

Southeast Coast Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure 1.1.02

Uploading Points to GPS Units—Version 2.1

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Summary

This standard operating procedure (SOP) describes the procedure for uploading coordinates of sampling locations (waypoints) to a Garmin GPSMAP 66i unit. Software used includes: ArcGIS Pro, Microsoft Excel, and Notepad++.

Revision Log

Revision Date	Author	Changes Made	Reason for Change	New Version #
–	B. Smrekar	Minor edits	Publication of anuran protocol.	1.1
05/2023	M. Parrish	Complete revision	New GPS hardware and software now in use.	2.0
04/2024	M. Parrish	Updated references to obsolete GIS software and added minor editorial changes.	New GIS software now in use.	2.1

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Required Equipment, Software, and Data

- Garmin GPSMAP 66i or similar.
 - USB cable and batteries
- Personal computer running Microsoft Windows 10.
 - Esri ArcGIS Pro ver. 3.x.
 - Microsoft Excel.
 - Notepad++ (available at: www.notepad-plus-plus.org).
- ArcGIS shapefile containing sampling location coordinate data.

Procedural Overview

Permanent sampling location coordinates for the SECN Landbird and Vocal Anuran community monitoring protocols are maintained on the SECN GIS server as an Esri shapefile (*L:\GIS\projects\Wildlife\SL_coords\SL_COORDS_2024.shp*). The coordinates must be transferred to a GPS handheld unit to allow for navigation to each sampling location in the field. The general procedure to accomplish this is:

1. Add the coordinates shapefile to ArcGIS Pro and open the shapefile attributes table.
2. Select the sample locations of interest and copy them to a blank Excel spreadsheet.
3. Add code to the Excel sheet to generate latitude/longitude XML waypoints.
4. Copy the XML code into an XML document created in Notepad++ and save it onto the GPSMAP 66i.

This SOP assumes a general familiarity with the above software packages.

Export Sample Location Coordinates from ArcGIS Pro to Excel

1. Open a new map in ArcGIS Pro. In the Contents Pane, right-click the map and select Add Data. Add the coordinates shapefile to the map. Right-click the coordinates shapefile and select Attribute Table.
2. Select the rows containing the sample locations of interest. On the Attributes bar, click Copy. Paste the copied data into a new Excel spreadsheet.
3. Close ArcGIS Pro. Optionally, save the new spreadsheet containing coordinates data as a CSV file.

Generate XML Waypoint Tags in Excel

1. Delete all columns except for park sample location identifier (*ParkSL*, column A) and the two sample location coordinates in decimal degree format (*LatDD*, column B; *LonDD*, column C). (See Figure 1).
 - a. ParkSL should be in the format “PPPP000”, where PPPP is the four character park abbreviation and 000 is a three digit sample location ID number with leading zeros (e.g., “PARK001”).
 - b. LatDD and LonDD should be numeric with six trailing digits. LonDD should be a negative number, since it is in the western hemisphere. Round entries to six trailing digits if they are not already (Figure 1).

The figure displays two Excel spreadsheets. The top spreadsheet shows a table with columns FID, Shape, ParkSL, Park, SL, LatDD, LongDD, IsAlt, isDropped, isScouted, and Notes. The bottom spreadsheet shows a table with columns ParkSL, LatDD, and LongDD, with extraneous information removed and coordinates rounded to six trailing digits.

	A	B	C	D	E	F	G	H	I	J	K
1	FID	Shape	ParkSL	Park	SL	LatDD	LongDD	IsAlt	isDropped	isScouted	Notes
2	20	Point	PARK001	PARK	001	35.8592	-75.5766	0	0	1	-
3	21	Point	PARK002	PARK	002	35.8885	-75.5917	0	0	1	-
4	22	Point	PARK003	PARK	003	35.8099	-75.5535	0	0	1	Cross creek to the west
5	23	Point	PARK004	PARK	004	35.1044	-75.9692	0	1	1	-
6											
7											

	A	B	C	D	E	F	G	H	I	J	K	L
1	ParkSL	LatDD	LongDD									
2	PARK001	35.859235	-75.576575									
3	PARK002	35.888488	-75.591672									
4	PARK003	35.809900	-75.553498									
5	PARK004	35.104402	-75.969225									
6												
7												

Figure 1. (Top) Excel spreadsheet containing data extracted from sample location coordinates shapefile. (Bottom) Excel spreadsheet with extraneous information removed and all coordinates rounded to six trailing digits.

2. In column D, enter one double quotation mark on each row. Name column E ‘XML’. Enter the following Excel expression in cell E2, and then copy that expression down to the rest of the rows in column E (Figure 2):

="<wpt lat="&D2&B2&D2;" lon="&D2&C2&D2;"><name>"&A2&"</name><sym>City (Large)</sym></wpt>"													
E5 = "<wpt lat="&D5&B5&D5;" lon="&D5&C5&D5;"><name>"&A5&"</name><sym>City (Large)</sym></wpt>"													
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	ParkSL	LatDD	LongDD	"	XML								
2	PARK001	35.859235	-75.576575	"	<wpt lat="35.859235" lon="-75.576575"><name>PARK001</name><sym>City (Large)</sym></wpt>								
3	PARK002	35.888488	-75.591672	"	<wpt lat="35.888488" lon="-75.591672"><name>PARK002</name><sym>City (Large)</sym></wpt>								
4	PARK003	35.809900	-75.553498	"	<wpt lat="35.809900" lon="-75.553498"><name>PARK003</name><sym>City (Large)</sym></wpt>								
5	PARK004	35.104402	-75.969225	"	<wpt lat="35.104402" lon="-75.969225"><name>PARK004</name><sym>City (Large)</sym></wpt>								
6													
7													

Figure 2. (Top) Excel expression as entered into cell E2. The expression generates a waypoint tag that will be added to the GPS unit in a later step. Note: there is a space preceding 'lon.' (Bottom) Excel spreadsheet with the waypoint expression copied into remaining cells in column E, generating waypoint tags for each sampling location. Note: column D contains one double quotation mark for each row (this approach simplifies Excel's handling of quotation marks).

3. Select the contents of Column E (starting with cell E2) and copy the contents to the clipboard. Right-click inside the selection, choose Paste Special, select Values and click OK (Figure 3). The Excel expressions in each cell will be replaced with the waypoint tag text.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	ParkSL	LatDD	LongDD	"	XML								
2	PARK001	35.859235	-75.576575	"	<wpt lat="35.859235" lon="-75.576575"><name>PARK001</name><sym>City (Large)</sym></wpt>								
3	PARK002	35.888488	-75.591672	"	<wpt lat="35.888488" lon="-75.591672"><name>PARK002</name><sym>City (Large)</sym></wpt>								
4	PARK003	35.809900	-75.553498	"	<wpt lat="35.809900" lon="-75.553498"><name>PARK003</name><sym>City (Large)</sym></wpt>								
5	PARK004	35.104402	-75.969225	"	<wpt lat="35.104402" lon="-75.969225"><name>PARK004</name><sym>City (Large)</sym></wpt>								
6													
7													
8													
9													

Figure 3. Excel spreadsheet illustrating the use of Paste Special > Values to replace Excel expressions with waypoint text entries. The waypoint entries will be imported onto a GPS handheld unit at a later point.

Produce a GPX Waypoints File Using Notepad++

1. Open a new tab in Notepad++. Access the Language menu and change the language to 'XML'.
2. Enter required schema header information (Table 1: Rows 01 to 20) into the Notepad++ window.

Note: Preceding tab indents are required for rows 03 to 19 and must be preserved. Copy the waypoint tags from Excel into Notepad++ and paste them in, starting on row 21 in Notepad++.

3. Include the closing tag `</gpx>` as the final row in the Notepad++ file, as shown in Table 1.
4. From the File menu, select Save As. In the Save As Type box, select "All Types (*.*)" Name the file in the File Name box, assigning it a file extension of .gpx. For example: PARK_2024_66i.gpx.
5. Connect the GPSMAP 66i to the PC using the supplied USB cable. Copy the new GPX file to the folder: `..\Garmin\GPX`.
6. Disconnect the GPSMAP 66i from the PC and power it on. Navigate to the Waypoints menu on the GPSMAP 66i and ensure that the desired waypoints were successfully uploaded to the device.

Table 1. XML code used to create a GPX waypoints file compatible with the Garmin GPSMAP 66i handheld device. Waypoints tags (“<wpt>”) are generated in Microsoft Excel from data exported from ArcMap as described above. Four waypoints are depicted below (lines 21-24) as an example, but an unlimited number of waypoints may be included in the GPX file. Note: Preceding tab indents on rows 03 to 19 are required.

Row	XML Code
01	<?xml version="1.0" encoding="UTF-8" standalone="no"?>
02	<gpx
03	xmlns="http://www.topografix.com/GPX/1/1"
04	xmlns:gpx="http://www.garmin.com/xmlschemas/GpxExtensions/v3"
05	xmlns:wpt="http://www.garmin.com/xmlschemas/WaypointExtension/v1"
06	xmlns:gpxtp="http://www.garmin.com/xmlschemas/TrackPointExtension/v1"
07	creator="GPSMAP 66i"
08	version="1.1"
09	xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
10	xsi:schemaLocation="http://www.topografix.com/GPX/1/1
11	http://www.topografix.com/GPX/1/1/gpx.xsd
12	http://www.garmin.com/xmlschemas/GpxExtensions/v3
13	http://www8.garmin.com/xmlschemas/GpxExtensionsv3.xsd
14	http://www.garmin.com/xmlschemas/TrackStatsExtension/v1
15	http://www8.garmin.com/xmlschemas/TrackStatsExtension.xsd
16	http://www.garmin.com/xmlschemas/WaypointExtension/v1
17	http://www8.garmin.com/xmlschemas/WaypointExtensionv1.xsd
18	http://www.garmin.com/xmlschemas/TrackPointExtension/v1
19	http://www.garmin.com/xmlschemas/TrackPointExtensionv1.xsd">
20	<metadata><link href="http://www.garmin.com"><text>Garmin International</text></link><time>2024-01-01T00:00:00Z</time></metadata>
21	<wpt lat="35.859235" lon="-75.576575"><name>PARK001</name><sym>City (Large)</sym></wpt>
22	<wpt lat="35.888488" lon="-75.591672"><name>PARK002</name><sym>City (Large)</sym></wpt>
23	<wpt lat="35.809900" lon="-75.553498"><name>PARK003</name><sym>City (Large)</sym></wpt>
24	<wpt lat="35.104402" lon="-75.969225"><name>PARK004</name><sym>City (Large)</sym></wpt>
25	</gpx>