DEMO FIELD MANUAL - 2016
OVERSTORY TREES, SNAGS, AND NATURAL REGENERATION

TABLE OF CONTENTS

IMPORTANT REFERENCE DOCUMENTS FOR THE FIELD

1. Tables affixed to the clipboard

Grid system bearings: compass declination and grid system bearings for each block x treatment unit
Transect bearings: transect (strip-plot) bearings for each block x treatment unit
Tree species codes and names: names and codes of all tree species
Tree species requiring heights for all tagged stems: list of "uncommon" species by block, treatment, and plot type requiring all ingrowth to have height measurements

2. Additional lists to carry

DEMO grid post needs (2016): list of grid points that need a new center post, tag transfer, or new tag
New tag numbers for 2016: list of tree tags that can be added to plots in each row or column of a treatment unit
Vertex IV User's Guide: user's manual for the hypsometer
Tagged planted trees (2009): list of tags on planted trees to avoid duplication of tree tags in a plot
Tagged natural regeneration (2003, UDIL and GWIR only): list of tags on natural regeneration in strip plots (UDIL and GWIR) to avoid duplication of tags in a plot
DEMO grid centers, transect end-points, and intermediate PVC positions: list of transect end- and intermediate-post distances from plot center, needed to establish start and end points of strip plots
DEMO grid-point reference-tag data: list of distances and bearings from reference tags at the bases of trees or stumps to grid points; used to re-establish grid points when transect posts are missing/down

GENERAL GUIDELINES: PREPARING FOR AND TAKING DATA

Grid points requiring maintenance. Once sample plots have been assigned for the day, consult the 1-page table, **DEMO Grid Post Needs (2016),** for those plots requiring new tall center posts, metal tags to be transferred to these post, or new tags to be added. Each day, carry a sufficient number of tall PVC posts, the necessary grid point tag(s), screws, and a screw-driver.

Short PVC posts for natural regeneration strip plots (transects). Each day, carry 6-8 short PVC posts to replace any missing transect posts. These were checked in 2015, so there should be few missing posts.

New tree tags. When new tags are added to or replace old tags on a plot, it is critical that the same tag# is not in used on different trees or snags in the same plot. Be sure to bring the appropriate tag series to the plots to be visited that day. The listing, **New Tag Numbers for 2016,** indicates which tag series (typically in 100s) can be used on each grid row or column without duplicating a tag in any of the plots.

Compass declination and hypsometer calibration. Check the declination on your compass prior to starting work in a new block (see declinations in **Table 1,** pg. 14). Each morning and after lunch, calibrate your hypsometer against a 10-m reference distance (using your meter tape). The hypsometer is sensitive to changes in temperature (see **Vertex IV User's Guide**).

Minimize physical damage to plots. When taking measurements, minimize damage to vegetation, decayed logs and the ground surface. Avoid walking in or through the four 1 x 6 m strips plots used to sample natural regeneration; these strip plots are also used to sample understory vegetation which is particularly sensitive to trampling.

Data-form headers. The following information present in the header of each field sheet, should be completed **prior to taking any data**.

- **Pg. __ of __.** For some data forms, only one sheet is used per plot. For others, multiple sheets may be used. When more than one sheet is used, pages should be numbered sequentially and the total number of pages per plot should be entered on each page at the conclusion of sampling (e.g., **Pg. 1 of 3, Pg. 2 of 3**, **Pg. 3 of 3**). If only one sheet is used, enter **Page 1 of 1**. This makes it possible to detect loss of field sheets.
- **Personnel.** Record the **last names** of those taking measurements or recording data.
- **Date.** Record date as year (4 digits), month and day (two digits each).
- **Forest/District.** A 4-letter code comprising the first letter of the **National Forest** (Gifford Pinchot = **G**, Umpqua = **U**), and three letters from the **Ranger District** (e.g., Diamond Lake = **DIL**) (see **Table 1,** pg. 14).
- **Block.** Block numbers (1, 4, 5, 6, or 7) are unique to the Forest/District (see **Table 1,** pg. 14). Blocks 2 and 3 were never harvested and were dropped from the experiment.
- **Treatment Unit.** 13-ha treatment units are numbered from 1 to 6 in each Block. Numbers correspond to harvest treatment defined by the % of basal area retained in a dispersed or aggregated fashion. Codes are: **1** = 100% retention (control), **2** = 75%A, **3** = 40%D (dispersed), **4** = 40%A (aggregated), **5** = 15%D (dispersed), and **6** = 15%A aggregated). The treatment # is the first number of the three-character plot identifier and is included on the metal tag attached to each grid-point (center) post. **Note:** We are no longer sampling treatment 2**.**
- **Plot.** A three-character identifier comprising the treatment # plus the position on the grid (row and column). For example, **1A7** = Treatment **1,** row **A**, column **7**.

Accuracy in data recording. To ensure the correct data are recorded, the reader (taking measurements)

and the recorder should use the following procedure: (1) the reader calls out the measurement; (2) the recorder calls back the value to ensure that she/he has heard it correctly; (3) the reader confirms if not heard correctly; (4) if the recorder notices a discrepancy between the previous and current values (e.g., tree with excessive growth or shrinkage), she/he asks for a remeasurement; (5) if it is determined that there was a measurement or recording error in the past, a comment is made in the **Comments** field using standard abbreviations, e.g., "DDC, 2009 error" (= diameter double-checked in 2016, 2009 error). Standard abbreviations for double-checking of diameter and height are: **DDC** = diameter double-checked, **HDC** = height double-checked, **HTLC** = height to live crown double-checked.

Determining whether trees or snags fall within the plot boundary. Tree and snag plots are slope corrected: distances on the ground increase with slope (see slope correction table, **Table 3,** pg. 15). On sloping terrain you will need to use the hypsometer to measure the horizontal distance from plot center to a new tree (ingrowth) or a snag, or the slope and straight distance and compare those values in **Table 3**. One person with the hypsometer stands at plot center; the other places the transponder on the tree of interest. Using the horizontal distance function of the hypsometer (see **Vertex IV User's Guide**) determine whether the center of the tree (or snag) falls within the plot boundary (tree plot = 11.28 m; snag plot = 15.96 m). Be sure to account for the additional distance to the center of the tree (half the diameter).

Units and precision of measurement. Be sure that data are recorded in the proper units and with the intended precision. Column headings indicate units (cm or m); previous data indicate precision.

Penmanship. Always use a mechanical pencil. Don't put extraneous marks (dashes, asterisks, or slashes) in data columns. Write with dark characters to ensure legibility (field forms are scanned and archived). When erasing, erase completely leaving no stray marks. Always use upper-case letters for species codes.

EQUIPMENT CARE AND MAINTENANCE

Vertex hypsometers, used for measuring tree heights, are expensive instruments. Carry it in the protective Pelican case as you move to and among the plots. Minimize exposure to dust and moisture. If it gets damp, remove the battery, unscrew the cap to the battery chamber, and leave the Pelican case open overnight in a safe place (e.g., a safe location in a UW vehicle) to allow the instrument to dry. Store during days off with battery chamber cap off, battery removed, and case slightly open.

Meter tapes have a foldable metal clasp at the end. Before reeling in a tape, close the clasp so it doesn't get hooked on vegetation. Use a rubber band if the clasp tends to open. If the clasp gets caught and the tape is pulled, the clasp can be ripped off. Before packing away a tape, fold down the handle and knob so the knob is protected by the body of the tape.

Grip clamps to hold meter tapes in place. The orange/red grip clamps are used to attach meter tapes to transect end posts. They have sharp metal tips that should be covered by plastic or flexible tubing. Before using a clip, be sure the tips are covered to avoid damage to the meter tape. Always carry extra tubing.

Chaining pins. Chaining pins are used to secure the end of the meter tape in place. The sharp tip is dangerous so be careful when carrying it or packing it away!

DBH tapes become covered in tree sap over time. Occasional light cleaning with alcohol can prevent or remove sap buildup.

Mechanical pencils are easily lost. A bit of flagging on the clip end will allow you to find it, if you drop it.

Tree tags should be carried on a shower-curtain clip to avoid loss.

FORM U-A. GENERAL PLOT CHARACTERISTICS

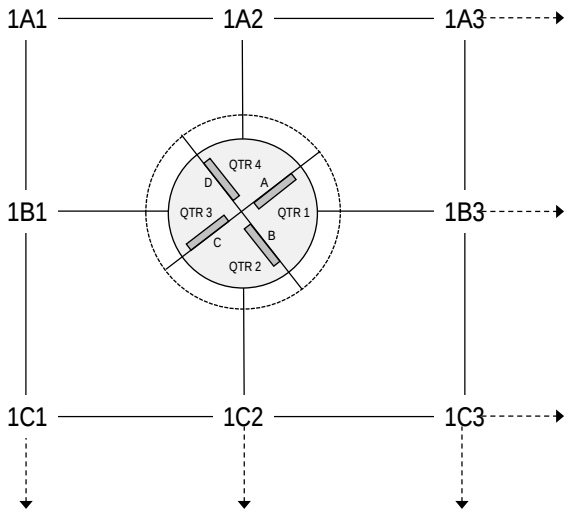
Overview of Plot Design

The grid and nested plot design. The schematic figure below illustrates a small section of an experimental grid and an example of the nesting of the four natural regeneration strip plots (A-D) within the tree plot (shaded circle) within the snag plot (white outer circle). The three-character codes are grid point (plot) identifiers. The first number is the treatment # (in this case, 1 = control); the second and third characters are row and column identifiers. Grid points are "tall" PVC posts (ranging from 0.5 to 1.5 m tall) with circular metal tags containing the grid point identifier. Last summer they were flagged in pink to improve visibility. At Watson Falls, grid posts are capped by, or associated with, a tall orange snow-survey posts. In some units at Little White Salmon, a second tall post has been added for extra visibility (dense vine maple).

The particular bearings of a grid system vary among treatment units (based on local topography). These bearing are listed in **Table 1,** pg. 14**,** or in the table of **Grid System Bearings** affixed to your clipboard.

Transect posts and strip plots. Short PVC posts at 4 and 10 m from plot center mark the end points of four perpendicular transects (A-D). Transect end posts were flagged in pink in 2015 to make them more visible. Each transect marks one edge of a natural regeneration strip plot (1 x 6 m). Transects and strip plots are oriented 45 deg off the grid system (see **Table 2,** pg. 14**,** or the table of **Transects Bearings** affixed to your clipboard). However, in several treatments, transect bearings deviate slightly from this standard. Strip plots lie on the clockwise side of the transect as viewed from plot center. The four quarters (**Qtr 1-4**) of each tree and snag plot lie between the transects, as shown in the diagram below.

Transect end posts can also deviate from the 4 and 10 m standard locations due to obstructions (trees, stumps, logs, stones). In addition, some transects have **intermediate posts** (again, due to obstructions). The locations of end posts and all intermediate posts are provided in the table, **DEMO Grid Centers, Transect End-Points, and Intermediate PVC Positions. Because strip plots sample natural regeneration at a distance of 4 to 10 m from plot center, it is critical to consult this table prior to sampling.**



Data to Record on Form U-A

General comments. Comment liberally about plot conditions, especially recent disturbance, tree mortality, other unusual conditions, or the need to re-establish a center or transect post. If a center post is replaced or the grid tag is moved to a new taller post, note as such. If a transect post needs to be re-established, do

so using a meter tape and other transect posts to help with alignment and distance. Record the transect (A-D) and meter post (4 m or 10 m) requiring re-establishment. If a center post needs to be re-established, do so using a meter tape and transect end posts as reference points. If necessary it is also possible to use **DEMO grid-point reference-tag data** to re-establish a center post. This document contains the distances and bearings from metal tags at the bases of two neighboring trees or stumps to the grid point. Use two tapes and compasses to triangulate. **Note:** these tags were established >20 yr ago; some haven't survived.

Data forms not used in the plot. At the bottom of **Form U-A** is an area to record data forms that are not used on a plot, e.g., if there was no mortality, snag recruitment, or ingrowth. Record "X" for any form type not used; this provides a record of why a particular data form does not exist for a plot.

FORM U-F2. NATURAL REGENERATION (trees >10 cm tall and <5 cm dbh)

Natural regeneration should be sampled first to avoid damaging smaller trees during overstory sampling.

Which plots are sampled? Each plot sampled for natural regeneration has a pre-printed form with data from the last measurement in 2009 (**Form U-F2. Natural regeneration**)**.** In the control and dispersed treatments, every other grid point is sampled (A1, A3 ... B2, B4, etc.). In aggregated treatments the 5 grid points internal to each one-hectare aggregate (or retained patch) are sampled, as well as a subset of points in the adjacent harvested portion of the treatment unit. **Note:** In Blocks 1 and 5 (UDIL and GRAN) understory transects were initially established at all grid points in treatment 5. When walking between grid points, ignore these "alternate" points for which there are transects, but no pre-printed data forms**.**

Distinguishing natural regeneration from planted trees. "Natural regeneration" are tree seedlings and saplings >10 cm tall, but <5.0 cm dbh that survived harvest, or established from seed after harvest. Species classified as trees are listed in the table affixed to your clipboard, **Tree Species Codes and Names**. Plots may contain **planted trees** of the same species, but all planted trees should have metal tags—on zip ties or nailed at dbh (unless tags have been lost)—thus it should be possible to distinguish planted trees from natural regeneration. For each plot we have provided a list of planted tree tag #s, **Tagged Planted Trees (2009)**. **This reference list should be carried at all times.** We are not sampling planted trees in 2016 unless they represent ingrowth (≥5 cm dbh) on **Form O-G. Ingrowth**.
Note: There are two exceptions to the rule of natural regeneration lacking tree tags. At blocks 1 (UDIL) and 7 (GWIR) in 2003, some natural regeneration in the strip plots were tagged as part of a separate study (subsequently terminated). For each plot, we have provided a list of natural regeneration with tags, **Tagged Natural Regeneration (2003, UDIL and GWIR blocks only)**. These should be tallied in the same way as the non-tagged stems. **This reference list should be carried at all times in these blocks.**

Determining strip plot boundaries. Natural regeneration is tallied in four 1 x 6 m strip plots (see pg. 4 schematic, or **Fig. 1**, pg. 16). Tallies are done by height or diameter class**.** Unlike overstory tree and snag plots, strip plots are not slope-corrected. One long side of each strip plot is defined by a transect connecting two (or more) PVC posts. The strip plot lies on the clockwise side of the transect (as viewed from plot center). Strip plot identities, **A-D**, are defined by bearing or position relative to the grid system (see **Table 2,** pg. 14**,** or the table, **Transect Bearings** affixed to your clipboard). The transect between posts can be marked during sampling in one of two ways: with a PVC line made from 1-m posts with connectors, or with a meter tape stretched tightly between posts (secured with a chaining pin and a grip clamp). The PVC approach may be easier in dense vegetation, but not on steep slopes unless it held securely in place (e.g., by the recorder). If a tape is used to mark the boundary, walk on the counterclockwise side of the transect to avoid stepping in the strip plot. The opposite edge of the strip plot is estimated with a 1-m PVC stick placed perpendicular to the transect line. Presence of natural regeneration is based on rooting

location (where the stem emerges from the ground surface). If necessary, place the 1-m stick on the ground perpendicular to the line to make this determination.

Note: End posts can deviate from their standard 4 and 10 m locations due to obstructions (trees, stumps, logs, stones); **intermediate posts** may also be present. Details on locations of end and intermediate posts are in the table, **DEMO Grid Centers, Transect End-Points, and Intermediate PVC Positions. Check this table prior to sampling each strip plot** to ensure that tallies are always made between 4 and 10 m from plot center—even if the end posts deviate from those distances. This may require that you use a calibrated meter stick to adjust the positions of strip plots relative to the existing posts.

Sampling procedure. Form U-F2 is used to tally natural regeneration in each strip plot by **height class** (for stems <1.5 m tall) or **diameter class** (for stems ≥1.5 m tall and < 5 cm dbh). Tallying of both types of classes can be done simultaneously as you move down the strip plot. The data form is structured as follows:

- Each pre-printed form lists the number of stems of each species of each height and diameter class found in 2009. It also contains blank lines allowing for new species in 2016.
- Columns on the left side of the page are used to tally by height class (**trees <1.5 m tall**). Space is provided for tally marks (**Tally**) and, when the strip plot is done, a **#** field to record the total for each height class. Use a height pole or calibrated PVC post to determine the height class. If a tree is rooted on a stump or log, height is measured from the rooting substrate.
- Columns on the right side of the page are used to tally by dbh class (**trees ≥1.5 m tall** and **<5 cm dbh**). Space is provided for tally marks (**Tally**) and, when the strip plot is done, a **#** field to record the total for each dbh class. Use a dbh tape, dbh strip, or ruler (for trees smaller <2 cm dbh) to gauge the dbh.
- If a new species is observed, record the species code, and tally and total the # stems by height or diameter class as described above.
- If there are no stems for a size class with a previous count in 2009, enter a "0" in the **#** field for 2016.
- If **a transect** had no stems in 2009 and no stems in 2016, record "None" in the Species column.
- If **all transects in a plot** had no stems in 2009 and no stems in 2016, record "None" in the Species column for each transect and a check mark in the upper right corner of the page (**None in plot _√_**).

Note: Hardwoods sometimes occur as multiple sprouts from a common base. Tally all stems of the appropriate height or diameter.

FORMS O-D, O-E, O-F, O-F2, and O-G: SAMPLING THE TREE PLOT AND ASSOCIATED PORTION OF THE SNAG PLOT

Overstory trees and snags are sampled after natural regeneration. As many as five data forms are used to record information on diameter, height, mortality or snag fall, and ingrowth/snag recruitment.

Which plots are sampled? The same plots are sampled as for natural regeneration, with the addition that in the dispersed treatments, all grid points are sampled (due to the lower density of trees).

Plot size, slope, and determination of "in" and "out" trees and snags. Live trees are measured in a 0.04 ha plot (11.28 m radius) and snags in a 0.08 ha plot (15.96 m radius) (**Fig. 1**, pg. 16). As you move through the plot avoid stepping in the strip plots unless it is necessary to measure a tree or snag. Presence in a plot is based on the center of a tree or snag where it meets the ground. Presence/absence may need to be determined for ingrowth near the boundaries of the tree or snag plot. Plots are slope-corrected: on sloping ground, plot radii will be >11.28 m for trees and >15.96 m for snags. Use the hypsometer in "horizontal-distance" mode to determine whether the center of the stem is within the radius of the tree or snag plot.

What qualifies as a snag? A snag must be **>50 cm tall** and **>25 cm dbh**. Stumps from the harvest treatments are not included. If a snag is leaning, it must be **>2 m off the ground at breast height** (1.37 m along the bole).

Measuring dbh. Measurements should be made **directly above (touching) the shaft of the nail** with the diameter tape level with the cross-section of the bole. The recorder should observe to ensure that the tape is straight and tight and to assist with tape placement on large trees.

Measuring height and height to live crown. The procedure for measuring tree height is described in the **Vertex IV/Transponder T3 Users Guide**. If necessary, the transponder can be attached w/ a rubber band to a linked-pair of PVC posts to place it above the shrub layer.

Overstory data forms. As many as five types of data forms may be used in a plot. These are:

O-D. Tree REE MORTALITY. This blank form is used to record data for trees that have died since 2009**. If there is no recent mortality in a plot, the form is not used and an X is placed in the appropriate blank at the bottom of Form U-A.**

O-E. OVERSTORY TREES. This pre-printed form lists all tagged trees ≥5 cm dbh within the 11.28 m radius tree plot that were alive or died in 2009, but not mortality prior to 2009. It is used to record diameter for all trees and height for a subset of trees. Records are sorted by quarter, then by tag#. **There is also a blank continuation page, Form O-E (Cont.), for comments that cannot be fit on the pre-printed form.**

O-F. SNAG REMEASUREMENT. This pre-printed form lists all snags within the 15.96 m radius snag plot that were standing or fell in 2009 (it also includes data from 2003 for reference). Records are sorted by quarter then by tag#. **Note:** some snags do not have tags because they are too decayed.

O-F2. SNAG RECRUITMENT. This blank form is used to record data on new snags—those resulting from recent (post-2009) mortality of **tagged trees** in the tree plot, or recent mortality of **non-tagged trees** in the outer ring of the snag plot (**Fig 1.**, pg. 16). **If there is no recruitment of new snags, the form is not used, and an X is placed in the appropriate blank at the bottom of Form U-A.**

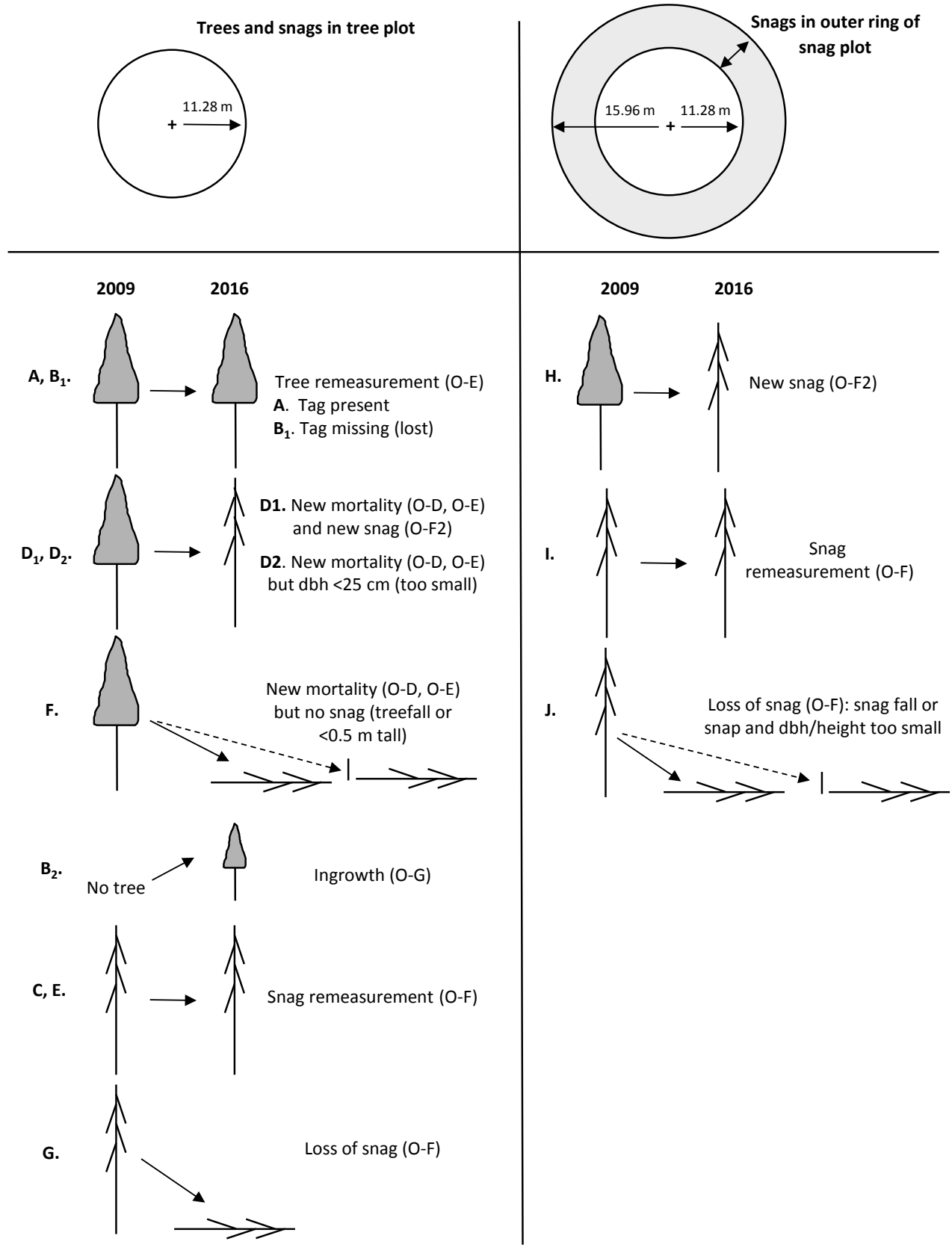
O-G. INGROWTH. This blank form is used to collect data for trees that were too small to tag (< 5 cm dbh) in 2009, but are now large enough (≥5 cm dbh). **If there is no ingrowth, the form is not used, and an X is placed in the appropriate blank at the bottom of Form U-A.**

General procedure for sampling trees and snags. Begin in the tree plot (11.28 m radius) and sequentially, by quarter, visit all stems ≥5 cm dbh. Live trees, snags, ingrowth, and recent mortality will be sampled at the same time, with information for the same tree often recorded on multiple forms (e.g., when a tagged tree dies, **O-E**, **O-D**, and **O-F2**). Use the 2009 data on **Form O-E. Tree mortality** and **Form O-F. Snags** as a guide. **Note**: there are often skips in the numbering of live trees and snags because they were tagged in the same year, sequentially. In addition, some snags lack tags because they are too decayed to hold a nail. These can only be identified by position (Qtr) and physical characteristics (species, diameter, decay class and height).

Once the tree plot (11.28 m radius) is sampled, move to the donut-shaped area remaining in the snag plot: 11.28 to 15.96 m from plot center. In this area, consider only snags. As in the tree plot, decayed snags without tags can only be identified by position and physical characteristics. Some snags may be new, a result of post-2009 mortality.

Detailed descriptions of sampling procedures follow, structured around a set of 10 “scenarios” that represent different conditions of trees or snags at the last measurement (2009) and at present (2016). These scenarios are illustrated diagrammatically on the next page.

SCHEMATIC OF OVERSTORY SCENARIOS (WITH ASSOCIATED DATA FORMS)



Scenario A. Stem is alive, tagged, and listed on Form O-E

This stem is a remeasurement tree. On **Form O-E. Overstory trees** record:

- **DBH 2016** (to the nearest 0.1 cm). If dbh has declined by >0.2 cm or increased excessively (> 10 cm), recheck the measurement. If you are confident in your measurement, make note in the **Comments** field: **DDC** (diameter double-checked).
- **Status 2016** (1, 6, or 9): 1 = present/alive
- **Vigor 2016** (1, 2 or 3): a rating of health, defined as follows:
  1 = good (no signs of stress)
  2 = fair (deficient, i.e., signs of stress including discolored foliage, loss of needles)
  3 = poor (near death, heavily damaged or few needles)
- **Height 2016*** and **height to live crown (HTLC) 2016: If there are underscore prompts on the data form,** measure total height and HTLC to the nearest 0.1 m. Only a subset of trees are measured for height and HTLC. **HTLC** = height to the lowest live branch at its attachment point on the bole. **Note:** Many trees in the dispersed treatments or at the edges of aggregates will have epicormic sprouts--new branches emerging from the bole (a response to canopy opening). Epicormics are typically shorter than the original canopy branches. Do not base "lowest live branch" on presence of epicormics; instead include them in a comment, noting height, e.g., "epicormics start at 20.2 m" (if they extend to the bottom of the live crown) or "epicormics from 20.2 - 27.0 m" (if separated from the main crown).
- **Comment**: Write a brief comment if there is something unusual about the tree (e.g., physical damage), if the vigor is not "1", or if the dbh is smaller or much larger than in 2009 (see above).

Note: Heights are taken only if the tree is not broken, does not have a damaged top, and does not have a lean angle of >15 deg (see schematic on pg. 11). If these conditions are not met, make a comment and try to find a **replacement height tree of the same species and ~dbh** (±4 cm) in the same plot. **Note:** Height data for a replacement tree are entered on **Form O-E (Cont.),** a blank continuation page for comments and replacement tree heights. Record **Qtr, Tag#, Species, DBH, Height,** and **HTLC,** and a **Comment: "replacement height tree for tag # __"**. If an appropriate replacement can't be found in the same plot, try the next plot of the same **Plot type** (**0** = uncut, or **1** = cut). Record the replacement height data on the **O-E. (Cont.)** page for the next plot (including a comment: "**replacement height tree for Plot __, tag # __"**). This substitution process requires that you make a note to locate a replacement tree once you arrive at the next or a subsequent plot of the same plot type. **Before leaving the plot, make the note on Form U-A. This may require adding the same note on subsequent U-As if a replacement is not found immediately.**

Next, check the nail and tag. If there is little room for growth along the nail, re-nail the tree **adjacent to (not above or below) the existing hole**. To remove the nail without damaging the cambium or bark, use a wood block to support the claw of the hammer, or pull/twist the nail straight out of the bole without touching the bark. If the nail can't be removed, the head can be snipped off with a cutting pliers and new nail added adjacent to the old. New nails should angled slightly downward, allowing the tag to fall away from the tree; the nail should be secure, but room for growth over the next 5-6 years.

Scenario B. Stem is alive and not tagged

This stem either has a missing tag (**B_1**) or is an **ingrowth** (<5 cm dbh in 2009, ≥5 cm in 2016) (**B_2**).

SCENARIO B_1: Tag missing. If the stem is considerably larger than 5 cm, it is likely to have lost its tag. Try to find the old nail hole. If you can't, but you can match it to a stem on **Form O-E** based on location (Qtr), Species, dbh, or Comment, assign a new tag, record the **New tag#,** then proceed as described for **Scenario A**. Before assigning a new tag, confirm that the same tag# does not occur on **Forms O-E or O-F** or on the lists of **Tagged Planted Trees** or **Tagged Natural Regeneration.** Add a comment: **Tag missing**. The tag

should be nailed at 1.37 m from the ground on the **up-slope** side of the tree (for odd situations, such as split or swollen boles, see **Fig. 2,** pg. 17). **However, the tag should always face plot center.**

SCENARIO B_2: Ingrowth. If dbh is equal to or slightly larger than 5 cm, the stem is likely to be **ingrowth.** If it can't be matched to a tagged record on **Form O-E**, treat as ingrowth and assign a unique tag#. Before assigning a new tag, confirm that the same tag# does not occur on **Forms O-E or O-F** or on the lists of **Tagged Planted Trees** o**r Tagged Natural Regeneration.** On **Form O-G. Ingrowth** record:

- In the header: **Personnel, Date, District, Block, Treatment Unit,** and **Plot**
- **Qtr** (see schematic figure on **Form U-A**), **Tag#, Species code,** and **DBH**
- **Height. For ingrowth, whether height is measured is contingent on species and location** (block, treatment and plot type):
  (a) For common species (those not listed under "b", below) record heights for **three ingrowth stems per plot**: those with the smallest (~5 cm), intermediate, and largest dbh. These can be selected after all ingrowth are tagged or as they are encountered, if one can see in advance the range of sizes.
  (b) For species that are "uncommon" in a block/treatment/plot type, record heights on **all** ingrowth in the plot. These are listed in the table, **Tree Species Requiring Heights for all Tagged Stems,** affixed to your clipboard**.** Always consult this table if you are uncertain about the need to measure height.
- **Canopy class:** relative position in the canopy. In most instances, ingrowth should be classified as **S** (suppressed) or **I** (intermediate). **Note:** This classification was developed for closed-canopy forests and used prior to treatment. For cut plots use the following guidelines: in dispersed treatments, assess canopy class relative to residual overstory trees; in the aggregated treatments, assess canopy class relative to trees in the aggregates.
  D = Dominant. Emerges from the general canopy layer; receive light from the top and sides.
  C = Co-dominant. Crown extends to the top of the general canopy layer; receives light from the top, but not much from the sides.
  I = Intermediate. Shorter than co-dominants; crown extends into the lower portion of the general canopy layer; receives filtered light from the top and sides.
  S = Suppressed. Shortest individuals forming the lowest tree layer; crown completely under the general canopy layer. Suppressed trees are not necessarily "suppressed", just shorter, younger, and typically more shade tolerant.
- **Vigor** (1-3): see **Scenario A**, above
- **Conditions:** These are series of crown, bole, and disturbance codes recorded when a tree enters the tagged population. See **Conditions** in the header portion of **Form O-G.** Up to three codes can be entered for crown or bole conditions and two codes for disturbance. If a tree has no unusual conditions, record "1" in the first cell of each category.

Note: It is critical that tree tagging, measuring, and rating are done carefully, as these data serve as the baseline for future comparisons. The recorder should verify the species, assess placement of the dbh tape, and aid in assessing conditions by viewing the tree from a different angle.

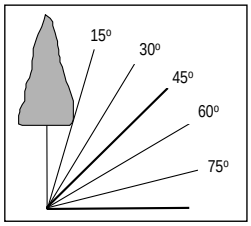
Scenario C. Stem is dead, standing, tagged, on Form O-F (may be on Form O-E)

This stem was a snag prior to 2009 or was recorded as newly dead in 2009. On **Form O-F** record:

- **Height 2016**
- **Decay class 2016** (1-5)**,** defined as follows (see illustration in **Fig. 3**, pg. 18):
  1 = needles and twigs present, bark tight; **2** = needles and twigs present, bark loose;
  3 = needles and twigs absent, bark absent; **4** = needles and twigs absent, top broken out
  5 = needles and twigs absent, bark absent, top broken out, decomposition obvious

Note: The characteristics of snags may vary from these descriptions and the illustrations in **Fig. 3**. If uncertain, base your decision to a greater extent on bole than on needle/twig characteristics.

- **Lean 2016** (angle in deg from vertical). Record only if ≥15 deg (otherwise 0). Estimate to the nearest 5 deg, if possible. On steep slopes, the angle can be >90 deg (leaning downslope).
- **Status:** 1 = still present; **Comment**: if necessary, comment on conditions.



Scenario D. Stem is dead, standing, tagged, not dead in 2009 on Form O-E, and not on Form O-F

This is a new mortality (died after 2009). There are two possibilities:

SCENARIO D_1: Stem is large enough to be a snag (≥25 cm dbh and >0.5 m tall).
Three forms are used: **O-D. Mortality**, **O-E. Overstory trees**, and **O-F2. Snag recruitment**.

SCENARIO D_2: Stem is too small to be a snag (<25 cm dbh).
Two forms are used: **O-D. Mortality** and **O-E. Overstory trees.**

Form O-D. Mortality is used to describe the physical conditions and possible causes of mortality:

- In the header record: **Personnel, Date, District, Block, Treatment Unit,** and **Plot**
- **Qtr, Tag#, Species, DBH**
- **Remaining crown (%) and remaining tree (%)**: see illustrations on data form.
- **Lean**: see **Scenario C**, above
- **Tree position:** in this case 1 or 2
  1 = standing with crown or **2** = main stem broken
- **Direction of uproot or break** (azimuth in deg): leave blank if the snag is intact. If a portion of the bole has snapped off, the direction is from the snag to the top of the downed piece.
- **Tree condition codes**: as many as six codes can be entered to describe the physical attributes of the tree including disease and damage. See **Tree condition codes** at bottom of form. If there is scarring of the bole, comment on the nature and location.
- **Comments**: in the lower section of the form under **Comments,** repeat the tag# and describe the physical conditions of the tree and circumstances of mortality (e.g., "standing, fine branches present").

On **Form O-E. Overstory trees** record the following:

- **DBH 2016**
- **Status 2016: 6** = dead
- **Vigor 2016: 6** = dead
- **Comment: "**Dead, standing" (other comments as needed)

On **Form O-F2. Snag recruitment** record the following for **SCENARIO D_1,** but not for **SCENARIO D_2** (snag is too small):

- In the header: **Personnel, Date, District**, **Block, Treatment unit, Plot**
- **Qtr, Tag#, Species**
- **DBH**: If height is <1.37 m, measure diameter at 0.5 m height
- **Height, Decay class, Lean**
- **Status: 2** = new snag
- **Comment:** as needed

SCENARIO E. Stem is dead, standing, not tagged, and significantly decayed

This is likely a snag on **Form O-F** that was never tagged due to its advanced state of decay. Consider all snags without tags listed in the same **Qtr** with similar characteristics (species, dbh, decay class, and height). Snags shrink in diameter or height as they fragment making it difficult to match to the 2009 data. Once you find the appropriate record on **Form O-F,** record the following (as with **Scenario C**):

- **Height, Decay class, Lean**
- **Status: 1** = still present
- **Comment** as needed

SCENARIO F. Stem is dead, on the ground, tagged, and live in 2009 on Form O-E

This is a case of recent mortality that did not result in a snag. Two data forms are used: **Forms O-D** and **O-E**.

Form O-D. Mortality is used to describe the physical conditions and possible causes of mortality:

- In the header record: **Personnel, Date, District, Block, Treatment Unit,** and **Plot**
- **Qtr, Tag#, Species, DBH**
- **Remaining crown (%) and remaining tree (%)**: see illustrations on data form.
- **Lean**: as in **Scenario C**, above
- **Tree position:** in this case, 3 or 4
  3 = crushed or **4** = uprooted
- **Direction of uproot or break**
- **Tree condition codes**: as in **Scenario D**, above
- **Comments**: in the lower section of the form under **Comments,** repeat the tag# and describe the physical conditions of the tree and circumstances of mortality (e.g., "windthrow with root mound").

On **Form O-E. Overstory trees** record the following:

- **DBH 2016:** if the dbh tape cannot be wrapped around the downed tree, record the 2009 dbh and comment as such
- **Status 2016: 6** = dead
- **Vigor 2016: 6** = dead
- **Comment: "**Dead, standing" (and other comments as needed)

SCENARIO G. Stem is dead, on the ground, tagged, and dead in 2009 on Forms O-E and O-F

This is a snag that fell after 2009. Data are recorded only on **Form O-F. Snags**:

- **Status: 6** = snag has fallen
- **Comment**: add the following comment "Snag has fallen."

Because the snag is down, **height**, **decay class,** and **lean** are not recorded.

FORMS O-F and O-F2: SAMPLING THE OUTER RING OF THE SNAG PLOT

In the outer ring of the snag plot (11.28-15.96 m), **only snags** are sampled. Data are recorded either on **Form O-F. Snags** or **O-F2. Snag recruitment**. Three scenarios are possible (see schematic).

SCENARIO H. Snag is not tagged and not on Form O-F

This is a new mortality (died after 2009). Record the following on **Form O-F2. Snag recruitment**:

- In the header: **Personnel, Date, District, Block, Treatment Unit,** and **Plot, Qtr**

- **Qtr**
- **Tag#:** Assign a tag# not listed on **Forms O-E** or **O-F** and not on the lists of **Tagged Planted Trees** or **Tagged Natural Regeneration**
- **Species**: if species cannot be determined, record **UNKN**
- **DBH:** If the snag is <1.37 m tall, measure diameter at 0.5 m
- **Height, Decay class, Lean**: as in **Scenario C**
- **Status: 2** = new snag
- **Comment:** Comment "in outer ring of snag plot"

SCENARIO I. Snag is tagged (or not) and on Form O-F

All previously tagged snags will be listed on **Form O-F.** Snags without tags are also listed if they were too decayed to hold a nail (typically decay classes 3-5). The 2009 data should confirm that a snag is in the outer ring of the snag plot. Snags shrink in diameter or height as they fragment making it difficult to match to the 2009 data. Similarly, a decayed snag may drop its tag as it fragments; search at the base of a snag if you suspect that it has lost its tag.

Note: If a non-tagged snag has a decay class of 1 or 2, it is probably a new mortality. If so, see **Scenario H**, above**.** Use your judgment to match stems with 2009 records and comment on your uncertainty as needed. Once you have found the appropriate tagged or non-tagged record on **Form O-F,** record:

- **Height, Decay class, Lean**
- **Status 2016: 1** = still present
- **Comment**: be sure to note "in the outer ring of the snag plot" and if necessary, why height, decay class, or lean has changed since 2009

SCENARIO J. Snag is on the ground and on Form O-F (with or without a tag)

This is a case in which a tagged or non-tagged snag has fallen. If the tag is visible, it should be easy to match with a record on **Form O-F.** If the tag fell off or is hidden, or if the snag was too decayed to hold a tag, it may be more difficult to match with a standing record from 2009. As described previously, use location (Qtr) and physical characteristics (Species, DBH, etc.) to aid in your decision. Record:

- **Status: 6** = snag has fallen
- **Comment**: note "snag has fallen"

DATA AND EQUIPMENT CHECKS BEFORE LEAVING A PLOT

- Carefully check all forms **before** leaving a plot. The measurer should check the work of the recorder.
- Make sure that all data are legible
- Make sure that every record requiring a value (i.e., with an underscore prompt) has one or there is a comment stating why data are missing.
- Recheck that **Form U-F2** notes the absence of natural regeneration on a transect or the entire plot.
- Recheck that every new dead tree (status = 6) on **Form O-E** has a record on **Form O-D** and, if it is standing, that is has a record on **Form O-F2.**
- If **Forms O-D**, **O-E (CONT.)**, **O-F2**, **or O-G** are not used, note as such at the bottom **Form U-A.**
- Be sure that the appropriate number of pages is entered for each form type.
- If a replacement height tree is needed, add note on the U-A form for the next plot; include the plot type, species, and approx. dbh needed.
- Check that you have all your equipment and supplies and that the hypsometer is secured in the Pelican case.

Table 1. Grid System Bearings. The first bearing (degrees) is A1→A7 (across rows), the second is A1→G1 (down columns).

Block	Declination	Tmt 1	Tmt 3	Tmt 4	Tmt 5	Tmt 6
UDIL – Watson Falls (Block 1)	14.9 E	113, 203	128, 218	105, 195	49, 139	56, 146
UDOG – Dog Prairie (Block 4)	14.9 E	120, 210	90, 180	115, 205	120, 210	90, 180
GRAN – Butte (Block 5)	15.5 E	45, 135	0, 90	45, 135	45, 135	55, 145
GMTA – Little White Salmon (Block 6)	15.4 E	231, 321	226, 316	316, 46	236, 326	279, 9
GWIR – Paradise Hills (Block 7)	15.5 E	310, 40	245, 335	349, 79	82, 172	348, 78

Table 2. Natural Regeneration Transect Bearings. Bearings (degrees) are from the plot center.

Block	Transect	Tmt 1	Tmt 3	Tmt 4	Tmt 5	Tmt 6
UDIL – Watson Falls (Block 1)	A	68.5	83.5	60.5	4.5	11.5
	B	158.5	173.5	150.5	94.5	101.5
	C	248.5	263.5	240.5	184.5	191.5
	D	338.5	353.5	330.5	274.5	281.5
UDOG – Dog Prairie (Block 4)	A	75	45	70	75	45
	B	165	135	160	165	135
	C	255	225	250	255	225
	D	345	315	340	345	315
GRAN – Butte (Block 5)	A	0	45	90	0	10
	B	90	135	180	90	100
	C	180	225	270	180	190
	D	270	315	0	270	280
GMTA – Little White Salmon (Block 6)	A	6	1	1	6	54
	B	96	91	91	96	144
	C	186	181	181	186	234
	D	276	271	271	276	324
GWIR – Paradise Hills (Block 7)	A	85	20	34	37	33
	B	175	110	124	127	123
	C	265	200	214	217	213
	D	355	290	304	307	303

Table 3. Slope-corrected radii for tree and snag plots.

Slope (%)	Radius (m) of tree plot	Radius (m) of snag plot	Slope (%)	Radius (m) of tree plot	Radius (m) of snag plot	Slope (%)	Radius (m) of tree plot	Radius (m) of snag plot
0	11.28	15.96	**51**	12.66	17.92	**101**	16.03	22.68
1	11.28	15.96	**52**	12.71	17.99	**102**	16.11	22.80
2	11.28	15.96	**53**	12.77	18.06	**103**	16.19	22.91
3	11.29	15.97	**54**	12.82	18.14	**104**	16.27	23.03
4	11.29	15.97	**55**	12.87	18.21	**105**	16.36	23.14
5	11.29	15.98	**56**	12.93	18.29	**106**	16.44	23.26
6	11.30	15.99	**57**	12.98	18.37	**107**	16.52	23.37
7	11.31	16.00	**58**	13.04	18.45	**108**	16.60	23.49
8	11.32	16.01	**59**	13.10	18.53	**109**	16.69	23.61
9	11.33	16.02	**60**	13.15	18.61	**110**	16.77	23.73
10	11.34	16.04	**61**	13.21	18.70	**111**	16.85	23.84
11	11.35	16.06	**62**	13.27	18.78	**112**	16.94	23.96
12	11.36	16.07	**63**	13.33	18.86	**113**	17.02	24.08
13	11.37	16.09	**64**	13.39	18.95	**114**	17.11	24.20
14	11.39	16.12	**65**	13.45	19.04	**115**	17.19	24.32
15	11.41	16.14	**66**	13.52	19.12	**116**	17.28	24.44
16	11.42	16.16	**67**	13.58	19.21	**117**	17.36	24.56
17	11.44	16.19	**68**	13.64	19.30	**118**	17.45	24.69
18	11.46	16.22	**69**	13.70	19.39	**119**	17.53	24.81
19	11.48	16.25	**70**	13.77	19.48	**120**	17.62	24.93
20	11.50	16.28	**71**	13.83	19.57	**121**	17.71	25.05
21	11.53	16.31	**72**	13.90	19.67	**122**	17.79	25.18
22	11.55	16.34	**73**	13.97	19.76	**123**	17.88	25.30
23	11.57	16.38	**74**	14.03	19.85	**124**	17.97	25.42
24	11.60	16.41	**75**	14.10	19.95	**125**	18.06	25.55
25	11.63	16.45	**76**	14.17	20.05	**126**	18.15	25.67
26	11.66	16.49	**77**	14.24	20.14	**127**	18.23	25.80
27	11.68	16.53	**78**	14.31	20.24	**128**	18.32	25.92
28	11.71	16.57	**79**	14.38	20.34	**129**	18.41	26.05
29	11.74	16.62	**80**	14.45	20.44	**130**	18.50	26.18
30	11.78	16.66	**81**	14.52	20.54	**131**	18.59	26.30
31	11.81	16.71	**82**	14.59	20.64	**132**	18.68	26.43
32	11.84	16.76	**83**	14.66	20.74	**133**	18.77	26.56
33	11.88	16.81	**84**	14.73	20.84	**134**	18.86	26.69
34	11.91	16.86	**85**	14.80	20.95	**135**	18.95	26.81
35	11.95	16.91	**86**	14.88	21.05	**136**	19.04	26.94
36	11.99	16.96	**87**	14.95	21.15	**137**	19.13	27.07
37	12.03	17.02	**88**	15.03	21.26	**138**	19.22	27.20
38	12.07	17.07	**89**	15.10	21.37	**139**	19.32	27.33
39	12.11	17.13	**90**	15.18	21.47	**140**	19.41	27.46
40	12.15	17.19	**91**	15.25	21.58	**141**	19.50	27.59
41	12.19	17.25	**92**	15.33	21.69	**142**	19.59	27.72
42	12.23	17.31	**93**	15.40	21.80	**143**	19.68	27.85
43	12.28	17.37	**94**	15.48	21.90	**144**	19.78	27.98
44	12.32	17.44	**95**	15.56	22.01	**145**	19.87	28.11
45	12.37	17.50	**96**	15.64	22.12	**146**	19.96	28.24
46	12.42	17.57	**97**	15.71	22.23	**147**	20.05	28.38
47	12.46	17.63	**98**	15.79	22.35	**148**	20.15	28.51
48	12.51	17.70	**99**	15.87	22.46	**149**	20.24	28.64
49	12.56	17.77	**100**	15.95	22.57	**150**	20.34	28.77
50	12.61	17.84						

Figure 1. Snag, Tree, and Regeneration Plot Designs. In the control (1), every other grid point is sampled. In the dispersed treatments (3 and 5), all grid points are sampled. In the aggregated treatments (4 and 6) all non-edge grid points within the aggregates are sampled as are a subset of points in the harvested matrix.

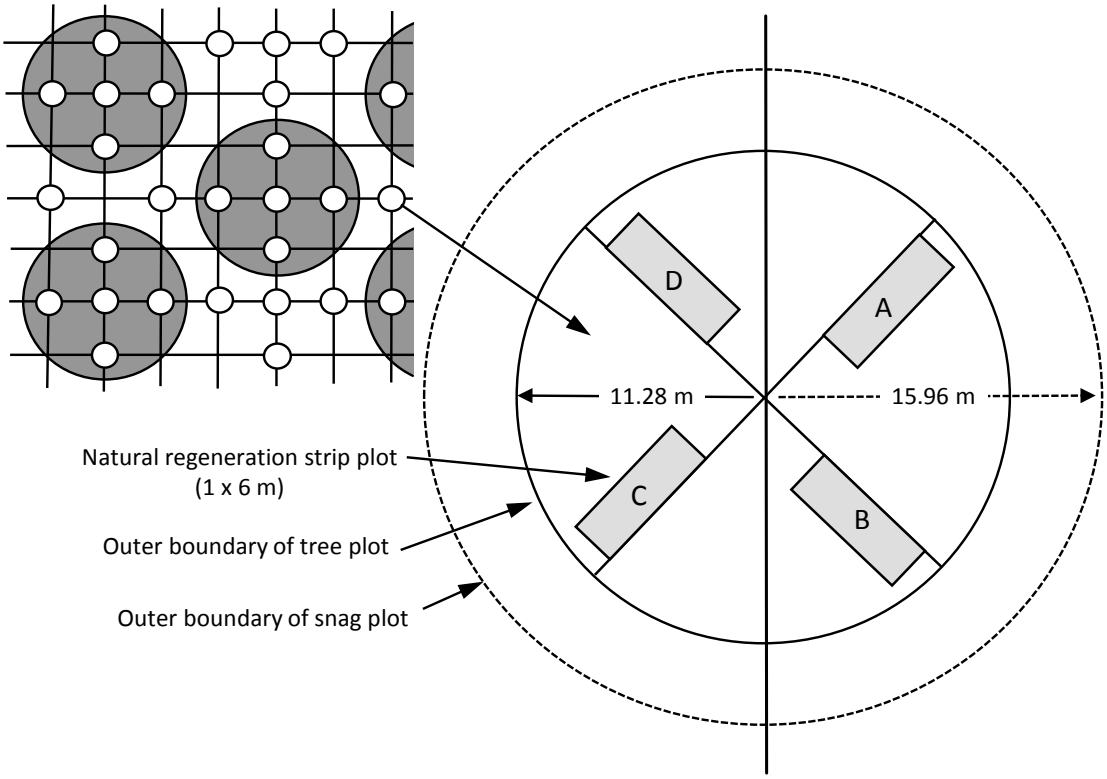


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Figure 2. Standards for Measuring Tree Diameter (dbh is **1.37** m, not 1.3 m).

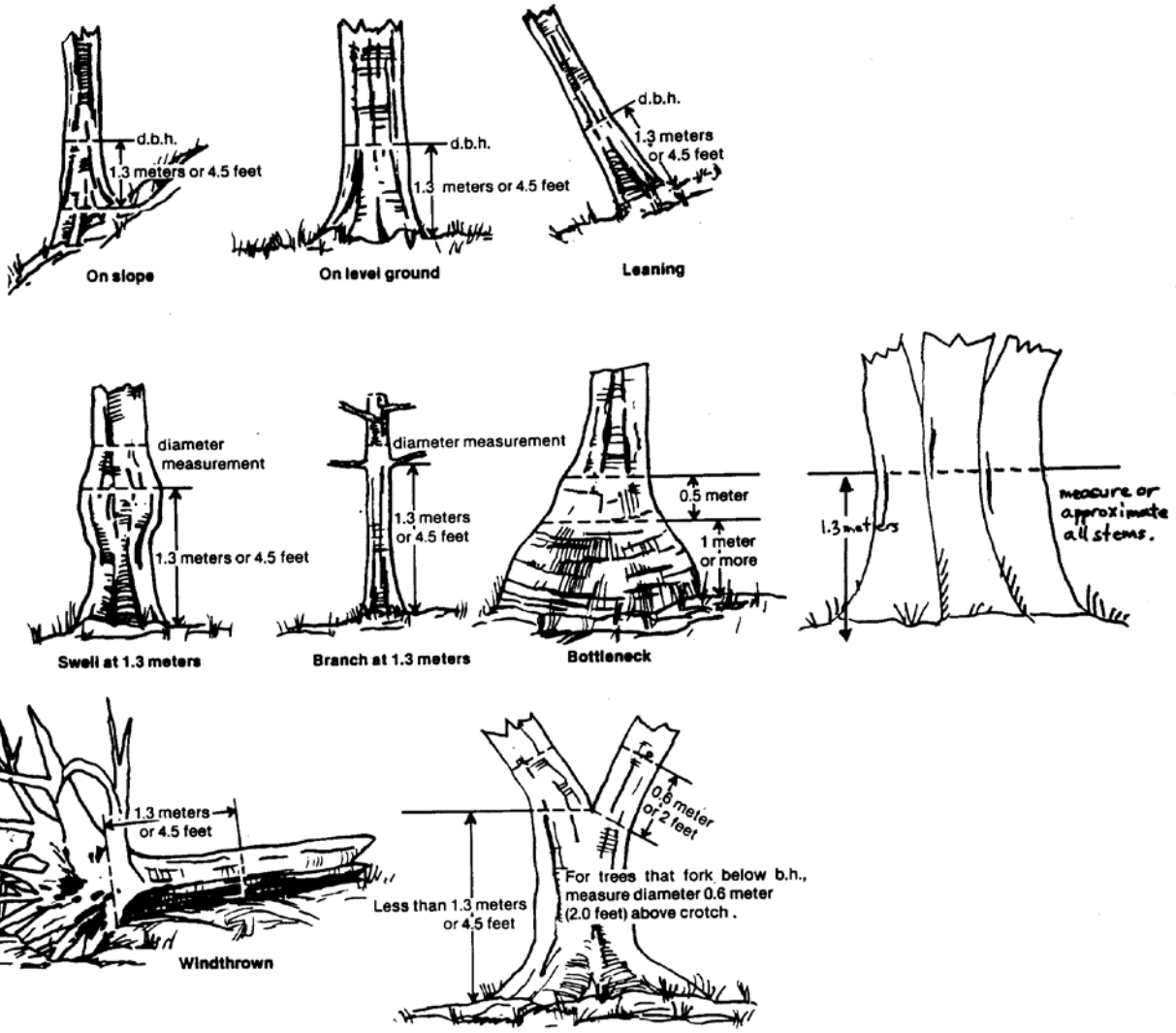

Figure 3. Snag Decay Classes.