write “None.”
- Note if corner posts are missing, and how many so the next crew can bring replacements.
- Note how long and how many people it took to complete measurements in the stand. This will help in planning future measurements.
- Estimate the number of ingrowth you’d expect in five years so the next crew will know how many ingrowth tags to bring.
- Offer any bits of advice for future crews (e.g., “plan for a very long day” or “access southern end of plot from road 1506,” etc.)

## MEASUREMENTS FOR TAGGED TREES

### Tree Status (ST)

- 1 Alive
- 2 Ingrowth (*not covered here – see page 6*)
- 3 Tree is fused with another tree and they must be measured as one. Record the joint dbh for both.
- 6 Dead: record mortality data (see Mortality section below)
- 9 Not found / missing: If, after repeated searching, you are unable to find a tagged tree, record status code = 9 and “NFAS” in the comments (NFAS stands for “not found after search”).

### Tree diameter (DBH)

Measure diameter of tagged trees (if alive) **just above the nail** for consistency with prior measurements. Call out your measurement to the recorder and wait until they repeat it back before removing your d-tape. Recorder will check current measurement against previous measurement. If the diameter is smaller than the previous, or the change in diameter is unusually large compared to similar trees, the recorder will ask the measurer to double-check dbh. If the second measurement confirms the first, enter “DDC” (“diameter double checked”) in the comments.

### Tips on measuring tree diameter

- D-tape must be perpendicular to main axis of tree bole, even when tree is leaning (see Figure 1, page 11).
- D-tape must be flat against the bark with no twists and no branches pinned under it.
- When you wrap the d-tape around a tree, make sure the tape is right-side up (not upside down).
- After wrapping d-tape around tree, cinch it back and forth to secure it tightly (i.e., no slack).
- If tree has a lot of moss, just pull the tape tight to compress the moss – don’t remove the moss.
- For large trees on sloping ground, straightening the tape is a two- or even three-person job, involving long sticks to push the tape up the bole to get it to the correct height.
- For trees that are difficult to measure, keep the d-tape at the correct height and then pound in one or two “guide nails” just below the d-tape to ensure future consistency in measurement location. Comment=“GNA”

- If an obstruction (log or other tree) prevents you from measuring diameter at the nail, measure as close as possible to nail height and note the distance (cm) of the measurement above or below the nail in Comments.
- If two or more trees have grown together at the point of measurement (fused), you have two options: (1) Set two nails at the height of the original nail at the halfway points of each tree's circumference on opposite sides of the bole, measure the "half-diameter" and multiply it by 2, then record the result along with Tree\_status = 1; also note in Comments: "tree fused, dbh est with 2-nail method" (see Figure 1f). (2) Wrap the d-tape around both stems and record the joint dbh for both trees along with Tree\_status = 3.
- If a measurement is not possible due to some hazard (e.g., yellow jackets), make a note in the Comments and leave the dbh field blank. Other fields can be assessed from a distance.

### Overall Vigor (OV)

- 1 Good vigor: no apparent signs of distress
- 2 Fair vigor: some signs of distress apparent (e.g., discolored foliage; sparse crown; broken stem with few healthy branches)
- 3 Poor vigor: extreme distress apparent (i.e., death likely within two or three years)

### Main Stem Condition (MS)

- 1 Main stem intact (not broken)
- 2 Main stem broken above ground level but tree still has live branches *above the nail*
- 3 – *Does not apply to live trees, only to dead trees* –

### Rooting Condition (RT)

- 1 Fully rooted: root-soil interface intact, stem is freestanding
- 2 Partially uprooted (some roots exposed due to disturbance), but stem is still freestanding and self-supporting (do not confuse with healthy, upright, stilt-rooted trees)
- 3 Uprooted and down but still alive (some roots may still be in ground)

**Lean Angle (LA)** If tree is freestanding (MS = 1 or 2) and leaning, estimate and record the angle of lean in **degrees** (not percent) from vertical, where vertical = 0 degrees (Figure 1). Record 0 if tree is not leaning.

**Percent Crown (%C)** Estimate the percent of a tree's live crown *volume* that is **still intact**. *This is not the same as crown ratio!* Maximum is 100%. Do not enter values of less than 100% for sparse crowns. Ignore dead branches at the bottom of the crown (i.e., those shaded out). What we're looking for here is characterizing crown loss due to recent damage (hit by another tree) or a broken main stem. *%C must always be < %T unless both are 100%.*

**Percent Tree (%T)** Estimate the percent of the entire main stem length that is intact. Maximum is 100%. If Main Stem Condition = 1, %T must = 100%. NOTE: %Crown + %Tree may be greater than, less than, or equal to 100%. **%T is always > %C unless both are 100%.** If a tree had a broken stem many years ago and a new leader has asserted apical dominance (reiterated), MS = 1 and PT = 100% (in this case, add comment: "reiterated leader").

**Comments** Record any pertinent comments about the condition or characteristics of the tree or to explain oddities about the measurement, prefaced with the current year. Use abbreviations for commonly used comments (*see table at end of document*). Note the presence of witches' brooms on western hemlock.

**Stem mapping:** If a tagged tree is mismapped, record its correct location by measuring the distance (to nearest 0.1 m) and compass azimuth (0-360 deg) from a tagged, healthy, mapped tree to the mismapped tree. Use this format for your comment: "from tag#, x.x m, xxx deg" (e.g., from 5899, 2.4 m at 127 deg)

**GS** (Gold-Star trees): On paper data forms, the box labeled "GS" is for trees that have MS=1, RT=1, LA=0, %C=100 and %T=100. Simply check the box instead of entering the gold-star values. A "silver star" tree is the same except lean angle (LA) = 5 degrees, and a "bronze star" tree is the same except for LA = 10 degrees.

## INGROWTH

In some reference stands, the minimum dbh for ingrowth may vary from subplot to subplot. In these cases, the subplots where smaller trees are tagged and measured are called “**Detail Plots**.” Check the Field Work Documentation form (“cover sheet”) to see if stand has “detail plots” and which plots (subplots) they are. Detail Plots are for trees 5.0 cm and larger; non-detail plots are for trees 15.0 cm dbh and larger.

### Ingrowth guidelines

- If there is no ingrowth in a plot or an entire stand, fill out the header of an ingrowth form and write in large letters “No Ingrowth.”
- Make sure the potential ingrowth tree is rooted within the plot boundary. If a tree straddles the boundary, it is considered “in” if half or more of the stem where it meets the ground is within the plot.
- Tagging and measuring ingrowth can be time consuming, particularly in stands where canopy gaps have formed and many small trees have established. In stands like these, it may be more efficient to flag the likely ingrowth as you measure the previously tagged trees, then go back through and tag and measure all the ingrowth (making sure they meet the dbh minimum). Afterwards, remove the flagging.

### Ingrowth tags

- Ingrowth tags are pre-selected for particular plots so there isn’t duplication of tag numbers being used. In the tag box, the tag series is labeled for each plot. If the label is missing, check the field season schedule document which shows the tag numbering series to use for ingrowth. You should be able to make a match.
- Try to maintain a sequential ordering of tag numbers for ingrowth trees located near each other.
- If ingrowth tags are lost while you’re in the field, look through the data sheets to see what tag numbers are currently being used and identify a number series not in use. Then use temporary tags to number each ingrowth tree, being careful not to duplicate any numbers.
- In watersheds or other areas with plots on transects, ingrowth tags should not have the same number series within an individual plot, but may repeat from plot to plot.

### Ingrowth tag placement

- Nail tags to ingrowth trees at 1.37 meters above the ground (breast height), measured on the *uphill side* of the tree, unless the specific protocol for a stand or watershed notes otherwise.
- In reference stands, tags should face a single direction – try to maintain this consistency. In circular plots, tags should face the center of the plot even though the height of the nail (1.37 m) is from the uphill side.
- Pound the nail in far enough to hold the tag firmly while leaving 1-2 inches of the nail shaft exposed to allow for growth. Be careful not to split the stem of a small tree by driving the nail in too deep.
- It’s better to nail an ingrowth tag where the stem is free of branches or burls rather than at exactly 1.37 m from the ground. It will make for more consistent measurements over the long term.
- If tree has multiple stems that fork *below 1.37 m*, tag and measure them as *separate trees*. If the stems are forked above 1.37 m, it is just a single tree (see Figure 1).

**Plot/Subplot:** Record the plot or subplot in which the ingrowth tree is rooted.

**Dbh:** measure dbh *after* nailing the tag so measurement is at the correct height

### **Canopy class (CC)**

- D** Dominant: Crown emerges from the general canopy layer and receives light from the top and the sides.
- C** Co-dominant: Crown extends to the top of the general canopy layer and receives light from the top but not much from the sides.
- I** Intermediate: Crown extends into the lower portion of the general canopy layer and receives mostly filtered light from the top and the sides.
- S** Suppressed: Crown completely beneath the general canopy layer (refers to the trees shading the tree being measured. Thus, a small tree in the middle of a large gap (with no canopy overhead) could be a C or D).

**Overall vigor (OV)**

- 1 Good vigor: no apparent signs of distress
- 2 Fair vigor: some signs of distress apparent (e.g., discolored foliage, sparse crown, broken stem with few healthy branches)
- 3 Poor vigor: extreme distress apparent (i.e., death likely within two or three years)

**GS** (Gold-Star ingrowth): On paper data forms, the column labeled “GS” is for trees that have MS=1, RT=1, LA=0, %C=100 and %T=100. Simply check the box instead of entering the gold-star values. A “silver star” tree is the same except lean angle (LA) = 5 degrees, and a “bronze star” tree is the same except for LA = 10 degrees.

**Crown ratio (CR):** *Not the same as percent crown (%C)!* Crown ratio is the percent of a tree's total height occupied by live branches around 1/3 or more of the bole's circumference. Do not include isolated branches separated from the main crown. Estimate to the nearest 5 percent. Note presence of epicormic branches in the Comments.

**Tree\_status (ST):** *Almost always = 2 for ingrowth.* The exception is for trees that are already tagged but not in the database or not on the data sheets. Record all info for this tree *as if it was ingrowth*, except Tree\_status should = 1. Also add this Comment: “*already tagged, add to db.*”

**Main Stem Condition (MS)**

- 1 Main stem intact (not broken)
- 2 Main stem broken above ground level but tree still has live branches *above the nail*.
- 3 – *Does not apply to live trees, only dead trees* –

**Rooting Condition (RT)**

- 1 Fully rooted: root-soil interface intact, stem is freestanding
- 2 Partially uprooted (some roots exposed due to disturbance), but stem is still freestanding and self-supporting (do not confuse with healthy, upright, stilt-rooted trees)
- 3 Uprooted and down but still alive (some roots may still be in ground)

**Lean Angle (LA):** If tree is freestanding (MS = 1 or 2) and leaning, estimate the angle of lean *in degrees* (not percent) from vertical (see Figure 1). Record 0 if tree is not leaning.

**Percent Crown (%C):** Estimate % of a tree's live crown *volume* that is **still intact**. *This is not the same as crown ratio!* Maximum is 100%. Do not enter values of less than 100% for sparse crowns. Ignore dead branches shaded out at the bottom of the crown. *%C must always be less than %T unless both are 100%.*

**Percent Tree (%T):** Estimate % of the entire main stem length that is standing unbroken. Maximum is 100%. If MS = 1, %T must = 100% (but %C can be less if there's been branch loss). Note: %Crown + %Tree may be greater than, less than, or equal to 100%. *%T is always greater than %C unless both are 100%.*

**Mapping (tree location):** In plots with stem maps, record mapping data for any tagged tree not on the stem map (note: occasionally some trees are mapped on top of others, in which case the tag number may not be visible on the map). Record the *horizontal distance* (nearest 0.1 m) and azimuth (degrees) **from** the *outer edge* of a healthy, tagged, mapped tree **to** the *outer edge* of the unmapped tree (i.e., shortest distance between trees; each tree's dbh is taken into account in the calculation of x-y coordinates). If a live tagged tree is not within ~10 m, use a sound, standing, tagged and mapped snag as the reference. As a last resort, use a plot corner. In circular (fixed-radius) plots, map trees from plot center, not from a reference tree. If measuring the distance with a tape, hold it horizontal to correct for slope. If using a laser, select HD (horizontal distance). If recording map info in the Comments, record as in this example: “*from XXXX, 2.4 m at 127 deg*” where XXXX is the tag number of the reference tree, or “PC” (for plot center).

**Comments:** Record any apparent characteristics or defects of the tree, including presence of witches brooms.



## TREE MORTALITY

**Definition of “dead”:** A stem is dead if there is no living foliage or live branches *above tag height*. If the “dead” tree is sprouting below the tag, the sprouts are considered *separate stems* and will be tagged as ingrowth when they surpass minimum dbh. If the tree is *sprouting above tag height*, it is still considered alive.

For trees that have died since the previous measurement

- Tree\_status (ST) = “6”
- No need to measure dbh since trees often shrink after they die (we assign the previous dbh to dead trees)
- Pound the nail flush with stem.

If there is no mortality in a plot or stand, fill out the header of a mortality data sheet and write in large letters “No mort.”

### Header info

- **StudyID** (four-letter code): HJRS = HJA reference stand, HJWS = HJA watershed, MRRS = Mt. Rainier, CHEF = Cascade Head, DFGY = Douglas-fir Growth + Yield, PPGY = Ponderosa Pine Growth + Yield, etc.
- **StandID** from Field Work Documentation sheet

### Mortality data

#### Plot and Tag number of the dead tree

#### Main Stem Condition (MS)

- 1 Main stem intact (not broken)
- 2 Main stem broken at or above the ground (i.e., root collar)
- 3 Main stem broken below root collar (can happen due to some root rots; *this is different than uprooting*)

#### Rooting Condition (RT)

- 1 Fully rooted: root-soil interface intact, stem is freestanding
- 2 Partially uprooted (some roots exposed), but stem is still freestanding and self-supporting
- 3 Uprooted and down, stem is not freestanding (*this includes uprooted trees that are supported by other trees or logs*)

**Standing portion:** entry indicates the dead tree has some portion of the main stem above ground (MS = 1 or 2) and is still rooted (RT = 1 or 2). See Figure 2 for examples.

- **Lean angle:** If dead tree is freestanding, self-supporting, and leaning, estimate the angle of lean in *degrees from vertical*, where vertical = 0 degrees. Record 0 if tree is not leaning. If MS = 3 or RT = 3, skip lean angle (i.e., leave it blank).
- **% Crown:** Estimate the percent of the tree’s crown that is intact along the stem. Maximum is 100%. Do not compensate for sparse crowns.
- **% Tree:** Estimate percent of the entire main stem length that is intact. Maximum in this category is 100%.  
NOTE: % Crown + % Tree may be greater than, less than or equal to 100%. *%Tree must always be ≥ %Crown.*

**Down portion:** Entry indicates that all or part of the dead tree is down. Leave these fields blank if Main Stem = 1 (i.e., %Tree = 100%). Broken tops hung up in the canopy are considered *down and fully supported*. The down portion is considered separately from the standing portion, therefore *% on Ground + % Supported must = 100%*.

- **% on Ground:** Estimate the % of the down portion of the tree bole that is in direct contact with the ground. Do not include branch contact with ground.
- **% Supported:** Estimate the % of the down portion of the tree bole that is supported above the ground by its own branches, other trees, downed logs, or other objects such as rocks.
- If MS=1 and RT=1 or 2, there should be no entry for down portion.
- If the down portion cannot be found, record “-1” for both % on ground and % supported, and enter Tree Condition Code = 22 (“*top not found*”)

**Tree Condition Codes**

- Evaluate the tree closely to look for clues to its demise (conks, bore holes, beetle galleries, scarring, etc.) and record the applicable condition codes (see table of codes on page 12).
- If you suspect pathogens or bark beetles, use a hatchet to cut away a “window” of bark at the tree base and at breast height to look for evidence (mycelia, hyphae, beetle galleries, etc.).
- Enter multiple conditions codes, as appropriate.

**Mortality Cause:** See table of mortality cause codes on page 12.

- Proximate: The cause that immediately precipitated tree death (i.e., the last straw).
- Predisposing: Anything that produced a susceptibility or disposition to mortality without actually causing it.
- Check the Comments from the past measurement for clues (e.g., broken top, conks, witch’s broom).
- Example: Dead tree with visible symptoms of rot was windthrown. In this case the proximate (immediate) cause is windthrow and the contributing cause is the pathogen which weakened the wood or roots.
- If conks or rot are evident, is it from a fungus that infects living tissue (e.g., *Phellinus sulphurascens*, *Phaeolus schweinitzii*, *Armillaria ostoyae*) or one that only infects dead tissue (e.g., *Ganoderma*)? Try to differentiate.
- Do condition codes support your conclusion for mortality cause?
- If cause is not obvious or apparent, record unknown (“60”) for proximate cause. It’s better to record 60 than take a wild guess.

**Comments:** Add comments to clarify observations and decisions (e.g., note the name of the pathogen if known).

## POST-MEASUREMENT REVIEW OF DATA AND DATA BACKUP

- Before leaving plot or subplot, review all data sheets (trees, ingrowth, mortality) for completeness. If using an electronic recorder, check the list of missing trees.
- Locate and measure any trees missed. Try to find *all* previously measured trees. If not found, enter “9” for Tree\_status (ST) and “NFAS” (*not found after search*) in Comments.
- Save the electronic file, close it (File → Close) and shutdown the recorder. At camp or the apartment, back up the electronic files onto the laptop and copy files to a jump drive (see separate instructions for handling electronic data). Keep laptop and jump drive in separate locations.
- If data were recorded on paper, put the forms in order, scan them and back up the scanned file (e.g., jump drive, dropbox/cloud, or email attachment to project manager), then file the data forms in the file box.

## TREE SPECIES FOUND IN PERMANENT PLOTS

ABAM	Abies amabilis	Pacific silver fir	PICO	Pinus contorta	Lodgepole pine
ABCO	Abies concolor	white fir	PIEN	Picea engelmannii	Engelmann spruce
ABGR	Abies grandis	grand fir	PILA	Pinus lambertiana	sugar pine
ABLA	Abies lasiocarpa	subalpine fir	PIMO3	Pinus monticola	w. white pine
ABMA	Abies magnifica	Shasta red fir	PIPO	Pinus ponderosa	ponderosa pine
ABPR	Abies procera	noble fir	PISI	Picea sitchensis	Sitka spruce
ACGL	Acer glabrum	Rocky Mtn maple	POBAT	Populus balsamifer v. trich.	black cottonwood
ACMA3	Acer macrophyllum	bigleaf maple	PREM	Prunus emarginata	bitter cherry
ALRU2	Alnus rubra	red alder	PRUNU	Prunus spp.	cherry
ALVIS	Alnus viridis ssp sinuata	Sitka alder	PSME	Pseudotsuga menziesii	Douglas-fir
ARME	Arbutus menziesii	Pacific madrone	QUGA4	Quercus garryana	OR white oak
CHCH7	Chrysolepis chrysophylla	golden chinkapin	QUKE	Quercus kelloggii	CA black oak
CADE27	Calocedrus decurrens	incense cedar	TABR2	Taxus brevifolia	Pacific yew
CANO9	Callitropsis nootkatensis	Alaska yellow cedar	THPL	Thuja plicata	w. redcedar
CONU4	Cornus nuttalli	Pacific dogwood	TSHE	Tsuga heterophylla	w. hemlock
FRPU7	Frangula purshiana	Cascara buckthorn	TSME	Tsuga mertensiana	mtn. hemlock

## COMMENT ABBREVIATIONS FOR LIVE TREES

Abbrev.	Meaning
BIScrp	Bole Scraped (by another tree, snag or limb)
BISnp	Bole Snapped (tree still alive)
BrknTp	Broken Top
BttSwll	Butt Swell
CHKSP	Check Species identification: if uncertain about species ID, add this code to alert the next field crew to check ID
Cnks	Conks present
Crk	Crook in stem
Crushed by snag	Crushed by dead tree
Crushed by tree	Crushed by another tree that was alive when it fell (e.g., windthrow)
DDC	Diameter Double Checked: use whenever a measured diameter is the same, smaller, or unusually larger than the previous measurement
DdTp	Dead top
DwrfMstl	Dwarf Mistletoe (mistletoe plants observed; contrast with WtchBrm)
EpBr	Epicormic Branches present
FltTp	Flat Top
FrkTp	Forked top
GNA	Guide Nails Added: to assist placement of d-tape on difficult-to-measure trees
JointDBH	Two (or more) trees measured as one because they are fused at tag ht (Status = 3)
Log against it	Log pressing against tree, causing it to lean or causing injury
LRR	Laminated Root Rot (evidence of <i>Phellinus weirii</i> )
MeasSwell	Diameter measured on a swelling (i.e., measurement includes swelling)
MOX	Measured on axis (i.e., perpendicular to lean angle).
NEWLOC	New Location: used to alert database manager to revised tree location; also record azimuth and distance from known tree or corner to tree in question.
NFAS	Not Found After Search: use when you cannot find a tagged tree (status = 9)
NNT	Needs New Tag: when tree tag is not found, attach a temporary tag at same height as original tag and nail (look for a nail hole if tag is missing), or at a height that is consistent with previous measurement and growth rate of similar-sized trees.
Pitching	Pitch sheets or copious amounts of pitch running down stem
PrevTagATD	Previously tagged, add to database (i.e., not in database and clearly not ingrowth)
PistlBtt	Pistol butt (pronounced tight curve in stem starting at base of tree)
ReitLdr	Reiterated leader (old broken top replaced by a side branch that has apical dominance)
StmSwp	Stem Sweep
Stilt-rooted	Tree rooted on log or stump that has decayed away
T_NBH	Tag or temp tag nailed at 1.37 m (breast height) above ground
TF_NEstHt	Tag found and nailed at height estimated from past dbh measurement
TF_NPrevHt	Tag found and nailed at same height as before
TgRepl	Tag Replaced: use when a temporary tag has been replaced with a permanent tag.
WtchBrm	Witch's Broom present: these are usually caused by dwarf mistletoe.
Void	No comment

## TREE MORTALITY CODES

### Main Stem Condition (MS)

- 1 Main stem intact (not broken)
- 2 Main stem broken above ground level
- 3 Main stem broken at or below ground

### Rooting Condition (RT)

- 1 Fully rooted and freestanding
- 2 Partially uprooted but freestanding
- 3 Uprooted and down

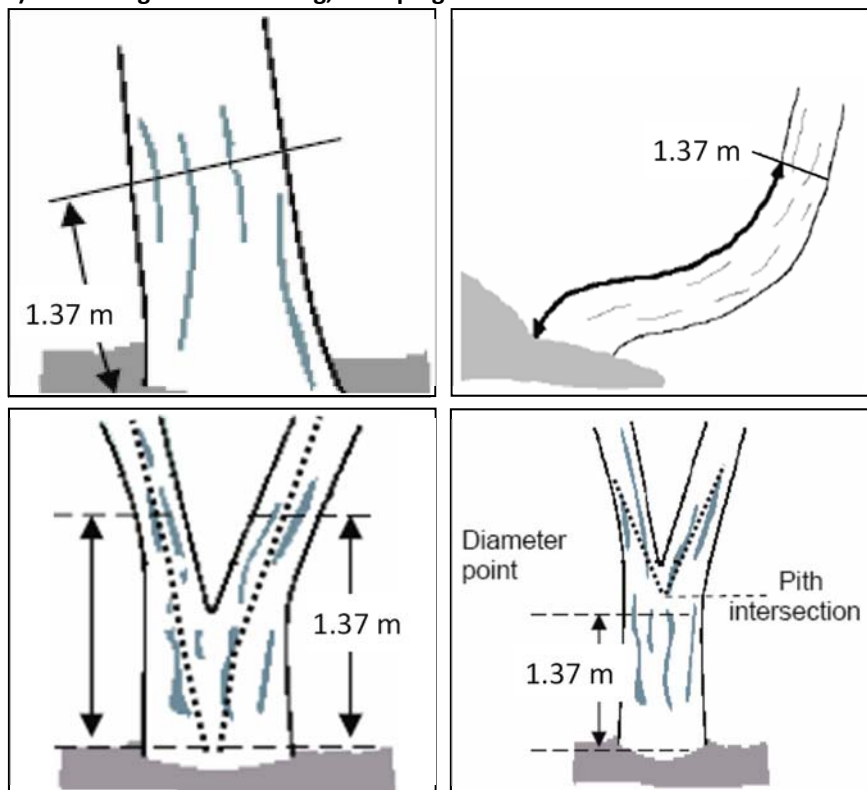
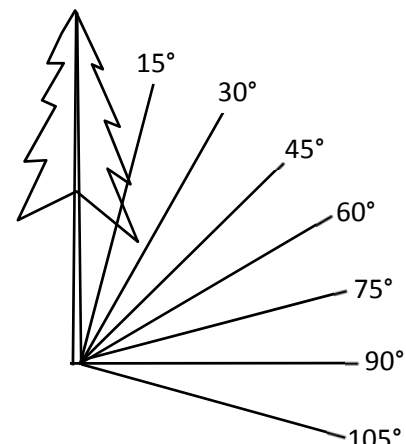
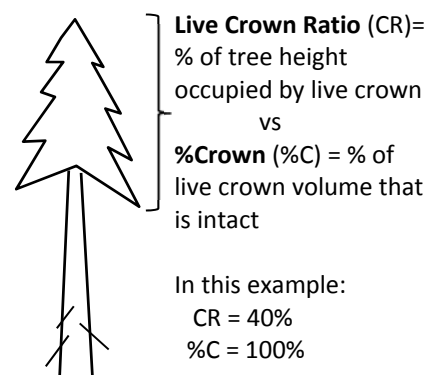
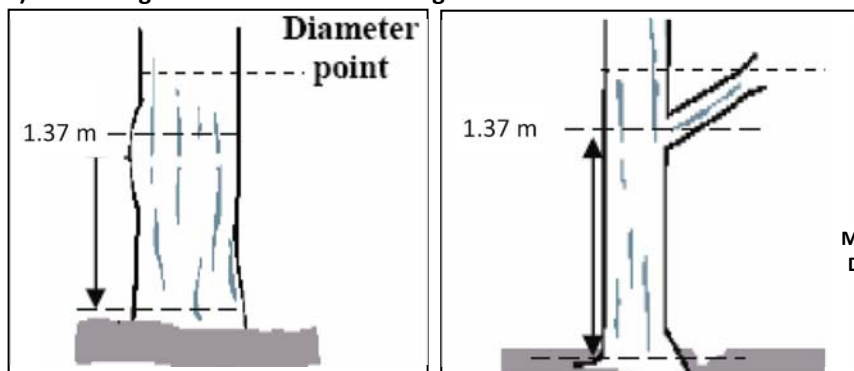
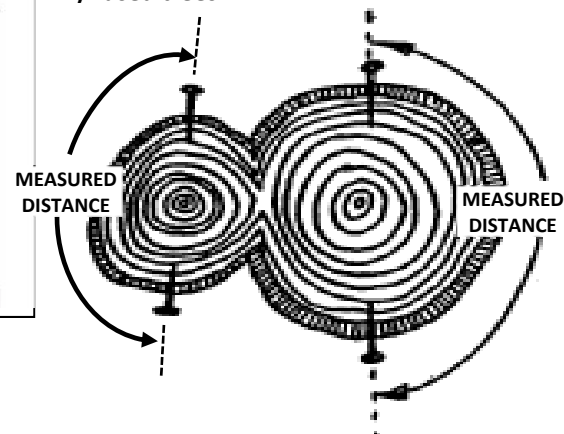
### Tree Condition Codes

- 1 Green needles or leaves present
- 2 Dead needles or leaves present
- 3 Bark sloughing
- 4 Tree dead several years (note reasoning and estimate years)
- 11 Crown is flat-topped
- 12 Evidence of earlier loss of part of crown
- 13 Spike top/top dieback
- 14 Crown/branches stripped by falling tree or snag
- 21 Rot at break
- 22 Top not found
- 41 Pitch tubes on bole
- 42 Beetle galleries
- 43 Insect frass
- 51 Conks (indicate type and position)
- 52 Rot (indicate type and position)
- 53 Tree is hollow
- 54 Pitch sheets
- 55 Oozing wounds
- 56 Mistletoe plants observed

- 60 Witch's brooms
- 71 Scarring of bole (note cause, location, extent)
- 72 Girdling (note cause)
- 73 Woodpecker/Sapsucker activity (note extent)

### Mortality Causes

- 1 Suppression
- 2 Previously noted injury/damage (note what)
- 10 Known pathogen (note which one)
- 11 Mistletoe
- 12 Bark insect (note which if known)
- 13 Defoliating insect (note which if known)
- 14 Unknown pathogen
- 20 Windthrow
- 21 Co-opted windthrow
- 22 Windsnap
- 23 Broken top (note cause if known)
- 24 Knocked over by fallen GREEN tree/limb
- 30 Knocked over by fallen DEAD tree/limb
- 31 Lightning
- 32 Animal kill (note animal if known)
- 33 Snow/ice breakage or crushing
- 34 Mechanical failure / stem collapse
- 40 Fire
- 50 Other (comment on nature of cause)
- 60 Unknown
- 70 Tree physically removed from plot (landslide, fell over cliff, logged, etc. Note: This code is not to be used for trees that are simply not found.

**Figure 1. Measurement situations** (graphics in 1a-c and 1f courtesy of FIA Program).**a) Measuring DBH on leaning, sweeping and forked trees.****d) Lean angle****e) Live Crown Ratio vs %Crown****b) Measuring DBH on tree with swellings or obstructions at 1.37 m.****f) Fused trees****c) Measuring or tagging downed trees and resprouting stems.**

The first one qualifies as ingrowth because a) it originates below b.h. of the main stem (if the main stem were vertical), and (b) its diameter at 1.37 m above the main bole exceeds the minimum dbh for the stand

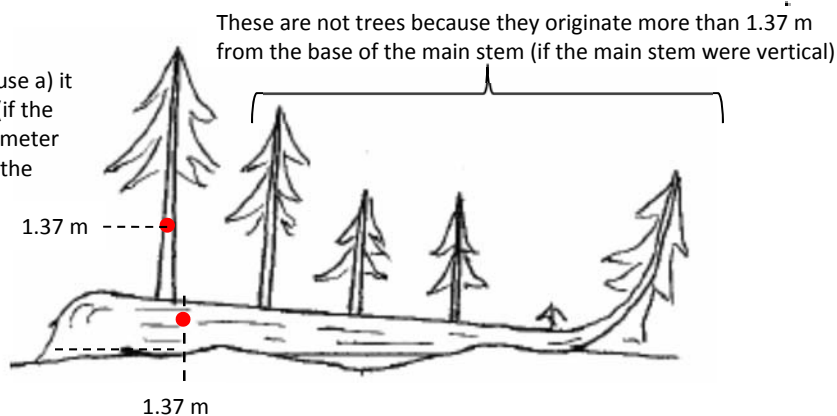













Figure 2. Tree mortality assessments.

<p>A) Main stem intact, crown intact, fully rooted</p>  <p>Main stem condition = 1 Rooting condition = 1 Lean angle = 5° <u>Standing</u> % crown = 100 % main stem = 100 <u>Down</u> % on ground = blank % supported = blank</p>	<p>B) Main stem intact with missing or broken branches</p>  <p>Main stem condition = 1 Rooting condition = 1 Lean angle = 10° <u>Standing</u> % crown = 100* % main stem = 100 <u>Down</u> % on ground = blank % supported = blank <i>*Rationale for 100%C: not known when branches lost.</i></p>	<p>C) Main stem broken, crown broken</p>  <p>Main stem condition = 2 Rooting condition = 1 Lean angle = 0° <u>Standing</u> % crown = 65% % main stem = 80% <u>Down</u> % on ground = 25% % supported = 75%</p>	<p>D) Main stem broken, crown broken and hung up in canopy</p>  <p>Main stem condition = 2 Rooting condition = 1 Lean angle = 0° <u>Standing</u> % crown = 40% % main stem = 65% <u>Down</u> % on ground = 0% % supported = 100%</p>	<p>E) Main stem broken, no crown remaining, some down material in contact with ground and some supported</p>  <p>Main stem condition = 2 Rooting condition = 1 Lean angle = 15° <u>Standing</u> % crown = 0% % main stem = 30% <u>Down</u> % on ground = 40% % supported = 60%</p>	<p>F) Main stem broken <u>above the root collar</u>, roots intact in the ground, and down piece supported by a log and its own branches</p>  <p>Main stem condition = 2 Rooting condition = 1 Lean angle = 0° <u>Standing</u> % crown = 0% % main stem = 2% <u>Down</u> % on ground = 0%* % supported = 100% <i>*Rationale: none of the <u>bole</u> is touching the ground</i></p>
<p>G) Main stem broken below the root collar and roots intact</p>  <p>Main stem condition = 3 Rooting condition = 1 Lean angle = blank <u>Standing</u> % crown = blank* % main stem = blank* <u>Down</u> % on ground = 25% % supported = 75% <i>*Rationale: tree is down, so there are no entries for lean or standing.</i></p>	<p>H) Tree is uprooted, main stem is intact</p>  <p>Main stem condition = 1 Rooting condition = 3 Lean angle = blank <u>Standing</u> % crown = blank % tree = blank <u>Down</u> % on ground = 5% % supported = 95%</p>	<p>I) Uprooted with main stem broken <u>above</u> the root collar</p>  <p>Main stem condition = 2 Rooting condition = 3 Lean angle = blank <u>Standing</u> % crown = blank % tree = blank <u>Down</u> % on ground = 20% % supported = 80%</p>	<p>J) Crushed by other tree or snow/ice, partially rooted and freestanding, with main stem broken</p>  <p>Main stem condition = 2 Rooting condition = 2 Lean angle = 55° <u>Standing</u> % crown = 50 % tree = 70 <u>Down</u> % on ground = 5 % supported = 95</p>	<p>K) Partially uprooted but freestanding and self-supporting</p>  <p>Main stem condition = 1 Rooting condition = 2 Lean angle = 40° <u>Standing</u> % crown = 100 % tree = 100 <u>Down</u> % on ground = blank % supported = blank</p>	

## CONFUSING SITUATIONS: WHAT TO DO

Tree Tags	What to do
Tree not tagged	<ol style="list-style-type: none"> <li>1. Check stem map and data sheet for trees not yet measured. If there is a match, attach a temporary (write-on) tag with the correct tag number and enter "NNT" ("needs new tag") in the comment field. Attach tag at a height that results in a dbh measurement consistent with the previous dbh measurement – <i>this may or may not be at 1.37 m!</i></li> <li>2. Is it a small tree and does dbh exceed the minimum dbh for the stand or plot? <ul style="list-style-type: none"> <li>- If yes, measure as ingrowth (use ingrowth sheet) and record its location (distance and azimuth from tagged tree or plot corner to tree in question). Tree status = 2.</li> </ul> </li> <li>3. Is the tree <u>much</u> larger than typical ingrowth and seems to be located within the stand or plot boundary? <ul style="list-style-type: none"> <li>- It's very unlikely that a large tree was overlooked previously. It's also possible the corner posts got moved to the wrong location in which case the stand boundaries should be resurveyed.</li> <li>- If you are absolutely sure the tree should be tagged and measured (i.e., well within the plot boundary), measure it and record its location (distance and azimuth from tagged tree or plot corner) on the ingrowth form and assign status = 1 (not 2).</li> </ul> </li> </ol>
Tagged tree found in field is not on the data sheet or the stem map.	<ol style="list-style-type: none"> <li>1. First make sure tree is not listed or mapped under a different plot number.</li> <li>2. If it is not, record dbh, overall vigor, and status=1.</li> <li>3. Add "ATD" (add to database) to comments.</li> <li>4. Record azimuth and distance from a previously mapped and tagged tree or plot center to tree in question, using this format: "from xxx, 3.1 m at 248 deg". NOTE: If stand does not have a stem map, record the tag number of a nearby large tree.</li> </ol>
Tagged tree is listed in the wrong plot on data sheet	<p>In Comments:</p> <ul style="list-style-type: none"> <li>- Offer evidence of misplacement and include the abbreviation "NEWLOC."</li> <li>- Note the correct plot number in the comments – do not change on data form or Nomad.</li> </ul>
Tagged tree is not on stem map	<ol style="list-style-type: none"> <li>1. In Comments, record azimuth and distance from a previously mapped and tagged tree or plot corner to the tree in question, using the format in this example: "from xxx, 3.1 m at 248 deg"</li> </ol>
Tree is mismapped (in a different location than what is shown on stem map)	<ol style="list-style-type: none"> <li>1. In Comments: <ul style="list-style-type: none"> <li>- Add "NEWLOC"</li> <li>- Record azimuth and distance from previously mapped and tagged tree or plot corner to the tree in question, using the format in this example: "from xxx, 3.1 m at 248 deg"</li> </ul> </li> </ol>
Tag number does not agree with what's on the data sheet or stem map.	<ol style="list-style-type: none"> <li>1. Double check tag number and tree location, species, size, canopy class and crown.</li> <li>2. If discrepancy is confirmed, note the correct tag number in comments.</li> </ol>
Two records on data sheet with the same tag number.	Are they the same tree or two different trees with the same tag number? If they are two different trees, note that there are duplicate tags in use in the plot or stand..
Tree cannot be measured at the tag due to branch or log.	<ol style="list-style-type: none"> <li>1. Do not move the tag.</li> <li>2. Measure the tree at an unobstructed point above or below the tag, and note in the comments the distance (cm) above or below.</li> </ol>
Tree with a newer tag seems to be a previously tagged tree based on location or info on data sheets.	<ol style="list-style-type: none"> <li>1. Check stem map, past and current dbh, and previous comments. Do they match closely or exactly? If yes, make note in comments. Correction will be made by database manager.</li> </ol>

Tree tags (continued)	What to do
Uncertain whether a previously tagged tree or potential ingrowth tree is within plot/stand boundaries.	<ol style="list-style-type: none"> <li>1. Reference stands: Re-flag stand boundary, using compass and corner posts as guides. Note that original stand surveys may not have been perfect.</li> <li>2. Circular plots: Use laser and pin flags to mark plot boundary (follow study-specific protocol on whether radius is slope distance or horizontal distance).</li> <li>3. Trees on boundary: Tree is "in" if <math>\frac{1}{2}</math> or more of base is in plot.</li> <li>4. For larger trees: <ul style="list-style-type: none"> <li>- If the tree is tagged and was measured before, measure it again, even if you think it might be outside the boundary.</li> <li>- If large tree is not tagged and wasn't measured before, ignore it.</li> <li>- If the tree is well within the boundaries and clearly has been overlooked in years past, tag it, measure it, and record azimuth and distance from center post or from a previously mapped and tagged tree.</li> </ul> </li> </ol>
Nail and tag maintenance	<ol style="list-style-type: none"> <li>1. Make sure there's at least 1-inch of space between the bark and end of nail so the tree doesn't swallow the tag as it grows.</li> <li>2. If you need to extract the nail, use a block of wood or a stick between the hammer and bark. Do not press the back of the hammer directly into the tree bark.</li> <li>3. If nail is almost overgrown or difficult to extract, clip the head, and reattach the tag with a new nail at the same height and in close proximity to the old one but not in the same hole.</li> <li>4. Whenever you pound in a new nail, angle it downward slightly so the tag slides away from the bark (makes it less likely that the tag will get swallowed).</li> </ol>
When to remove a tree tag.	<ol style="list-style-type: none"> <li>1. Never.</li> <li>2. Add comment why tree should not be tagged.</li> </ol>
Shrub is tagged.	<ol style="list-style-type: none"> <li>1. Consult list of tree and shrub species to make sure it's considered a shrub.</li> <li>2. If shrub species, remove tag and make note in comments to delete record from database.</li> </ol>
Situation: Mortality	What to do
Tree that was alive at the last measurement has no tag and is dead.	Make sure it's the tree you think it is based on species, size, crown info, and mapped location, then enter status = 6 and fill out a mortality record. No need to replace tag.
Tree is dead and has no tag.	Leave as is – do not tag.
Tag on a dead tree	Leave tag on tree and pound nail in to secure tag against bole.
Stem is dead but tree is sprouting below bh	Fill out mortality form for tagged stem. If sprout dbh $\geq$ minimum dbh, tag as ingrowth.
Situation: Live tree measurements	What to do
When to use guide nails (extra nails around the tree to facilitate dbh measurement)	<ol style="list-style-type: none"> <li>1. Large tree on steep slope.</li> <li>2. Large tree with butt swell.</li> <li>3. Bark of large tree is lumpy or variable and could lead to spurious measurement.</li> <li>4. Add "GNA" (guide nails added) to comments.</li> </ol>
Dbh is impossible to measure at the current location of the nail (e.g., branch in the way).	<ol style="list-style-type: none"> <li>1. Clip nail head and remove the tag, then pound in the tag with a new nail in a more accessible spot as close to the same height as the former nail.</li> <li>2. Measure distance from the old nail height to the new nail height and note in comments.</li> </ol>
Current dbh is smaller than the previous dbh.	<ol style="list-style-type: none"> <li>1. Double-check measurement and your placement of diameter tape.</li> <li>2. If dbh is still smaller, make note in comments: "DDC" (diameter double-checked).</li> </ol>
Species misidentified at previous measurement(s).	In comments, note correct species code. This will alert database managers to problem.



<b>Situation: Live tree measurements (cont.)</b>	<b>What to do</b>
Tree is leaning: how do you align dbh tape?	Measure diameter perpendicular to the axis of tree lean. Record "MOX" in comments which stands for "Measured on Axis"
Tagged tree is fused with another and cannot be measured independently at tag height.	<ol style="list-style-type: none"> <li>1. Measure both trees together at tag height and record the joint dbh for each tree, and assign a tree status = 3, and estimate individual dbh's of each tree using the FIA method, and record those measurements in the comments ("FIA dbh = xx.x cm").</li> <li>2. Alternatively, measure both trees individually at some height above their tags and note the distance (cm) of each measurement above or below the original tag.</li> </ol>
Tree recorded as being dead in the past is confirmed alive.	<ol style="list-style-type: none"> <li>1. Measure tree and add comment about tree being recorded as dead previously.</li> <li>2. If the nail has been pounded in, replace it with a fresh one. Replace tag if needed.</li> </ol>
Thick layer of moss or lichen on stem (typically found on hardwood trees).	<ol style="list-style-type: none"> <li>1. Do not scrape off the moss.</li> <li>2. When you measure dbh, simply compress the moss as much as possible with the tape.</li> </ol>
Previous measurement was at some specified height above the nail (noted in comments).	<ol style="list-style-type: none"> <li>1. If possible, measure diameter at the original tag.</li> <li>2. If measurement is still not possible at the tag, and the previous crew put a nail at the height they measured the tree or noted it in the comments, measure it there again and again note the height above or below the tag that you measured diameter.</li> </ol>
Yellow jacket nest, wasp nest, or copious amounts of poison oak near or in tree.	Record tree status and vigor, leave dbh blank, and note reason for not measuring dbh in the comments.
<b>Topic: Ingrowth</b>	<b>What to do</b>
Small tree (ingrowth size) has a nail but no tag.	<ol style="list-style-type: none"> <li>1. Make sure the tree is within the stand boundary.</li> <li>2. Does location and data match those of an unmeasured tree on the data sheet? <ul style="list-style-type: none"> <li>- If yes, attach a temporary tag matching the number that it should be and enter "NNT" ("needs new tag") in comments.</li> <li>- If not, attach a new ingrowth tag, record ingrowth data, and add a comment about tree with nail but no tag.</li> </ul> </li> </ol>
Potential ingrowth is a sweeper tree – should it be tagged and measured?	Consider the tree ingrowth if dbh exceeds the minimum dbh at 1.37 meters along the length of the stem starting from the base (i.e., not 1.37 m above ground). Attach flagging to the nail so the next crew can find the tag.
Ingrowth rooted on a log or mound – where to put tag?	Attach the tag at 1.37 m above the surface on which the tree is rooted.
Ingrowth is stilt-rooted and the "stem" at breast height is actually a root.	Attach the tag to the stem (not the root) at 1.37 m above the surface on which the tree was originally rooted but has since rotted away.
Tree is rooted at the top of a snag that is inaccessible, but a root growing down the snag exceeds minimum dbh.	Ignore the tree.
Tree has multiple basal sprouts that exceed minimum diameter for the stand.	Tag and measure each individual sprout that exceeds the minimum dbh at 1.37 m above ground or along the stem if leaning.
Tree is down but still alive and has sprouts growing vertically from the bole that exceed the minimum dbh.	<ol style="list-style-type: none"> <li>1. Measure or estimate dbh of the main bole as one record, AND</li> <li>2. Tag any sprouts that initiate within 1.37 m of the base of the main bole <u>and</u> exceed the minimum dbh at 1.37 m above the bole ("rooting point" of the sprout).</li> </ol>