



Early Detection of Invasive Plant Species Monitoring Plan

Standard Operating Procedure #7A: Using Global Positioning System (GPS) Units

Version 1.1 (6 June 2017)

Change History

New Version	Revision Date	Author	Changes Made	Justification
1.0	2006	R.Camp	Developed for implementing I&M Landbird monitoring protocol.	Original see citation below.
1.1	6/6/2017	A. Ainsworth	Modified for ED monitoring plan.	Originally developed for landbirds.

Only changes in this specific SOP will be logged here. Version numbers will be incremented by a whole number (e.g., Version 1.3 to Version 2.0) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.6 to Version 1.7) when there are minor modifications that do not affect requirements or procedures for publication in the series.

Based on: Camp, R.J. 2006. Standard Operating Procedure (SOP) #4 “Using GPS to Navigate and Mark Waypoints,” Version 1.00. *in* Camp, R. J., T. K. Pratt, C. Bailey, and D. Hu. 2011. Landbirds vital sign monitoring protocol – Pacific Island Network. Natural Resources Report NPS/PACN/NRR—2011/402. National Park Service, Fort Collins, Colorado.

Purpose

This SOP explains how to use an autonomous, non-differential Garmin Global Positioning System (GPS) receiver and GPS transfer software within Pacific Island Network (PACN) parks as part of the Early Detection of Invasive Species Monitoring Plan (Ainsworth et al. 2017). This SOP may be used for any Garmin GPS that can average a waypoint and store tracklogs. The GPS transfer process uses DNRGarmin Version 6.0.0.11 and Geographic Information System (GIS) software. DNRGarmin software can be updated for free via the State of Minnesota Department of Natural Resources web site (MN-DNR 2010).

Pre-Field Preparation

Garmin GPS Preparation

1. Load fresh batteries and have extra, charged sets available. Extra batteries should be placed in a water tight “dry bag” or a re-sealable plastic bag.
2. Initialize and download a fresh almanac into a Garmin™ if more than one week has passed since last collection or if the GPS unit has moved more than a straight-line distance of 150 miles. Downloading the almanac takes roughly 20 minutes in open areas - away from buildings, canopy, and obstructions.
3. Delete old waypoints and tracks from memory (download and save data elsewhere if appropriate).
4. Turn off active tracklog. Set “Tracklog” to the preferred collection method (“Time” is recommended) and an appropriate logging rate for the data collection (“five seconds” is recommended for most walking collection, but keep in mind the total storage capacity of the GPS).
5. Ensure Simulator Mode is not ON when collecting data.
6. If necessary, transfer data (e.g. background maps) to the GPS unit using DNRGarmin software. See below for DNRGarmin instructions.
7. Set Time and Date on the GPS Unit (note that no Pacific Island Network (PACN) parks use daylight savings time, rather the entire PACN is always in ‘standard’ time).
8. Make sure that “Interface Protocol” is set to Garmin.
9. Make sure that Wide Area Augmentation System (WAAS) is enabled.
10. Set the Coordinate System (UTM or LAT/LONG) and Datum to ensure compatibility with any written coordinates needed for navigation or mapping. Recommended settings are:
 - a. State of Hawai‘i: NAD83 UTM
 - b. Guam, Saipan, and American Samoa: WGS84 UTM
11. Set Heading to Magnetic, and make sure your compass is set the same way. Setting your GPS and compass inconsistently will make accurate navigation unnecessarily challenging at best.
12. If needed, use Trimble Planning Software (Trimble Navigation Limited 2010) to ensure best time of day for GPS data collection.
13. Prior to fieldwork, ensure the GPS has been placed in a “dry bag” with a desiccant pack.

GPS Transfer Software for DNRGarmin

1. Uninstall any previous versions of DNRGarmin
2. Download and install the latest version to any computer that will receive GPS data from the Garmin. DNRGarmin can be downloaded from the State of Minnesota Department of Natural Resources web site (MN-DNR 2010).
3. In DNRGarmin, set projection to ensure compatibility with data stored in GIS.
 - a. Hawai‘i Island: ESRI (or EPSG) POSC code of 26905 (NAD83 UTM zone_5N).
 - b. Maui Island: ESRI (or EPSG) POSC code of 26904 (NAD83 UTM zone_4N).
 - c. Moloka‘i Island: ESRI (or EPSG) POSC code of 26904 (NAD83 UTM zone_4N).
 - d. Saipan: ESRI (or EPSG) POSC code of 32602 (WGS 84 UTM zone_55N).
 - e. American Samoa: ESRI (or EPSG) POSC code of 32775 (WGS 84 UTM zone_2S).
4. In ArcMap®, ensure that Data Frames are set to the appropriate projection.
 - a. State of Hawai‘i: UTM, NAD83
 - b. Guam: UTM, WGS84
 - c. Saipan: UTM, WGS84
 - d. American Samoa: UTM, WGS84

GPS Field Procedures

Data Collection

Data collection is not anticipated to be a frequent task. Initially, actual data collection locations will need to be documented, relative to sample design specifications. Other data collection needs are not anticipated.

1. Hold GPS unit or antenna at or above your head. Use an external antenna to free hands.
2. Electronically store all data (waypoints and tracks). Write down positions for backup.
3. Note that a Garmin™ will collect data no matter what the GPS positioning quality is, so it will be necessary to monitor the GPS Satellite Page continuously for anomalies and accuracy. Collect only when “3D GPS” or “3D Differential” is shown. Do not collect data in 2D unless absolutely necessary. 2D Differential should not be used either.
4. Waypoints:
 - a. Collect all waypoints in “Averaged Position” mode if you are standing still. Obtain a minimum of 30 position points per site, or record for a maximum of 2 minutes at that site. Somewhere in between is enough to generate a quality position in most cases.
 - b. Collect instantaneous waypoints only when moving.
5. TrackLogs:
 - a. Use “Stop when Full” or “Fill” Record Mode to prevent overwriting TrackLog points when Active TrackLog becomes full.
 - b. Begin collecting Active TrackLog once the desired destination is known and immediately begin moving when TrackLog begins collecting.
 - c. Stop Active TrackLog when stopped.
 - d. Always stop Active TrackLog when nearing the beginning point of a polygon area you want closed. A line between the last track point and the initial point will automatically be generated in order to close the polygon.
 - e. Always turn Active TrackLog to OFF when finished collecting. If TrackLogs are turned ON when you are in the office, ugly data will result.
 - f. NEVER ‘store’ or ‘save’ an active Tracklog unless you need to save space, rather choose to ‘stop’ an active TrackLog. Garmin III+ receivers remove the Active TrackLog, while modern Garmins merely make a copy of the Active TrackLog. In any case, saved tracklogs degrade original data, whereas a ‘stopped’ TrackLog retains data quality.

Back in the Office

1. Connect GPS to PC with cable and place GPS in Simulator Mode.
2. Check that TrackLog is OFF! Again, do not save Track!
3. Open DNRGarmin from the desktop (for ArcGIS™ users) or from within ArcView® by loading the extension.
4. Check Projection in DNRGarmin one more time. This will define the projection the GPS file will be stored in.
5. Download Waypoints and Tracks and save to Shapefile (if in ArcGIS™) or if saving a shapefile from the desktop DNRGarmin, save to projected shapefile. Use naming conventions as below.
 - a. The file-naming convention is to indicate the GPSModel, type of data (Waypoint or Tracks), projection and datum, and date (YYYYMMDD) separated by an underscore (_). For example, a set of waypoints collected with a Garmin™ GPS76c, using UTM

and WGS84 as the projection and datum, on Christmas Day 2005, would be named “GPS76c_waypt_UTMWGS84_20051225.”

- b. If additional notes about GPS collection exist, such as data collected in ‘2D’ mode; create a simple *text* file with an identical filename in the same location which contains this information, with a .text filename extension.
6. Delete all Waypoints and Tracks for the next mapping mission.
7. Turn off the GPS and disconnect cables, returning equipment to its proper storage location.
8. Recharge batteries if appropriate.

Options to Consider

- External antennae, with long cable and pole in order to extend the antennae above a thick vegetated canopy.
- An external beacon, such as the Thales Mobile Mapper Beacon®, for DGPS (Differential GPS). This will improve the accuracy of your GPS location.
- Averaging will improve your GPS locations, if and only if, the satellite geometry improves during point collection. Otherwise, averaging can sometimes result in a less accurate position.