ATTACHMENT L

EDWARD MILLER TRUST - BRUSH CREEK
DRAFT CARBON PROJECT TIMBER INVENTORY

This document contains specifications for the collection of data in the field for the Brush Creek Timber Inventory. It spells out the data to be collected and the standards for this data.

Definitions

The following definitions apply to this document. Definitions included in each of the above mentioned documents also apply to this document.

- Center of the Tree – the point where a line projected through the center of the tree at DBH is perpendicular to the line projected from plot center.
- "Breast Height Age (BHA)" –the age of a sampled tree at DBH, measured on site trees.
- "Diameter Breast Height (DBH)" – the diameter of a tree stem 4.5 feet above the natural ground line on the uphill side of the tree. Debris (logs, stumps, rocks, etc) lodged against the tree stem shall not be used to identify DBH.
- "Break DBH" – The Diameter Breast Height (DBH) to be included in the portion of the sample taken in any one of the nested fixed area plots. This is 0.6" to 3.5" DBH for the 1/100 acre plot, 3.6" to 11.5" DBH for the 1/50 acre plot and 11.6" DBH and larger for the 1/5 acre plot on this cruise.
- "Defined Fixed Plot Sizes" – The size of the fixed plots in a fraction of an acre. This is 1/100 acre, 1/50 acre and 1/5 acre for all plots as a nested sample.
- "Defined Fixed Length Radius" – The length of the radius used for the fixed plot sizes. For this cruise this is 11.8 feet (1/100 acre) for the smallest of the nested plots, 16.7 feet (1/50 acre) and 52.7 feet (1/5 acre) for the largest.
- "DIB" – Diameter Inside Bark.
- "DOB" – Diameter Outside Bark.
- "Defect" – an estimate of the amount of fiber that is missing (carbon defect). This will be recorded for each 1/3 of the total height (butt 1/3, mid 1/3, top 1/3). Total height is estimated for trees with missing (broken) tops.
- "Measure Plot" – A plot that records all attributes - species, component code, DBH, count, height, crown and defect - for all trees sampled (height may be a subsample within the "Measure Plot").
- "Measured Tree" – tree having species code, component code, DBH, total height, Site data, live crown data and tree defect data in the record (height, crown and site data may be a subsample). 1/100 acre fixed-plot tree having species code, component code, DBH and total height data in the record.
- "Plot" – the point in the ground used as the center point for the cruise sample. For Fixed-plot sampling it is the center of the circle used to define the plot.
- "Site Tree" – a subsample of Measured Trees between 25 and 70 years of age that are dominant or co-dominant and exist in a "free to grow" condition. Total height and Breast Height Age (BHA) will be recorded.
- "Stand" – designation within the property boundary, based on dominant vegetation types and tree size, to be designated by JLA. The property, for the purpose of this inventory, is broken up into 3 stands representing the major stand components.
- "Witness Flag" – any flagging placed around plot center, typically at eye-height to help locate the plot. Witness flags shall consist of two ribbons of different colors as noted in the field notes.
- "Monumented Plot" – each "Measure Plot" established shall be monumented for relocation. Bearing Trees (BTs) adjacent to the plot shall have an aluminum metal tag nailed below stump height with plot number, azimuth, and slope distance to the plot center shall be recorded on the tag. A GPS coordinate will also be recorded at each plot location.

Maps

Roads shown on the map are considered for the net acreage and are to be sampled as encountered. Make a note about road on the maps and in the comments.

The location of all plots is to be shown on the maps prior to beginning sampling. A rectangular grid (8 chains by 8 chains) is to be applied.

Cross out plots on the map you do not place, and add extra ones to the map. Comments may be written on the back of the map or on extra sheets of paper. Whenever you deviate from the Cruising Instructions, a brief explanation will usually suffice.

If plots must be added or dropped from the grid described, the map of property boundary may need adjustment. A clear note on a separate sheet shall detail the boundary or boundaries to be reviewed, a description of where the line should be placed (draw the line clearly on the map, except when it is a mapped road), and a description of the conditions or suggested boundary call.

All plots shall be located utilizing a GPS unit with hand compass utilized for general location. The actual GPS point and coordinates shall be taken and recorded for each plot.

Plot Placement

Plots must fall entirely within the property. Cruise to the proximity of the property line, even if that means dropping or adding a plot or two. Do not squeeze in an extra plot just because the map shows one, but do put in extra plots if there is room. Plots shall be a minimum of 52.7 feet perpendicular from any boundary. Where a boundary is obvious, no plot will be placed to include trees or area from the adjacent property. You may have to move the plot (change the spacing) or adjust the number of plots (drop or add plots) if the map boundaries do not match what is actually on the ground.

In cases where the plot falls on the property boundary the cruiser will move the plot up to 100 feet (1.5 chains) and place it. Also, if the plot falls in a mapped area that does not match the ground, and moving the plot up to 100 feet will keep it within the subject property, the cruiser shall so move the plot, rather than dropping it.

Sample Plot Procedures

The following standards apply.

Stand Information

Required information for each stand sampled includes:

1. Stand ID as indicated on the Timber Type Map (per JLA)
2. Cruiser's ID
3. Date of sampling
4. Fixed Plot sizes used

Plot Identification

Required information for each plot sampled includes:

1. Plot ID – described below.
2. GPS coordinates (recorded in GPS unit referenced to Plot ID and transferred to GIS).

Plot identification shall utilize a numerical sequence for all plots within the inventory. The plots shall be identified in a logical pattern on the map. If JLA assigns the plot ID's, they must be used.

Never use the same Plot ID for two unique plots.

Plot centers on cruise plots shall be marked with flagging tied to a metal spike (or large nail) in the ground. 'Witness Flags' shall also be attached to a tree limb near plot center to aid in location of it. These witness flags should be at least 3 feet long and attached at eye level within 10 feet of plot center. In stands where eye-level stems do not exist within the 10-foot limit, attach one set of Witness Flags on the tree nearest plot center that is to be measured. Witness Flags of two different colors shall be utilized at each plot.

Write the plot number on the flag at plot center (on metal spike). Write the plot number, cruiser initials and date on the Witness Flag with a ***permanent-ink*** marker. The ink color for the marker shall contrast with the colors used in the ribbon.

In addition each plot shall be considered a "Monumented Plot". As such each plot established shall be monumented for relocation. BTs (Bearing Trees - 2) adjacent to the plot shall have an aluminum metal tag nailed below stump height facing the plot center with plot number, azimuth, and slope distance to the plot recorded on the tag. Flagging shall be attached to such tags to assist in future relocation. GPS coordinates shall also be recorded at each plot location. All tag information shall be included in the field notes.

"Defined Fixed Length Radius" shall be utilized to determine whether trees are in or out of the plot. Radius measurement point will be at DBH and tally will begin from **true North** and commence in a **clockwise** manner.

Height Data

Height data shall be collected for each stand using the following guidelines:

- Height data shall be collected for at least one tree per species per DBH grouping (see below) on each "Measure plot".
- Height data shall be collected for trees of different DBH's, which shall be distributed across the range of DBH's sampled (4" – 11", 12" - 17", 18" – 23", 24" – 33" and 34" and over). At each plot the first tree tallied in each DBH group, that meets the criteria below shall be measured for height. Trees less than 4" total height shall be measured to the nearest 3' (i.e. 6, 9, 12, etc.).
- Height trees shall not show evidence of crooks, forked tops (conifer only) or dead tops
- Note: all trees with a broken top shall be measured for height (height to break and DOB at break)
- Live crown percentage shall be taken for all trees larger than 3.5 inches DBH.

Form Data

Form data shall be collected for each stand using the following guidelines:

- Form data shall be measured at the point described in the "Definitions".
- Form data shall be collected for conifer trees selected for height data collection that meets the criteria below shall be measured for form.
- Trees selected for form data collection shall have normal bole shapes, shall not lean excessively (> 15 feet as measured from groundline center of tree to point directly below tip). Dead trees may be chosen, if the top is intact.

Site Data

Site Tree data (age data) shall be collected for each stand using the following guidelines:

- Site trees will be selected from a subsample of trees selected for Form Data. Site trees will be taken in every third plot with the first "Form Tree" that meets the following criteria being measured:
- Such trees shall be between 25 and 70 years of age (12 inches to 24 inches DBH), dominant or co-dominant trees that are in a "free to grow" condition. They shall not include trees that make up a small portion of the stand and are significantly larger or smaller than the majority of the trees in the stand, ie, leftover seed trees or residual trees from highgrading. Only redwood or Douglas-fir Site Trees will be measured.
- BHA will be taken on all Site Trees.

Defect

Defect shall be coded to the nearest 5 percent of the volume of each 1/3 of the total height (butt 1/3, mid 1/3, top 1/3). This deduction will be taken for missing carbon volume. For trees with missing or broken tops the total height shall be estimated for the purpose of determining the defect by position (1/3s in tree). Trees with broken or missing tops shall have the height taken to the break and a top diameter estimated.

If a portion of a tree does not contain the minimum of 25% sound merchantable volume enter a defect percentage value of 99%. Trees with broken or missing tops shall have the height taken to the break and a top diameter estimated.

Summary of Tree Data – All plot

Required information for each Prism sample tree:

1. Species code – See "Species Code Table".
2. Component code (default is ".." [Live-healthy]) – See "Component Code / Tree Condition Table"
3. DBH to nearest inch (Trees 4.6" DBH and larger).
4. Number (Count) of similar trees – 1 tree per record is recommended for Prism sample trees. All species must be counted.
5. Percent of live Crown.
6. Defect data (bd.ft. and carbon).
7. The following data shall be collected on Height, Form and Site trees (sub-sampled as indicated above) as follows:
   a. Total height.
   b. Height to form point, the point where DOB is 80% of DBH, recorded as total feet from ground line on all conifers.
   c. BHA is taken on a subsample of trees selected for Site Data as indicated.

   Note: all trees with a broken top shall be measured for height (height to break and DOB).

Required information for each sample tree on the fixed area plot – 1/100th acre plot – 11.8' (Trees >.5 inch DBH @ 4.5' in height and less than 4.6" DBH are tallied):

1. Species code – See "Species Code Table".
2. Component code (default is ".." [Live-healthy]) – See "Component Code / Tree Condition Table"
3. DBH to nearest inch (Trees .5" to 4.5" DBH).
4. Number (Count) of similar trees – 1 tree per record is recommended for Prism sample trees. All species must be counted.
5. Total Tree Height – 1-inch DBH and larger trees must have a minimum height of 4.5 feet (by 3 foot classes).

All trees 1-inch DBH and larger that, in cruiser's opinion, are vigorous enough to survive for one year following measurement, must be counted,

No Tally Plots

The proper data entries for a **No Tally** plot are:

Stand ID
Plot ID
Tree number
Species = 'XX'
Component = '..'
DBH = 0
Count = 0
Height = 0 (1 or default entry for collection devices that do not accept zero (0) height for zero (0) ` DBH entries.)

Summary of Tree Data – All plots

Required information for each sample tree on the 1/5th acre and 1/50th acre fixed area plots:

1. Species code – See "Species Code Table".
2. Component code (default is ".." [Live-healthy]) – See "Component Code / Tree Condition Table"
3. DBH to nearest inch (Trees 3.6" DBH and larger on 1/50th, 11.6" DBH and larger on 1/5th).
4. Number (Count) of similar trees – 1 tree per record is recommended for sample trees. All species must be counted.
5. Percent of live Crown.
6. Defect data (carbon).
7. The following data shall be collected on Height and Site trees (sub-sampled as indicated above) as follows:
    a. Total height.
    b. BHA is taken on a subsample of trees selected for Site Data as indicated.

   Note: all trees with a broken top shall be measured for height (height to break and DOB).

Required information for each sample tree on the fixed area plot – 1/100th acre plot – 11.8' (Trees >.5 inch DBH @ 4.5' in height and less than 3.6" DBH are tallied):

1. Species code – See "Species Code Table".
2. Component code (default is ".." [Live-healthy]) – See "Component Code / Tree Condition Table"
3. DBH to nearest inch (Trees .5" to 4.5" DBH).
4. Number (Count) of similar trees – 1 tree per record is recommended for Prism sample trees. All species must be counted.
5. Total Tree Height – 1-inch DBH and larger trees must have a minimum height of 5 feet (by 3 foot classes, i.e. 6, 9, 12, etc.).

All trees in the 1-inch DBH class and larger that, in cruiser's opinion, are vigorous enough to survive for one year following measurement, must be counted.

<u>No Tally Plots</u>

The proper data entries for a **<u>No Tally</u>** plot are:

Stand ID
Plot ID
Tree number
Species = 'XX'
Component = '..'
DBH = 0
Count = 0
Height = 0 (1 or default entry for collection devices that do not accept zero (0) height for zero (0) DBH entries.)

Species Codes

Species Code	*Common Name*
DF	Douglas-fir
RW	Redwood
PP	Ponderosa Pine
SP	Sugar Pine
IC	Incense Cedar
GF	Grand Fir (White Fir)
CX	Misc. Conifers
PY	Pacific Yew
TO	Tanoak
PM	Pacific Madrone
WO	Oregon White Oak
BO	Black Oak
LO	Live Oak
RA	Red Alder
CL	California Laurel
GC	Golden Chinquapina
BM	Big Leaf Maple
BC	Black Cottonwood / Cottonwood Species
HX	Misc. Hardwoods
XX	No Tally Plot Species Record

Component Code

Component Code	*Classification within species*
..	Live, healthy tree
SN	Snag

- A Snag (SN) tree shall be tallied if a) they are in the sample b) they are 4.6" DBH or larger, and c) the tree is at least 10' in height. Record Species, Component code as "SN", DBH, Count, Height, carbon defect and Decay Class as follows:

  1 - Tree has recently died with leaves intact.
  2 - Leaves mostly still attached, intact bark, fine twigs, and branches.
  3 - Leaves mostly gone, fine branches mostly gone, bark loose and starting to fall off.
  4 - A few large branches or stubs remain, bark falling off in large patches, softwood sloughing is evident.
  5 - Highly decomposed, no branches, little bark, broken off top.
  6 - Mostly decomposed, no branches, very little bark, broken off close to the ground.

SPECIFIC CRUISING PARAMETERS

Parameters to be used with this cruise:

The "Cruise area" is described in the attached maps.

Stand ID coding is: stand ID as displayed on cruise maps.

Plot DBH Breaks (Min)	…	…	=	.5", 3.6" and 11.6"
Fixed Plot Sizes	…	…	=	1/100 acre (11.8' or 3.60m radius) 1/50 acre (16.7' or 5.09m radius) 1/5 acre (52.7' or 16.06m radius)
Measure Height to	…	…	=	Tip of tree
Heights Recorded as	…	…	=	Feet
Top DIB	…	…	=	0 (zero) inches (Tip of tree)
Flagging	…	…	=	As directed

Monumented Plots - Special Marking

Plot centers on cruise plots shall be marked with flagging tied to a metal spike (or large nail) in the ground. 'Witness Flags' shall also be attached to a tree limb near plot center to aid in location of it. This witness flag should be at least 3 feet long and attached at eye level within 10 feet of plot center. In stands where eye-level stems do not exist within the 10-foot limit, attach one Witness Flag on the tree nearest plot center that is to be measured. Write the plot number on the flag at plot center (on metal spike). Write the plot number, cruiser initials and date on the Witness Flag with a ***permanent-ink*** marker. The ink color for the marker shall contrast with the colors used in the ribbon.

In addition each plot shall be considered a "Monumented Plot". BTs (Bearing Trees) adjacent to the plot shall have an aluminum metal tag nailed below stump height facing the plot center with plot number, azimuth, and slope distance to plot recorded on the tag. Flagging shall be attached to such tags to assist in future relocation. GPS coordinates shall also be recorded at each plot location. All tag information shall be included in the field notes.

Equipment to be utilized:

Plot Location -	GPS unit capable of locating designated plot coordinates with hand compass to assist. (actual GPS Plot info to be recorded at each plot utilizing Garmin 60CSx, 62st or equivalent GPS Unit)
Plot Radius -	Measuring tape and/or laser range finder
DBH -	Diameter tape
Height -	Laser range finder or measuring tape and relaskop or clinometers (laser hypsometer acceptable)

Specific criteria pertaining to data collection

DBH – taken at 4.5 feet above the natural ground line on the uphill side of the tree (see "Definitions"). Measurement shall be taken perpendicular to the bole of the tree, avoiding abnormal bumps, burls, swells and scars.

Trees with double stems (fused trees) or other situations where taped measurements around the bole cannot be obtained, will have the diameter measured for ½ of the bole and this number doubled.

Forked trees will be measured (cruised) as two trees if such trees will be felled as two separate trees when harvested and as one tree if they will be felled as one tree at the time of harvest (fork further up the bole).

Height – taken as near perpendicular to any lean as possible. Height trees shall not show evidence of crooks or forked tops in conifers or dead tops in all species.

Draft Stratification Information –

The area was stratified into dominant types utilizing the following criteria:

- Species dominance –
  - DF = *10*
  - TO = 20
  - Other = 30

- DBH size Class
  - 0" - 11" DBH = 2
  - 12" – 22"+ DBH =3

The above stratifications are based on the criteria indicated in "PNW Forest Typing System Stratum Labels". Stratification was done pre sampling utilizing aerial photos with GIS system polygon overlays. Vegetation strata were verified utilizing historic and current pre sampling field verification. Boundaries were established utilizing GIS overlays with sample stratification based on plot location within identified vegetation strata polygons. No post sampling stratification was utilized.

Quality Assurance/Quality Control (QA/QC) –

To assure quality data collection and quality control –

- JLA established cruise standards, sampling procedures and established plot locations within identified vegetative types (strata).
- Crew chief presented cruise standards, sampling requirements and maps with plot locations (including GPS coordinates) to field crew (cruisers).
- Crew chief field check each cruiser upon startup, and systematically throughout data collection period, to insure accurate adherence to required data collection procedures and documentation on field notes.
- Field notes (data) are collected by crew chief daily, along with map of the sample plots taken, and deposited at JLA office.
- Data entry personnel make a copy of all field notes and maps and place these in secure file.
- Data entry personnel systematically enter field data into appropriate computer program to facilitate compiling of data.
- Data entry personnel compare computer plot list with field notes and edit for errors.
- Computer data base is systematically backed up of minimize potential for loss of entered data.
- Complete data base for all sample plots taken is given a final edit.
- JLA compiles list of Stand_ID and actual GPS plot location for each sample plot along with final plot location map.
- Plot data, Stand_ID and mapping information are backed up (archived) and provided for compilation and growth analysis.