

Standard Operating Procedure FVM03

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Summary

The datasheet for plot establishment is *SFCN Veg Form 1—Forest Vegetation Plot Establishment* and the datasheet for site-level measurements is *SFCN Veg Form 2—Site Characteristics*. Both datasheets are included in Appendix A of this SOP.

Revision Log

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Overview

This SOP provides instructions for evaluating and establishing plots, and collecting site information for both plot establishment years and plot revisit years. Prior to the first field season, selected and alternate plot locations were generated using a generalized random-tessellation stratified (GRTS) sampling methodology. Additional details on site selection, maps of plot locations, and R-code generated for the GRTS draw are in SOP FVM02 *Sampling Design and In-Office Review-Version 1* (Patterson and Londoño 2019).

During plot establishment years, the field crew assesses whether pre-selected locations are suitable for monitoring. Plots may be removed from the sampling frame if they are not the focal forest community targeted for sampling (see the *South Florida/Caribbean Network Forest Vegetation Monitoring Protocol Implementation Plan* [Whelan et al. 2020] for general focal forest community descriptions and SOP FVM02 *Sampling Design and In-Office Review—Version 1* [Patterson and Londoño 2019] for detailed map codes selected), present a safety hazard to the field crew, or other specific reasons (see below). For all acceptable locations, the field crew establishes the 20 × 20-meter plot (65.6 × 65.6-ft) with a compass, measuring tapes and seven permanent markers following the plot layout instructions described below. They also record GPS points for the plot center marker. All plots are oriented towards true north, and plot boundaries are measured as slope distances rather than horizontal distances. During plot establishment years, all GRTS selected (or their oversample/alternative locations) plots located in focal forest communities are sampled. During plot revisit years, the crew relocates an established plot following written directions and GPS coordinates, and they re-establish and re-mark the plot whenever markers are damaged or removed.

It is important to ensure plot locations and marking procedures have been approved by the natural resource manager at each park prior to plot establishment. These procedures may vary by park in response to individual park requirements.

SOP Source and How It Was Modified

This SOP is an adaptation of SOP 3 *Site Selection and Plot Establishment—Version 1.3* of the *Cumberland Piedmont Network Vegetation Monitoring Protocol* (White et al. 2011). The SOP 9 *Site U. S. National Vegetation Classification Measure —Version 1.3* of the *Cumberland Piedmont Network Vegetation Monitoring Protocol* (White et al. 2011) was modified and incorporated into this SOP as well. For a general explanation of how the South Florida/Caribbean Network modified the Cumberland Piedmont Network (CUPN) protocol and its SOPs, see the *South Florida/Caribbean Network Forest Vegetation Monitoring Protocol Implementation Plan* (Whelan et al. 2020). The South Florida/Caribbean Network made eight specific modifications to CUPN SOP 3, and incorporated CUPN SOP 9 including:

1. parks were stratified into focal forest communities of interest and these polygons were used during the GRTS draw;
2. plot sizes and shapes cannot be modified in the South Florida/Caribbean Network;

3. plots in the South Florida/Caribbean Network are established initially by using a GPS and pacing procedure outlined by the Northeast Temperate Network (NETN; Tierney et al. 2016);
4. SFCN plots can be shifted up to 10 meters (32.8 ft) if any portion of a plot occurs within an exclusion area, rather than if more than 25% of the plot occurs in an exclusion area, like with the Cumberland Piedmont Network;
5. additional information on site hydrology similar to the Gulf Coast Network vegetation monitoring effort (Carlson et al. 2018) was added;
6. areal cover percentages are estimated for each disturbance indicator located within a SFCN forest plot;
7. the South Florida/Caribbean Network uses the FIREMON (Fire Effects Monitoring and Inventory System) protocol (Lutes et al. 2006) for fuel transect establishment—three woody debris transects 25 meters (82 feet [ft]) in length. Further details for woody debris measurements are found in SOP FVM08 *Woody Debris—Version 1* (Prats 2019). The detailed list of modifications to CUPN 3 is in Appendix B of this SOP; and
8. the South Florida/Caribbean Network uses forest community definitions from specific map products for each park unit instead of following the definitions in the U. S. National Vegetation Classification.

Definitions

Magnetic north is the direction toward which the observer's compass needle points when in the northern hemisphere.

True north is the direction of the North Pole relative to the observer's position. True north is a fixed spatial location, but magnetic north varies across the landscape and over time. To find true north, use a magnetic declination chart or table to find the correct declination between true north and magnetic north for a given position and time (such as at [NOAA's Magnetic Field Calculators website](#)). Then, adjust the compass by dialing this declination into the faceplate. Most compasses have a setting ring on the bottom of the compass that allows for this correction. Simply turn the main compass ring so that the index pin is over the correct declination value for a park. Once this setting has been changed, it will not need to be changed until moving to a new park with a different declination. Take care to adjust the declination in the correct direction (i.e., east vs. west). Declinations will need to be updated yearly for each park before fieldwork begins. All plots will be oriented towards true north, regardless of whether this is upslope or downslope from the plot center point. Declination adjustment values for SFCN parks in 2019 are listed in Table 1.

Plot size is 20 × 20 meters (65.6 × 65.6 ft) at all South Florida/Caribbean Network parks.

Table 1. Declination adjustment values used for SFCN parks in 2019.

Park Code	Declination as of July 23, 2019	Compass Adjustment for Summer 2019
BICY	6° 16' W	6° W
BISC	6° 38' W	6° W
BUIS	13° 45' W	13° W
DRTO	4° 58' W	5° W
EVER	6° 29' W	6° W
SARI	13° 45' W	13° W
VIIS	13° 44' W	13° W

Procedure

Plot Establishment Years

Navigating to Potential Plot Centroid

- At the beginning of the field day, the field crew determines which plots are sampled based on the relative accessibility of the first plot to the second, with a goal of completing three plots per two field days. Note: in very rugged or remote situations one plot per day may be the maximum (e.g., Big Cypress National Preserve).
- Using the GPS unit, select Find > Waypoints to navigate to an identified potential location for sampling. These targets are referred to with an Evaluation ID comprised of a lower-case “e”, four-letter park code, three-letter community type, and three-digit GRTS order number (e.g. eBISCMAN110). Navigate in the safest manner to the location using the GPS navigation system and a handheld compass. Use walking trails or roads as much as possible. See SOP FVM09 *Using GPS -Version 1* (Muxo 2019).
- When nearing the pre-selected location, use the following method to locate the center of the potential plot: as soon as the GPS is within 15 meters (50 ft) of the pre-selected location, continue exactly 10 steady paces (20 steps) in the direction of the pre-selected location and stop. Do not veer off course to avoid obstacles. This is the location of the center of the plot. Do not spend extra time using the GPS to pinpoint the location of the plot to meter-scale accuracy.
- Upon arrival at the location, make sure sampling the plot would not pose a safety risk (e.g., plot occurs along a cliff face or abundance of unstable snags). Ensure the plot is the focal forest community type of interest; refer to specific map product and definition in said product for specific definition of the forest type (SOP FVM2 *Sampling Design and In-Office Review-Version 1* [Patterson and Londoño 2019]) record the forest type on the SFCN *Veg Form 1—Forest Vegetation Plot Establishment* datasheet.

- The forest community type can be quickly identified in the field by referring to the vegetation map report for each park. Included in each vegetation map report are habitat definitions for each specific habitat included in the vegetation map. The habitat definitions provide a series of site characteristics that include typical species of trees, shrubs, grasses or other plants found at the location of interest, plus other characteristics of the site. Identify the forest type as follows:
 - Stand in the middle of the 20 × 20-meter plot and use the correct forest definition for the park (provided to each field team at the beginning of the season). Determine if the forest type in that plot matches the forest type desired for sampling. The forest type may be fairly stable over time, but in the case of early successional types, the forest type may change over time as the stand matures or recovers from disturbances. Forest communities may also change as broad climate changes affect the survival and distribution of plants. Determine the forest type each time you visit the plot.
 - The forest definitions for each SFCN park are hierarchical and relatively dichotomous. The forest definition is dependent on the forest stand height and dominant vegetation present. The user must make a determination that best fits the vegetation. The user should be familiar with the other forest types present in the park unit to make sure they use the best definition for the forest community present. Note that there may be more than one path through the forest definitions to arriving at an individual forest community type. The forest definitions reference the specific map product used for each park unit.
 - It is always a good idea to confirm a final answer by reading the corresponding forest community description to the entire team and having agreement before moving forward.
- Make sure the plot center is greater than or equal to 15 meters (65.6 ft) from marsh habitat, open water, privately owned land, non-vegetated surfaces (e.g., transportation corridors, built-up lands, roads, swamp buggy trails, open water or beaches), heavily used trails, sensitive archaeological resources, or cultural sites. Confirm that the plot is accessible (estimated travel to and from the plot, and sampling the plot, can be accomplished in a 10-hour day) by boat or foot travel. Note that most of these features should be excluded during point selection review in the office, but on-the-ground confirmation is essential. **Abundant poison ivy (*Toxicodendron radicans*) or poisonwood (*Metopium toxiferum*), dense brambles, and location near a hiking trail are not appropriate reasons for excluding a plot.** Plots are not located on top of cultural sites (check with park resource staff before setting up the plot). If the site is a forested wetland with standing water covering much or all the vegetation in the plot, do not discard the site if it is the target community type. If water levels are unusually high, postpone installation and measurement where feasible and note that the plot will be revisited later in the season when water has receded. If the field schedule does not allow for postponing plot measurement and sampling can be implemented safely, then sample the plot and take extra care not to trample the plot.

- If any portion of the plot falls in an exclusion area, the plot will be moved a short distance (up to 10 meters [32.8 ft]). Try to relocate by following a standard order of cardinal directions. First check if the plot can be moved 10 meters to the north. If not, then try moving 10 meters to the east, then 10 meters to the south, then 10 meters to the west. If a new location cannot be established within 10 meters of the original location, then the site is discarded. Once at a new location reconfirm the forest community type still matches the desired forest type.
- If the plot does not meet the criteria listed herein, or if the plot presents a safety hazard such as extremely steep slopes (i.e., > 30°/60% slope) or unstable snags, discard the plot and record the reason on the SFCN *Veg Form 1—Forest Vegetation Plot Establishment* datasheet. Add a new point to the list of plot locations for establishment by selecting the next unused location on the list of alternate plots. If there is sufficient time, travel to the next-nearest location in the park where a plot is to be established and start this SOP again.
- When the field crew is satisfied with the location, set a chaining pin or tripod in the ground. Holding the GPS unit above this location, depress the “Enter” button on the unit for more than two seconds. A Mark Waypoints screen will appear. Rename the new Waypoint using the following naming conventions: <plot id>_<YYYYMMDD>. The Plot ID consists of the four-letter park code, the three-letter focal forest community code (see SOP FVM2 *Sampling Design and In Office Review—Version 1* [Patterson and Londoño 2019], Table 1) and the plot number that is on the sequential marker that will be installed at the site (e.g., BICYCYP02 for plot #2 in cypress forest at Big Cypress National Preserve). Hit “OK.” Record the x and y UTM values, the UTM zone, and estimated GPS error on the SFCN *Veg Form 1—Forest Vegetation Plot Establishment* datasheet. See SOP 9 *Using GPS—Version 1* (Muxo 2019).
- Field crews, at this time, document directions to the plot from the starting point to aid future efforts in plot relocation. This information is captured on the SFCN *Veg Form 1—Forest Vegetation Plot Establishment* datasheet.

Marking the Plot Center

After selecting the plot for establishment, begin setting up the plot and gathering data. First, drive a piece of rebar into the ground at the plot centroid (where the chaining pin or tripod is located) approximately one inch remains visible above ground. Adhere a plastic surveyor’s marker marked with “C” (for plot center) on the visible end (top) of the rebar. Before leaving the plot, tag two trees near the plot center with a stainless steel plot ID marker tag (a pre-stamped washer identifying the plot as a National Park Service vegetation monitoring plot) at 1.27 meters (4.2 ft), 10 centimeters below DBH, to facilitate plot relocation in future years. Note the tree tag numbers on Veg Form 1.

Laying Out the Plot

The standard SFCN forest vegetation monitoring unit includes a 20 × 20-meter (65.6 × 65.6 ft) forest vegetation plot and three 25-meter (82-ft) fuel transects (Figure 1). The following steps will be followed to most efficiently establish the unit boundaries:

1. Starting at plot center, feed a 30-meter (98.4-ft) tape through the eyelet of a chaining pin, which is placed on the center rebar. While crew member 1 holds the tape reel and compass, crew member 2 stretches the tape 10 meters (32.8-ft) to the west, following the directions and distance provided by crew member 1 (refer to Figure 2a, Step 1). If any large trees are directly in the path of this 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 affixes 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 places a wire pin flag at this point. This marks the center western point of the forest plot. Crew member 1 can place a wire pin flag at their location (plot center).
2. Using the two pin flags just placed by crew members 1 and 2 for guidance to stay on line, crew member 1 can now stretch the tape 10 meters (32.8 ft) to the east, stopping when the tape reaches 20 meters (65.6 ft) to place a wire pin flag at this location. The 20-meter point marks the center eastern point of the forest plot (refer to Figure 2a, Step 2).
3. Standing at the center eastern point, feed a second 30-meter (98.4-ft) tape through the eyelet of a chaining pin, placed at the wire pin flag at this location. While crew member 1 holds the tape reel and compass, crew member 2 stretches the tape 10 meters (32.8-ft) to the north following the directions and distance provided by crew member 1 (refer to Figure 2a, Step 3). When crew member 1 is satisfied with the direction and distance, crew member 2 affixes 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 places a wire pin flag at this point. This marks the northeastern point of the forest plot.
4. Using the two pin flags just placed by crew members 1 and 2 for guidance to stay on line, crew member 1 can now stretch the tape 10 meters (32.8-ft) to the south, stopping when the tape reaches 20 meters (65.6-ft) to place a wire pin flag and chaining pin at this location. This marks the southeastern point of the forest plot. Crew member 1 feeds the tape through the eyelet of the chaining pin and stretches the tape 10 meters to the west, stopping when the tape reaches 30 meters (98.4-ft) to place a wire pin flag at this location (refer to Figure 2a, Step 4). This marks the central southern point of the forest plot.
5. Standing at the center western point, feed a third 30-meter (98.4-ft) tape through the eyelet of a chaining pin, placed at the wire pin flag at this location. While crew member 1 holds the tape reel and compass, crew member 2 stretches the tape 10 meters (32.8-ft) to the north following the directions and distance provided by crew member 1 (refer to Figure 2a, Step 5). When crew member 1 is satisfied with the direction and distance, crew member 2 affixes 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 places a wire pin flag at this point. This marks the northwestern point of the forest plot. Crew member 1 can place a wire pin flag at their location (center western).

6. Using the two pin flags just placed by crew members 1 and 2 for guidance to stay on line, crew member 1 can now stretch the tape 10 meters (41ft) to the south, stopping when the tape reaches 20 meters (65.6 ft) to place a wire pin flag and chaining pin at this location. This marks the southwestern point of the forest plot. Crew member 1 feeds the tape through the eyelet of the chaining pin and stretches the tape 10 meters to the east, stopping when the tape reaches 30 meters (98.4 ft) and at the already marked central southern point of the plot (refer to Figure 2a, Step 6).
7. Back at plot center, feed a fourth 50-meter (164-ft) tape through the eyelet of a chaining pin, which should be placed on the center rebar. While crew member 1 holds the tape reel and compass, crew member 2 stretches the tape 10 meters (41 ft) to the south, until reaching the marked central southern point of the plot. Crew member 1 can use the two pin flags along this line to stretch the same tape 10 meters (41 ft) north to the center northern point of the forest plot. Place a wire pin flag at this location, which marks 20 meters (65.6 ft) on the tape. Crew member 1 continues to stretch the fourth tape at a north bearing 15 meters (49.2 ft) beyond the forest plot, and places a wire pin flag at this location, which marks 35 meters (114.8 ft) on the tape. The 25-meter (82 ft) line from the plot centroid to this location marks the 0° woody debris transect (refer to Figure 2b, Step 7). Wire pin flags are placed at the 5-, 7-, 10-, and 25-meter (16.4-, 22.9-, 32.8-, and 82.0-ft) point along this transect.
8. Use a fifth 30-meter (98.4-ft) tape to establish the northern forest plot boundary (refer to Figure 2b, Step 8). All the forest plot and module sides have been established once this step is complete. Once any needed adjustments are made and both crew members are satisfied with the tape layout, one crew member drives the remaining pieces of rebar into the ground at the necessary corners so approximately 1 inch (2.5 centimeters [cm]) remains visible above ground. Adhere a plastic surveyor's marker marked with "Mod-Corner" (for Module and Corner Numbers—e.g., 1–4 marker should be staked at the Module 1, Corner 4 plot corner) on the visible end (top) of each rebar. Including the one already driven at the plot center, a completed plot should have seven pieces of rebar driven (black circles on plot diagram, Figure 3). All vegetation, woody stem, and woody debris transect 0° data should be collected at this time. If one of the woody debris transects extends into an exclusion area, follow the instructions found in SOP FVM08 *Woody Debris* (Prats 2019).
9. To establish the remaining two woody debris transects, crew member 1 affixes the end of the 50-meter (164-ft) tape with a chaining pin at the plot centroid. Crew member 1 stretches the tape 25 meters (82 ft) at a 225° bearing, following the directions provided by crew member 2. Data are collected along this transect. Repeat the same procedure for the third woody debris transect, following a bearing of 135° (refer to Figure 2c, Step 9). Wire pin flags are placed at the 5-, 7-, 10-, and 25-meter (16.4-, 22.9-, 32.8-, and 82.0-ft) point along each of these transects.

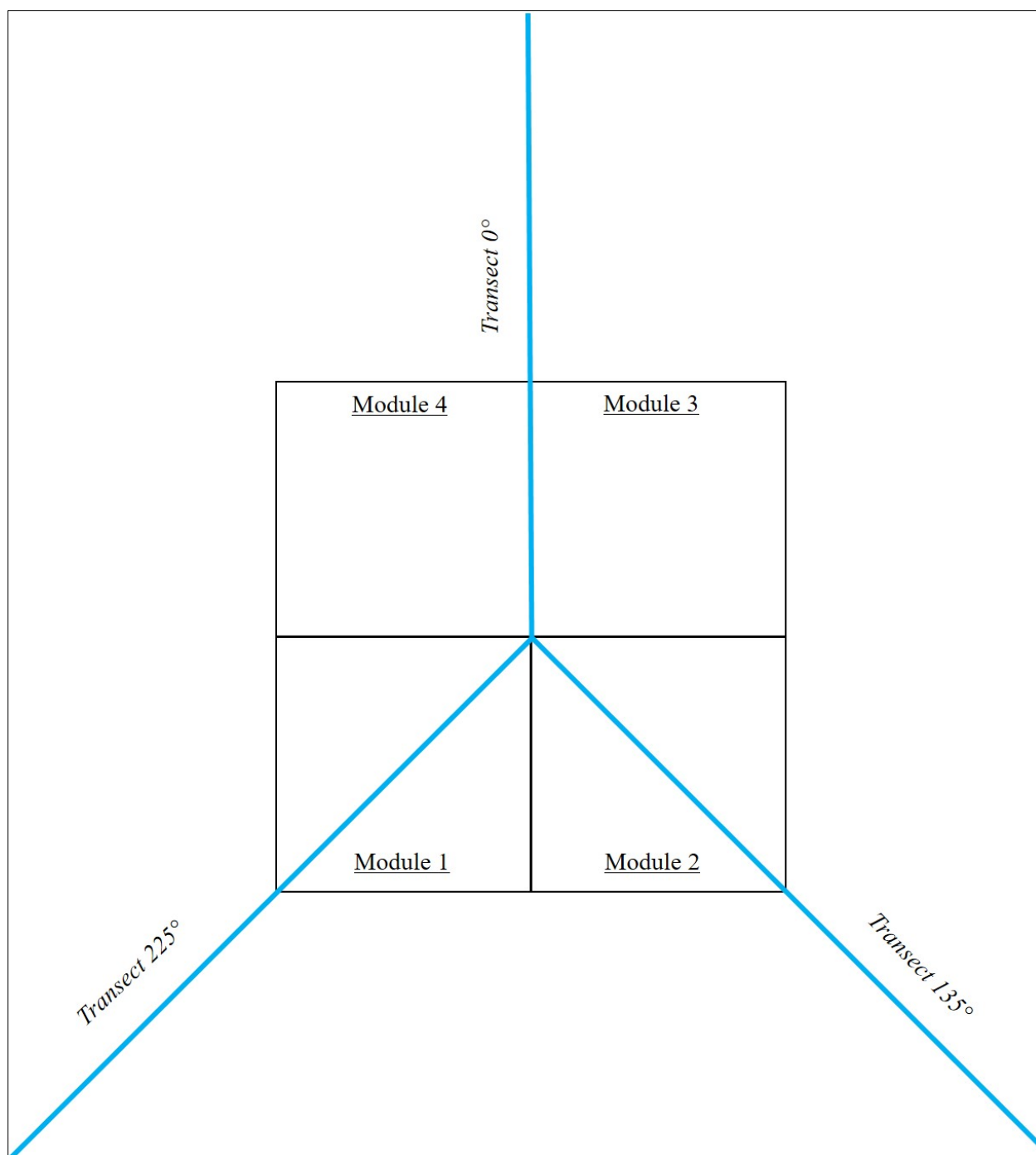
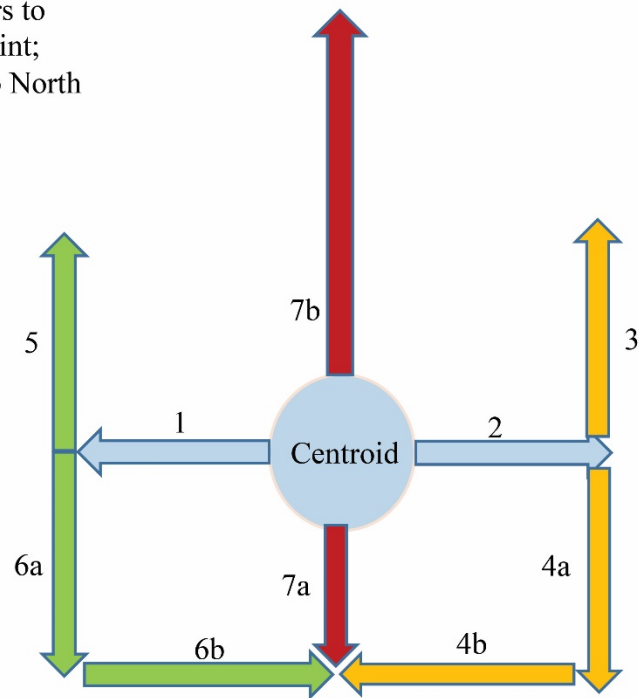


Figure 1. The standard South Florida/Caribbean Network forest sampling unit, which includes a 20 × 20 (65.6 × 65.6 ft) modified Carolina Vegetation Survey plot (black lines; Peet et al. 1998) and three 25-meter (82-ft) woody debris transects (blue lines).

7) Run tape #4 10 meters to South from Centroid Point;
run tape #4 25 meters to North from Centroid Point



8) Run tape #5 10 meters to West from tape #4 20 meter point; run
tape #5 10 meters to East from tape #4 20 meter point

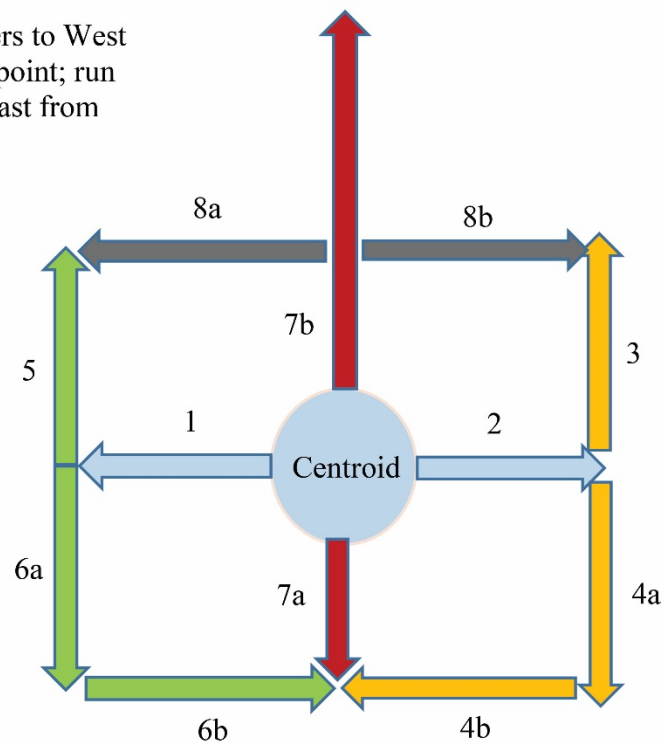


Figure 2b. Illustration of steps 7–8 for laying out the SFCN forest sampling unit (Boyle 2018).

9) Record vegetation diversity and woody stem measurements within the vegetation plot and fuel measurements across the 0° transect. When complete, run tape #4 25 meters 225° from Centroid Point and record fuel measurements across the 225° transect. When complete, run tape #4 25 meters 135° from Centroid Point and record fuel measurements across the 135° transect.

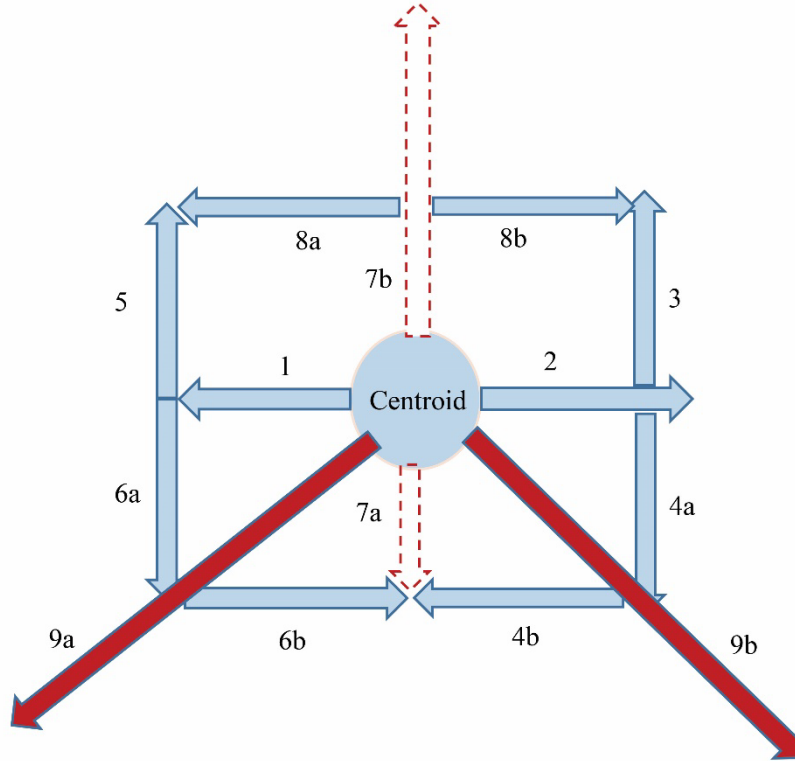


Figure 2c. Illustration of step 9 for laying out the SFCN forest sampling unit (Boyle 2018).

Before moving on to other tasks, 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. Look around the plot and sketch any landmarks likely to be present on future visits including downed trees and outcrops. Record where all rebar is driven. Do not use the Plot Layout Notes section to document site characteristics, which are addressed on another datasheet.

There may be cases where parks will not allow rebar placed into the ground or where there are other considerations that prevent rebar or tags. In these cases, field workers should provide clear notes on the plot datasheets to explain alternative permanent markings. If the plots cannot be marked, and survey grade GPS with sub meter 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 rebar would normally be placed. If teams cannot place the rebar 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 plot layout notes and on the plot diagram detailing the actual location of the centroid point relative to the rebar.

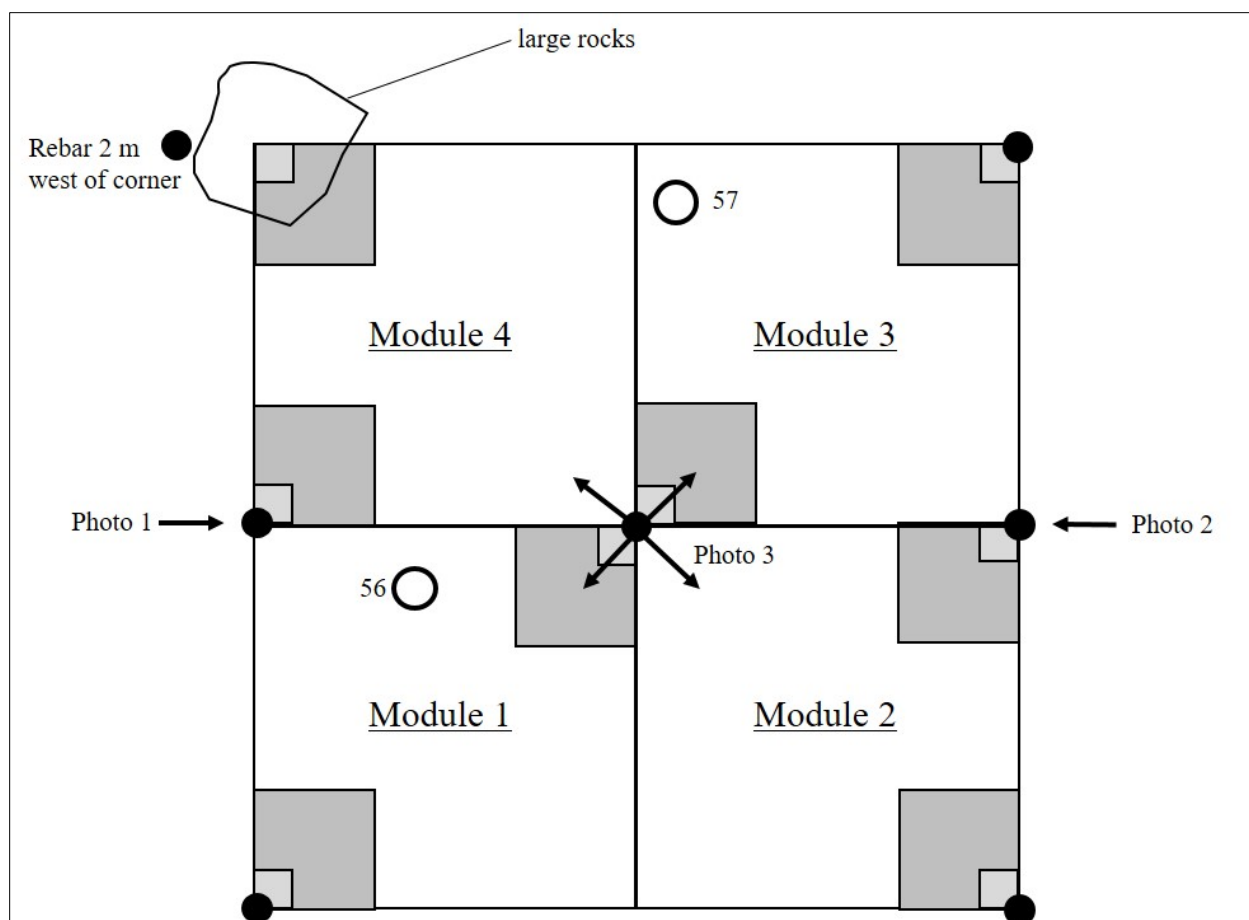


Figure 3. Plot diagram showing modules, rebar locations (closed circles), tagged trees (open circles), plot irregularities, and photo point locations (arrows).

Recording Site Characteristics

Site Characteristic information is recorded on the SFCN *Veg Form 2—Site Characteristics* datasheet.

Slope: At Virgin Islands National Park, slope is calculated from the average of the absolute values of the terrain shape reading at aspect and 180° from aspect. At other park units, slope is calculated along the line of steepest slope with the sighting going through the plot center from edge to edge. At locations with no observable slope, we record zero for slope.

Aspect: Once done with slope, measure aspect facing downhill along the line of steepest slope. Aspect is measured by holding the compass in your hand so that the air bubble in the middle of the compass shows that the compass is perfectly perpendicular with the ground. At this point, you can adjust the outer black ring so that the red north point arrow matches the stationary red arrow embedded in the compass. Record the aspect to the nearest 10° or record N/A for locations with no observable slope.

Percent under water: Record the percentage of the 20×20 meter (65.6×65.6 ft) plot that has standing water visible on or above ground level. Estimate the percentage to the nearest 10% on a scale from 0–100%.

Water on plot code: Record the water source having the greatest impact on the plot using the codes below. This information will be recorded during the first visit and verified or updated on subsequent visits. It will be necessary to re-examine the plot for temporary water sources during each visit.

Codes:

- 0: None—no water sources on plot
- 1: Permanent streams or ponds
- 2: Permanent water in the form of deep swamps, bogs and marshes
- 3: Ditch/canal—human made channels such as for irrigation or drainage
- 4: Temporary streams
- 5: Flood zones—evidence of flooding when bodies of water exceed their natural banks
- 6: Vernal pool
- 7: Other water—specify in Plot Notes

Landform: Select only one landform type from the region-specific subset list below which was taken from Grossman et al. (1998). Landform types that may be encountered include:

- **ACTIVE SLOPE**—(metastable slope) A mountain or hill slope that is responding to valley incision, and has detritus accumulated behind obstructions, indicating contemporary transport of slope alluvium. Slope gradients commonly exceed 45%.
- **ALLUVIAL CONE**—The material washed down mountain and hill slopes by ephemeral streams and deposited at the mouth of gorges in the form of a moderately steep, conical mass descending equally in all directions from the point of issue.
- **ALLUVIAL FAN**—A body of alluvium, with or without debris flow deposits, whose surface forms a segment of a cone that radiates downslope from the point where the stream emerges from a narrow valley onto a less sloping surface. Common longitudinal profiles are gently sloping and nearly linear. Source uplands range in relief and aerial extent from mountains and plateaus to gullied terrains on hill and piedmont slopes.
- **ALLUVIAL FLAT**—A nearly level, graded, alluvial surface.
- **ALLUVIAL PLAIN**—A flood plain or a low-gradient delta. It may be modern or relict.

- **ARROYO**— (wash) The flat-floored channel or an ephemeral stream, commonly with very steep to vertical banks cut in alluvium.
- **BACKSWAMP**—(valley flat) Extensive marshy, depressed areas of flood plains between the natural levee borders of channel belts and valley sides or terraces.
- **BAR**—An elongated landform generated by waves and currents and usually running parallel to the shore, composed predominantly of unconsolidated sand, gravel, cobbles, or stones with water on two sides.
- **BASIN**—A depressed area with no or limited surface outlet. Examples are closed depressions in a glacial till plain, lake basin, river basin, or fault-bordered intermontane structure such as the Bighorn Basin of Wyoming.
- **BEACH**—The unconsolidated material that covers a gently sloping zone, typically with a concave profile, extending landward from the low-water line to the place where there is a definite change in material or physiographic form (such as a cliff) or to the line of permanent vegetation; the relatively thick and temporary accumulation of loose water-borne material (usually well-sorted sand and pebbles, accompanied by mud, cobbles, boulders, and smoothed rock and shell fragment) that is in active transit along, or deposited on the shore zone between the limits of low water and high water
- **BLUFF**— (a) A high bank or bold headland, with a broad, precipitous, sometimes rounded cliff face overlooking a plain or body of water, especially on the outside of a stream meander; (b) any cliff with a steep, broad face.
- **BRAIDED CHANNEL OR STREAM**— (flood-plain landforms) A channel or stream with multiple channels that interweave as a result of repeated bifurcation and convergence of flow around interchannel bars, resembling in plan the strands of a complex braid. Braiding is generally confined to broad, shallow streams of low sinuosity, high bedload, non-cohesive bank material, and step gradient. At a given bank-full discharge, braided streams have steeper slopes and shallower, broader, and less stable channel cross sections than meandering streams.
- **CANYON**—A long, deep, narrow, very steep-sided valley with high and precipitous walls in an area of high local relief.
- **CLIFF**—Any high, very steep to perpendicular or overhanging face of rock or earth; a precipice.
- **CREST**—(summit) The commonly linear top of a ridge, hill or mountain.
- **DELTA**—A body of alluvium, nearly flat and fan-shaped, deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, usually a sea or lake.

- **DUNE**—A mound, ridge, or hill of loose, windblown granular material (generally sand), either bare or covered with vegetation.
- **ESCARPMENT**—(scarp) A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and produced by erosion or faulting. The term is more often applied to cliffs produced by differential erosion.
- **FLAT**—A general term for a level or nearly level surface or small area of land marked by little or no relief, e.g., mud flat or valley flat.
- **FLOOD-PLAIN**—(bottomland) The nearly level alluvial plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the stream.
- **GORGE**— (a) A narrow, deep valley with nearly vertical rocky walls, enclosed by mountains, smaller than a canyon, and more steep-sided than a ravine; especially a restricted, steep-walled part of a canyon. (b) A narrow defile or passage between hills or mountains.
- **HILL**—(foothills) A natural elevation of the land surface, rising as much as 300 meters (984 ft) above the surrounding lowlands, usually of restricted summit area (relative to a tableland) and having a well-defined outline; hill slopes generally exceed 15%. The distinction between a hill and a mountain is often dependent on local usage.
- **HUMMOCK**—A rounded or conical mound of knoll, hillock, or other small elevation. Also, a slight rise of ground above a level surface.
- **KNOB**—(a) A rounded eminence, as a knoll, hillock, or small hill or mountain; especially a prominent or isolated hill with steep sides, commonly found in the southern United States. (b) A peak or other projection from the top of a hill or mountain. Also a boulder or group of boulders or an area of resistant rocks protruding from the side of a hill or mountain.
- **LEVEE**— (floodwall, earth dike) An artificial or natural embankment built along the margin of a watercourse or an arm of the sea, to protect land from inundation or to confine streamflow to its channel.
- **PLAIN**—(lowland, plateau) An extensive lowland area that ranges from level to gently sloping or undulating. A plain has few or no prominent hills or valleys, and usually occurs at low elevation with reference to surrounding areas (local relief generally less than 100 meters (328 ft), although some, such as the Great Plains of the United States, are as much as 1,000 to 1,800 meters above sea level.) Where dissected, remnants of a plain can form the local uplands.
- **RAVINE**—(gulch, draw) A small stream channel; narrow, steep-sided, and commonly V-shaped in cross section; and larger than a gully.

- **RIDGE**—A long, narrow elevation of the land surface, usually sharp topped with steep sides and forming an extended upland between valleys. The term is used in areas of both hill and mountain relief.
- **SADDLE**—A low point on a ridge or crestline, generally a divide (pass, col) between the heads of streams flowing in opposite directions.
- **SHOULDER**—(hill slope) The geomorphic component that forms the uppermost inclined surface at the top of a hill slope. It comprises the transition zone from back slope to summit of an upland. The surface is dominantly convex in profile and erosional in origin.
- **SINKHOLE**—(doline) A closed depression formed either by solution of the surficial bedrock (e.g. limestone, gypsum, salt) or by collapse of underlying caves. Complexes of sinkholes in carbonate-rock terraces are the main components of karst topography.
- **SPIT**—(a) A small point or low tongue or narrow embankment of land, commonly consisting of sand or gravel deposited by longshore drifting and having one end attached to the mainland and the other terminating in open water, usually the sea; a fingerlike extension of the beach. (b) A relatively long, narrow shoal or reef extending from the shore into a body of water.
- **SWALE**—(a) A slight depression, sometimes swampy, in the midst of generally level land. (b) A shallow depression in an undulating ground moraine due to uneven glacial deposition. (c) A long, narrow, generally shallow, trough-like depression between two beach ridges, and aligned roughly parallel to the coastline.
- **TERRACE**—A step-like surface, bordering a valley floor or shoreline, that represents the former position of an alluvial plain, or lake or sea shore. The term is usually applied to both the relatively flat summit surface (platform, tread), cut or built by stream or wave action, and the steeper descending slope (scarp, riser), graded to a lower base level of erosion.
- **VALLEY**—(basin) An elongate, relatively large, externally drained depression of the earth's surface that is primarily developed by stream erosion. Gap/saddle.
- **OTHER**—Additional landforms may be added. Please specify and define.

Terrain shape index: This index will only be determined in the U.S. Virgin Island park units. The terrain shape index is calculated from slope estimates taken in eight directions around the plot. Slope at each location is recorded using a clinometer. To use a clinometer to record slope, the shortest crew member should first calibrate the device. Have the second (taller) crew member stand 10 meters (32.8 ft) away on level ground. The first crew member looks through the clinometer lens keeping both eyes open simultaneously and points the device at the second crew member, looking for the place on their body where the clinometer reads 0-0. Once calibrated, the second crew member stands 10 meters directly at aspect (direction of steepest downhill slope) from the first crew member. The first member 'shoots' the clinometer to the same position on the second member's body that they

established when calibrating the clinometer. The value at this position is reported in degrees (make sure to record if the value is negative or positive). Repeat this procedure turning clockwise 45° from aspect; repeat six more times, always turning clockwise at a 45° bearing. Record all slopes to the nearest 5°.

Topographic position: This is a qualitative category system that relies on the field worker's best judgement of the landscape to determine the type that best fits the situation (definitions are from Grossman et al. [1998]):

- **INTERFLUVE:** (crest, summit, ridge): linear top of ridge, hill, or mountain; the elevated area between two fluves (drainageways) that sheds water to the drainageways.
- **HIGH SLOPE:** (shoulder slope, upper slope, convex creep slope): geomorphic component that forms the uppermost inclined surface at the top of a slope. Comprises the transition zone from backslope to summit. Surface is dominantly convex in profile and erosional in origin.
- **HIGH LEVEL** (mesa): level top of plateau.
- **MIDSLOPE** (transportational midslope, middle slope): intermediate slope position.
- **BACKSLOPE** (dipslope): subset of midslopes which are steep, linear, and may include cliff segments (fall faces).
- **STEP IN SLOPE** (ledge, terracette): nearly level shelf interrupting a steep slope, rock wall, or cliff face.
- **LOWSLOPE** (lower slope, foot slope, colluvial footslope): inner gently inclined surface at the base of a slope. Surface profile is generally concave and a transition between midslope or backslope, and toe slope.
- **TOESLOPE** (alluvial toeslope): outermost gently inclined surface at base of a slope. In profile, commonly gentle and linear and characterized by alluvial deposition.
- **LOW LEVEL** (terrace): valley floor or shoreline representing the former position of an alluvial plain, lake, or shore.
- **CHANNEL WALL** (bank): sloping side of a channel.
- **CHANNEL BED** (narrow valley bottom, gully arroyo): bed of single or braided watercourse commonly barren of vegetation and formed of modern alluvium.
- **BASIN FLOOR** (depression): nearly level to gently sloping, bottom surface of a basin.

Disturbance indicators: The field crew observes the plot and its environs and documents the presence of any recent or historic disturbance history within or very near the vicinity of the plot. When a disturbance indicator is noted within the plot, an estimated areal cover percentage is recorded

to the nearest 10%, using two observers standing at opposite ends of the plot (one at the eastern edge of the plot, the other at the western edge of the plot). Areal cover is estimated from a consensus reached by the two observers. There are many choices for indicators of disturbance and each requires a certain level of familiarity with the signs that would indicate disturbance. An open-grown canopy tree in the plot is generally a much older and larger tree than all the other trees in the plot with unusually spreading branches indicating the plot was likely a farm or other cleared area with just one or a handful of trees in the past that grew in a full-sun, low competition environment. Sign of recent fire can be seen based on charring combined with a lack of a leaf or coarse woody debris layer. Sign of historic fire usually shows from heavy tree scarring, charcoal, and other signs of fire with signs of recovery that show the fire was more than one year ago. Signs of heavy browse include browse lines that match up with the height of the deer's reach, and branches with deer browse marks on palatable species. Signs of recent or historic logging are generally given away by human cut stumps where the rest of the tree was removed. Historic plowing is often seen in forests and is easily recognized by uniform rows of raised up soil (mini swales). Heavy erosion is common along streams and is checked if the creek or river is incised or embedded in a bed that is deeper than it would be naturally. There are many other indicators of disturbance (hog rooting, camping, wind throw, 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 will be used to further describe conditions already noted.

Equipment List

- Paper copies of maps; printed on Rite in the Rain paper
- GPS plus spare batteries
- Compass
- Clinometer
- Datasheets for plot establishment (SFCN *Veg Form 1: Forest Vegetation Plot Establishment*) and site-level measurements (SFCN *Veg Form 2: Site Characteristics*); one set per plot, plus spare copies; all printed on Rite in the Rain paper
- Pencils
- 12-inch (30.5-cm) long rebar ($\times 7$ per plot) plus pillowcase (or similar heavy-duty bag) for rebar transport
- Permanent plastic surveyor's markers (rebar covers; $\times 7$ per plot), labeled by subplot and corner
- Hammer with prongs
- Numbered aluminum tree tags (specific 100 series needed for the plot)

- Wood siding sinker head style aluminum nails or Stainless Steel Nails depending on the site.
- Diameter tape, metric, fabric
- Open reel fiberglass tape, Five 30–50 meters (98.4–164 ft)
- Chaining pins, set of 11 plus Chaining Pin Quiver (× 2)
- Flagging tape
- Wire stake flags, bundle
- Distance measuring device to assist with module corner locations (see SOP FVM16 Using Haglöf DME Distance Ranger Finder—Version 1 [Shamblin 2019] for further instructions).

Plot Revisit Years

Prior to Field Work

Print out corresponding resample form and plot and tree diagrams from the previous sampling effort for the set of plots to be sampled in each year. Make sure the most recent plot points are loaded into the field crew's GPS unit.

Navigating to the Plot

1. Field crews will navigate to the plot with the aid of a GPS unit, as before. 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 or 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, update 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 on the back of the sheet so that we can later replace the old directions with the new.*
2. Field crew should 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, travel time should be viewed as a realistic estimate (i.e., we are 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 should begin looking for tree tags and plot center rebar. A magnetic locator will be used to aid this process. The plot diagram and tagged tree information should also be consulted at this point to aid in location of the center rebar.
4. Once the center rebar is located, place an orange flag in the center rebar and record start time on the datasheet.
5. 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 located without difficulty) then a new set of coordinates may need to be taken. However, do not automatically assume the

coordinates stored in the GPS are in error. It is possible that satellite coverage may be poor and you may need to provide the GPS additional time to estimate location. 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.

Laying Out the Plot

Follow the steps outlined in “Laying Out the Plot” section during Plot Establishment years. For any rebar that cannot be located in a reasonable amount of time, place a flag in the location where crew believes it should be located and attempt to find all the remaining plot rebar before making the decision to drive a new piece of rebar.

Recording Site Characteristics

For plot revisits, information on key environmental data including slope, aspect, terrain shape index (VIIS only), and landform are reviewed, and new measurements recorded if the original data do not match. However, these attributes very rarely change over the time periods in which we are working. Determine the forest type and record on the SFCN *Veg Form 1—Forest Vegetation Plot Establishment* datasheet. Indicators of disturbance need to be assessed in the same way as a newly established plot, as some of these measures are independent between sampling years and are important to use as covariate data in the vegetation change analyses.

Equipment List

- Paper copies of maps; printed on Rite in the Rain paper
- GPS plus spare batteries
- Compass
- Datasheets for plot establishment (SFCN *Veg Form 1—Forest Vegetation Plot Establishment*, see Table 1) and site-level measurements (SFCN *Veg Form 2—Site Characteristics*, see Table 2); one set per plot, plus spare copies; all printed on Rite in the Rain paper with pre-printed information like plot coordinates, directions to the plot, and slope
- Pencils
- 12-inch (30.5-cm) long rebar (2–3 per plot) plus pillowcase (or similar heavy-duty bag) for rebar transport
- Extra rebar (×3)
- Permanent plastic surveyor’s markers (rebar covers; seven per plot), labeled by subplot and corner. If new rebar is installed at a later date, it will have a different color to distinguish it from the original.
- Claw hammer
- Numbered aluminum tree tags (specific 100 series needed for the plot)

- Wood siding sinker head style aluminum nails
- Diameter tape, metric, fabric
- Open reel fiberglass tape, five 30-50 meters (164 ft; ×4)
- Chaining pins, set of 11 plus Chaining Pin Quiver (×2)
- Flagging tape (×24)
- Wire stake flags, bundle
- Magnetic Locator
- (Optional) Distance measuring device for relocation of module corner rebars (see SOP FVM16 *Using Haglöf DME Distance Ranger Finder—Version 1* [Shamblin 2019] for further instructions).

Table 2. Datasheet field descriptions for SFCN Veg Form 1—Forest Vegetation Plot Establishment.

Field Name	Field Description
Evaluation ID	Unique identifier comprised of a lower-case “e”, four letter park code, three letter community type, and three digit GRTS order (e.g. eBISCMAN110).
Visit Date	The date that data collection starts in mm/dd/yyyy format (e.g., 05/17/2019).
Park	For new plots, 4-letter park code (i.e., BISC, EVER, etc.)
Unit	For parks broken up by management units (EVER east or west for cypress), list the management unit or enter “N/A”.
QA/QC Plot	Is this a "repeat" data collection effort, as designated by the data manager 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 field crew leader (botanist).
Site is safe to access?	Is it safe to approach and visit the plot location? Circle Yes or No.
Forest Community	The name of the Forest Community found at the plot. Definitions are by park unit and follow specific map product.
Plot contains the desired Forest Community?	Does the plot contain any of the desired Forest Community? Circle Yes or No.
Plot entirely within the desired Forest Community?	Does the plot fall entirely within the desired Forest Community? Circle Yes or No.
Moved Plot	Was the plot moved to fit within the desired Forest Community? Circle Yes or No.
Moved Plot Distance	If the plot was moved, this records the move distance in meters (maximum of 10).
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 FVM03.
Plot ID	If a permanent plot is established, record the permanent Plot ID that will be used on all revisits. This is comprised of a four-letter park code, three-letter community code, and the two-digit plot number that is printed on the marker installed at the site (e.g. BISCMAN01).
Rejection Justification	If a permanent plot is not established, record details on why it was rejected. Reference the criteria found in SOP FVM03.
GPS waypoint	For new plots (or revisit plots whose coordinates are incorrect), waypoint 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 is <park acronym><community code><3 digit GRTS order>. (e.g., BISCMAN079).

Field Name	Field Description
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., SFCN001). May also use the last 3 digits of the serial number.
Field UTM X	For new plots (or revisit plots whose coordinates are incorrect), the 6-digit latitude of the plot center, also known as easting, as recorded (and saved) in the field with the GPS. (e.g., 579129).
Field UTM Y	For new plots (or revisit plots whose coordinates are incorrect), the 7-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 where the plot is located.
Estimated GPS error	For new plots (or revisit plots whose coordinates are incorrect), record the horizontal error estimate from the GPS (in meters).
Elevation (m)	For new plots (or revisit plots whose coordinates are incorrect), elevation recorded from GPS unit in meters.
WAAS enabled	Yes, No, or Unknown
Directions to Plot	Starting from a road, known trail head, etc. provide <u>detailed</u> 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. This field will be pre-populated on revisit forms, correct/update if necessary.
Approximate Travel Time from Vehicle to Plot	Length of time taken to travel from vehicle to plot, recorded in minutes. This field will be pre-populated on revisit forms, correct/update if necessary.
Installed Plot ID Tags	Were plot ID tags installed? Circle Yes or No.
Tree 1 tag #	Tree tag number for first tree with plot identification tag.
Tree 2 tag #	Tree tag number for second tree with plot identification tag.
Field Use – Reviewed By	Initials of the individual who reviewed completed data sheet for SOP FVM03 elements while still in the field. Ideally this should be someone other than individual who completed this portion of datasheet.
Office Use – Entered By	Initials of the person who enters this datasheet into the database.
Office Use – Modified By	Initials of the person who modified this datasheet back in the office.
Office Use – Modification Reason	Description of what was modified (if anything) on the datasheet back in the office.
Office Use – Data Verified By	Initials of the person who verifies that this datasheet was correctly entered into the database.
Office Use – Data Validated By	Initials of the person who performs the final validation of these data.

Table 3. Datasheet field descriptions for SFCN *Veg Form 2—Site Characteristics*.

Field Name	Field Description
Plot ID	Four-letter park code, three-letter community code, and the two-digit plot number that is printed on the marker installed at the site (e.g. BISCMAN01). This field will be pre-populated on revisit forms.
Visit Date	The date that data collection starts in mm/dd/yyyy format (e.g., 05/17/2019).
Reviewed by	Last name of individual who reviewed completed data sheet for SOP FVM03 elements. Ideally, this should be someone other than individual who completed this portion of datasheet.
Slope (degrees)	Predominant slope of plot measured with compass/clinometer. This field will be pre-populated on revisit forms, correct if necessary.
Aspect (degrees)	Predominant aspect of plot measured with compass. This field will be pre-populated on revisit forms, correct if necessary.
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 clinometer, 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.
Topographic position	Best estimate of topographic position. This field will be pre-populated on revisit forms, correct if necessary.
Indicators of Disturbance	Check all that apply in terms of disturbance indicators. For “Other Indicators”, describe indicator. Record cover % (to nearest 10%) of each indicator.
Plot Submerged (percent)	The overall areal cover of standing water across the plot (to nearest 10%).
Water on Plot (type)	Circle the water type that best characterizes the source of the water.
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.

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Appendix A. Field data forms

SFCN Forest Vegetation Monitoring Veg Form 1: Vegetation Plot Establishment Form		Evaluation ID _____ (park code + community code + GRTS #)	Visit Date _____ (mm/dd/yyyy)
<i>Refer to SOP VEG03 – Site Selection, Plot Establishment, and Return Visits for details on using this form.</i>			
Park _____ Unit _____		QA/QC Plot (circle one) Yes or No	
Start Time _____		Total Time _____	
Crew _____ (circle crew leader)			
Site is safe to access? (circle one) Yes or No			
Forest Community _____			
Plot contains the desired Forest Community? (circle one) Yes or No			
Plot entirely within the desired Forest Community? (circle one) Yes or No			
Moved Plot (circle one) Yes or No (if yes, provide distance; max of 10 meters) _____ m			
Permanent Plot Established (circle one) Yes or No (if yes, provide permanent plot ID; if no, provide justification)			
Plot ID _____		Rejection Justification _____	
(This is the permanent name that will be used on revisits. It is made of a park code, community code, and the 2-digit plot number that is printed on the site marker installed at the site e.g. BISCMA01)		_____	
_____		_____	
GPS waypoint _____		GPS model _____ GPS Unit ID _____	
Field UTM X _____ m E		Field UTM Y _____ m N NAD83 Zone (circle one) 17 or 20	
Estimated GPS error _____		Elevation _____ m WAAS enabled (circle one) Yes or No or Unknown	
Directions to Plot (Be specific, including where parked, landmarks used, if any gate keys needed, etc.)			

Approximate Travel Time from Vehicle to Plot _____ minutes			
Installed Plot ID Tags (circle one) Yes or No			
Tree 1 tag # _____		Tree 2 tag # _____	
		For Field Use (initials) Reviewed By _____	
For Office Use (initials and mm/dd/yy)			
Entered By _____		Modified By _____	
Modification Reason _____			
Data Verified By _____		Data Validated By _____	

SFCN_Form_1_PlotEstablishment_Datasheet_Page_1.docx 9/20/2019

Figure A-1. Sample of SFCN Veg Form 1—Forest Vegetation Plot Establishment, page 1 of 2.

SFCN Forest Vegetation Monitoring

Veg Form 1: Vegetation Plot Establishment Form

Refer to SOP VEG03 – Site Selection, Plot Establishment, and Return Visits for details on using this form.

Plot ID _____
(park code + community code + plot #)

Visit Date _____
(mm/dd/yyyy)

Plot Layout Notes (notable plot features or irregularities) _____

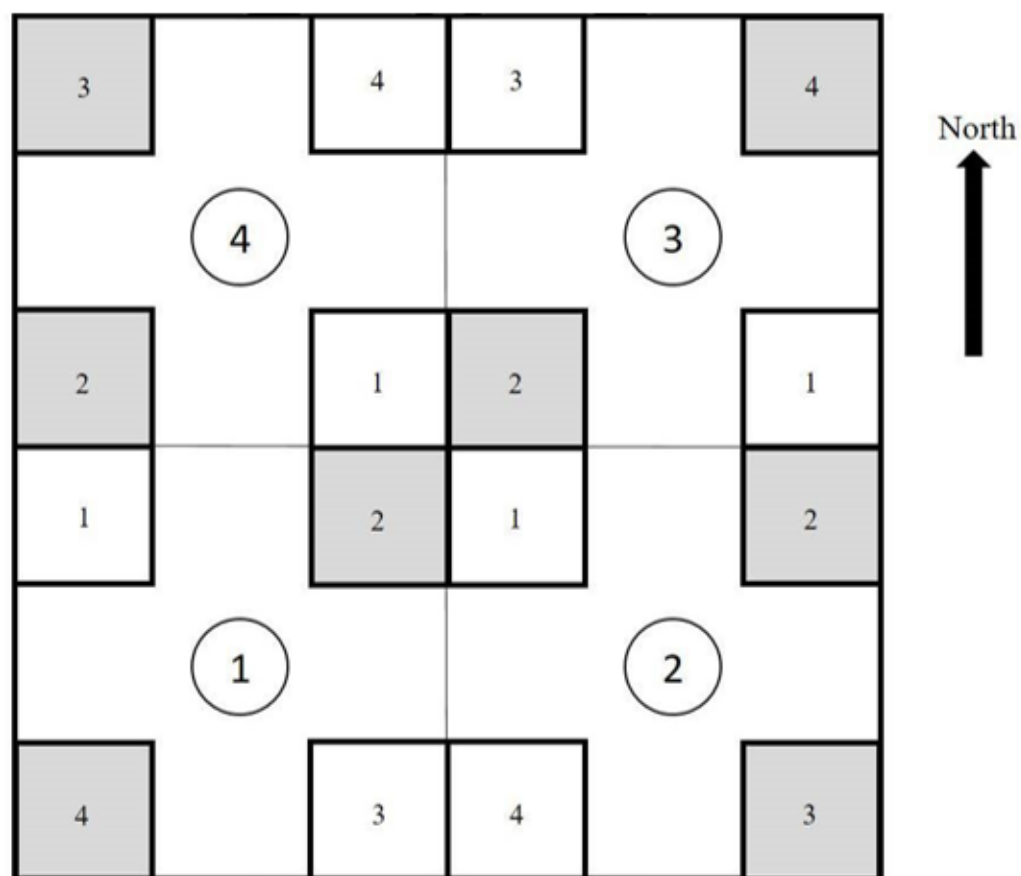


Figure A-2. Sample of SFCN Veg Form 1—Forest Vegetation Plot Establishment, page 2 of 2.

SFCN Forest Vegetation Monitoring Protocol
Veg Form 2 - Site Characteristics

Plot ID _____
 (park code + community code + plot #)

Visit Date _____
 (mm/dd/yyyy)

SOP 03 – Plot Evaluation, Plot Establishment, and Return Visits

Reviewed By: _____

Slope (degrees): _____

Aspect (degrees): _____

Landform (circle one)

Active Slope	Canyon	Levee
Alluvial Cone	Cliff	Plain
Alluvial Fan	Crest	Ravine
Alluvial Flat	Delta	Ridge
Alluvial Plain	Dune	Saddle
Arroyo	Escarpment	Shoulder
Backswamp	Flat	Sinkhole
Bar	Flood-Plain	Spit
Basin	Gorge	Swale
Beach	Hill	Terrace
Bluff	Hummock	Valley
Braided Channel	Knob	Other

Topographic Position (check one)

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

MCNAB INDICES (degrees) + for upslope/-for down	TSI: Terrain Shape Index (site microtopography)
At aspect	
45°	
90°	
135°	
180°	
225°	
270°	
315°	
TSI only for U.S. Virgin Islands parks	

Indicators of Disturbance (check all that apply)

- ☐ Open grown canopy tree in plot
- ☐ Sign of homesite/barn/cemetery present
- ☐ Sign of fire within past year
- ☐ Sign of historic fire (> 1 year ago)
- ☐ Sign of heavy deer browse
- ☐ Sign of feral hog damage
- ☐ Sign of recent or historic logging (stumps)
- ☐ Sign of historic plowing (ruts, terraces)
- ☐ Sign of historic pasturing (barbed wire)
- ☐ Heavy erosion along streams
- ☐ Other _____

Cover (nearest 10%)

Indicators _____

☐ None

Is plot submerged Y / N (circle one); if yes, report % (to the nearest 10%) _____

Water on Plot Code (see below for description of codes) _____

- 0 None—no water sources on plot
- 1 Permanent streams or ponds
- 2 Permanent water in the form of deep swamps, bogs, marshes
- 3 Ditch/canal—human-made channels such as for irrigation or drainage
- 4 Temporary streams
- 5 Flood zones—evidence of flooding when bodies of water exceed their natural banks
- 6 Vernal pool
- 7 Other water—specify in Plot Notes

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

Figure A-3. Sample of SFCN Veg Form 2—Site Characteristics.

Appendix B. Modifications to CUPN SOP 3 and CUPN SOP 9 for SFCN SOP 3

The SOP 3 *Site Selection and Plot Establishment—Version 1.3* of the *Cumberland Piedmont Network Vegetation Monitoring Protocol* (White et al. 2011) was modified to create this SOP. The SOP 9 *Site U. S. National Vegetation Classification Measure—Version 1.3* of the *Cumberland Piedmont Network Vegetation Monitoring Protocol* (White et al. 2011) was also modified and incorporated into this SOP. The major modifications to this SOP is listed and explained below.

Changes to Plot Selection Approach

The Cumberland Piedmont Network approach to plot selection focuses on park-wide inference for forest and woodland habitats, whereas the South Florida/Caribbean Network focuses on specific forest communities within parks. The focal forest communities are typically the dominant forest types within the SFCN parks or they are forest communities of special management concern. These focal forest communities are affected by a combination of physical features and processes that have historically been present (hydrology, salinity, fire, frost, topography, aspect, soil type and depth). Monitoring focal forests over time allows for greater understanding of these ecosystems within the SFCN geography, which provides managers information about the degree of change within these communities.

Stratification by Focal Forest Communities

The Cumberland Piedmont Network does not stratify parks into broadly defined habitats to determine plot locations and sample size. The South Florida/Caribbean Network uses specific focal forest community polygons to stratify the location of vegetation plots, and uses their relative size to determine the number of plots within each habitat sample. Sampling frames and spatial arrangements of plots were developed by the South Florida/Caribbean Network to fit park-specific needs and constraints.

Determination of Forest Community Type

The Cumberland Piedmont Network determines the forest vegetation type by standing in the center of the forest plot and following a dichotomous vegetation key, which references the U. S. National Vegetation Classification (US NVC) (CUPN SOP 9). The South Florida/Caribbean Network follows similar field steps of standing in the center of the plot and rapidly determining the forest community, however, the reference is to the vegetation community definitions that are related to the specific map products that were used for the site selection process.

Plot Sizes and Shape are Fixed

Plot sizes can be modified from a standard 20 × 20-meter (65.6 × 65.6 ft) shape to either a 20 × 10-meter (65.4 × 32.8 ft) or 10 × 10-meter (32.8 × 32.8 ft) array to fit the plot in the targeted sampling frame in the CUPN SOP 3. The South Florida/Caribbean Network has chosen to maintain a consistent plot size and array (20 × 20 meter) across all parks and habitats to more accurately assess status and trends of vegetation across park-wide and landscape-wide scales. This technique removes

the inherent sampling error attributed to differing scales of inference (e.g., smaller plots have a lower error rate of species detection than larger plots).

Plot Center Establishment

The South Florida/Caribbean Network uses the GPS and pacing procedure outlined by the Northeast Temperate Network (Tierney et al. 2016), where once the handheld GPS is within 15 meters (49.2 ft) of the centroid, the crew member responsible for navigation moves ten steady paces in the direction that the GPS identifies. The CUPN protocol suggests that the crew navigate as close to the point as time allows.

No Restricted Categories

South Florida/Caribbean Network plots must be shifted up to 10 meters (32.8 ft) if any portion of the plots occurs within a restricted category, rather than if more than $\frac{1}{4}$ of the plot occurs in a restricted category in the Cumberland Piedmont Network.

Additional Site Characteristics Pertaining to Water

Because certain habitats (especially cypress and hardwood swamp communities) are periodically inundated with water, the South Florida/Caribbean Network has adopted additional site characteristic measurements from the Gulf Coast Network vegetation monitoring protocol (Carlson et al. 2018). These are a description of the percentage of water on the plot, and a water on plot qualitative descriptor.

Cover Estimates for Disturbance Indicators

The CUPN records presence of disturbance indicators on its forest monitoring plots without calculating an estimated coverage of each indicator. The SFCN approach estimates a plot-level percent cover for each disturbance indicator observed on each vegetation plot. Estimates are a consensus by two observers located on different sides of the plot. Although these estimates may be imprecise, compared with data taken from vegetation richness and cover and woody stem density, they can provide a categorical importance estimate (low, medium, high) of each disturbance indicator.

Three Woody Debris Transects are 25 meters (82 ft) in Length

The Cumberland Piedmont Network records Coarse Woody Debris (CWD) along two 40-meter (131.2-ft) transects that cross the primary vegetation plot. The South Florida/Caribbean Network has chosen to employ the transect design of the FEAT/FIREMON Integrated (FFI) fuels monitoring system (Lutes et al. 2009) to account for additional fuel types that are more meaningful to fire behavior in the Southeastern Coastal Plain—duff or litter, fine, as well as coarse and fine woody debris, and fuel bed size. Following the FIREMON protocol (Lutes et al. 2006), the South Florida/Caribbean Network has chosen to record woody debris variables across three 25-meter (82-ft) long transects. Transects are arranged spatially in the pattern used by the Northeast Temperate Network (Tierney et al. 2016). These details can be found in SOP FVM08 *Woody Debris* (Prats 2019).

Appendix B Literature Cited

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