

Cumberland Piedmont Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure 3

Site Selection and Plot Establishment—Version 1.48

Please cite this as:

Cumberland Piedmont Network. 2023. Site selection and plot establishment—Version 1.48.

Cumberland Piedmont Network Standard Operating Procedure NPS/CUPN/SOP—3. Cumberland Piedmont Network, Mammoth Cave, Kentucky.

Overview

This standard operating procedure (SOP) provides instruction for establishing plots and collecting site information for both plot establishment years and plot revisit years. It is divided into two sections: step-by-step instructions for plot establishment years and step-by-step instructions for plot revisit years.

Contents

	Page
Definitions.....	3
Step by Step Instructions for Plot Establishment Years	4
Prior to Field-Based Work.....	4
Overview of the steps for rejecting plots a priori:	4
Navigating to Potential Plot Centroid.....	4
Determining Whether a Plot Should be Established or Resized	5
Reasons or justification for excluding potential plot locations.	5
Marking and Recording the Plot Center	6
Laying out Plot	8
Documenting Plot Layout and Irregularities	13
Site Characteristics	14
Equipment List for Plot Establishment Years	15
Step by Step Instructions for Plot Revisit Years.....	16
Prior to Field-Based Work.....	16
Navigating to Plot.....	16
Laying out Plot	18
Site Characteristics	20
Equipment List for Plot Revisit Years.....	20
Completing Field Data Forms.....	21
Literature Cited	28
Revision Log	29

Definitions

True north is the direction of the North Pole, from your position. This contrasts with magnetic north—the direction a compass needle points when in the northern hemisphere.

Magnetic north varies across North America with location and over time. To locate true north, it is necessary to adjust a compass to account for the declination, which is the difference between true north and magnetic north using a magnetic declination chart or table (e.g., [NOAA Magnetic Declination Page](https://ngdc.noaa.gov/geomag/declination.shtml) [https://ngdc.noaa.gov/geomag/declination.shtml]). Adjust your compass by dialing the declination into the faceplate to the nearest degree. Set the compasses of all field crew members for the same declination. As an example, declination adjustment values for CUPN parks in 2012 are listed below (Table 1).

Table 1. Declination adjustment values utilized for CUPN parks in 2012.

Park	Declination as of July 1, 2012	Compass Adjustment for Summer 2012
Abraham Lincoln Birthplace National Historic Park	4° 23' West	4° West
Carl Sandburg Home National Historic Site	6° 23' West	6° West
Chickamauga and Chattanooga National Military Park	4° 17' West	4° West
Cowpens National Battlefield	6° 51' West	7° West
Cumberland Gap National Historical Park	5° 42' West	6° West
Fort Donelson National Battlefield	2° 35' West	3° West
Guilford Courthouse National Military Park	8° 18' West	8° West
Kings Mountain National Military Park	7° 00' West	7° West
Little River Canyon National Preserve	3° 52' West	4° West
Mammoth Cave National Park	3° 58' West	4° West
Ninety Six National Historic Site	6° 28' West	6° West
Russell Cave National Monument	3° 56' West	4° West
Shiloh National Military Park	2° 3' West	2° West
Stones River National Battlefield	3° 34' West	4° West

As an example, in 2012 when the field crew visited Guilford Courthouse National Military Park to collect plot data, the crew adjusted the declination on the compass to correct for the 8° difference. Most compasses have a setting ring on the bottom of the compass that allows for this correction. Simply turn the main compass ring so the index pin is over 352° (8° to the west of north is 352°).

Once this setting has been changed, it will not need to be changed until moving to a new park with a different declination. Make sure to adjust the declination in the correct direction (west not east). Declinations will need to be updated yearly for each park before fieldwork begins.

Step by Step Instructions for Plot Establishment Years

Prior to the field season, the team leader will use the list of all generalized random tessellation stratified (GRTS) selected plot locations and numbers to determine which plots will be visited in this field season in each park. For parks with extra resources to sample additional plots, this is the time to also identify those plots and determine the order they will be visited and by whom.

Prior to Field-Based Work

Overview of the steps for rejecting plots a priori:

1. After generating the ordered list of GRTS centroid points for each park, the points will be overlaid in GIS with derived slope measures, digital orthoquads or aerial imagery to determine whether any of the centroid points overlap with one of the situations mentioned and listed below.
2. If any centroids occur on roads, trails, or the park boundary or if they fall in areas that have less than 10% tree cover, they will be excluded from the selection and will be replaced by new points from the next available centroids in consecutive order from GRTS sequence of points. If there is any doubt as to whether a plot should be disqualified, the plot will remain on the list to be visited but should be flagged and marked with the potential reason it may be thrown out so the field team can visit the point and decide whether to sample at that time.
3. Maps of the selected monitoring plot locations after the a priori assessment will be sent to park managers and they will be able to “veto” any points based on the situations above or other issues they might have with placement of particular plots. Parks will also be asked to give advice on best routes to easily access plots and any logistical challenges.

Navigating to Potential Plot Centroid

When field crews are conducting fieldwork, they may either move or eliminate any points where one of the *a priori* situations above applies to the centroid of the plot or where they feel their safety is being compromised (e.g., open mine shaft present). Final maps will be printed and sent out with field crews, with enough “extra” points also printed on the maps to ensure teams have an adequate number of points to sample should they need to throw out points at the time of the field visit.

At the beginning of the field day, determine points the team will visit that day based on the relative accessibility of the first point to the second, with goal of completing two plots per day. Note: in very rugged or remote situations two plots per day will not always be possible (e.g., Cumberland Gap NHP).

Turn on GPS enabled device (either GPS unit or handheld unit with GPS capabilities) and navigate to the point (Refer to SOP 2 *Using GPS [Based on the use of GPSMAP 64]—Version 1.26* [CUPN

2023a]). Once the field teams have navigated to the location of the plot using GPS, they will be at the center of the plot, which is also the center or “centroid” of the grid cell that was chosen using GRTS.

Determining Whether a Plot Should be Established or Resized

Sampling points have been selected using GRTS so that each of the points visited is the “centroid” of one of the park’s 40×40 -meter (131.2×31.2 feet [ft]) grid cells. First, be confident the team is as close to the actual mapped centroid as the handheld GPS unit and available satellites will allow. Typically, this should be less than 5 meters (16.4 ft). This step should not be rushed as the unit may take one to two minutes as it seeks to adjust and improve accuracy for its current location. If after three to five minutes the location cannot be readily located due to poor GPS coverage, then check to see if you have only a few satellites locked in on the GPS unit and wait until you have more satellites to move closer to the point. If this is not the problem, then note “poor satellite coverage” is an issue and continue setting up the plot in the approximate location.

If the area around the plot or access to the plot represents a safety hazard (e.g., slippery waterfall, cliff), or meets one of the criteria listed below, discard the plot and record the justification on the first page of the plot data sheets. Note, the first page of the plot data sheet must be completed (with the exception of tag trees) before moving on to the next potential plot location.

If more than one quarter of the plot’s total area is within an exclusion category or if **any** of the plot occurs outside of the park boundary, then there is an option to shift the plot up to 10 meters (32.8 ft). Choose the most obvious direction that will allow for better plot placement. If the new center allows you to place the plot with less than one quarter of the area in a restricted category, then do so. If a corner of the plot hits a restricted category, then you may still include that corner if the restricted category does not take up more than one quarter of the total plot and as long as the entire plot now lies within the perceived park boundary. Do **not**, however, place conduit or other types of permanent markers in any of these restricted areas. Do not place conduit on road shoulders or fields that appear to be mowed regularly. If the plot center and adjacent area are safely accessed and do not fall into a “restricted” category, then go to “Marking and Recording the Plot Center.”

Reasons or justification for excluding potential plot locations.

1. Plot would fall partially or completely on privately owned land or directly on a park boundary.
2. Plot would be dissected by heavily used trails or roads. If trails are narrow or not heavily used, the team can use their own discretion and may place the plot there but should not place any conduit on or within 1 meter (3.3 ft) of the trail.
3. Plot would fall partially or completely on non-vegetated land, including transportation corridors, built-up land, rivers, ponds, and pavement.
4. Plot would occur on inaccessible slopes greater than or equal to 30° (equivalent to $\geq 58\%$ slope) as calculated from digital elevation models or in the field with the aid of compass or clinometer.

5. Plot would occur in a non-forested area. This is defined as an area that has a combined canopy and understory coverage of tree species of less than 10%.
6. Plot would be dissected by medium to large bodies of water or streams. As a rule of thumb, streams that one can jump across or streams that are very shallow in normal conditions should still be sampled. Streams that are large enough that they require wading or ponds with open water should be avoided.
7. Plot would fall partially or completely on intensively managed lands including road right-of-way, regularly mowed lawns, regularly mowed fields, and heavily managed landscaping.

*Note: Partial is defined as greater than or equal to 25% of the plot's total area. In situations where more than one quarter of the plot's total area is considered a restricted category or if **any** of the plot occurs outside of the park boundary, standard operating procedures allow for option to shift the plot up to 10 meters (32.8 ft).*

If the plot cannot be moved successfully, but the plot can be reduced to either a 20 × 10-meter (65.6 × 32.8 ft) plot or a 10 × 10-meter (32.8 × 32.8 ft) plot and sampled successfully, then reduce the plot size (Figure 1). If not, then throw out the plot and replace it with a plot from the list of “extra” plots on the alternate plots list that were generated for this purpose.

As noted earlier, even if the plot was thrown out because there was no suitable area to sample or because of safety concerns, complete the first page of the plot sheet and the appropriate blanks on that page (all of first page except tag trees), so we can document the site was visited and why the potential plot location was excluded.

Marking and Recording the Plot Center

Now that the plot has been selected for establishment, you are ready to set up the plot and gather data. The first step is to drive a piece of conduit into the ground at the plot centroid, once the team is satisfied this point has been located as accurately as possible with the handheld GPS unit. Conduit is driven into the ground until approximately 3 inches (7.6 centimeters [cm]) remains visible above ground.

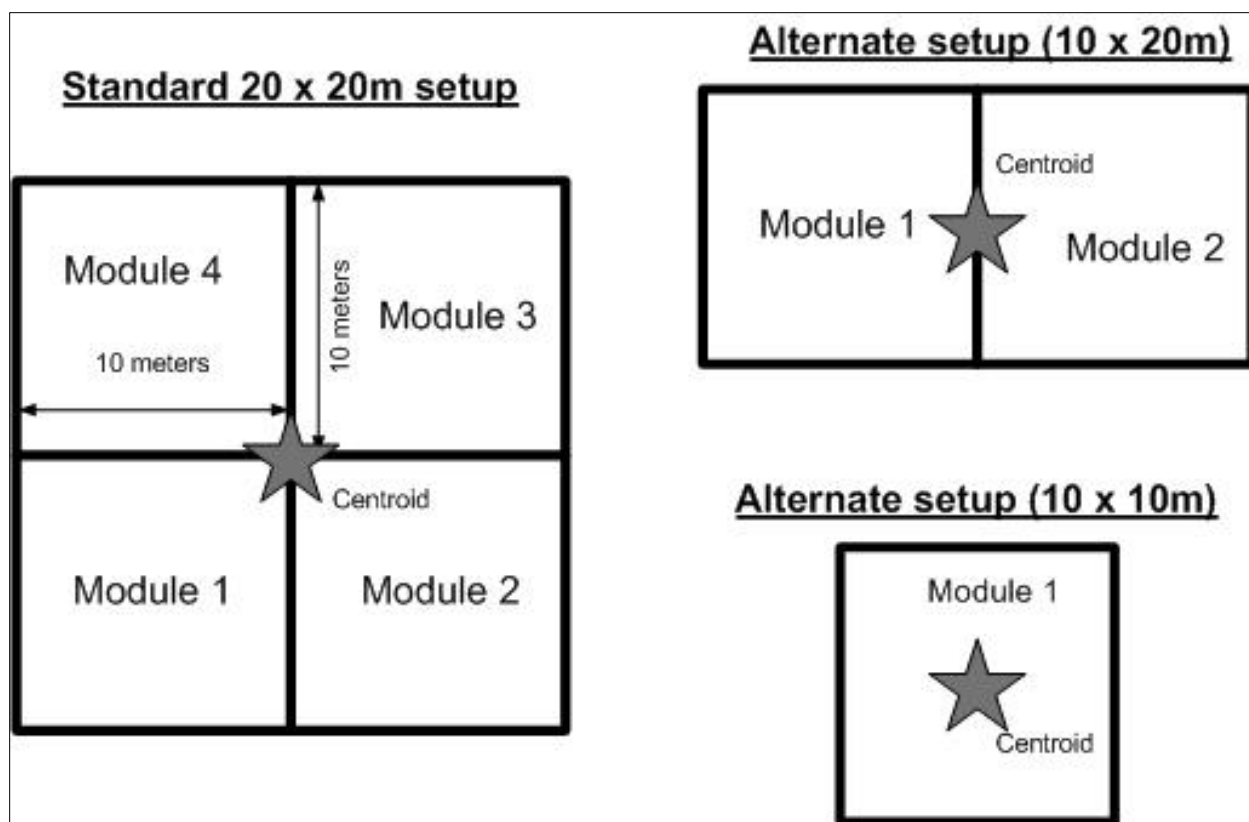


Figure 1. Different plot options for setup of plot in difficult circumstances (standard setup preferred).

If the conduit cannot be secured in the middle for any reason, then the conduit placement can be adjusted slightly if detailed notes of this modification are made on either the Plot Diagram or in Plot Layout Notes. This information is critical for ensuring future teams can relocate these exact locations for plot revisits. Examples of reasons why a team may choose to modify the location of conduit or not drive it at all include: location is solid rock or conduit would be too easily visible from roads or trails.

Once the center conduit is driven, the handheld GPS unit should be set to record and average a waypoint. If a rock or branch 0.5 meters (1.6 ft) or more above ground can supply a place to rest the GPS unit while it is averaging, this will help the GPS obtain accurate points faster. If not, then place on ground face up and try to avoid standing over or very close to the unit so as not to block it from receiving satellite signals.

To begin the process of marking your position, utilizing a Garmin GPSMAP 64xx handheld device, press and hold MARK. At this point a screen showing a generic waypoint name (e.g., 001, 002) will appear, along with your approximate location in UTM's. Toggle up to the Waypoint Name, when

highlighted press ENTER. Use toggle to enter name of new waypoint, (e.g., CUGA###)¹, select DONE.

For waypoint averaging, navigate to the Waypoint screen, hit Menu, then Enter (Average Location). Points will be averaged (by number of samples). Enter “Start” and “Yes.” When the confidence status bar reaches 100%, press SAVE and DONE and record the two UTM values and accuracy on the field form. Ensure that the plot is named using CUPN’s standard naming conventions, then scroll down to OK, and press DONE. Also press Menu and select Satellite to get to the screen that shows the graphics for your satellites. There is a bar shown for each satellite you are receiving. If you are receiving a WAAS (Wide Area Augmentation System) signal, there will be a “D” on the bottom of one or more bars. WAAS is a system of satellites and ground stations that provide GPS signal corrections, giving you much better positional accuracy. Before moving onto next steps, or turning GPS unit off, ensure the first half of the first page of plot data sheets is complete. This includes everything down to “Permanent Plot Established Yes or No,” which should be circled Yes.

Next, find two “tag” trees that are large or distinctive, appear to be in good health, are species that are long lived (not Virginia pine, for instance), and ideally within 5 meters (16.4 ft) of the centroid point. If no large trees are present, find a tree that is unique within the stand so it can be easily rediscovered when revisiting the site. Mark each tag tree by attaching the tag at 1.37 meters (4.5 ft) from the ground (breast height) with an anodized, numbered tag so it will be easy to find in future years. Record the tree’s diameter at breast height (DBH) using the DBH tape (rounding to the nearest centimeter), compass direction from the tree tag to the conduit, the number of the tag, and distance from tag tree to conduit on the datasheet. Use a tape measure and measure to the nearest 10th meter. Record this information on the datasheets, along with the color of the tag, the tag number, and tree species for all tag trees. This process will make the centroid point much easier to find in future years and will make it easier to relocate the center should the conduit disappear. Tags are affixed using a hammer and nail with the nail head lower than the point at which it goes into the tree so the tag slides down the nail as the tree grows. The tags should generally either face the center conduit or the direction from which teams accessed the plot. One exception is when the trees are very close to a trail. In this case, tags should be on the opposite side of the tree from the trail, especially if the tree is within 3 meters (9.8 ft) of the trail, to avoid drawing the casual visitor’s eye to it. Also, avoid placing conduit closer than 2 meters (6.6 ft) from any well-travelled trail if the conduit would be easily visible from the trail.

Laying out Plot

The following directions for plot layout assume a three-person crew will be available for new plot establishment (i.e., crew leader and two crew members). In instances where the crew is comprised of only two members (i.e., crew leader and only one crew member), plot layout work and additional tasking should be divided in the most efficient manner possible, as determined by the crew leader.

¹ Note that the naming convention when recording new waypoints is the first four letters of the park acronym plus the plot number (for instance CUGA005 for plot #5 at Cumberland Gap NHP).

Different circumstances (e.g., excessively thick vegetation) will likely necessitate unique strategies in laying plots out. However, the following is a suggested approach to aid in efficiently and accurately laying out a newly established plot. Plot layout should begin by laying out the north-south coarse woody debris (CWD) transect (transect Y), followed by the east-west CWD transect (transect X; see Figure 2 for location of CWD transects in relation to the 20×20 meter [65.6×65.6 ft] plot).

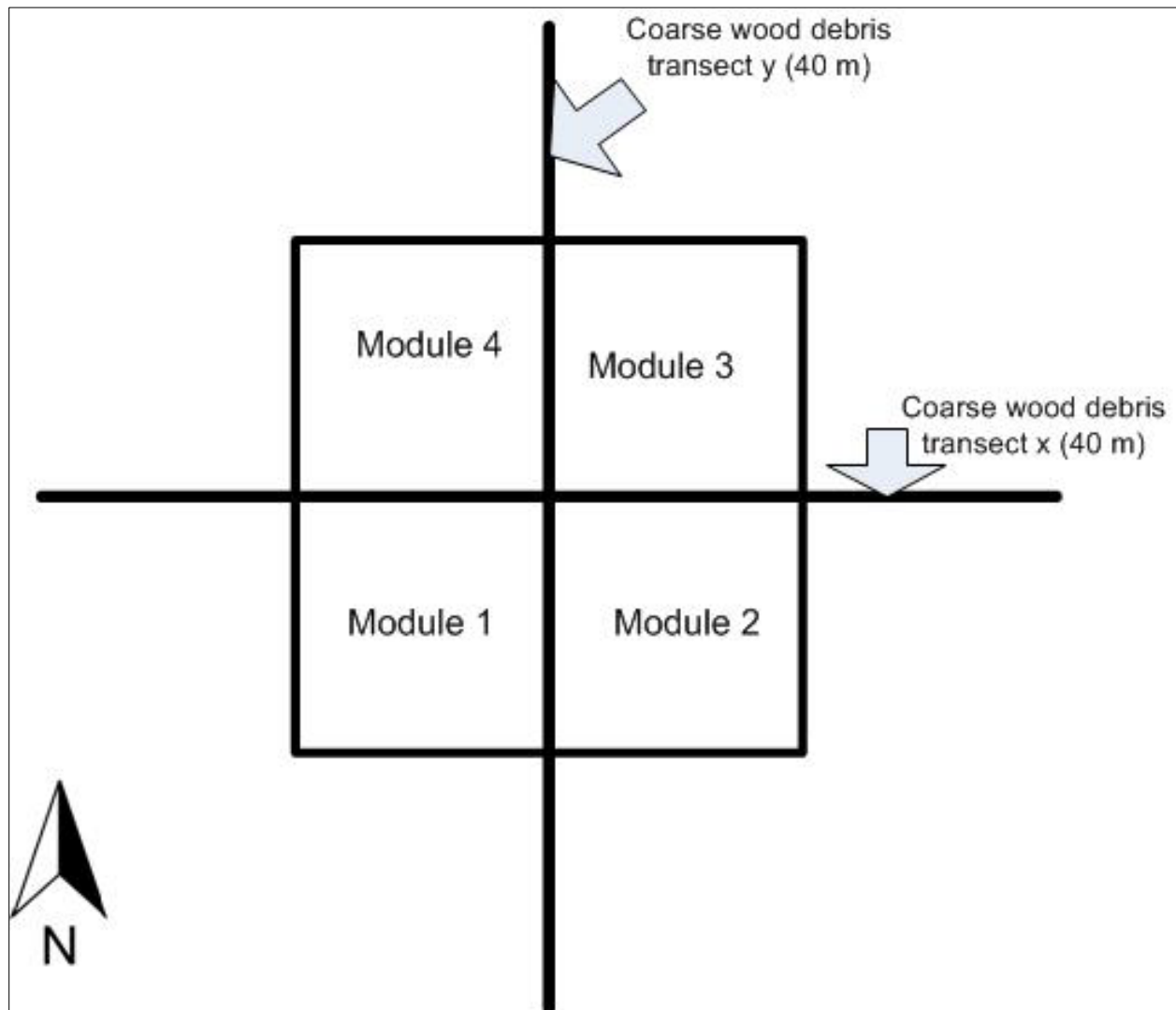


Figure 2. Location of coarse woody debris sampling transects in relation to 20×20 meter [65.6×65.6 ft] plot.

1. Starting at plot center, feed a 50-meter (164 ft) tape through the eyelet of a chaining pin, which should be placed inside the center conduit. While crew member 1 holds the tape reel and compass, crew member 2 should stretch the tape 20 meters (65.6 ft) to the south, following the directions and distance provided by crew member 1 (Refer to Figure 3, Step 1). If any large trees are directly in the path of your centerline, then simply continue around the tree as best as possible and pick up with your direction on the other side of the tree. When crew member 1 is satisfied with the direction and distance, crew member 2 should affix the

end of the tape to the ground via a chaining pin through the end of the tape. Once the end of the tape is secure, crew member 2 should walk back to the 10-meter (32.8 ft) point of the tape and place a pin flag at this point. This pin flag marks the southern boundary line of modules 1 and 2 (Figure 2).

2. Using the pin flag just placed by crew member 2 and a pin flag placed in the center conduit for guidance to stay on line, crew member 1 can now stretch the tape 20 meters to the north, stopping when the tape reaches 40 meters (131.2 ft; Figure 3, Step 2). This centerline will serve as the north-south central axis for the 20 × 20 meter plot, but will also serve as a transect Y for CWD (Figure 2). On the way back to the plot center, crew member 1 should place a pin flag at the 30-meter (98.4 ft) mark on the tape. This flag marks the northern boundary line of modules 3 and 4 and will be useful in laying out the plot boundaries in subsequent steps below.
3. With both crew members back at the centroid or plot center, repeat the above steps with the exception being that this time crew member 2 will pull the tape toward the east, while following the directions of crew member 1, who should be positioned at the plot center (Figure 3, Step 3). Using the pin flag that was placed at the 10-meter mark on this tape by crew member 2 and the pin flag at the centroid, crew member one can now stretch the tape to the west, while keeping the two aforementioned flags in a straight line. Crew member 1 should stop at 40 meters (Figure 3, Step 4). Again, crew member 1 should place a pin flag at the 30-meter mark on the tape on their way back to the plot center.

At this juncture, the x and y 40-meter coarse woody debris transects should be laid out (Figure 2) and a pin flag should be placed 10 meters from the plot center in each of the four cardinal directions (i.e., N, S, E, and W). For directions regarding modification of coarse woody debris transects, including modifying lengths due to roads, boundaries, refer to SOP 8 Coarse Woody Debris—Version 1.35 (CUPN 2023b).

4. Now the team is ready to lay out the outer boundaries of the 20 × 20-meter plot. Begin at the pin flag which is 10 meters south of the plot center (10-meter mark of Y CWD transect). Crew member 1, while holding tape reel and compass, should guide crew member 2, who will pull the tape directly west of this pin flag (Figure 3, Step 5). Crew member 1 should stop crew member 2 when the tape reaches 10 meters. When crew member 1 is satisfied with direction and distance (i.e., 10 meters due west), crew member 2 should secure end of tape with a chaining pin. This chaining pin will mark the southwest corner of Module 1.
5. Crew member 2 should then attach a second 50-meter tape to this chaining pin and pull the tape reel 10 meters to the north toward the pin flag that was placed by crew member 1 as part of Step 4 (Figure 3, Step 6). Ideally, this pin flag will be at exactly 10 meters. However, ± 0.25 meters (0.82 ft) is acceptable. Make any necessary adjustments, beginning with the chaining pin at the southwest corner of Module 1 (if minor) or rechecking to make sure the x (east-west) and y (north-south) coarse woody debris transects are running perpendicular to one another.

6. Once adjustments are made crew member 2 can continue laying out the plot boundary from previous spot by going 10 meters north, placing a chaining pin at this point to hold the tape in place, and then turning and proceeding 20 meters east (Figure 3, Step 7 and 8). Crew member 1 can simultaneously head east with the first tape by extending the tape reel 10 meters east and then turning to proceed 20 meters north (Figure 3, Step 9 and 10). Both crew members should be placing pin flags at each turn and should utilize these and other previously placed pin flags to sight on, forming a straight line. The two tapes should come together at the northwest corner of Module 3, and ideally the two tapes should read 40 meters. Again some variability is acceptable. However, the goal should be that both tapes cross ± 0.5 meters (1.6 ft) of the 40-meter marks.
7. Once any needed adjustments are made and both crew members are satisfied with the tape layout one crew member should drive the remaining pieces of conduit. Including the one that was already driven at the plot center, a completed plot should have seven pieces of conduit driven (black circles on plot diagram, Figure 4).

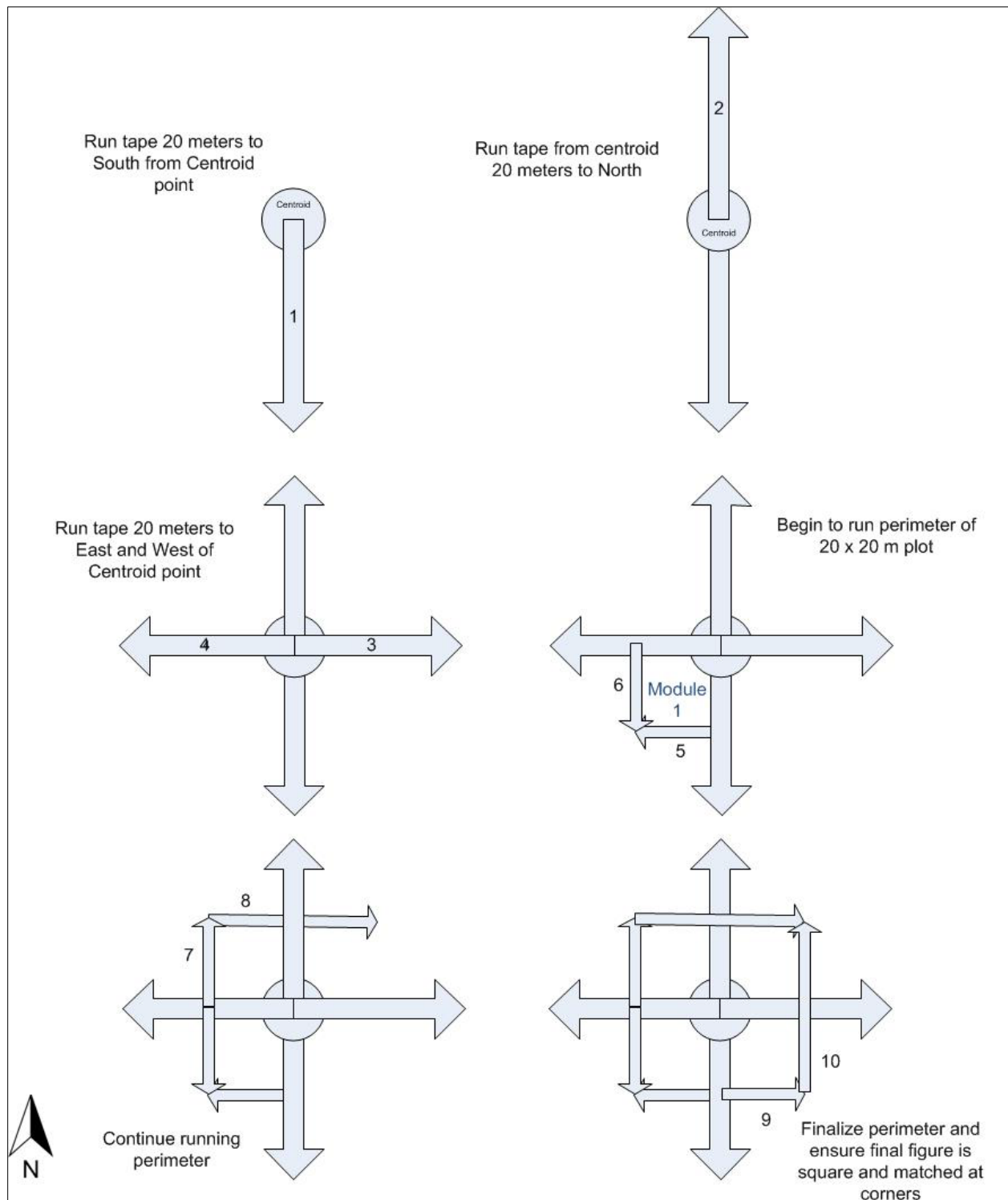


Figure 3. Step by step instructions for laying out coarse woody debris transects and 20 × 20 meters (65.6 × 65.6 ft) plot boundary.

In some cases (such as large rock outcrops within the plot), it will be impossible to drive conduit to mark some locations at the exact location. If for some reason a conduit cannot be driven into the

ground at the exact spot, the conduit can be adjusted slightly with detailed notes of this modification being made on the plot diagram and in Plot Layout Notes on page two of the data sheets. This is critical for ensuring future teams can relocate these exact locations for plot revisits. If for some reason a piece of conduit is not driven at all, which will happen in some cases, please note this on the plot diagram and in Plot Layout Notes as well.

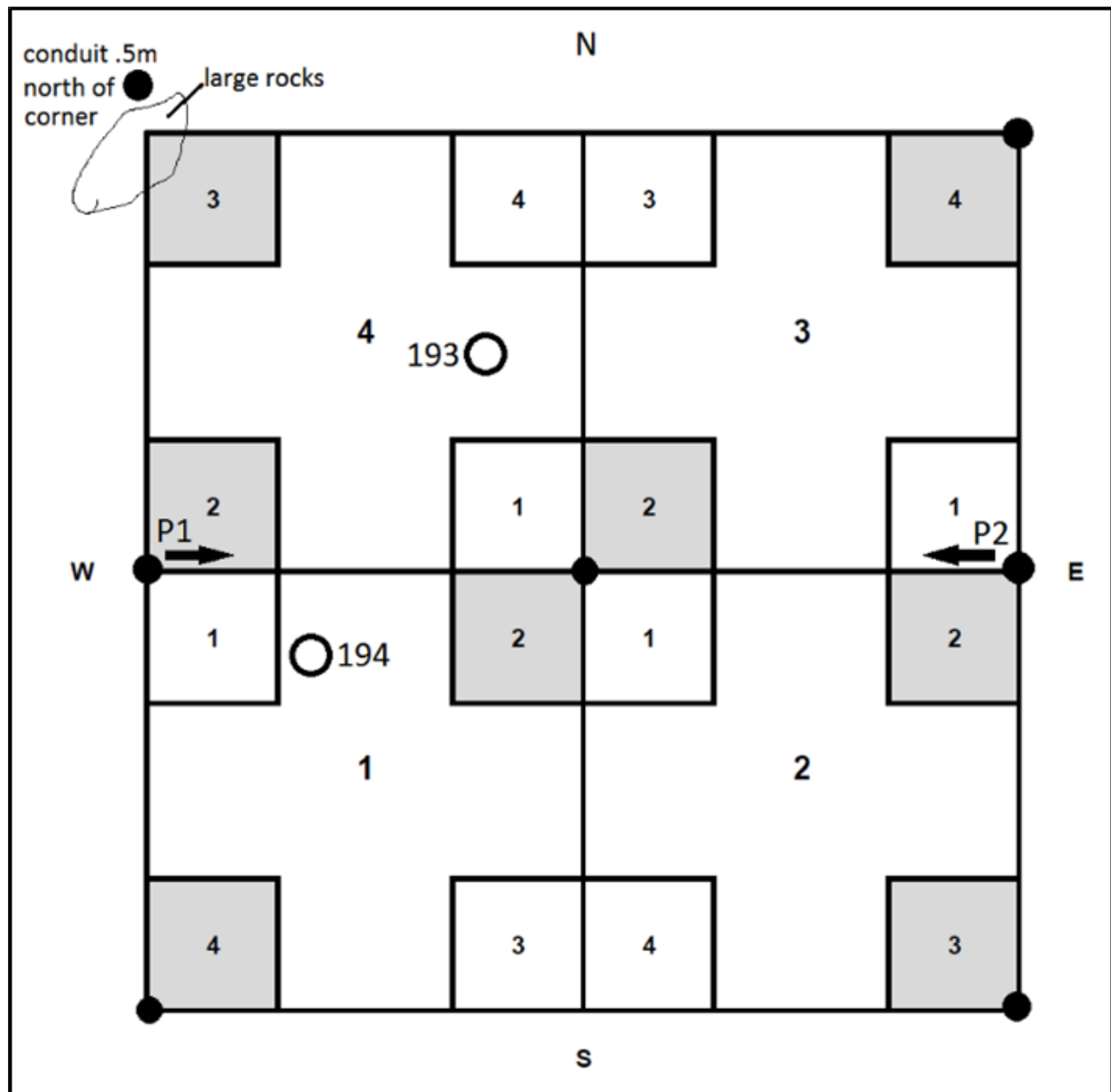


Figure 4. Plot diagram showing modules, tag trees, locations of plot conduit, plot irregularities, and photo point locations.

Documenting Plot Layout and Irregularities

Before moving on to other tasks, it is important that a crew member ensures the plot diagram and Plot Layout Notes are utilized to record all items to assist future teams in locating and laying out the

plot as close as possible to its current layout. Therefore, look around the plot and sketch-in any landmarks likely to be present on future visits including downed trees, trails, and outcrops. In addition, record where all conduits were driven and tag tree locations and tag numbers. Do not use the Plot Layout Notes section to document site characteristics, which are addressed on the next page of the datasheets. At this point, data elements are filled in on the first two pages of the datasheets, except for the location of photo points on the plot diagram, which will be addressed in SOP 4 *Plot Photopoints—Version 1.34* (CUPN 2023c).

There will be cases where parks will not allow conduit to be put into the ground or where there are other considerations that prevent conduit or tags. In these cases, fieldworkers will provide clear notes on the plot datasheets to explain alternative permanent markings. Where there is no ability to permanently mark any points (such as in glades), field teams are required to collect the most precise GPS measurements possible and document the exact location of tag trees in relation to the centroid point. If there is no way to mark the plots and survey grade GPS with submeter accuracy is available and travel distances are not far, teams should use those units instead, taking GPS points at each of the locations on the plot where conduit would normally be placed. If teams cannot place the conduit in the exact location where it is supposed to go, try to place it 1 meter (3.3 ft) to the north. If this does not work, pick another location and give specific directions in the data sheet detailing the actual location of the centroid point relative to the conduit.

Site Characteristics

Fieldworkers will next record information on key environmental data including slope, aspect, TSI and landform. Although these measures can be derived using the digital elevation model (DEM) spatial layer, we hope to take data on the ground so we can obtain a finer-scale portrayal of these key features.

Slope. Using a compass with a hinged mirror (most Silva brand compasses come with hinged mirrors), move the outer black ring so the E (90°) mark matches the directional line on the compass. Determine the prevailing direction of the slope. The prevailing direction will generally be the area of steepest grade from the point at which you are standing. However, in cases where the plot has variable topography, fieldworkers should use their best judgment based on the prevailing slope. Tilt the compass sideways and fold in the mirror so that you can see the small black arrow that hangs down inside the compass. This arrow always points towards the center of the earth. You can read off the slope measurement in degrees using the hash marks embedded on the inner circle of the compass (measurements are limited to from 0–90°). There are many methods to get the most accurate slope reading, but one seems to work the best. Stand up when taking the measurement and concentrate on finding a tree downslope that is easy to see from where you stand. Pick the point on the tree trunk that would be approximately at eye level for you if you were standing next to the tree. Use that point to site on when measuring slope. If a clinometer is available, it can also be utilized to record slope.

Aspect. Once done with slope, measure aspect in the same direction from which you measured slope (downhill). Aspect is measured by holding the compass in your hand so the air bubble in the middle of the compass shows the compass is perfectly perpendicular with the ground. At this point, you can adjust the outer black ring so the red north point arrow matches the stationary red arrow embedded in

the compass. If you use the same “siting” tree you used for the slope measurement, then it is possible to get an aspect reading that matches well with your slope reading.

Landform. Circle only one. Most CUPN landforms will either be a side slope, gap/saddle, interfluve, ravine, or rolling upland. Other landform types are possible but rare.

Terrain shape index. The terrain shape index is similar to the slope measure but is taken in eight directions around the plot in a more standardized way than the slope measurement. From the center of the plot, start out by looking in the direction that you recorded for aspect (0° from aspect). Then turn clockwise 45° from aspect and take the second measurement. Repeat this until you have completed eight measurements in total, covering 360°.

Topographic position. Like landform, topographic position is a qualitative category system that relies on the fieldworker’s best judgement of the landscape to determine the type that best fits the situation. Interfluve, high slope, midslope, lowslope, channel bed, and low level (terrace) are the most common topo positions, though all are possible within the Cumberland Piedmont Network.

Indicators of Disturbance. Fieldworkers should observe the plot and its environs and document any significant disturbances which appear to have occurred since the previous sampling event. This is a departure from plot establishment and early plot revisits where an attempt was made to record both historic (i.e., prior land use history) and recent disturbances. Moving forward the focus will be on recording disturbances that will have (or are believed to have) measurable impact on monitoring results. For purposes of this protocol, “measurable” is somewhat quantitatively defined as impacting 25% or more of canopy trees or other strata or soil surface.

Although this measure remains qualitative in nature, we believe it will be useful in helping to understand potential outlier data for some plots. There are multiple choices for indicators of disturbance and each requires a certain level of familiarity with the signs that would indicate disturbance. For instance, sign of recent fire can be seen based on charring combined with a lack of a leaf or coarse woody debris layer. Signs of heavy deer browse include browse lines that match up with the height of the deer’s reach, branches with deer browse marks on palatable species like *Euonymus americana*. Signs of recent logging are generally given away by human cut stumps where the rest of the tree was removed. Heavy erosion is common along streams and is generally checked if the creek or river is incised/embedded in a bed that is deeper than it would be naturally. There are many other indicators of disturbance (windthrow, bush hogging, flooding) that can also be noted under “other indicators.” There is also a section called “Notes (related to landform, terrain, position, or disturbance)” that can be used to further describe conditions already noted above.

Equipment List for Plot Establishment Years

- bundle of conduit (at least seven pieces per plot)
- claw hammer
- 4 nails

- 2 anodized and numbered aluminum tags
- GPS unit (Garmin GPSMAP 64xx preferred)
- Bright colored flagging (at least one roll)
- 8–10 pin flags
- 4 50-meter (164 ft) or longer tapes
- 8 chaining pins

Step by Step Instructions for Plot Revisit Years

Prior to Field-Based Work

1. Double-check that you have the correct resample form and corresponding plot and tree diagrams for the plot. Plot ID (e.g., CHIC001) should be preprinted on the first page of the field form.
2. Make sure you have access to previous plot photos and plot datasheets, either hard copy or stored on a tablet computer. The plot photos, plot diagrams and tree diagrams are essential in laying out the resample plot. Except for plot layout, the previous plot datasheets are not consulted prior to completion of plot resampling as this can create subconscious bias. However, there may be instances where the original plot datasheets may need to be consulted to avoid errors in resampling.

Navigating to Plot

1. Field crews will navigate to the plot with the aid of a GPS unit or tablet. However, crews should also be following the written directions to the plot. The written directions should begin at an obvious starting point (e.g., the visitor center, road intersection) to the parking location, as well as from the parking location to the actual plot. If the written directions prove inadequate or unclear, these should be updated on the resample form. **Note:** if there is an easier way to access the plot, go ahead and document that new way. Enter a new description for accessing the plot in the space provided so that we can later replace the old directions with the new.
2. Field crew will also take note of the travel time from vehicle to plot. Recognizing that some people travel faster than others and there may be obstacles this year that weren't in place a few years ago, this travel time should be viewed as a realistic estimate. We're not concerned about differences of only a few minutes.
3. Once the navigator (person with the GPS) informs the field crew they are within a few meters of the plot, the crew begins looking for tree tags and plot center conduit. The plot diagram, tree diagram and tag tree information should be consulted at this point to aid in location of the center conduit. **Note:** The original data sheet has information on which direction the tag is

facing, which could be very helpful should the team have trouble finding the blue tags. Additionally, the handheld metal detector can be very helpful in locating a difficult to find conduit.

4. If the center conduit is not initially found:
 - a. Locate the two tag trees and based on the information on the first page of the field datasheet (i.e., distance and bearing to plot center). Use tapes and compass to identify the location the center conduit should be located independent from each tag tree. Ideally these two points will be very near each other and the conduit can now be located.
 - b. If conduit is still not visible, sweep the area, approximately 1 meter squared (10.8 square feet [ft²]), with the handheld metal detector. Refer to user manual on tablet or in field binder if there are any questions on the correct operation of the metal detector.
 - c. If conduit is still not visible, leave a flag(s) where the field team believes the conduit should be located based on tag tree information and turn your attention to locating the conduits at corners 2-2 (10 meters [32.8 ft] east) and 4-2 (10 meters west). Again, plot diagram and tree diagram should be helpful in relocating these conduits, as well as the metal detector if needed. Once these conduits are located, place a chaining pin inside the conduits and measure back from each 10 meters toward the plot center.
 - d. Assuming the center conduit is still not located use the information obtained above to relocate and replace the center conduit.
 - e. Continue with steps to lay out the plot.
5. Once the center conduit is located, place a pin flag in the center conduit and record start time on the datasheet. If you have extra or minimally trained field crew members, a task to assign them is to update the tag tree DBH and any previously incorrect data on the tag trees (i.e., direction tag is facing and distance to plot center).
6. If the plot coordinates are discovered to be in error (i.e., the GPS did not lead you to the plot or at least close enough that tag trees or other markers are not located without difficulty) then a new set of coordinates may need to be taken. However, don't assume the coordinates stored in the GPS are in error. It is possible satellite coverage may be poor, and you may need to provide the GPS additional time to estimate location. Thus, it is recommended to move to plot layout, leaving the GPS at the plot center allowing it to continue to locate, before averaging and recording a new set of coordinates for the plot. If at the conclusion of plot layout the GPS coordinates are still off by greater than 10 meters, then a new point waypoint should be saved. This new point should be saved with plot ID and year truncated on end to differentiate between the establishment year point (e.g., CUGA005_2024).

Laying out Plot

Different circumstances due to excessively thick vegetation will likely necessitate unique strategies in laying plots out. However, the following is a suggested approach to aid in efficiently and accurately laying out the resample plot. For any conduit that cannot be found in a reasonable amount of time place a flag in the location where crew believes it should be and attempt to find all of the remaining plot conduit before making the decision to drive a new piece of conduit. Refer to Figure 5 for suggested layout of a revisit plot.

1. Consult plot diagram and plot layout notes to determine locations of plot conduit relative to trees and other plot characteristics. In most cases these should have been placed at the appropriate 10-meter (32.8 ft) marks, but occasionally they were moved slightly due to tree roots or in rare circumstances a conduit may not have been driven. Also consult the tree diagram to aid in tape layout, as there may be trees right on the inside or outside of the plot or a module. The plot must be laid out as exactly as possible to the layout of the previous sample to gather consistent data.
2. Once the plot center conduit has been located or reestablished, begin locating plot conduit 10 meters west of plot center. One crew member should place a chaining pin in center conduit, hook 50-meter (164 ft) tape on the pin, and begin stretching tape toward the targeted conduit location. The second crew member should stand at plot center with compass (set to correct declination), to direct the first crew member (Figure 5, Step 1). If conduit is not quickly found, start by using meter stick to gently push away vegetation. Try not to disturb vegetation too much as this is an intensively sampled corner. Plot photographs should also be useful in the location of this conduit. Assuming this conduit is found, crew should check tree diagram (and plot photos) to confirm the tape has been laid on the correct side of any trees that fall within the modules. Place a flag in the conduit, drop this tape, and return to plot center.
3. Repeat the above steps (attaching a second 50-meter tape to plot center chaining pin) in locating the conduit 10 meters east of plot center (Figure 5, Step 2).
 - a. If one of these conduits is not quickly found, double-check tree diagram to ensure you are in the correct location. Also check plot layout notes to make sure the conduit was not offset in anyway.
 - b. Next, utilize the metal detector to locate the conduit. Be patient and sweep the area slowly as it can sometimes take a few minutes of sweeping before the conduit “magically” appears.
 - c. If conduit is still not found and you are certain you are in the correct location, place a chaining pin and flag in this location and wrap tape around outer edge, extending a few centimeters north from the conduit east of the plot center and extending south a few centimeters from west conduit.
 - d. Do not replace any of the exterior conduits until all the tapes have been laid out and the plot is fully delineated. Sometimes an error can be detected in the attempted

layout and the missing conduit located (e.g., the tapes do not form a straight 20-meter (65.6 ft) line on the east or west boundary of the plot).

4. At this point you should have two tapes extending east and west of plot center. The next steps in the process are to stretch out tapes 10 meters north and 10 meters south of plot center. There will not be a conduit in these positions. However, crew should stretch these tapes out to the 10-meter mark (forget about the CWD extension beyond the plot for now) and place a flag in the location that best approximates the plot/module boundaries (Figure 5, Steps 3 and 4). Again, don't forget to consult the tree diagram to confirm trees are within the correct modules. The one-meter squares on the tree diagram can also be useful in placing the tapes back in the same general position as the previous sampling event.
5. At this point all interior boundaries of the plot modules should be in place with flags 10 meters from the plot center in each of the cardinal directions. The next step is to return to one of the four tape heads lying around the boundary and begin wrapping it around the plot boundary. It is suggested to return to the initial tape laid out at the conduit 10 meters west of the plot center and continuing that tape to the south and then east along the southern boundary of the plot (Figure 5, Step 5). This will complete the first module and if plot layout is relatively easy (e.g., open understory), then the team's botanist can begin working in Module 1 while the second crew member completes the plot layout. Again, it is very important the tree diagram be consulted often while laying out the plot boundaries. It is very important all trees included or excluded from the plot during the previous sampling event remain the same during the current sampling event.
6. The "initial tape" used to wrap around Module 1 can be continued around Module 2 to the conduit that is 10 meters east of plot center (Figure 5, Step 5 continued).
7. At this point, the tape extending from plot center to this conduit can be used to wrap around the exterior boundary of modules 3 and 4 (Figure 5, Step 6).
8. The two tape heads that are laying on the ground 10 meters north and south of the plot center can be extended 10 meters further from plot center to complete layout of the Y CWD transect (Figure 5, Steps 7 and 8).
9. A final 30-meter (98.4 ft) tape (and extra chaining pin) can be used to extend the X CWD transect when needed (Figure 5, Steps 9 and 10).
10. At this point, each of the four module boundaries are clearly delineated. If you have extra or minimally trained field crew members a task to assign them at this time is to straighten or re-drive (or replace missing) conduits. A properly driven conduit should be fully upright (minimal to no lean) with approximately 3 inches (7.6 cm) exposed or visible above the leaf litter.

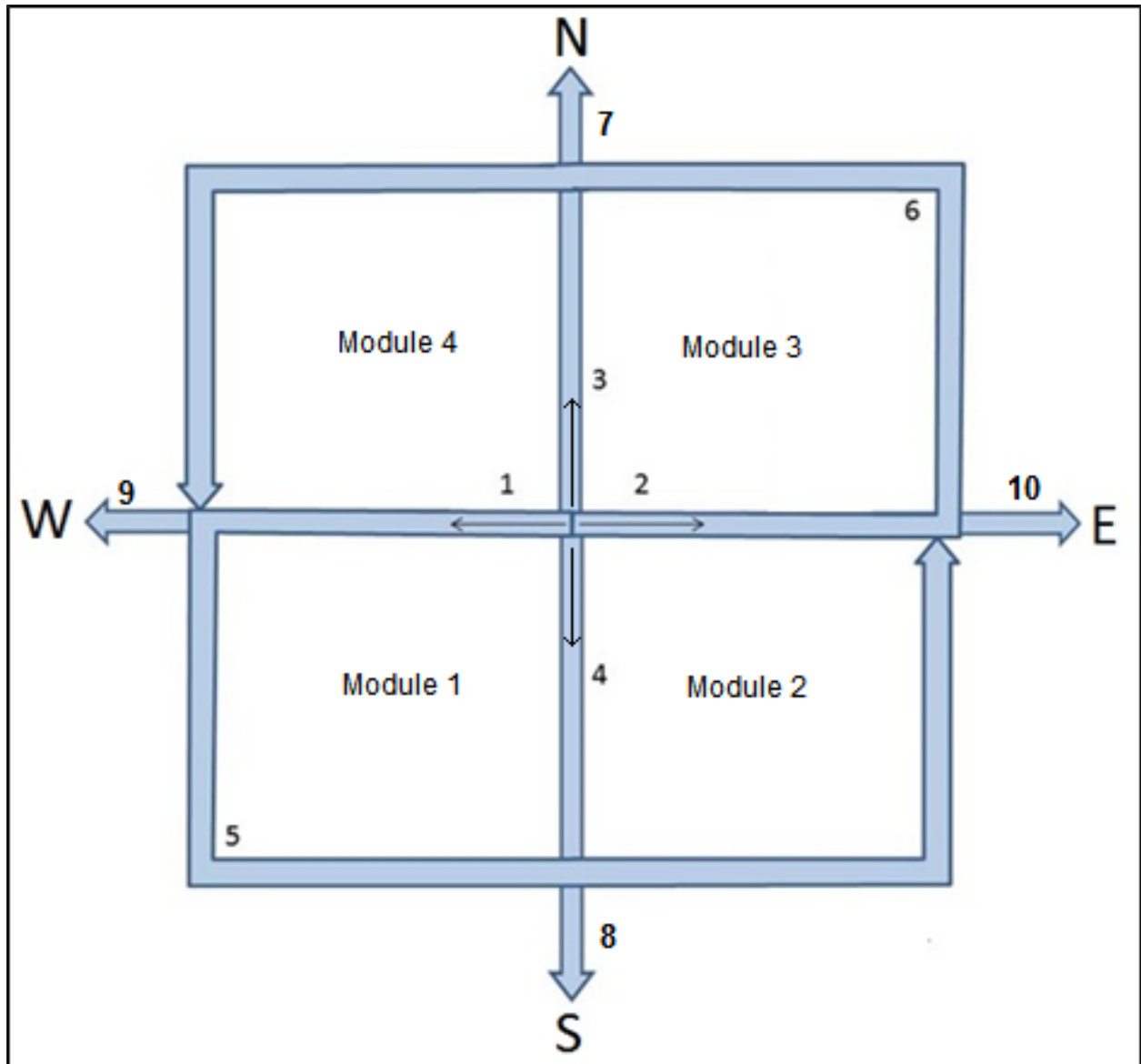


Figure 5. Suggested plot layout of a revisit plot.

Site Characteristics

For revisit plots, information on key environmental data including slope, aspect, TSI and landform generally does not need to be taken (since these attributes very rarely change over the time periods in which we are working). However, indicators of disturbance need to be assessed in the same way as a newly established plot, as these measures are independent between sampling years and are important to help explain outlier data in the plot. Fieldworkers should observe the plot and its environs and document any significant disturbances which appear to have occurred within the past five years, or since the previous sampling event.

Equipment List for Plot Revisit Years

- 3 pieces of conduit (in case there are any missing from plot)

- Hammer with prongs (in case missing conduits need to be added or tree tags were driven in too far)
- 2 nails (in case tree tags have been removed or driven in too far)
- 2 anodized and numbered aluminum tags (in case previous tags are damaged or new tag tree needs to be added)
- GPS unit
- Bright colored flagging (at least one roll)
- 8–10 pin flags
- 4 50-meter (164 ft) or longer tapes
- 1 30-meter (98.4 ft) tape
- 8 chaining pins

Completing Field Data Forms

A detailed list of field descriptions for each field on the field data form associated with this SOP, (Figures 6, 7, and 8) can be found in Table 2.

CUPN Vegetation Monitoring Protocol Data Resample Form

Based on Data_Form_20150415 revised 2018-05-10 MTL printed 2/17 07:51

SOP 3

COWP001

Start Date: (mm/dd/yy) / /21

Vegetation Plot Establishment (page 1)

Last sampled: 06/21/16 Reviewed by:

Start Time: Total Time (hrs): (1.25) QA/QC Plot: Yes or No

Crew: (circle leader)

GPS File Name: GPS Model: GPS Unit ID: *Take New GPS Point only if previous point is inaccurate.
Field UTM X: (missing) m E UTM Y: (missing) m N NAD 83 Zone: (missing)
waypts /confid: GPS Error: m Elevation m WAAS enabled Yes or No

Directions to plot (add additional notes if previous directions are inadequate):

Park just past Battlefield parking area #2 on roadside where plot is about 60m away. Vehicle visible from plot center.

Approximate Travel Time from Vehicle to Plot (min): (2)

Compass Declination (°): (7)

(CUPN parks range from 2 - 8°)

Tagged Tree 1: (X out tagged tree box if tree missing/fallen)

Tagged Tree 2:

Tagged Tree 3 (add if fewer than two tagged trees are still alive and standing):

Tag #:	575	Tag Color:	blue	Tag #:	583	Tag Color:	blue	Tag #:		Tag Color:	blue
Species:	QUERFAL	Species:	OXYDARB	Species:		Species:		Species:		Species:	
DBH:	48 cm, new:	DBH:	18 cm, new:	DBH:		DBH:		DBH:		DBH:	
Dir. tag facing:	308 °	Dir. tag facing:	97 °	Dir. tag facing:		Dir. tag facing:		Dir. tag facing:		Dir. tag facing:	
Dir. to Plot Center:	308 °	Dir. to Plot Center:	97 °	Dir. to Plot Center:		Dir. to Plot Center:		Dir. to Plot Center:		Dir. to Plot Center:	
Distance to Plot Ctr:	3.5 m	Distance to Plot Ctr:	1.5 m	Distance to Plot Ctr:		Distance to Plot Ctr:		Distance to Plot Ctr:		Distance to Plot Ctr:	

Office Use Only (print initials and mm/dd/yy)

Entered by: Updated by:

Verified by: Certified by:

Notes:

(fill in new page numbers if additional pages are added)
p. 1 of 12 (____)

Figure 6. Example CUPN Forest Vegetation pre-printed data form (revisit form) for recording of plot attribute data, Page 1.

SOP 3 COWP001

Vegetation Plot Establishment (page 2)

Start Date: / /21
(mm/dd/yy)

Taxonomic Standard for
Plant Names:

Vegetation Database 2015

Guidebook
Used:

Weakley 2015

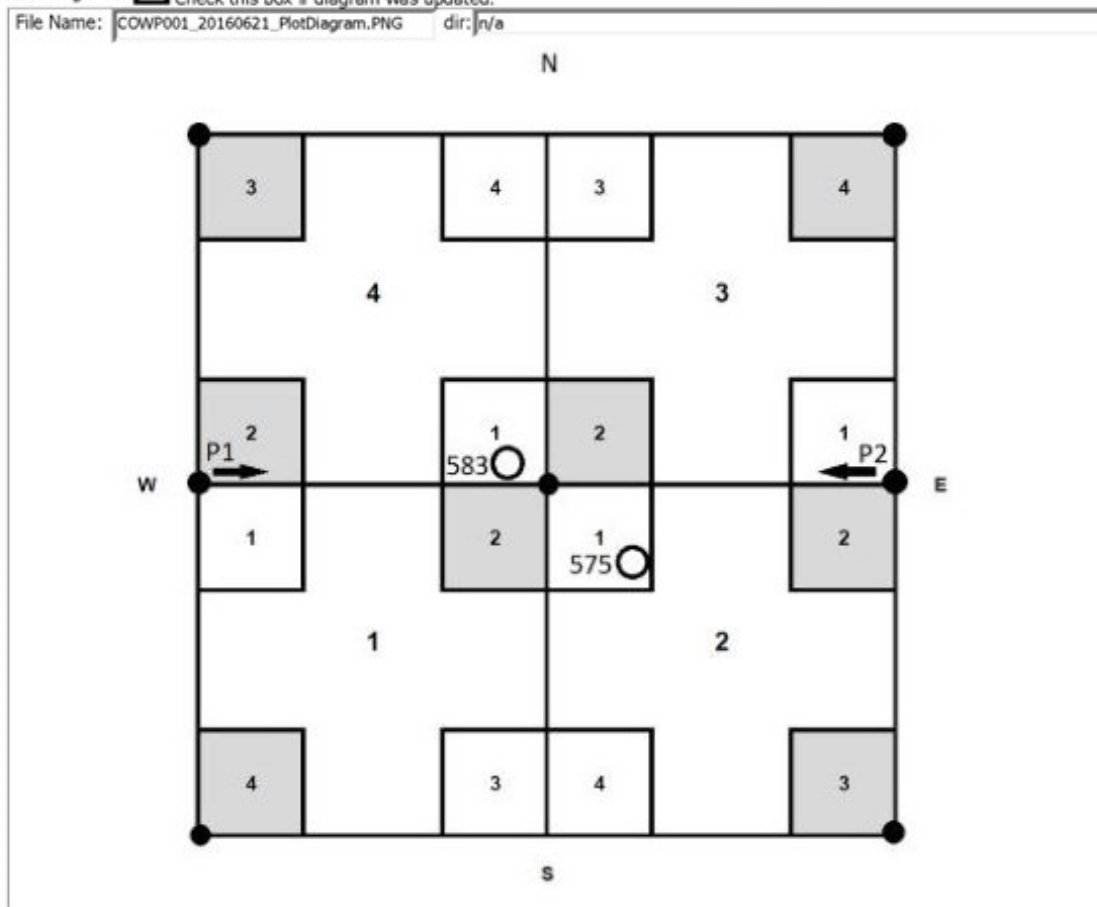
Plot Layout Notes (unusual plot features, irregularities, or was plot moved?, add new notes if any significant changes have occurred:
dogwood anthracnose prevalent

Plot Dimensions (m): X: 20 Y: 20

Indicate conduit (solid circle), location and direction of plot photos (P and arrow) tag trees (T{tag#}), and any unusual features.

Plot Diagram: ☐ Check this box if diagram was updated.

File Name: COWP001_20160621_PlotDiagram.PNG dir: n/a



(fill in new page numbers if
additional pages are added)
p. 2 of 12 ()

Figure 7. Example CUPN Forest Vegetation pre-printed data form (revisit form) for recording of plot attribute data, Page 2.

CUPN Vegetation Monitoring Protocol Data Resample Form

Based on Data_Form_20150415 revised 2018-05-10 MTL

printed 2/17 07:51

SOP 3

COWP001

Start Date: / /21
(mm/dd/yy)

Site Characteristics (page 3)

Check old values and correct any that are significantly wrong.

Slope (deg): 2

Aspect(deg): 7

Landform (correct if necessary):

interfluv	flat plain
gap/saddle	tidal flat
side slope	ravine
slope bench	seep/swale
fan piedmont	alluvial plain
cove	levee
escarpment/face	channel shelf
bedrock outcrop	backswamp
debris slope	basin/sag pond

rolling upland

Other:

Topographic Position (correct if necessary):

Interfluv (crest, summit, ridge)
High slope (shoulder, upper, convex)
 High level
Midslope
Backslope (cliff)
Step in slope
Lowslope (lower, foot, colluvial)
Toeslope
Low level (terrace)
Channel wall (bank)
Channel bed (valley bottom)
Basin floor (depression)
Other:

MCNAB INDICES TSI: Terrain Shape Index (site microtopographic shape)
+ for upslope
- for downslope

Aspect:	
45:	
90:	
135:	
180:	
225:	
270:	
315:	

Indicators of Disturbance (Check all that apply):

- ☐ Open-grown canopy tree in plot
- ☐ Sign of homesite/barn/cemetery present (foundation plantings, old chimney, etc.)
- ☐ Sign of fire within past year
- ☐ Sign of historic fire (> 1 year ago)
- ☐ Sign of *heavy* deer browse (angular cut stems, browse line visible)
- ☐ Sign of recent or historic logging (stumps)
- ☐ Sign of historic plowing (ruts, terraces)
- ☐ Sign of historic pasturing (barbed wire)
- ☐ Heavy erosion along streams (deep incision)
- ☐ Other indicators:

Notes (related to landform, terrain, position, or disturbance):

(fill in new page numbers if additional pages are added)
p. 3 of 12 (____)

Figure 8. Example CUPN Forest Vegetation pre-printed data form (revisit form) for recording of plot attribute data, Page 3.

Table 2. Field data form field descriptions. ABLI=Abraham Lincoln Birthplace National Historic Park; CARL=Carl Sandburg Home National Historic Site; CHCH= Chickamauga and Chattanooga National Military Park; COWP= Cowpens National Battlefield; CUGA= Cumberland Gap National Historical Park; FODO= Fort Donelson National Battlefield; GUCO= Guilford Courthouse National Military Park; KIMO= Kings Mountain National Military Park; LIRI= Little River Canyon National Preserve; MACA= Mammoth Cave National Park; NISI= Ninety Six National Historic Site; RUCA= Russell Cave National Monument; SHIL= Shiloh National Military Park; STRI= Stones River National Battlefield.

Field Name	Field Description
Plot ID	Four letter (Sub) Park acronym plus three-digit GRTS order # (e.g., COWP001). This field will be pre-populated on revisit forms.
Start Date	The date that data collection starts in mm/dd/yyyy format (e.g., 05/17/2020).
Reviewed by	Initials of individual who reviewed completed data sheet for SOP 3 elements. Ideally this should be someone other than individual who completed this portion of datasheet.
Park	For new plots, four-letter park acronym (i.e., ABLI, CHCH).
(Sub) Park	For new plots. In most cases this will be same as Park acronym. However, exceptions are BIRT and KNOB at ABLI; LOOK and CHIC at CHCH; and DONE and HEIM at FODO.
GRTS Order	For new plots, three-digit plot number or id assigned to plot via the generalized random-tessellation stratified (GRTS) sampling methodology (e.g., 123, 001, 022).
QA/QC	Is this a “repeat” data collection effort for quality control purposes? Circle Yes or No.
Start Time	The time of arrival to the plot using local time.
Total Time	Total time needed to complete plot, rounded to nearest quarter hour (e.g., 2 hours and 45 minutes would be 2.75 hours).
Crew	Full name of all involved in the field data collection. Circle the name of the crew leader.
GPS file name	For new plots (or revisit plots whose coordinates are incorrect), file name created by field observer in the hand held GPS (i.e., what did you name the point in the GPS device when you saved it?). Naming convention should be subpark acronym><3 digit GRTS order> for new plots. (e.g., STRI079). If you are recording new coordinates, because you believe the current coordinates are in error than truncate name with year (e.g., STRI079_2021).
GPS model	For new plots (or revisit plots whose coordinates are incorrect), the model of the GPS unit used in the field to acquire coordinates for the plot (e.g., Map 76cs).
GPS Unit ID	For new plots (or revisit plots whose coordinates are incorrect), unique identifier assigned to the GPS unit used in the field (e.g., CUPN1, 465, 470, ...). May also use the last three digits of the serial number.
Field UTM (Universal Transverse Mercator) X	For new plots (or revisit plots whose coordinates are incorrect), the six-digit latitude of the plot center, also known as easting, as recorded (and saved) in the field with the GPS. (e.g., 579129).

Field Name	Field Description
Field UTM Y	For new plots (or revisit plots whose coordinates are incorrect), the seven-digit longitude of the plot center, also known as northing, as recorded (and saved) in the field with the GPS. (e.g., 4116209).
Zone	The UTM zone is 17 for CARL, COWP, CUGA, GUCO, KIMO, and NISI. The zone is 16 for ABLI, CHCH, FODO, LIRI, MACA, RUCA, SHIL, and STRI.
# times waypoint averaged/confidence	For new plots (or revisit plots whose coordinates are incorrect), utilizing the averaging function on the GPS unit, the number of iterations or times the point is averaged/confidence in percent. Although not always possible it is recommended to allow unit to complete 100 iterations/100% confidence.
GPS Error	For new plots (or revisit plots whose coordinates are incorrect), record the horizontal error estimate from the GPS (in meters).
Elevation (meters)	For new plots (or revisit plots whose coordinates are incorrect), elevation recorded from GPS unit in meters.
WAAS (Wide Area Augmentation System) enabled	Are you picking up WAAS when recording GPS coordinates? Will need to look at the satellite screen on the hand help GPS device. On some units, if you are receiving a WAAS signal, there will be a "D" on the bottom of one or more bars. Circle Yes or No.
Directions to Plot	Starting from a road, known trail head, etc. provide detailed directions to aid another crew in returning to the plot. Ideally include GPS coordinates for where your vehicle was parked or where you accessed the area. Directions are pre-populated on revisit forms, correct/update if necessary.
Travel Time from Vehicle	Length of time taken to travel from vehicle to plot, recorded in minutes. This field will be pre-populated on revisit forms but should be updated each trip. If accessing plot via boat, this time should begin when leaving ramp.
Permanent Plot Established	For new plots, circle Yes or No; If no, provide criteria/justification for not establishing plot (e.g., on private land, within mowed field, etc.) Use criteria found in SOP 3.
Compass declination	Record the compass declination adjustment setting used on the compass utilized for plot establishment.
Tag #	Number on tag attached to "tag tree" for plot. Ideally these trees (two per plot) should be fairly large and distinctive and within 5 meters (16.4 ft) of centroid of plot.
Tag Color	Color of tag attached to tag tree.
Tag Tree Species	Record the 7-character species code of tag tree (e.g., LIRITUL for Tulip Tree, QUERALB for white oak, etc.). This field will be pre-populated on revisit forms, correct if necessary by crossing out old value and printing new.
Diameter at breast height (DBH) of Tag Tree	DBH of tag tree (rounded to nearest cm).

Field Name	Field Description
Direction Tag is Facing	Compass bearing (1-360°) the tag is actually facing. This is determined by standing with tag at your back and compass held out directly in front of you. This field will be pre-populated on revisit forms, correct if necessary by crossing out old value and printing new.
Direction from Tag Tree to Plot Center.	Compass bearing (1-360°) from tag tree to plot center. Stand with back to tag tree aiming compass at center conduit. This field will be pre-populated on revisit forms, correct if necessary by crossing out old value and printing new.
Distance from Tag Tree to conduit	Measured distance from tag tree to plot center. Typically plot center marked by rebar stake. Measure to nearest tenth meter. Don't guess, use tape. This field will be pre-populated on revisit forms, correct if necessary by crossing out old value and printing new.
Taxonomic Standard and Guidebook used.	Taxonomic standard refers to source of taxonomic names. In almost all cases this will be NPSpecies. Guidebook used refers to primary key used for plant identification.
Plot Layout Notes	Record any unusual plot features or problems encountered during plot setup. Note any problem or irregularities inserting plot markers. This field will be pre-populated on revisit forms, correct/update if necessary.
Plot Dimension X and Y	Record plot dimensions in meters along X (east-west) and Y (north-south) lengths. A typical 20 x 20 plot would obviously be 20 in both instances. This field will be pre-populated on revisit forms.
Plot Diagram	Diagram which is used to add any notes about particularly important plot features such as rock outcrops, trails, etc. Plot conduit locations, tag tree numbers and location of plot photo points. Update/correct if necessary on revisit plots and check "updated" box.
Slope (degrees)	Predominant slope of plot measured with compass/clinometer. This field will be pre-populated on revisit forms, correct if necessary by crossing out old value and printing new.
Aspect (degrees)	Predominant aspect of plot measured with compass. This field will be pre-populated on revisit forms, correct if necessary by crossing out old value and printing new.
Landform	Circle landform that best characterizes the location of the plot. This field will be pre-populated on revisit forms, correct if necessary.
McNab indices: Terrain Shape Index	Using clinometers, while standing at plot center, record slope in degrees at aspect and then at 45 degree increments around the plot going in clock-wise fashion. This field will be pre-populated on revisit forms, correct if necessary by crossing out old value and printing new.
Topographic position	Best estimate of topographic position. This field will be pre-populated on revisit forms, correct if necessary by crossing out old value and printing new.
Indicators of Disturbance	Check all that apply in terms of disturbance indicators. For "Other Indicators", describe indicator.

Field Name	Field Description
Notes (related to landform, terrain, position, or disturbance)	Use this box to further describe selections chosen above on datasheet. Do not use this space for plot layout notes.

Literature Cited

- Bate, L. J., M. J. Wisdom, E. O. Garton, and S. C. Clabough. 2008. SnagPRO: snag and tree sampling and analysis methods for wildlife. Gen. Tech. Rep. PNW-GTR-780. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 80 p.
<http://www.arlis.org/docs/vol1/A/309145529.pdf>
- Cumberland Piedmont Network. 2023a. Using GPS (based on use of GPSMAP 64)—Version 1.26. Cumberland Piedmont Network Standard Operating Procedure NPS/CUPN/SOP—2. Cumberland Piedmont Network, Mammoth Cave, Kentucky. Available at: [DataStore - Forest Vegetation Monitoring Protocol SOP 2: Using GPS \(Based on use of the GPSMAP 64\) - Version 1.26 \(nps.gov\)](#) (last accessed November 2023).
- Cumberland Piedmont Network. 2023b. Coarse woody debris measurements—Version 1.35. Cumberland Piedmont Network Standard Operating Procedure NPS/CUPN/SOP—8. Cumberland Piedmont Network, Mammoth Cave, Kentucky. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2299609> (last accessed November 2023).
- Cumberland Piedmont Network. 2023c. Plot photopoints—Version 1.34. Cumberland Piedmont Network Standard Operating Procedure NPS/CUPN/SOP—4. Cumberland Piedmont Network, Mammoth Cave, Kentucky. Available at: [DataStore - Forest Vegetation Monitoring Protocol SOP 4: Plot Photopoints - Version 1.34 \(nps.gov\)](#) (last accessed November 2023).

Revision Log

Revision History Log.

Version #	Date	Revised by	Changes
1.1	01/15/12	B. Moore and R. White	Removed language about potential park specific procedures for marking plots (no park specific procedures were implemented in year one). Removed definition of "horizontal distance." Updated declination settings for 2012. Copied steps/criteria for rejecting points a priori (prior to field based work) from narrative to this SOP. Added a table clarifying reasons or justification for excluding potential plot locations (based on text in narrative). Emphasized goal of establishing plot "as close to the actual mapped centroid as the handheld GPS unit" will allow, recognizing poor satellite coverage may limit this ability. Attempted to clarify (i.e., make more understandable) directions for plot setup. Removed reference to using yard staples as an acceptable plot marking method. Added some guidance on collecting site characteristic information: slope, aspect, landform, TSI, topographic position and disturbance. Previously lacking from SOP/protocol.
1.2	9/26/12	B. Moore and R. White	Plot should be visited in field if there is any doubt about whether it qualifies for disqualification. Accommodate use of GPS Map 78 for navigation. Make sure tag trees appear to be in good health before using. Added text that first TSI reading should be taken at downslope direction of the aspect as per Carolina Vegetation Survey direction and not due north (There was some confusion regarding this with early field teams).
1.3	3/28/17	C. Bledsoe	Updated figures and text to accommodate layout methods for plot revisits.
1.4	4/2/18	C. Bledsoe	Minor editorial changes

Version #	Date	Revised by	Changes
1.43	3/30/20	C. Bledsoe, B. Moore and L. Scoggins	Editorial changes made by L. Scoggins to update marking and saving plot waypoints using Garmin GPSMAP 64 GPS Units. Removed directions to record # of satellites as there has never been a place to record this information on plot datasheets. Added additional steps of what to do if center conduit is not initially found when conducting a plot revisit or resampling event. Added additional steps of what to do if exterior conduits are not initially found when conducting a revisit or resampling event. Identified potential tasks that could be performed by extra or minimally trained field crew members. Slight modifications to equipment checklist. Moved Revision History to end of SOP and added more detailed list of changes made to date.
1.44	8/9/2020	B. Moore	Address grammatical changes and clarifying comments made by IMD regional program manager.
1.46	2/18/2021	B. Moore	Added some quantitative measure to aid in recording disturbance (though is still a judgment call). Additionally, re-defined disturbance to only include those that appear to have occurred since last sampling event (i.e., no more recording of historic disturbance – old homesites nearby, etc.). Added naming convention for when a new waypoint is taken during a plot revisit. Added images of Field Data Forms and table of field data form descriptions (moved from SOP 14).
1.48	7/17/2023	–	Formatted by editor to regional I&M publication standards