###### GPS Data Collection

The *Global Positioning System* (GPS) is a satellite-based navigation system. A GPS unit determines its position using satellites that orbit the earth. Each satellite’s position, as well as the current time, is transmitted via radio signals. The GPS unit receives these signals and uses them to calculate its position in terms of latitude, longitude, and altitude.

**GPS and MICS**

The cluster geocodes may already be available from the country. However, if not, they need to be collected during the survey. As GPS units are relatively inexpensive and generally available in countries, UNICEF recommends the use of units during the Mapping & Listing Operation to record information on the exact geographic location of the sample cluster.

It is strongly recommended that any GPS data collection activity entail special training of a GPS Coordinator. Depending on the level of GPS data collection and existing capacity, this extra training ranges from simple oversight to extensive technical assistance. There are vast opportunities to collect more than just basic GPS cluster waypoints, but a very careful assessment must be made if more advanced data collection is sought. Please contact the Regional MICS Coordinator if such considerations are being made.

Please note that it is important to clarify ownership of collected GPS data in the Memorandum of Understanding. UNICEF recommends that GPS data are not shared publicly before being anonymised. The Global MICS Team offers to anonymise the data as per global gold standard protocols, enabling the National Statistical Office to more conveniently share data with more emphasis on respondent protection. The anonymised geocode data will be publicly available in the MICS website. The interested parties need to submit a formal request for access and use of the anonymised data to mics.unicef.org.

**Benefits of GPS data collection**

The benefits of GPS waypoint[[1]](#footnote-1) collection are substantial – unless geocoded cluster locations are already available from Census cartography. This will make it possible after the survey to link MICS data with other data sets containing similar geographic information. Typical examples are to use databases that include geographic location information on health facilities, schools, road network, climate, altitude, or many other geographically located attributes. With the use of GPS, it becomes possible to carry out further analyses of MICS data sets by expanding them with information available from other databases.

GPS units may also be used while updating the sample frame, meaning that listing teams may have used GPS units to record information on the geographic location of the clusters in the sample. In such cases, using GPS during the main fieldwork may facilitate locating the clusters, since information on longitude and latitude will be available to Supervisors during fieldwork. In most countries that have conducted a Census recently, GIS (Geographic Information System) data is often available at cluster level and can be validated during listing and employed during fieldwork. Collaboration with a GIS specialist at the implementing agency can be very fruitful.

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| **Why use GPS to collect cluster locations?*** Permits linking of additional data to MICS data through covariates
	+ E.g. Census data, facility data, other geo-located data
* Permits geographic grouping of data beyond political boundaries
	+ E.g. Climactic zones, agricultural zones, etc.
* Permits mapping of sample clusters
	+ E.g. with QGIS or other mapping software for presentation purposes
* Allows monitoring of fieldwork to ensure that teams have visited all clusters
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**Operational considerations**

GPS data collection can almost always be done without hiring additional personnel. The set-up of roles and responsibilities may vary according to the survey and what data is already available. However, there should be a person on each field team who is responsible for collection of the GPS points (the GPS Operator) and an overall GPS Coordinator at the implementing agency headquarters.

Since the collection of GPS waypoints occurs during the Mapping & Listing Operation, UNICEF recommends that all mappers and listers are trained and the mapper on each team is responsible overall for GPS data collection.

The responsibilities of the GPS Operators are as follows:

1. Capture and record three GPS waypoints at the centre of the cluster. The distance between the three waypoints should be more than 20 meters and less than 200 meters from each other. To get adequate satellite signal power, the location of capture should be relatively open (in all directions), away from tall buildings, and out from under tree canopy.
2. Complete the GPS Data Collection Questionnaire.
3. Make a circle on the paper map (orthophoto, sketch map, etc.) of the place where each GPS waypoint was recorded.
4. Once the cluster listing is completed, bundle the GPS Questionnaire with the full Mapping & Listing package for the cluster.
5. Communicate with the GPS Coordinator about any problems encountered in the field and follow his or her instructions.
6. Ensure that the unit and accessories are handled properly during fieldwork. This includes maintaining battery level and transfer of data when the GPS Coordinator visits the team.
7. Never delete the collected waypoints from the GPS receiver during the whole fieldwork.

The responsibilities of the GPS Coordinator are explained in detail in the subsequent sections:

**Obtaining materials**

It is the role of the GPS Coordinator to manage all aspects of implementation of GPS data collection, including obtaining the necessary material:

1. Hardware:
	* One GPS receiver per field team, plus two (2) extra GPS units. See below for recommended unit.
	* Eight (8) AA batteries per GPS unit.
	* Two (2) standard USB to Micro-USB cables for downloading data from receivers (usually a cable is provided with the GPS receiver).
	* Optional: One vehicle dashboard mount per vehicle used in survey.
	* Optional: One vehicle unit charger per vehicle used in survey.
	* Optional: Four (4) rechargeable (NimH) AA batteries and one charger per field team, plus eight (8) extra batteries and two (2) chargers.
2. Software:
	* One (1) copy of a GPS software to visualize and troubleshoot GPS waypoints. This could be [BaseCamp](https://www.garmin.com/en-US/software/basecamp/) (free), [GPS Trackmaker](https://www.trackmaker.com/main/en/download-gps-software-free) (free), [Garmin MapSource](https://www8.garmin.com/support/download_details.jsp?id=209) (free with unit purchase), or any other appropriate software already in use by implementing agency.
3. Data:
* Paper map (orthophoto, sketch map, etc.) which contains one survey site and includes cluster boundaries if possible.
* Possibly waypoints indicating sampled clusters.
1. Training/other field materials
	* Customise and copy (parts of) the GPS Operator’s Manual for each training participant.
	* Customise and provide copies of the GPS Data Collection Questionnaire – enough so that all survey sites can be recorded and for training exercises.

**Preparing the GPS units**

This should be done before training and field work:

* 1. Ensure each unit has appropriate settings (Set-up differs between models. UNICEF recommends the Garmin eTrex 32x). It is highly recommended that the unit Firmware is updated as well.
	2. Tag each GPS unit with a number. This number should be recorded by the GPS data collectors on the GPS Data Collection Questionnaire (GP2).

**Training**

The GPS Operators must be trained in the basics of the GPS units, point collection protocols, and simple troubleshooting techniques. The training of GPS Operators should take a half to a full day. It is extremely important to give time during the training to practice GPS waypoint collection where there is a clear view of the sky. This training must be conducted by the GPS Coordinator.

The GPS Coordinator may need additional training beyond what is provided to the GPS Operators. The GPS Coordinator needs to know how to transfer points from the GPS units to a computer, operate a GPS unit, and how to modify the GPS unit settings (e.g., coordinate system, datum, measurement units). Training of the GPS Coordinator should occur early on so s/he can take a lead role in the training of field staff, data collection, and data processing.

**Data collection / processing**

As in regular field monitoring, the GPS Coordinator must verify that Questionnaire and Unit data match.

Specifically, the tasks during fieldwork include:

1. Data should be copied from GPS units as often as possible. This is most conveniently done during regular field monitoring. The GPS units can be connected to a laptop with the USB cable supplied with the unit and the data can be directly copied/synchronised.
2. Type the hand-recorded GPS coordinates from the GPS data collection Questionnaire into an Excel spreadsheet.
3. Use the chosen GPS mapping software to verify the accuracy of GPS readings
4. Inform the survey management of any inconsistencies
5. Arrange for the recollection of any missing/inaccurate GPS waypoints

Once all locations are verified, the data must be added to the CSPro data. This should be done after the secondary editing is complete (when the database is final). This is the responsibility of the Data Processing Expert, who has received training and documentation on how to perform this task.

Please remember that the GPS data should be removed from the SPSS data files for anonymisation when the data is prepared for sharing on Government and the UNICEF websites.

**Available material**

The following material is available:

* GPS Operator’s Manual: Instructions using unit and completing Questionnaire, as well as some information on the role and responsibility of the GPS Operator. This manual should be customised and be part of the material copied to all GPS Operators and Field Supervisors
* GPS Data Collection Questionnaire: The Questionnaire should be customised and enough copies distributed to GPS Operators (1 per cluster, plus extra copies).
* GPS Coordinator’s Manual: This document provides details on the responsibilities of the GPS Coordinator: Materials (including customisation needs), preparing units, conducting training and monitoring, addressing data quality, and steps in data processing. Manuals to software are also included here.
1. A set of coordinates that identify a point in physical space, in this case to identify the location of a surveyed site using [longitude](http://en.wikipedia.org/wiki/Longitude), [latitude](http://en.wikipedia.org/wiki/Latitude), and altitude and the time surveyed. [↑](#footnote-ref-1)