

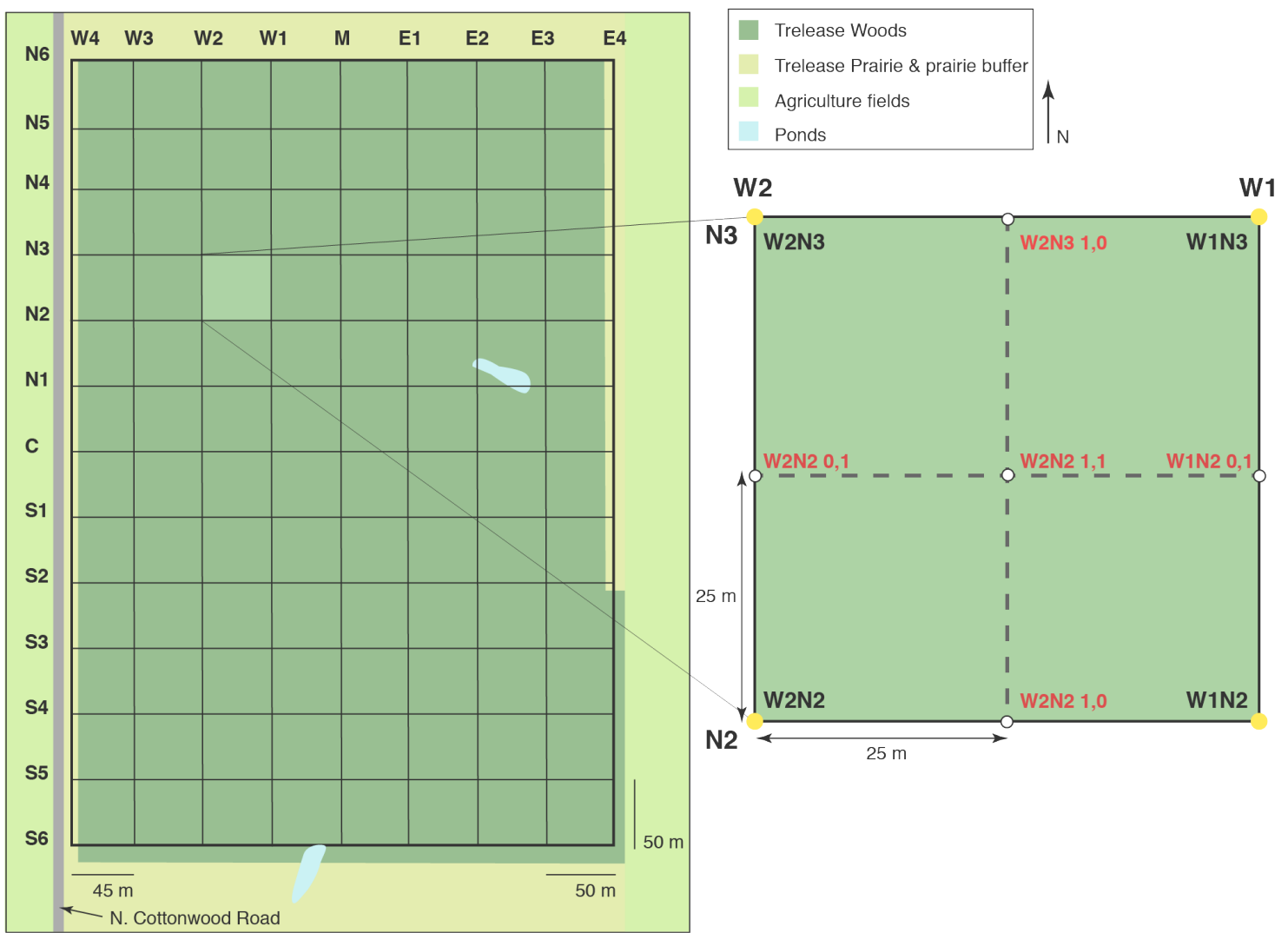
**PROTOCOL**  
**Trelease Woods CTFS-ForestGEO**  
 University of Illinois, Urbana-Champaign  
 Census 2018 - 2019

**INTRODUCTION**

Trelease Woods is 24 ha old-growth forest remnant of the “Big Grove” that once occupied a 10 square mile area in a bend of the Salt Fork River. Trelease is relatively undisturbed, apart from selective logging and cattle grazing prior to its acquisition by the University in 1917, and represents a recent forest invasion (~400-600 YA) of an upland occupied by prairie.

**PLOT GRID DESIGN**

Trelease Woods is approximately 600 x 400 m, running north-south and east-west, respectively (Fig. 1). The plot was originally surveyed and gridded in 1939.



**Figure 1.** Map of Trelease Woods showing plot grid and labeling system.

### ***Quadrats***

The plot is divided into 84 50 m<sup>2</sup> quadrats and 12 45 x 50 m quadrats (column W4, see 'W4 Column Quadrats' for additional information). Corners of quadrats are delineated by yellow (installed in 1939) or orange (replacements installed between 1994 and 2016) metal fence posts and labeled with metal plates. On the western edge of the W4 column, quadrat marker plates are affixed to the chain link fence, and PVC pipe markers that correspond to these fence markers have been installed ~3 m to the east. For the purposes of this study these PVC markers should be considered the edge of the plot. North-south edges of quadrats are roughly delineated by yellow paint spots that can be used to navigate between corner posts.

### ***Sub-quadrats***

Quadrats are subdivided into 25 m<sup>2</sup> sub-quadrats (except for W4, see below). Sub-quadrat markers consist of a rebar pole driven into the soil with a PVC pipe over top and are labeled with a metal tag.

### ***Grid Labeling System***

The East-West axis of the quadrat grid is labeled "E4" through "W4" with "M" denoting the middle at ~200 m. The North-South axis of the quadrat grid is labeled "N6" through "S6" with "C" representing the center at 300 m (Fig. 1). Quadrat names correspond to the southwest corner of each quadrat and follow the format E/W#N/S#. Sub-quadrat corners are labeled with coordinates (0,0; 1,0; 0,1; or 1,1) denoting their position within the quadrat (Fig. 1).

### ***W4 Column***

Quadrats in the W4 column are 45 x 50 m. Western sub-quadrats in this column (0,0 and 0,1) are 20 x 25 m and eastern sub-quadrats (1,0 and 1,1) are 25 x 25 m.

## **SAFETY, FIELD HAZARDS & PREPAREDNESS**

Follow safe practice, use common sense, and watch out for your teammates.

- ***Plants***: Know how to identify poison ivy. If you come in contact with it, wash exposed area under cold with a strong soap, such as Dawn, as soon as possible. Do not lean on woody stems that appear solid as many are not. On occasion, snags and large branches do come down while we are working in the plot. Always be looking and listening for falling debris.
- ***Animals***: Trelease is habitat for lone star ticks, American dog ticks, blacklegged/deer ticks, copperhead snakes, and bees and wasps. Watch your step, as stinging insects often nest in the ground or in downed wood. Ticks can spread Rocky Mountain spotted fever, southern tick-associated rash illness (STARI), and Lyme disease. If you start experiencing symptoms of one of these diseases seek medical attention immediately. Treatment is most effective when caught early. Be careful handling fallen trees, which often have raccoon poop on them. Raccoon feces can transmit raccoon roundworm, salmonella, and giardia.
- ***Weather***: Windstorms and tornados occur in Central Illinois. Do not enter the plots on days with high wind. If in the field, take cover in the nearest low-lying area or ditch.

Come prepared with comfortable clothes, hat, rain gear, and bug spray, if desired. Long pants and sturdy shoes are required. Pay attention to the weather forecast and dress accordingly. Bring plenty of water. If you are at all uncomfortable with performing any of our field tasks, please come and discuss it with Jim Dalling or Jennifer Fraterrigo.

## CLEANLINESS

Keep the study areas clean. Pack everything out, including biodegradable items. Pick up all trash in the plot or along the access roads, including stray pieces of grafting tape and loose tags. Carefully note found tags and return them to their appropriate locations. Peeing is allowed in the plot. If you need additional facilities, a porta-potty is located across the road in Phillips Tract.

## PLANT COLLECTION

Plant material can be removed for identification.

## EXOTIC SPECIES

Exotic plant species are part of the study. Do not remove them.

## EQUIPMENT & SUPPLIES

### FIELD SUPPLIES

The following items are required for a three-person team to census one quadrat:

**Table 1.** Checklist of equipment needed to census one quadrat with a three-person team.

iPad (1 per team)	Tool Buckets (2 per team)	Other equipment/supplies
<ul style="list-style-type: none"><li>Waterproof case (1)</li><li>Your team's current quadrat and next quadrat sheets, with "Available Offline" selected.</li></ul>	<ul style="list-style-type: none"><li>Tree tags (~100 per bucket)</li><li>Grafting tape (1)</li><li>Nails (~50)</li><li>Hammer (1-2)</li><li>Steel DBH tape (1)</li><li>Soft DBH measure (1)</li><li>Dial caliper (1)</li><li>Sharpies (2)</li><li>Tree paint tubes (2)</li><li>Paint brushes (2)</li><li>Clips for paint tubes (2)</li></ul>	<ul style="list-style-type: none"><li>Cell phone (1)</li><li>Compass (2)</li><li>Flagging tape – hot pink (1)</li><li>Rangefinder &amp; spare battery (1)</li><li>Rangefinder staff (1)</li><li>Census poles (2)</li><li>Reflector (1)</li><li>Binoculars (1)</li><li>Ziplock bags (2)</li><li>Rite in the Rain notebooks (1 per person)</li><li>Scissors (1)</li></ul>

### *Suppliers*

- Tree nails: Nichols Wire Incorporated, Aluminum Hy-Tensil Alloy Clous Nails
- Tree tags: National Band and Tag Company, #161 Oblong Aluminum
- Tree paint: Nelson Paint Company, Nel-Script in Lite Blue
- Laser range finder: Laser Technology Inc., TruPulse 360R

## PROTOCOL

The protocols below follow the protocols used by the Center for Tropical Forest Science-Forest Global Earth Observatory (CTFS-ForestGEO) (Condit 1998; Anderson-Teixeira et al. 2015) and were modified from Jonathan Myers' tree census protocol for the Tyson Research Center SPFD Experiment.

All trees with a diameter at breast height (DBH)  $\geq 1$  cm are to be tagged, measured for diameter, identified, and mapped:

### TAGGING TREES

#### *Tagging Trees DBH $\geq 10$ cm*

Trees with a DBH  $\geq 10$  cm are marked with a tag nailed to the tree at 140 cm. On level grounds, tagged are placed on the southern side of the tree. If ground is sloped, place tags on the uphill side. Do not nail tags at the same height as DBH.

- *For regular, cylindrical trees:* 140 cm is measured with wooden census pole
- *For non-cylindrical trees (curved or forked stems):* 140 cm is measured using a soft DBH tape placed along the length of the stem

Drive nails at an angle slightly depressed from the horizontal (i.e. slightly towards the ground) so the tag tends to hang at the nail head and away from the tree. Do not hammer the nail and then bend it down. Attach tags before measuring trees.

#### *Tagging Trees DBH $< 10$ cm*

Trees with a DBH  $< 10$  cm are marked with a tag strung on grafting tape that is tied around the tree. Grafting tape may be attached near eye level by wrapping the tape around the main stem and resting it on a firm branch, or at the base of the tree, with the tag and tape resting loosely on the ground. Make sure the tape has enough extra length so the tree has room to grow until the next census in 5 years. Use a tag with tape if there is any question that a nail might damage a stem or interfere with its growth.

#### *Tagging Trees with Multiple Stems*

For trees that have multiple stems (more than one stem with DBH  $\geq 1$  cm), only tag the stem with the largest diameter (the main stem).

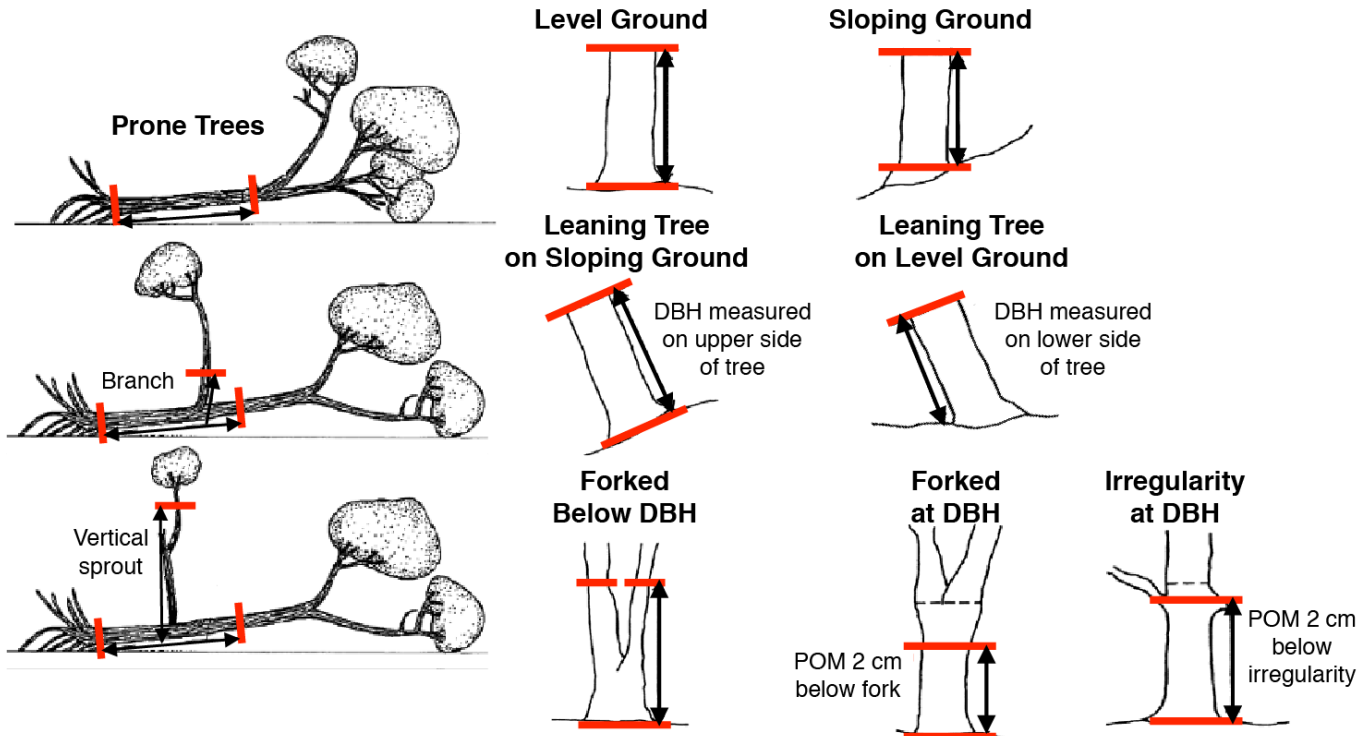
### MEASURING TREE DIAMETERS

Breast height, the standard point of measure (POM), is 130 cm above the base of the tree on the uphill side. DBH is always measured perpendicular to the trunk/stem (Fig. 2). Record DBH to the nearest 0.1 cm (rounding up or down).

Determining POM for different circumstances (Fig.2):

- *For straight trees:* Use a census pole
- *For curved/bent trees:* Use a soft tape measure placed along the length of the stem
- *For prone trees:* Measure along the lower side of the trunk
  - Only branches/sprouts between the base of a prone tree and 130 cm are measured
  - Branches: measured 130 m along the lower side of trunk and up the branch.
  - Vertical sprouts: measured vertically 130 m from the lower side of the trunk (as if the tree was resting on the ground and you were measuring from the ground).

- **For leaning trees:**
  - On level ground: DBH measured on lower side of tree
  - On sloping ground: DBH measured on upper side of tree



**Figure 2.** Protocols for measuring DBH. Arrows show locations of the POM.

### ***Measuring Trees DBH $\geq$ 5 cm***

For trees with a DBH  $>$  5 cm, measure diameters using a DBH tape. Ensure that the entire diameter tape is level (perpendicular to the trunk) and that it is snug before taking the measurement. Make sure you are measuring diameter at the “zero point” and not the end of the tape, and that you are reading the diameter side of the tape, not circumference.

### ***Measuring Trees DBH $<$ 5 cm***

For trees with a DBH  $<$  5 cm, measure diameters using a dial caliper. Find the largest DBH by rotating the calipers while they are clamped lightly on the stem. On highly irregular stems, take at least two measurements at  $90^\circ$  to one another to find the largest measurement.

### ***Measuring Alternative Heights***

Measuring diameters at an alternative POM may be necessary because of branches, swelling, or inaccessibility (Fig. 2). In these cases, the diameter is taken 2 cm below the lowest point of the irregularity (Fig. 2). It is important to measure the diameter below, rather than above, the irregularity, since diameters above the irregularity may be  $<$  1 cm.

### ***Measuring Trees with Vines***

Lianas and vines should be pulled away from the tree and the DBH tape should be slid underneath them whenever possible. If there is poison ivy growing on the tree, make a note on the data sheet and flag the tree, and someone will measure the tree for you.

## PAINTING TREES

A small line of paint (~ 5 cm) is applied at the POM after measuring DBH. Generally, paint should be applied to the southern side of the tree, unless the tree is prone. If a tree has multiple stems, only the main stem is painted. If the tree is wet and paint will not adhere, skip painting.

## IDENTIFYING TREES

Use provided species guides to help identify trees. If you are not confident on the ID, use an unknown species code.

### *Species Codes*

Species codes consist of the first 3 letters of the genus and first 3 letters of the species. Unknown genera and species are identified as follows:

\_\_\_SPP = Known genus, but unknown species  
UNKSPP = Unknown genus and species

## MAPPING TREES

Trees are mapped from grid markers or other reference points using a laser rangefinder. The coordinates of trees in relation to a reference point will automatically be calculated from measured horizontal distance and azimuth data and populate a map. Refer to this map periodically to confirm that your measurements are accurate (see ‘Stem Map’ section for more information).

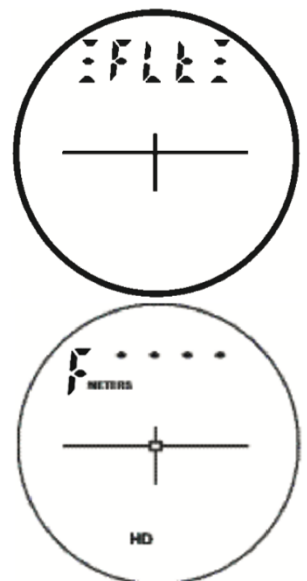
Carefully follow the following instructions to ensure accurate measurements (modified from NEON “TOS Standard Operating Procedure: TruPulse Rangefinder Use and Calibration”):

### 1. Reference point (RP)

- Find the SW quadrat corner marker. The starting RP  $x = 0$  and RP  $y = 0$ . Record these values.

### 2. Horizontal distance (HD)

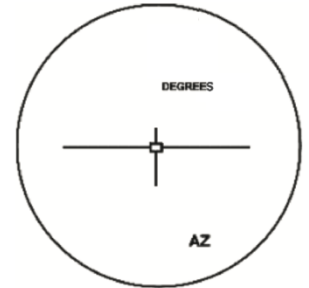
- Turn on rangefinder (press “Power/Fire”).
- Check that the foliage filter is attached.
- Press ▲ (away from ocular) for 4 sec. Scroll (press either ▲ or ▼ button) until you reach **Flt** (Filter). Press “Power/Fire.” **F** will appear on the left side of the viewfinder.
- Scroll through measurement modes (press either ▲ or ▼ button) until **HD** appears at the bottom of the viewfinder.
- **Person at tree:** Hold the reflector at POM at SW side of tree.
- **Person with rangefinder:** Stand at RP, level the rangefinder, look through the viewfinder, aim the crosshairs at the reflector, and press and hold “Power/Fire” until the distance is displayed.



- Check that the reading contains one decimal digit (e.g. 3.0). If the reading does not contain one decimal digit (e.g. 3) remeasure. Record the value.

### 3. Azimuth (AZ)

- Scroll through the measurement modes (press either the ▲ or ▼ button) to **AZ**. Press and hold “Power/Fire” until the azimuth is displayed. Record this distance.



4. Measure tree locations using the same RP until you no longer have a clear line of sight. Move to another RP (a tree that has already been measured for HD and AZ). Record this tree’s calculated coordinates in the RP columns and continue measuring tree locations.

### Important Notes

- Location measurements are taken for main stems only.
- Horizontal distances of trees within 0.5 m of the reference point may need to be measured by hand with the diameter tape or meter tape. (Remember not to use the diameter side of the DBH tape!)
- An azimuth of due north should be recorded as 0°, rather than 360°.
- When firing the rangefinder, be aware that metal objects may interfere with compass readings.
- When the range finder shows the low battery warning, stop using the range finder. Let Jim, Jennifer, or Sierra know. The battery will have to be replaced and the range finder recalibrated.

## DATA COLLECTION

Always complete each datasheet header and every applicable column. Ensure that all measurements are made and recorded to the correct precision.

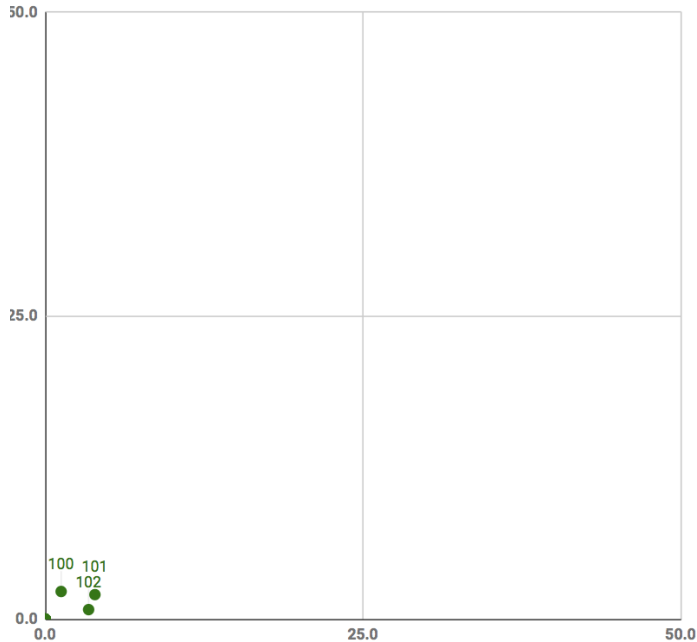
### Main Stem Data Sheet

Main Stem Data Sheet																				
Quadrat		Names																		
W3S6		Sierra Perez																		
MS Sheet		<input checked="" type="checkbox"/>																		
Date	Q	SQ	Tag	Species	A/D	DBH (cm)	POM (cm)	MS	RP x	RP y	HD (m)	AZ (deg)	Tree x	Tree y	S/L/P	DC 1	DC 2	DC 3	Comments	FC
9/4/2018	W3S6	0,0	100	CELOCC	A	48.5	130.0	0	0.0	0.0	2.6	28.7	1.2	2.3	S					
9/4/2018	W3S6	0,0	101	ACESAC	A	5.3	128.0	1	0.0	0.0	4.4	62.6	3.9	2.0	S				Alternate POM b/c knot	
9/4/2018	W3S6	0,0	102	FRASPP	D	20.6	130.0	0	0.0	0.0	3.5	77.0	3.4	0.8	S				Species check	✓

Figure 3. Example of a completed Main Stem data sheet.

### Stem Map

A map included in the file self-populates a tree’s relative location in the subquadrat once horizontal distance and azimuth data are entered (Fig. 4).



**Figure 4.** Example of a quadrat tree location map.

### ***Multiple Stem Data Sheet***

Multiple Stem Data Sheet											
Quadrat		Names									
W3S6		Sierra Perez									
Date	Q	SQ	Main Stem Tag	Species	DBH (cm)	POM (cm)	DC 1	DC 2	DC 3	Comments	FC
9/4/2018	W3S6	0,0	101	ACESAC	2.6	130.0					

**Figure 5.** Example of a completed Multiple Stem data sheet.

### ***Condition & Damage Codes***

The “A/D”, “S/L/P”, and “DC” columns provide information on a tree’s overall condition. Note the tree’s state and record it in the appropriate columns. Additional information on the tree’s condition can be included in the “Comments” section.

#### A/D

A = Alive

D = Dead (only census recent dead ash (*Fraxinus*) trees)

- Distinctive bark should give away that it's an ash.
- Check dead trees for a tag, which means they have already been measured for a "dead tree" census. Do not include if already tagged.
- If the tree is missing all of its bark, it likely has been dead for a while.
- If borderline dead (i.e. mostly/entirely defoliated, but if you scratch the bark with the back of a hammer, it is not dry, indicating it is still alive), use your best judgement to determine if it's alive or dead.



### S/L/P

S = Standing

L = Leaning ( $\geq 45$  deg.)

P = Prone/prostrate

### Damage

R = Rotten

B = Broken below 130 cm, but still alive

ST = Stem break above POM

C = Crown damage

T = Tip-up (tree prone with root ball exposed)

RS = Re-sprout (main stem dead, measuring the re-sprout)

### ***Uncollected Data & Field Checks***

If data cannot be collected for whatever reason (e.g. unknown ID, need a ladder to reach POM, etc.), make a note in the “Comments” section, check the field check (“FC”) box, and flag the tree with pink flagging tape.

### **REFERENCES**

Anderson-Teixeira, Kristina J. 2015. CTFS-ForestGEO: a worldwide network monitoring forests in an era of global change. *Global Change Biology* 21, 528–549.

Azuaje, E. “TOS Standard Operating Procedure: TruPulse Rangefinder Use and Calibration” (NEON Doc. #: NEON.DOC.001717) (Revision: A 2/6/2015). *National Ecological Observatory Network (NEON)*. August 21, 2018. <https://www.neonscience.org>

Condit, Richard. 1998. Tropical forest census plots: Methods and results from Barro Colorado Island, Panama and a comparison with other plots. Springer-Verlag, Berlin.

Lutz, James A. “2015 Field Procedures pdf” (Version 2.3 2015/02/09). *The Western Forest Initiative - Studying Primary Forests of the West*. May 12, 2016. <http://westernforestinitiative.org>

Myers, Jonathan A. “Field Protocols: Tree Census” (Version 1.1 06/05/2017). *Tyson Research Center SPFD Experiment*. August 21, 2018.