

### LOCATING THE TREE PLOT

- Consult the "Plot Check-off List" — not all plots are present nor sampled on a particular transect line.
- Plots are spaced 30 m apart, but distances are slope corrected, thus walking distances between plots increase on steeper slopes.
- Locate the 250 m<sup>2</sup> (8.92 m radius) circular tree plot (Fig. 1). Blue flagging is used to delineate the plot boundary.
- Before beginning any work, consult the documentation in "*Watershed 1 and 3: Miscellaneous Plot Notes*" — it may contain notes on locations/conditions of vegetation quadrats and tree plots.
- Locate the plot center marked with a steel reinforcing bar (rebar). At the base of the rebar is an aluminum tag with transect and plot number (e.g., 1 / 4 = transect 1, plot 4). The tag may be buried by litter. If the tag is missing, please make a note at the top of the first "*Tagged Tree Remeasurement Form*". The rebar serves as one corner of a 2 x 2 m permanent vegetation quadrat (Quadrat 0; Fig. 1). Often, the second corner post that lies in the direction of the transect line is a tall (>2 m) metal "sighting" pole. Usually, but not always, the remaining corners of Quadrat 0 are red spray-painted PVC posts. However, other types of corner markers are possible: a white or orange PVC pipe, a nail on a log or a stump, spray painted orange and/or flagged in red, an orange spray-painted dot on a bedrock surface, boulder, or rock. Red flagging is also typically hung above Quadrat 0.

**Important:** Quadrat 0 is sampled for understory vegetation, thus it is important to avoid stepping on or otherwise damaging plants adjacent to or in the quadrat.

- As you enter a tree plot, you may encounter PVC posts marking four additional "satellite" quadrats (Fig. 1); these are typically white or spray-painted orange. These quadrats are no longer maintained, thus one or more corner posts may be down or missing.

**Important:** in several instances during establishment of "satellite" quadrats on Watershed 3, the circular tree plot was established so that Quadrat 0 was placed at a "satellite" position. Thus, the rebar (with tag) is not at the center of the tree plot. Here, use the appropriate corner of the **central-most vegetation quadrat** as the center of the tree plot. All instances of this non-conventional setup are noted in "*Watershed 1 and 3: Miscellaneous Plot Notes*".

### MARKING THE PLOT BOUNDARY

- Using a meter tape or precut rope, delineate the plot boundary (8.92 m radius) by flagging the perimeter in blue, particularly trees that fall near the perimeter. **The tape should be run straight and parallel to the ground surface (plots are not slope corrected).** Although some flagging will remain from past remeasurements, other pieces are likely to have disappeared. Along the plot perimeter use the following procedure to mark trees as "in" or "out": if a tree is rooted outside the plot, flag a branch of the tree on the side nearest the rebar (bole is out); if a tree is rooted inside the plot, flag a branch of the tree on the side away from the rebar (bole is in). Determination of "in" vs. "out" is based on the center of the bole where it meets the ground surface.

## REMEASURING TAGGED TREES

Use the data form “*TP73 Watershed 1 and 3 Tagged Tree Remeasurement.*” Complete all information in the header. Using the following procedures, systematically remeasure all tagged stems and tag and measure all non-tagged stems  $\geq 1.37$  m tall (as measured on the side slope). Stems are ordered sequentially by quarter number (see Fig. 1) and tag number.

**Important:** be sure to carefully read all pre-printed comments associated with a tree record. Comments may include instructions to resolve past discrepancies with tags or tree diameters.

### 1. For live trees tagged at breast height (MP = H) record the following:

- DBH (measured directly above the nail) in the 07 Dbh column, to the nearest tenth of a centimeter,
- status = 1 in the 07 ST column, meaning present and alive. (Other possible status codes are 2 = ingrowth, 6 = dead, and 9 = missing).
- overall vigor in the 07\_OV column: 1 = good, 2 = fair (some loss of foliage, branches, or crown), or 3 = poor (few needles or live branches, almost dead),
- if necessary, a near tag number (tag number of the largest adjacent tree) in the 07 Near Tag column (only if the existing near tag is missing or inaccurate, e.g., the near tree is too distant or is dead or of poor vigor).
- if the tag is being overgrown, or if there is little room on the nail for future growth use wire cutters to clip the head off the nail or clip the tag off, if no room is left on the nail. Place the tag on a new nail at the same height, facing plot center.

**Important:** do not pry a tag off by placing the head of a hammer against the bole of the tree; this can cause damage to the cambium/bark.

- if the tag has been overgrown and cannot be removed, place a new tag on the tree at the same height, facing plot center, and record the new tag number in the 07 New Tag column.

**Important:** if you place a new tag on a tree, be absolutely certain that the same tag number does not already exist in that plot.

### 2. For live trees with a tag wired onto side branch (MP = B), but not large enough to nail at breast height record the following:

- the basal diameter (measured above any basal swell) in the 07 Dba column, to the nearest tenth of a centimeter,
- status = 1 in the 07 ST column, as described above,
- overall vigor, as described above,
- near tag number, if necessary, as described above.
- if the wire appears flimsy, replace it (loosely on a side branch); if it appears that it may slip off the branch soon, move it to a more secure position on a sturdier branch, preferably one that arches upwards.

### 3. For live trees with a tag wired onto side branch (MP = B), but now large enough in diameter to nail at breast height, take the following steps:

- remove the wire and nail the tag at breast height (as measured on the side slope), facing plot center. Then record:
- **both** the basal diameter (07 Dba) and DBH (07 Dbh), as described above,
- status = 1 in the 07 ST column, as described above,
- overall vigor, as described above,
- near tag number, if necessary, as described above.

#### 4. For tagged trees that have died since the last remeasurement record the following:

- either Dba in the Dba 07 column for a tree whose last measurement was Dba (tag wired), or Dbh in the Dbh 07 column for a tree whose last measurement was Dbh (tag nailed),
- status = 6 (meaning present and dead) in the 07 ST column,
- **leave overall vigor (07 OV) blank**
- in the Comments column, describe the physical characteristics of the tree (e.g., broken crown, down on the ground, crushed) and **always** record the probable cause of death using the following syntax and examples: "mortality = suppression", "mortality = mechanical damage", "mortality = slope failure", "mortality = root rot", or "mortality = unknown". Here is how we have defined the causes of mortality (extracted directly from Lutz & Halpern 2006):
  - **Suppression:** smaller stems in subordinate canopy positions that exhibited slow growth (i.e., minimal increment in diameter since the previous measurement and minimal leader or branch growth), but no sign of physical damage or pathogen activity.
  - **Mechanical damage** resulting from wind or snow loading: stems that were completely uprooted or whose boles were snapped or crushed beneath other uprooted or broken stems within the stand.
  - **Crushed by old-growth trees:** stems that were crushed by old-growth trees that fell into harvest units from adjacent forest.
  - **Slope failure:** uprooted stems associated with local slope failure.
  - **Pathogens:** two primary types of fungal pathogens were observed: root rots and dogwood anthracnose (*Discula destructiva*). Symptoms of root rot included gradual loss or chlorosis of needles in non-suppressed trees, absence of physical damage to boles or bark, and mortality often clumped in disease centers. (Although field crews were unable to identify fungal species, we revisited several infection centers in 2004 and verified presence of *Armillaria ostoyae*, a native pathogen.) Symptoms of the introduced pathogen, dogwood anthracnose, included distinctive brown spotting or senescence of leaves, with eventual dieback of twigs and entire stems.
  - **Animal damage:** stems that exhibited obvious signs of browsing damage or stripping of bark and cambium.
  - **Unknown:** If insufficient evidence existed to assign a cause, mortality was recorded as "unknown".

#### 5. For tagged trees that cannot be found:

Before leaving a plot, check carefully that all trees in the plot list have been accounted for, and that all data have been recorded properly. Search for trees that have not be found. If a tag number cannot be located, there may be several explanations:

- **you missed it.** Look again in the appropriate quarter and use the near tag number as a clue to where the tree might be. Sometimes, a tree is listed in the wrong quarter or the near tag number is wrong. Occasionally a tree has mistakenly been nailed with two tags and you have already taken data for the first one. If you find a tree with two tags and already have data recorded for the first tag, make a note in the comments column for the second tag ("same as tree # \_\_\_") and leave the remaining data columns blank.
- **the tree has died and dropped its tag, the tree is alive but has fallen over, the tree has been crushed by another stem or by an old-growth tree falling from the adjacent forest, or the tree is alive but has simply dropped its tag.** In the area of the quarter where adjacent tag numbers exist, look again for a dead or fallen tree or for a tag that is on the ground beneath a tree without a tag. Check if old nail holes exist on prospective trees. If you feel confident that you have found the tree, but it is down without a tag, approximate the position of DBH and take the measurement there (if possible).

- **the tree is alive, has dropped its tag, and you have "retagged" it as ingrowth (see below for Ingrowth Trees).** Return to the area of the quarter where adjacent tag numbers exist. Among the recently tagged ingrowth, consider which individuals share the missing tree's characteristics (species, diameter). If you feel confident that you have found the tree (e.g., same species, a location next to other trees numbered close in sequence, appropriate diameter), enter the new tag number (07 New tag) on the Remeasurement Form, take the appropriate measurements, comment that the tag was missing but was assumed to be the correct tree, and remove the entry from the Ingrowth Form.

If, after a reasonable search, the tree is not found, enter a "9" in the 07 ST column, leave the remaining data columns blank, and add the following comment "Missing".

**Important:** Any changes that need to be made to the quarter number (e.g., a tree was assigned to the wrong quarter), or Species (e.g., a tree was misidentified) should be done as follows: put a strikeout line through the incorrect quarter or species code, pencil in the correct quarter or species name adjacent to the error, circle the change to make it obvious, and add a comment in the Comment column about the correction.

#### **INGROWTH TREES: TREES WITHOUT TAGS, BUT $\geq$ 1.37 M TALL**

Trees without tags that have reached the minimum height for measurement (1.37 m tall) are considered "ingrowth." Data for these stems should be recorded on the form "*Watershed 1 and 3 Ingrowth Tree Measurement*." However, first check carefully that each non-tagged tree does not have a tag wired or nailed in an inconspicuous location, or that a tag has not fallen off and is lying on the ground. If a tag cannot be found and you are certain that the individual should be recorded as ingrowth, proceed as follows:

##### **1. For a small diameter tree whose tag must be wired onto a side branch:**

- wire the new non-duplicated tag onto a sturdy limb facing the plot center and record:
- the quarter number (Qtr) of the plot (see Fig. 1); tag number (Tag); Species code, measurement point (MP) = B, diameter at the base (Diam.), overall vigor (OV; as described above), and Near tag number (as described above). Comments on tree conditions are also helpful.

##### **2. For a larger diameter tree whose tag can be nailed at DBH:**

- nail the new non-duplicated tag at DBH facing plot center (as described above) and record:
- the quarter number (Qtr) of the plot (see Fig. 1); tag number (Tag); Species code, measurement point (MP) = H, diameter at Dbh (Diam.) directly above the nail, overall vigor (OV; as described above), and Near tag number (as described above). Comments on tree conditions are also helpful.

**Important:** if there are no ingrowth stems in the plot, fill out the plot header and write in large letters across the data portion of the page: "No ingrowth." Every plot should have an Ingrowth Form with its header completed whether or not data are taken.

**PROCEDURES FOR NON-TAGGED HARDWOODS THAT GROW IN CLUMPS**

When damaged or cut, many hardwoods (and some conifers, e.g., *Taxus brevifolia*) resprout from the base to produce many stems in a clump. The following species show this behavior in WS1/3:

- bigleaf maple, *Acer macrophyllum* (ACMA),
- madrone, *Arbutus menziesii*, (ARME),
- dogwood, *Cornus nuttallii* (CONU),
- chinquapin, *Castanopsis chrysophylla* (CACH),
- cottonwood, *Populus trichocarpa* (POTR2),
- yew, *Taxus brevifolia* (TABR), and
- occasionally cherry, *Prunus emarginata* (PREM), red alder, *Alnus rubra* (ALRU), and cascara, *Rhamnus purshiana* (RHPU).

In the past, we did not tag all stems in these clumps because there were too many to track. Instead we tagged larger stems ( $\geq 5.0$  cm DBH) and tallied any remaining stems  $\geq 1.37$  m tall in two size classes: 0 = 0.1-2.9 cm DBH, and 3 = 3.0-4.9 cm DBH. These appear on the Remeasurement Form as stems with a clump number (Clmp), no tag number, MP = 0 or 3, and a stem count (01 CT). We will no longer use this system. Instead, we will tag and measure each stem individually. Note that there are no underscore blanks to record data for these stems on the Remeasurement Form. Instead we will record new information on the Ingrowth Form. The stem count (01 CT) on the Remeasurement Form should serve an approximation of how many stems will require tags, but note that clump stems may have died or new stems may have arisen since the last remeasurement (2001). Thus, the number of stems added to the Ingrowth Form may differ from the total of class 0 and 3 stems on the Remeasurement Form.

Use the same procedures noted above for “Ingrowth Trees: Tree Without Tags” to tag and record data for previously untagged clump stems on the Ingrowth Form. **In addition,**

- on the Ingrowth Form, place a check mark,  $\surd$ , in the column labeled “Was clump?”
- on the Remeasurement Form, record in the Comments column: “Tagged as Ingrowth”

These two steps will allow us to track the transition from tallied to measured stems for each former clump.

**Species considered trees in WS1 and 3**

Scientific Name	Species Code	Common Name
<b>Conifers</b>		
<i>Pseudotsuga menziesii</i>	PSME	Douglas-fir
<i>Taxus brevifolia</i>	TABR	Pacific yew
<i>Thuja plicata</i>	THPL	western redcedar
<i>Tsuga heterophylla</i>	TSHE	western hemlock
<b>Hardwoods</b>		
<i>Acer macrophyllum</i>	ACMA	bigleaf maple
<i>Alnus rubra</i>	ALRU	red alder
<i>Arbutus menziesii</i>	ARME	madrone
<i>Castanopsis chrysophylla</i>	CACH	golden chinquapin
<i>Cornus nuttallii</i>	CONU	dogwood
<i>Populus trichocarpa</i>	POTR2	black cottonwood
<i>Prunus emarginata</i>	PREM	cherry
<i>Rhamnus purshiana</i>	RHPU	cascara