

Standard Operating Procedure #4:

Using the Global Positioning System

Version 2.1 (1/26/2024)

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Revision History Log

Date	Previous version	New version	Authors
2012	1.0	1.1	Mark Hart, Ulf Gafvert, David VanderMeulen, Jessica Grochowski, Suzanne Sanders
Details on the use of the Trimble were added, as was detail about new software. A great deal of extraneous material was deleted.			
2013	1.1	2.0	Mark Hart, Ulf Gafvert, David VanderMeulen, Jessica Grochowski, Suzanne Sanders
Downloading instructions were revised to reflect use with the GeoExplorer 6000 units			
2024	2.0	2.1	Suzanne Sanders and Jessica Kirschbaum
Revised to: • reflect the fact that we will be using recreation-grade GPS units for both navigation and plot relocation and do not plan to collect additional sets of site coordinates any longer; • remove very specific details about settings and data transfer that are specific to one brand or type of unit; • remove Appendix A, which provided detailed (but outdated) steps on downloading and differentially correcting data.			

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4.0 Introduction

This Standard Operating Procedure (SOP) provides guidance on the common operations associated with global positioning system (GPS) units. The term GPS unit is used in this SOP in reference to units on the United States Global Positioning System (US GPS) satellite constellation, and to units on the Global Navigation Satellite System (GNSS) satellite constellation.

From 2007 through 2022, two GPS systems were used by the Great Lakes vegetation monitoring program. Mapping-grade Trimble GeoXT units were used to record the location of all six transect endpoints. Recreation-grade Garmin units have been used, in conjunction with maps, for navigation.

As of the end of the 2022 field season, all planned permanent monitoring sites have been established, and the six transect endpoints have been recorded with Trimble GeoXT units, providing 1- to 3-meter locational accuracy. We do not plan to re-record coordinates as we revisit sites. Beginning with field season 2023, we rely on Garmin recreation-grade units both for navigation to the site, and also to relocate transect endpoints, once at the site. Using recreation-grade GPS units is now possible since the newest models have much greater location accuracy than earlier models. Further, since our use and marking of witness trees is both thorough and distinct, the transect endpoints tend to be very apparent and we typically locate these easily, using only the recreation grade units. Thus, beginning in field season 2023, we do not carry mapping-grade units into the field. In the event that any new plots do need to be established in the future, we will use a Trimble mapping-grade GPS or other technology with similar, or better locational accuracy to record location information, on a site-by-site basis. We will follow the guidelines established in version 2.0 of this protocol (Sanders and Grochowski 2014).

4.1 Using Recreational-Grade GPS Units

Recreational-grade GPS units are the primary tool for navigation.

Planning

The monitoring sites must be loaded onto the GPS unit before departure to the field. In addition, topographic maps and other GIS layers (e.g., roads, campsites, river miles, etc.) which can aid in navigation should also be loaded beforehand.

Data Collection

Location data are captured by recreational-grade GPS units as waypoints. When taking a waypoint, enter the site ID or site designation in the text field provided. This ID should be consistent with the naming convention used in the data dictionaries. For example, transect endpoint 5 of plot 7045 will be labeled as “7045-5”.

Data Processing

Data should be downloaded from GPS units after a sampling trip, or after each field season. Data should be downloaded both as a text file and a shapefile. Each file name should include the download date. Points should be checked for reasonable spatial accuracy and errors. Subsequent downloads

should be error-checked in the same manner. When data collection is finished, all files should be compiled into one spatial file, and along with the raw downloads, should be saved to the appropriate location on Great Lakes Network servers.

4.2 QA/QC

Long-term monitoring is only useful if users have confidence in the data. Efforts to detect trends and patterns in ecosystem processes require high-quality, well-documented data that minimize error and bias. Data of inconsistent or poor quality can result in loss of sensitivity and lead to incorrect interpretations and conclusions.

NPS Director's Order #11B: Ensuring Quality of Information Disseminated by the National Park Service (www.nps.gov/policy/DOrders/11B-final.htm) specifies that information produced by the NPS must be of the highest quality and based on reliable data sources that are accurate, timely, and representative of the most current information available. Therefore, GLKN will establish and document procedures for quality assurance (QA) and quality control (QC) to identify and reduce the frequency and significance of errors at all stages in the data life cycle. Under these procedures, the progression from raw data to verified data to validated data implies increasing confidence in the quality of those data. Quality assurance and quality control procedures will document internal and external review processes and include guidance for addressing problems with data quality.

Examples of QA/QC practices pertaining to use of GPS include:

- Ensure that GPS-related software is periodically updated as it becomes available and has been tested.
- Check to see if the accuracy of the GPS unit meets or exceeds the National Map Accuracy Standards.
- Ensure that the appropriate coordinate system is used when collecting and exporting data.
- Use mapping software (e.g., Pathfinder Office or ArcGIS Pro) to view features (or waypoints) overlaid on a geo-referenced air photo or topographical map to check for accuracy.

4.3 Literature Cited

Hart, M., and U. Gafvert (editors). 2005. Data management plan: Great Lakes Inventory and Monitoring Network. GLKN/2005/20. National Park Service, Great Lakes Network Office, Ashland, Wisconsin.