

Southeast Coast Network

National Park Service
Inventory & Monitoring Program



Standard Operating Procedure (SOP) #1.4.19

Installation and Relocation of Permanent Terrestrial Monitoring Sampling Locations

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Summary

This Standard Operating Procedure explains the installation and relocation of permanent sampling locations as part of the implementation of the Southeast Coast Network's terrestrial-monitoring protocols (i.e., amphibian, landbird, and vegetation communities, and fire fuels).

Because of the potentially controversial issues involved with installing rebar and relocating with metal detectors in parks with electrically-conductive metal artifacts (i.e., those detected with a metal detector), permission must be obtained from park managers to allow the permanent installation of sampling locations.

Revision Log

Previous Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

Overview

The macroplot, or transect, plot, and subplot array for four co-located terrestrial Vital Signs, is permanently marked with seven $0.5'' \times 12''$ rebar. Each piece of rebar serves as the permanent tie-in for a specific transect and the plots and subplots associated with that transect. The rebar are installed in a radial array on azimuths of $0^\circ/360^\circ$, 60° , 120° , 180° , 240° and 300° (Figure 1).

Each piece of rebar is capped with a unique identifier indicating the position of the rebar within the macroplot. Specifically, the markers identify the transect bearing, the distance from the center of the circular plot, or the center of the plot itself. The rebar caps are labeled and colored as indicated in Table 1 and depicted in Figure 2.

Monitoring protocols associated with four Vital Signs are currently co-located at each sampling location, therefore at least one rebar serves a purpose for each protocol. The landbird- and amphibian-community monitoring protocols only warrant the center rebar, whereas the fire-fuels monitoring protocol requires three rebar, and the vegetation-community monitoring protocol involves the entire array of rebar.

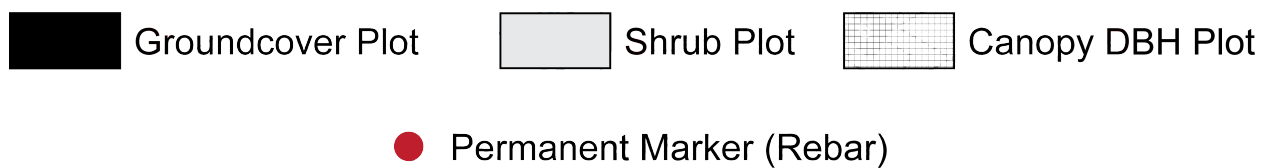
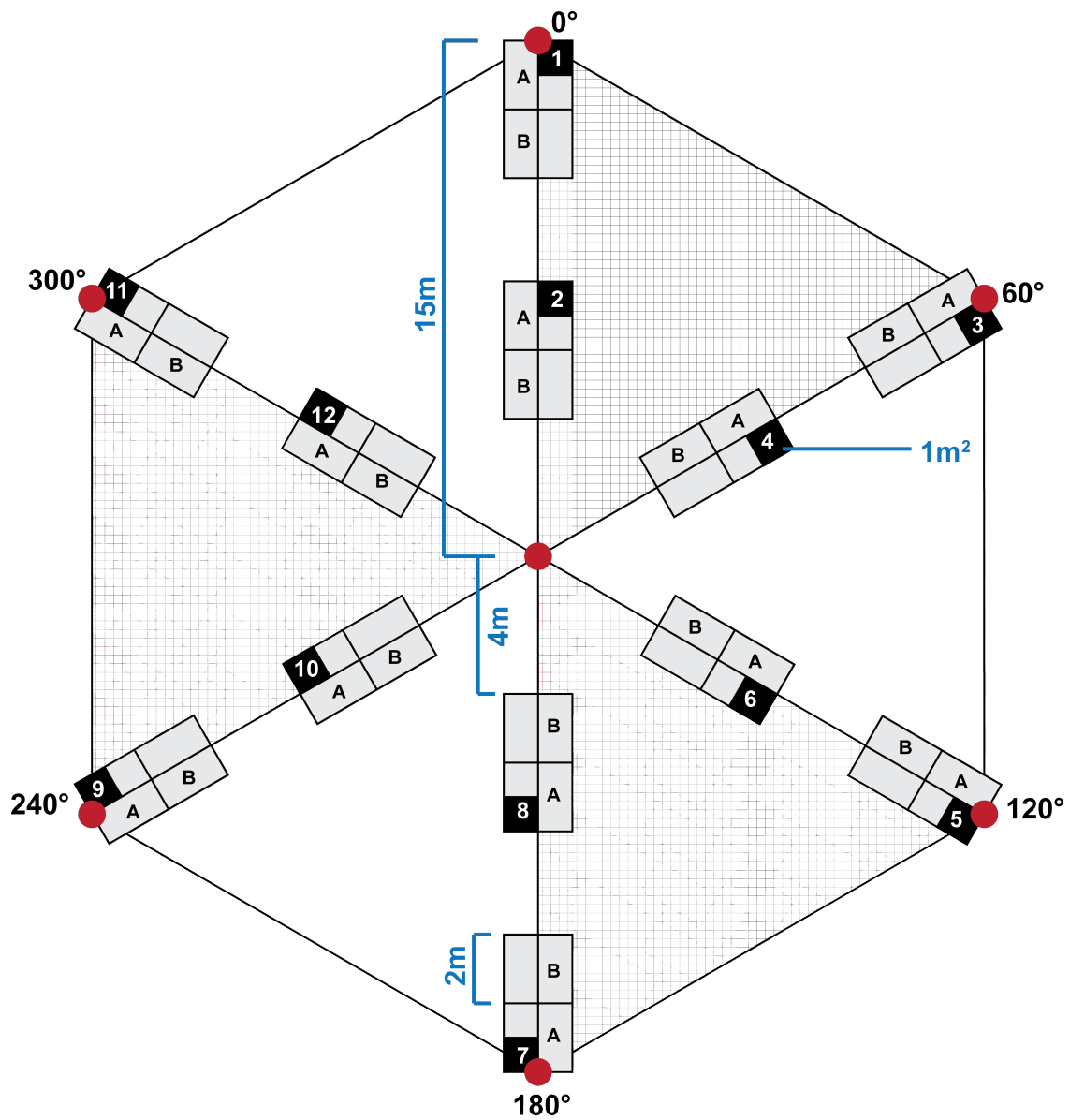


Figure 1. Macroplot layout for SECN vegetation-, landbird-, and amphibian-community, and fire fuels monitoring protocols.

Table 1. Permanent plot rebar caps for the SECN vegetation-, landbird-, and amphibian-community, and fire fuels monitoring protocols.

Rebar Location	Rebar Cap / Marker Color and Label
Plot center	Yellow; Center
0°/360° transect	Orange; 0 DEG, 15M
60° transect	Orange; 60 DEG, 15M
120° transect	Orange; 120 DEG, 15M
180° transect	Orange; 180 DEG, 15M
240° transect	Orange; 240 DEG, 15M
300° transect	Orange; 300 DEG, 15M



Figure 2. Permanent plot rebar caps for the SECN vegetation-, landbird-, and amphibian-community, and fire fuels monitoring protocols.

Equipment

- Rebar, 0.5” diameter, 10–12” length
- Hammer (2)
- Labeled plastic rebar caps/markers (from Bernsten International, Inc.)
- GPS units (Garmin and Trimble)
- 50-m tape measure
- Compass
- Metal detector

Installation

A standard GPS is used to navigate to the 0.5-ha sampling location. A sub-meter GPS unit (e.g., Trimble) is used to accurately locate the sampling location. Allow the GPS to collect data and refine its location for several minutes to ensure the location is as accurate as possible. When confident of the location accuracy, drive a rebar into the ground flush with the surface and place the “Center” cap on it (Figure 3). With a compass, lay out the tape measure on the appropriate azimuths and identify the locations where rebar is to be installed. Use a hammer to drive the rebar in to just about 0.5–1” above the surface of the soil, affix the appropriate rebar cap indicating the bearing and distance from the center point of the plot, and drive the rebar the remainder of the way into the ground so the cap is flush with the surface of the soil (Figure 4). Drive the rebar into the ground as much as possible prior to attaching the cap, or the cap will become unreadable from the hammer strikes. If the exact location for rebar placement is a rock, premixed concrete can be used to affix the cap to the surface of the rock, however it must be noted that the metal detector will be useless for relocating this particular marker. If subsurface rocks exist and preclude driving the rebar to its fullest depth, it can be angled sideways or laid flat, ensuring the rebar cap is in the exact target location.

Document the layout of the plot, with the accompanying form or in a field notebook, relative to any features that are less likely to change and can aid with relocation efforts. Because terrestrial monitoring in SECN parks occurs on a three-year rotation, use features that are most likely to remain static over that length of time. The directions can be updated, as necessary, each time the location is monitored. For, example, “from the west junction of Willow Pond Trail and Parallel Trail travel off trail at 20° for approximately 100 paces to a large grove of oaks”, or “from the L-shaped boulder that is 1.5-m in height, follow a 165-degree bearing seven paces to locate the 300°15 m rebar”. Draw pictures as necessary; exceptional artistic talents are **not** necessary.



Figure 3. Example of rebar and center cap.



Figure 4. From left to right, a) hammer rebar into ground to about 1 in above the soil surface, b) affix rebar cap, c) hammer the remainder of way into the soil, d) so cap is flush with soil surface.

Relocation

GPS units and metal detectors are used to relocate the sampling locations. Relocating permanent plot markers in most southeastern U.S. ecosystems can be a time consuming and challenging endeavor, despite the use of sub-meter accuracy GPS units and metal detectors. Sediment movement, litter deposition, variable satellite reception for GPS units, influences of canopy cover and topography on GPS reception, and vegetation density influence the relocation effort. Further, plot attrition is to be expected. For example, natural events (i.e., tropical storms, extreme tides) that occurred at CALO between our 2010 and 2012 sampling events moved sand sufficient enough to make the relocation of approximately 20% of our sampling locations impossible.

A standard GPS is used to navigate to the 0.5-ha sampling location. A sub-meter GPS unit (e.g., Trimble) is used to precisely relocate the sampling location. If the sub-meter GPS unit is unable to estimate a position but has a reasonable satellite constellation, increase the PDOP accordingly. Be mindful that as PDOP increases precision decreases (i.e., the error radius of the location estimate increases) and the area that must be searched for the markers increases. Error radii for location estimates with a PDOP of greater than 20 can be well over 50 meters, which translates to 1.5 times the size of the 0.5-ha sampling unit that must be searched. Field staff can also allow the GPS unit to collect positional data for a long period of time (i.e., approximately 30–45 minutes) as this can provide a more precise estimate.

When confident the GPS units indicate a reasonable proximity to the center of the 0.5-ha grid cell, a metal detector is used to find at least one rebar. Because each rebar is labeled with its position in the macroplot, if the sampling location has not been disturbed, the other rebar can be relocated by reconstructing the rebar-installation array with a compass and measuring tape. If the cap is missing (e.g., melted during a fire, removed by a person), then another rebar will need to be located in order to identify the entire array. In this situation, because the rebar radiate from the center at distances of 15m, an effective technique to locate the remaining rebar is to search the edges of a circle created by measuring out 15 m in the cardinal and intermediate directions from the known rebar location. Check the status/integrity of each rebar cap and replace as necessary. Once all rebar are successfully located, take this opportunity to identify landmarks or other location characteristics that would prove useful supplements to the written relocation directions and update accordingly.

If relocation of a sampling location exceeds four hours, then the location is deemed unable to relocate, and replaced with a new sampling location. New (i.e., replacement) sampling locations are added by the Terrestrial Ecologist and in accordance with SOP 1.1.1. Generating a Spatially-balanced Random Sample with the RRQRR Tool in ArcGIS.

SECN Form SL1. Directions, compass bearings, paces/distances, distinctive landmarks, sketches of the area, or other characteristics or useful information that can aid in the relocation of permanent sampling locations. Use as many pages as necessary.

Park	Sampling Location	Install Date