

Standard Operating Procedure #5:

Plot Establishment

Version 2.1 (1/26/2024)

Prepared by

Suzanne Sanders and Jessica Kirschbaum

National Park Service

Great Lakes Network Office

2800 Lakeshore Drive East

Ashland, Wisconsin 54806

Revision History Log

Date	Previous version	New version	Authors
2012	1.0	1.1	Suzanne Sanders and Jessica Grochowski
Permanent marking details were added, and the criteria for applying declination was modified.			
2013	1.1	2.0	Suzanne Sanders and Jessica Grochowski
Explanation of reestablishing an existing plot was added.			
2024	2.0	2.1	Suzanne Sanders and Jessica Kirschbaum
Revised to: • reflect the fact that we have now established all planned sites; specific details on how to establish a new site have been removed and the reader is directed to earlier versions of the protocol; • include updated conditions and processes when replacing reference objects; • improve wording and flow of text.			

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5.0 Introduction

Potential sampling sites were selected for all parks prior to the first round of sampling. These potential sites were generated by a computer algorithm following a generalized random-tessellation stratified design (GRTS, Stevens and Olsen 2004). This design ensures that the sampling areas are both spatially balanced throughout the sampling frame but also randomly placed. All existing and potential sites are limited to areas with at least 10% cover, or the potential for such. Sites were established during our initial sampling round at all parks, with additional sites added during the second sampling round at APIS, GRPO, INDU, ISRO, MISS, SACN, VOYA. As of Fall 2022, we have established the full complement of planned sites in each park. Currently, we do not plan to add any additional sites, although we do acknowledge that plans can change in response to any number of situations which may arise. In the event that we do establish new sites in parks, we will refer to the previous version (2.0) of this protocol (Sanders and Grochowski 2014).

5.1 Plot Reestablishment During Subsequent Site Visits

Sites and transect endpoints are relocated using a combination of GPS, a handheld metal detector, and reference trees. Because sites are visited only once every nine years, permanent markers and the reference points are checked during each visit and reestablished as needed.

5.1.1 Reestablishing Points

When sampling established plots, we relocate the rebar designating transect endpoints using a combination of reference trees and a hand-held metal detector. Crews navigate directly to the transect endpoint using the mapping-grade GPS unit. Once at the correct coordinates, crews try to locate the reference objects. When at least one reference object is located, measure out from that object at the bearing and distance provided to locate the rebar. Begin sweeping with the metal detector to locate the rebar. Continue to identify the remaining reference object(s) to hone in on the location of the rebar. It may be helpful to leave plastic flagging on the ground at the precise point each reference tree leads you to, and then use the metal detector at and in between those points. Once the rebar representing the transect endpoint is located, the distance and bearing from each of the reference objects to the transect endpoint is rechecked. The values should be within 10 cm and 2° from the values recorded during the previous visit to the plot. For any reference tree where these criteria are not met, the new values are recorded. All tag numbers are checked to confirm that they are correct and correspond to the respective tree measurements. A new DBH is recorded for every reference tree, as this value will continue to change through time.

Replace transect endpoint reference objects that are dead, severely stressed, injured, or fallen. Update the reference object's status in the data and mark it as inactive. It is unnecessary to update any DBH or distance measurements for this tree, as it will no longer be active. Remove the tag from the tree. Replace this now inactive reference object with a new reference object. Use a new tag number on the new reference object.

In addition, you may choose to eliminate a healthy, intact tree from the reference object list. Reasons for this include a reference tree that is in the *Fraxinus* genus, which is subject to emerald ash borer,

as well as poor triangulation of reference objects, or poor species choices made for reference objects. If you encounter this, mark it as eliminated in the data and change it to inactive, remove the tag, and replace the tree with a new reference object, making sure to use a new tag number.

Where rebar cannot be relocated, it is left to the discretion of the field crew to reposition the rebar based on reference tree data. It is up to the discretion of the field crew to position the rebar by any means possible. This could include reconstructing the likely locations of fallen reference trees or extrapolating the transect endpoint position from an adjacent transect endpoint.

5.1.2 Reestablishing the Transect Line

Once the rebar at the transect endpoints is located, the transect lines are reestablished between transect endpoints 1 and 2, transect endpoints 3 and 4, and transect endpoints 5 and 6. The transect line is laid out at a 90° bearing using flags. If the flagged line meets up with the known location of the rebar, the meter tape is pulled out along the flags. If the flagged line does not meet up with the known location of the rebar, adjust the flags accordingly to create a straight line between the two pieces of rebar representing the transect endpoints (Figure 1).

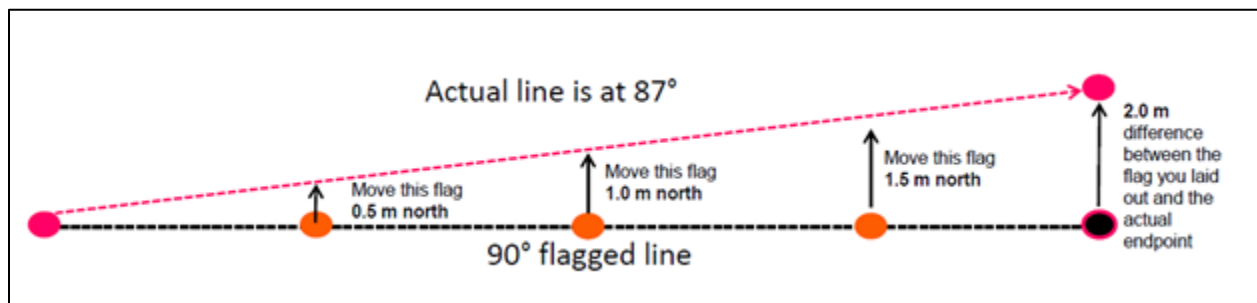


Figure 1. A representation of how the line is adjusted to create a straight line between the two pieces of rebar at the transect endpoints (pink circles).

5.2 Literature Cited

- Johnson, S. E., E. L. Mudrak, and D. M. Waller. 2006. A comparison of sampling methodologies for long-term monitoring of forest vegetation in the Great Lakes Network National Parks. GLKN 2006/06. National Park Service, Great Lakes Network Office, Ashland, Wisconsin.
- Stevens, D. L., and A. R. Olsen. 2004. Spatially balanced sampling of natural resources. *Journal of the American Statistical Association* 99:262–278.