# **GPS FUNDAMENTALS**

Training on the Pacific Islands Protected Area Portal (PIPAP) and Geographic Information Systems (GIS) for improved protected area planning and management in the Republic of the Marshall Islands Bradley Eichelberger

August 17-21, 2020







From Knowledge to Action for a Protected Planet

This package/collection of training materials constitute an introductory, basic-level training to open source GIS software (QGIS) targeting technical-level government officers. The primary goal of the material is to provide participants with the tools to visualise, map, and collect spatial data for more effective planning and management of protected areas.

The materials include a series of presentations, video lectures and step-by-step instructions which were utilised in recent in-country technical trainings successfully carried out for two Pacific island countries, Samoa and Vanuatu and are planned to be used for further country trainings in the Pacific region.

The training materials were produced by the Secretariat of the Pacific Regional Environment Programme (SPREP) through assistance from the EU-ACP Biodiversity and Protected Areas Management (BIOPAMA) Programme (www.biopama.org). The contents of these materials are the sole responsibility of SPREP and can in no way be taken to reflect the views of the donors.



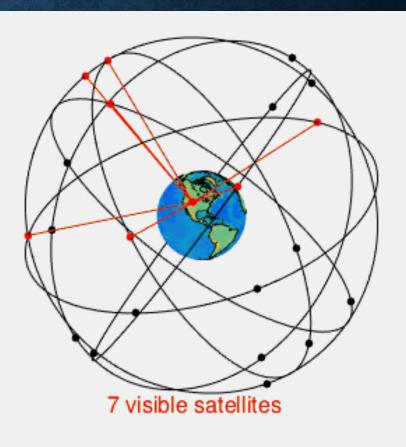


From Knowledge to Action for a Protected Planet



#### GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS)

- Series of 18-30 satellites that transmits time and location data through radio waves to a receiver
  - GPS (USA), GLONASS (Russian), Galileo (EU), Navic (India), BeiDou (China)
- At least 4 satellites required for geolocation
  - 3 possible if at sea level
- Currently, 24 satellites in operation for GPS
- Receiver picks up signal
  - More satellites = less error
  - Garmin units +/- 3 meters
  - Units with high receiver +/- few centimeters













Garmin GPS +/- 3 meters



Time

X

Y

- Error from bounce of trees, other structures, bad angles from satellites
- Star = Actual Location (100, 100)
- Red Circle = uncertainty +/- 3 meters
- Purple X's = GPS recording

Section 2	Time	X	Y
	10:00:14	97.2	99.9

- Error from bounce of trees, other structures, bad angles from satellites
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Time	X	Y
10:00:14	97.2	99.9
10:00:15	100.8	97.4

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Time	X	Y
10:00:14	97.2	99.9
10:00:15	100.8	97.4
10:00:16	97.5	98.5

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	10:00:14	97.2	99.9
	10:00:15	100.8	97.4
	10:00:16	97.5	98.5
-	10:00:17	100.3	100.2

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10:00:14	97.2	99.9
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10:00:16	97.5	98.5
10:00:17	100.3	100.2
10:00:18	100.0	101.5

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	10:00:17	100.3	100.2
	10:00:18	100.0	101.5
	10:00:19	105.0	105.0

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X		Y
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15 100	.8	97.4
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10:00:15	100.8	97.4
10:00:16	97.5	98.5
10:00:17	100.3	100.2
10:00:18	100.0	101.5
10:00:19	105.0	105.0
10:00:20	99.0	101.5
10:00:21	99.5	99.5

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10:00:18	100.0	101.5
10:00:19	105.0	105.0
10:00:20	99.0	101.5
10:00:21	99.5	99.5
10:00:22	100.0	99.5

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N.	10:00:19	105.0	105.0
	10:00:20	99.0	101.5
	10:00:21	99.5	99.5
	10:00:22	100.0	99.5

#### HOW DO WE KNOW WHICH OF THESE IS THE CLOSEST?

- Error from bounce of trees, other structures, bad angles from satellites
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10:00:21	99.5	99.5
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WE DON'T KNOW

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10:00:14	97.2	99.9
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10:00:21	99.5	99.5
10:00:22	100.0	99.5
Average	101.4	100.3

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10:00:20	99.0	101.5
10:00:21	99.5	99.5
10:00:22	100.0	99.5
Average	101.4	100.3

THE LONGER WE LET THE GPS AVERAGE POINTS, THE MORE POINTS ARE AVERAGED AND THE MORE POINTS WE AVERAGE THE LESS CHANCE OF ERROR!!!!

#### **TODAY'S ASSIGNMENT**

- Collect GPS data for the boundaries of a protected area (or boundary of the building)
- Record the GPS Coordinates from first point and then the averaged coordinates
- Log the averaged point as waypoints
- Name the waypoints after your first name
- Enter in the coordinates into a table
- Use Basecamp to export GPX file
- Import GPX file in QGIS
- Add the table coordinates into QGIS and turn them into points
- From the points, we are going to connect the points to draw a polygon
- Make a map of the protected area boundary
- Enter in the metadata for the new polygon shapefile





# First We Need to set the Coordinate System

**Acquiring Satellites** 

Click Menu button Then Select Setup Then Enter

#### GPSmap 60CSx III (\_) (+) Highway Routes 61 Proximity Calendar Calendar Setup Calculator Games **B** Hunt & Fish 17-FEB-20 9:11:15% GARMIN IN OUT FIN PAGE MENU ENTR

Select Units And Click Enter

GPSmap 60CSx

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Time 9:11:24

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QUIT



Set Coordinate System Position Format: UTM UPS Map Datum: WGS 84 Click Enter

Position Format UTM UPS Map Datum	
WGS 84 Distance/Speed Metric Elevation (Vert. Speed) Meters (m/min) Depth Meters Temperature Celsius	
Pressure Millibars GARMIN	OUT
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QUIT ENTR	

#### To Collect a Waypoint: Click MARK





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ENTR

Use the Directional Pad to go to the Name and Click ENTER to change name



Use the Directional Pad to go to the Note and Click ENTER to add notes

	GPSmap 60	CSx
	96	
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Coordinates WITHOUT Averaging Write the Name of Waypoint And Unaveraged Coordinates down

GPSmap 60CSx

17-FEB-20 9:10:18PM

02 L 0416990

Map

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GPSmap 62s

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For 62s: To Average a Waypoint: Click MENU Use directional pad To find Waypoint Averaging Click ENTER

OUT



GPSmap 62s Select Save to add a sample with averaged values 003 Sample Confidence Averaging Averaged Time Location 00:00 Save GARMIN When Sample Confidence is 100%,

Write down updated coordinates Use directional Pad to select Save MARK Click ENTER To AVERAGE, use directional pad to go to AVG And click ENTR



Wait for measurement count to get to 40 and observe estimated accuracy when at 40 click Save

> GPSmap 60CSx m () (\*) (\*) asurement Count Jure GARMIN 1N FIND MARK QUIT

GPSmap 60CSx 1096 17-FEB-20 9:10:18PM 02 L 0416990 UTM 8466692 0K Avg Map GARMIN 1N FIND MARK ENTR QUIT

**Coordinates will** 

be updated with

averaged coordinates

Write down the coordiantes

**Click OK to save waypoint** 

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