Standard Operating Procedure (SOP) #6

Using Garmin® GPS Units

Version 2.02 (June 3, 2022)

Change History

New Version #	Revision Date	Author	Changes Made	Reasons for Change	Previous Version #
1.01	5/31/2016	Scott.Kichman	Update software versions	Improving safety	1.0
2.0	7/30/2019	Mark Wasser	Significant updates to procedures, naming conventions, and software references	Clarity & consistency, standardize spatial data management across PACN, reflect current software	1.01
2.01	03/1/2021	Mark Wasser	Minor changes to reflect current GPS units and file directories	New GPS units and file directory changes	2.0
2.02	6/3/2022	Kim Weisenborn	Updated content to refer to new PACN I&M SharePoint. Added figure captions and references.	PACN data is no longer stored on a networked server (I:\ drive) and is now stored on the PACN SharePoint site. Added figure captions and references for clarity.	2.01

Only changes in this specific SOP will be logged here. Version numbers increase incrementally by hundredths (e.g., version 1.01, version 1.02) for minor changes. Major revisions should be designated with the next whole number (e.g., version 2.0, 3.0, 4.0). Record the previous version number, date of revision, author of the revision, changes made, and reason for the change along with the new version number.

Purpose

This SOP explains how to use an autonomous, non-differential Garmin® Global Positioning System (GPS) receiver and GPS transfer software for Pacific Island Inventory and Monitoring Network (PACN I&M) Focal Terrestrial Plant Communities (FTPC) Monitoring. This protocol may be used for any Garmin® GPS that can average a waypoint and store tracklogs. The data transfer process uses DNRGPS 6.1.0.6. (See SOP #7 Downloading and Uploading Data from/to a Garmin® GPS for more complete details on data transfer.)

Pre-Field Preparation

Equipment

The following navigation related equipment is recommended for general field work:

- GPS receiver
- Printed Map
- Spare AA batteries
- Compass (declinated)
- Notebook for recording waypoint description and notes (if desired)

Garmin® GPS and Compass Preparation

1. Load fresh batteries and have extra sets available. Extra batteries should be placed in a watertight "dry bag" or a re-sealable plastic bag.

2. 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, allow the GPS unit to download a current almanac by turning it on outside in an open area. Downloading the almanac should take no more than 20 minutes, happens automatically when you turn the unit on, and is complete once the GPS unit has acquired a satellite signal and fixed its location.

3. If additional background maps or layers are desired [default is base Garmin® topographic map], please see the GIS Specialist to have the appropriate background layers loaded.

4. Delete old waypoints and tracks from memory (download and save data elsewhere if appropriate / necessary).

5. Upload all necessary waypoints for field work to the GPS unit. Refer to SOP #7 Downloading and Uploading Data from/to a Garmin® GPS for more complete details on data transfer or see the GIS Specialist to have waypoints uploaded.

6. Set important system settings as listed below in steps 6-10. *All these settings can be accessed from the Setup menu. To access this menu, press the menu button twice to go to the main menu, then select the square/rectangle labeled 'Setup' (Figure SOP 6.1).*

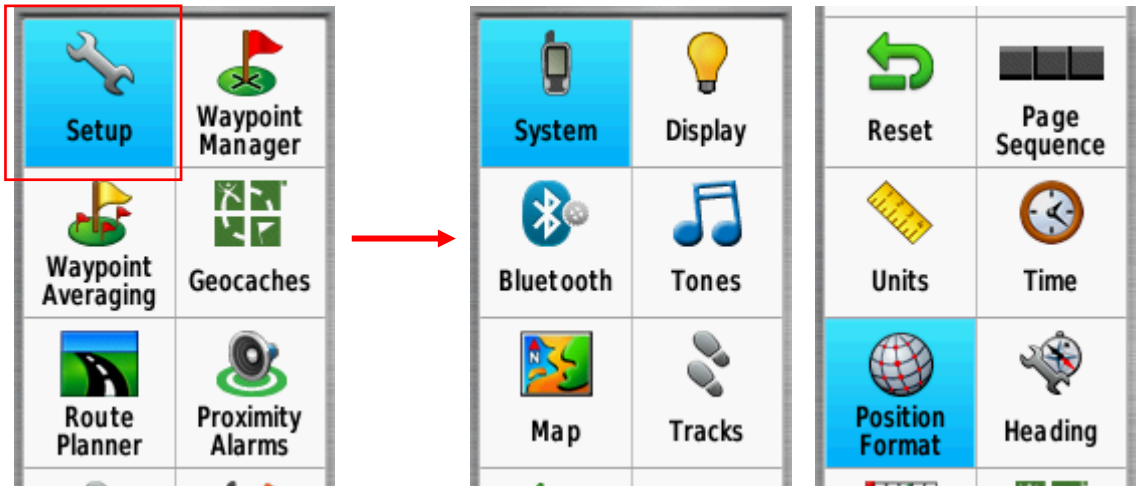

Figure SOP 6.1. Setting system settings on Garmin® GPS device.

7. Set general system settings.
    a. From the Setup menu, select the square labeled ‘System’.
    b. Verify the correct settings for different fields are set as follows:
        i. Satellite System = GPS + GLONASS
        ii. WAAS/EGNOS = Off
        iii. Language = English
        iv. Interface = Garmin® Serial
        v. AA Battery Type = Traditional NiMH
8. Set datum, coordinate system, and position format settings.
    a. *As of 2018, PACN transitioned to the consistent use of WGS 84 datum, and decimal degrees position format (how coordinates look). To avoid confusion, please do not use UTM coordinates.*
    b. From the Setup menu, select the square labeled ‘Position Format’.
    c. Verify the correct settings for different fields are set as follows:
        i. Position Format = hddd.ddddd°
        ii. Map Datum = WGS 84
        iii. Map Spheroid = WGS 84
9. Set date/time settings.

a. From the main menu, select the square labeled ‘Time’.

b. Verify the correct settings for different fields are set as follows:

    i. Time Zone = Automatic

    ii. Time Format = 12-hour or 24-hour (as desired)

10. Set track log settings.

    a. From the setup menu, select the square labeled ‘Tracks’.

    b. Verify the correct settings for different fields are set as follows:

        i. Track Log = Record, Show on Map

        ii. Record Method = Auto

        iii. Recording Interval = Normal

        iv. Auto Archive = Daily

    c. Once complete, exit the Track menu.

11. Set compass settings.

    a. From the setup menu, select the square labeled ‘Heading’.

    b. Verify the correct settings for different fields are set as follows:

        i. Display = Numeric Degrees

        ii. North Reference = True

        iii. Compass = Auto

    c. You may also calibrate the compass from this menu by selecting the ‘calibrate compass button’ (last one within the heading menu) and following the on-screen instructions.

    d. Heading to True, decline your compass appropriately. Setting your GPS and compass inconsistently will make accurate navigation unnecessarily challenging at best. You can lookup current compass declinations here[1].

[1] NOAA Magnetic Field Calculators, https://www.ngdc.noaa.gov/geomag/calculators/magcalc.shtml#declination (accessed 3 June 2022).

12. Declinate your compass appropriately based on your location. Current compass declinations are listed below (Table SOP 6.1), and updated declinations may be found here[1].

Table SOP 6.1. Compass Declinations (current January 2021)

Hawai'i	9.4° E
Guam & Saipan	0.5° E
American Samoa	11.9° E

GPS Field Procedures

Data Collection - Waypoints

Data collection locations need to be documented relative to sample design specifications.

1. Try to collect all waypoints by using the "Averaging Waypoints" function. You may either take the waypoint first and then average an existing waypoint (described here) or use the Averaging Waypoints function to create a new waypoint at your location. *When using the averaging waypoints function, be sure to have the GPS is a stationary position.* It is best to set it down on the ground or have it clipped to a tree over target location. Waypoint averaging may take time and should have an Average Waypoint with 100% 'Sample Confidence' within a few minutes.

2. To mark a waypoint (Figure SOP 6.2):

   - Press the *MARK* button on your GPS unit. On all Garmin® 60 series GPS units this button is on the lower left. On all Garmin® 70 series GPS units 'marking' is a secondary function of the *ENTER* button – you will need to press and hold that button for about one second to utilize the mark function.

   - This will pull up a screen showing the information about the waypoint you are taking (image below, at right). To change any information about that waypoint (symbol and/or name are most likely to need changing), use the directional keypad button to move the blue highlighted area to the feature you want to change (for example, the waypoint name is highlighted in the graphic below). Press enter and the details of that feature will be displayed and can be adjusted as needed.

   - When everything is satisfactory, highlight the ***Done*** button on the screen and press enter.

Figure SOP 6.2. Steps for marking waypoints.

3. To average a waypoint (Figure SOP 6.3):
    - Go to the main menu (press the menu button twice), and select Waypoint Averaging
    - Select the waypoint from the list.
    - Select ***Start***. If you are shown a prompt stating "For best results, wait 90 minutes between samples. Would you like to continue anyway?", select ***Yes***.
    - Wait for sample confidence to reach 100%, then select ***Save***.
    - A notification will inform you the waypoint has been updated. Select ***Done***.

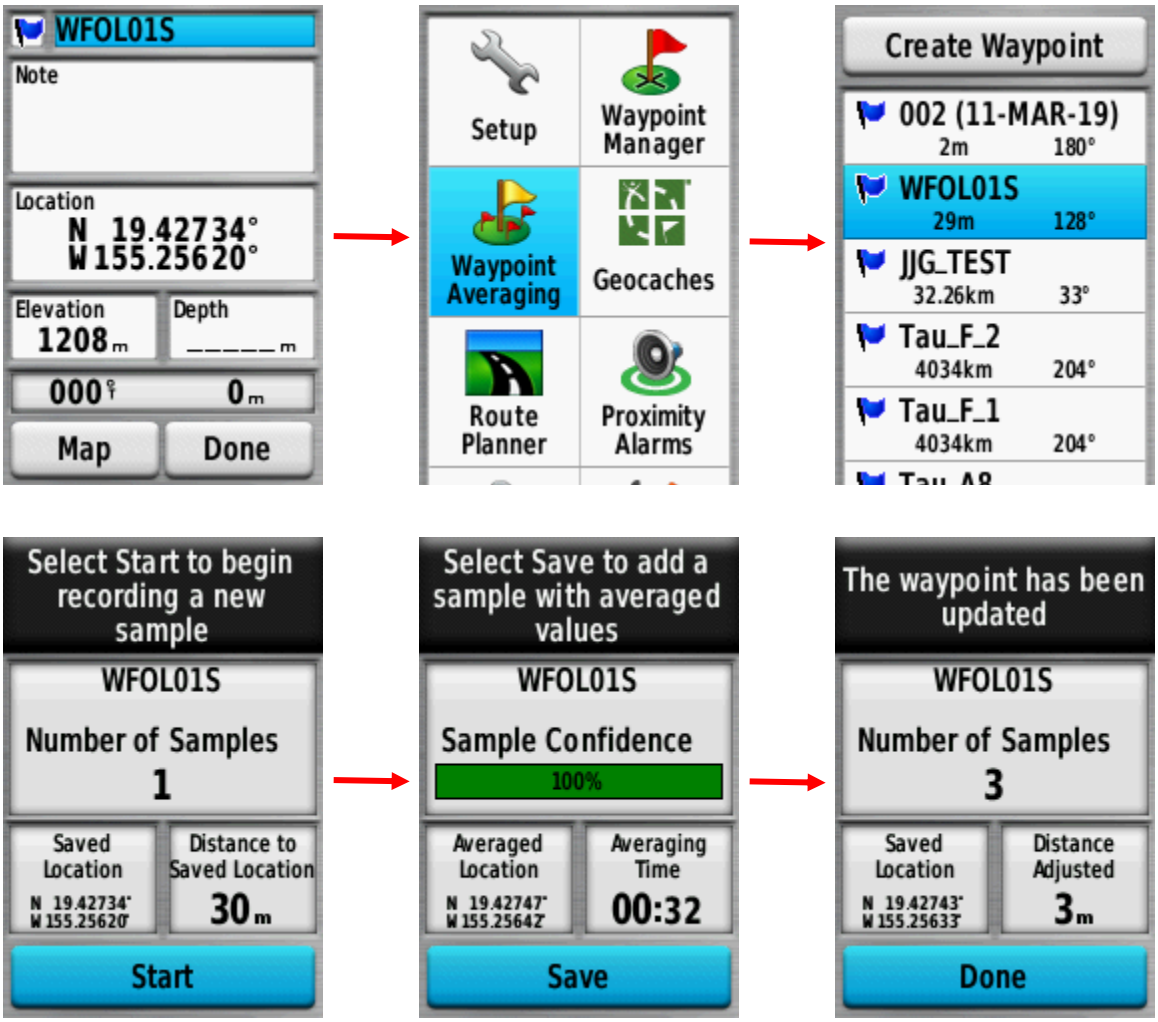

Figure SOP 6.3. Steps for averaging waypoints.

4. **Note**: 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. If you are attempting to average a waypoint and sample confidence is not consistently rising towards 100%, please discard the averaged waypoint and take a standard, non-averaged waypoint.

5. Please assign all waypoints a name following the standardized naming conventions detailed below.

   Waypoint Name = "*Site Name + Date Sampled [YYYYMMDD]*" with no spaces in between (e.g., THALE01 sampled on 7/1/2019 would be named *THALE0120190701*).

Data Collection – Tracks

Follow item 10 in the *Garmin® GPS and Compass Preparation* Section for proper GPS configuration so that tracks are being logged by the GPS unit and can be saved whenever needed.

Please note these instructions do not apply to Garmin® 66 models.

1. To save a track:
    - Go to the main menu (press the menu button twice) and select Track Manager.
    - Select ***Current Track***.
    - Select either ***Save Track*** or ***Save Portion***. Selecting save portion will allow you to select a portion of the current track to save (i.e., the current days progress only), while save track will save all the contents of the current track stored on the device since the last time it was cleared.
    - Name track as appropriate and select ***OK***.

Back in the Office

1. See SOP #7 Downloading and Uploading Data from/to a Garmin® GPS for instructions on using DNRGPS software to download waypoints.
2. Save downloaded waypoints as an "ESRI Shapefile (2D) (*.shp)". Choose the appropriate file directory and use standard naming conventions described below to name your shapefile and place it in the proper location.
    - *GPS File Naming Convention*: The file-naming convention is *Date* (YYYYMMDD) + *GPS number* (4 digit property number on unit) + *type of data* ('pt' for waypoints, 'ln' for lines/tracks, and 'pol' for polygons) + *datum* (generally wgs84, but possibly nad83), each separated by an underscore (_). For example, a set of waypoints collected with GPS #1380, using WGS 84 datum, on New Year's Day 2019, would be named "GPS_20190101_1380_pt_wgs84."
    - *GPS File Directory*: Shapefiles of downloaded waypoints and/or tracks should be saved in the following directory in the FTPC Monitoring project workspace in the PACN I&M SharePoint site[2]:

      "Spatial_info" folder → Year folder → Park folder → "GPS_Data" folder
    - **Datum note**: Please note that all GPS units should be set to collect data in WGS 84 datum. This does not always happen. If the unit has been collecting datum in NAD 83

[2] PACN I&M SharePoint site, https://doimspp.sharepoint.com/sites/nps-PWR-PACNIM (accessed 3 June 2022).

(see item 8 in the *Garmin® GPS and Compass Preparation* Section), please name your file accordingly and the GIS Specialist will convert the data appropriately.

- **Additional note**: If additional supplemental information about GPS collection relative to the downloaded waypoints exists; create a simple *text* file with an identical filename in the same location which contains this information, with a .text filename extension.

3. Delete all Waypoints and Tracks as necessary. Internal storage is greater on newer GPS units and saving waypoints and tracks for reference until the completion of the field season is feasible if desired.

4. Disconnect GPS and return equipment to its proper storage location.

Other Data Collection Tips and Resources

For more detailed information on data collection with different handheld Garmin® GPS units, the User Guides for the different units PACN currently uses can be found at the following links:

Garmin® 62 (all models)

Garmin® 64 (all models)

Garmin® 65 (all models)

Garmin® 66 (all models)

Garmin® 76 (all models)

Garmin® 78 (all models)

There are small interface and menu differences between the 60 and 70 series GPS units. The 70 series float and are generally preferred for field work in and around water. Within the 60 series, there are also differences between the Garmin 66 and all other 60 series models. Please see the PACN GIS Specialist if you have any questions about different GPS Units.