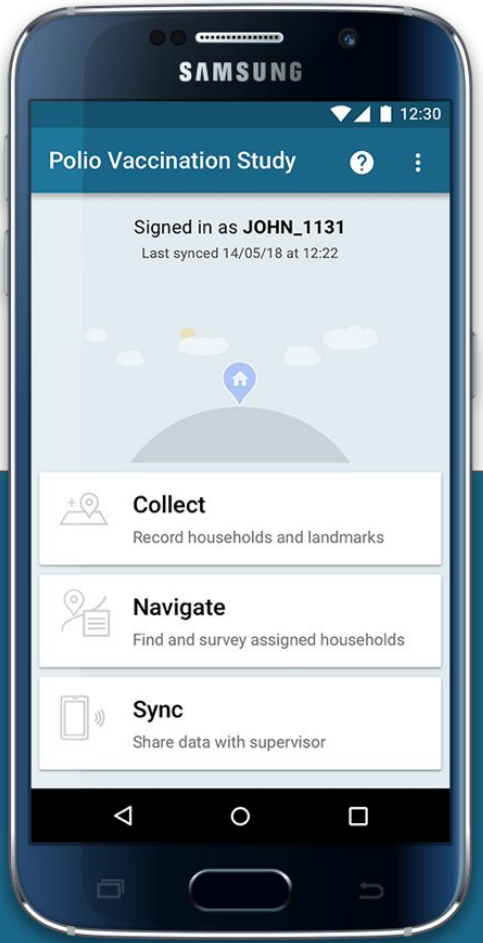
GPSSample

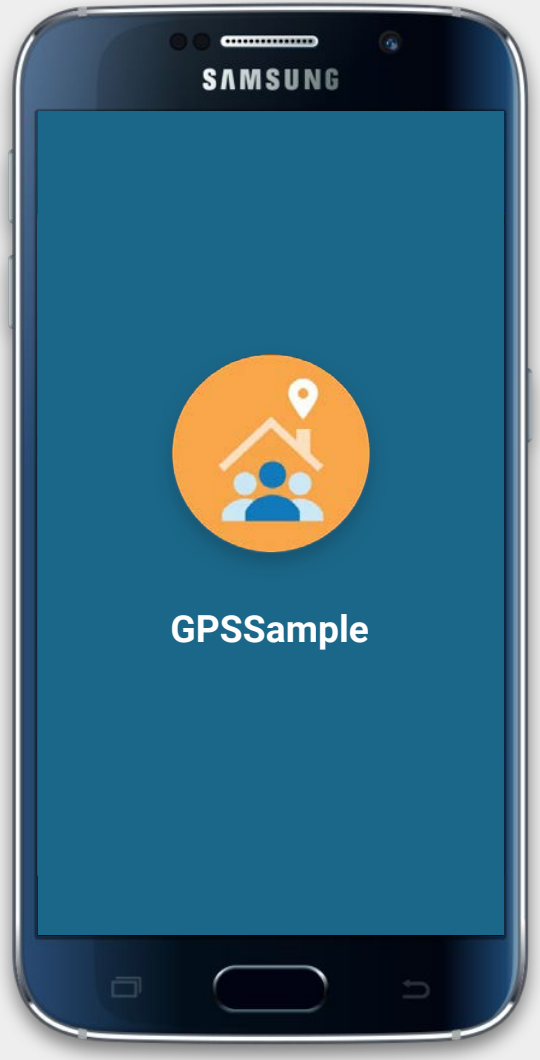
Administrator Guide



Revised 17 October 2018

What Is GPSSample?

GPSSample lets your team record location-based information and generate statistical samples from it.



What Is GPSSample?

GPSSample is an Android application that allows you to record the locations of any subjects of interest in an area and then generate a statistically valid sample from the collection. Once your team has gathered data and generated a sample, the app will help them navigate back to the locations in the sample, where they can perform surveys using compatible apps such as ODK Collect.

GPSSample was made with special consideration for teams in areas without reliable Internet connections. It contains features for syncing offline with other team members running the same study and only requires Internet for initial configuration and for uploading all of the data to a remote server at the end of the study. The app has been designed to be easy-to-use for teams in the field with minimal training, helping you run studies that have fewer recording errors, more accurate samples, and more reliable results.

Terminology

There are some terms used throughout this document that have very specific meanings in the context of the app. A proper understanding of these terms at the outset will make the setup process much easier.

Configuration vs Study

Configuration

A **configuration** is a framework for a study that contains all the settings you need to run your study, including sampling methods, geographical data, and languages.

A configuration contains only settings (and no actual recorded data), so you can use a single configuration for multiple studies. However, you can only have one study on a device at a time.

Your device can hold multiple configurations that can be accessed by users logged in as Admins. A maximum of one configuration will be in use during a given study.

Configuration vs Study

Study

A **study** is built off a single complete configuration and acts as a container for the actual data of your study, including collection points, landmarks, user IDs, the generated sample, and map layers.

Studies are created by Admins from a configuration, deployed to all devices that will participate in it, and populated with data until the study is over and all of its data is uploaded to the server (as specified in its configuration).

Only one study can run at a time on a device. Creating a new study or receiving one that has been shared by another device will require that you overwrite the existing study on the device.

Configuration vs Study

Configuration Properties

- Name
- Geographical Data
  Enumeration Area Names
  Quick Start
  Map Style (with Shapefiles)
  Map Download (Local)
- Custom Fields for Records
- Default Display Information
  Date/time formats
- GPS Validity settings for recording collection points
  Preferred, minimum GPS precision
  Minimum distance between points
- User Settings
  Allow photos during collection
  Photo compression settings
  Comment requirement
- Admin Security
  Admin password

Study Properties

- Name of Study
- Supervisor Password for Study

Enumeration Subjects

All geographical points collected during a study are classified as either enumeration subjects or landmarks.

Enumeration Subjects

An **enumeration subject** (set to “household” by default) is the subject of your study that will be potentially included in the sample for surveying. You can only have one type of enumeration subject (example: you cannot collect both households and water sources as distinct enumeration subjects). You can distinguish between distinct types of enumeration subjects using custom fields (example: households *with* occupants younger than five years old and households *without* occupants younger than five years old).

A **collection point** is an individual record of an instance of the enumeration subject of your study. If your enumeration subject is households, then each collection point will represent an individual household that was recorded with its geographical coordinates.

Enumeration Subjects

Enumeration Subjects (continued)

A collection point can only be considered for inclusion in the sample if that record is **valid**. A valid collection point is one that is complete (contains all required fields) and geographically precise (meets the minimum GPS precision requirements as outlined by the Admin in the configuration). Invalid records will still exist in the database, but will not be included as potential sample points in order to ensure the validity of the sample.

A **sample point** is a collection point that has been selected for inclusion in the study sample. Sample points are assigned to **sublists** for users to navigate to them and gather data for the study using external survey applications like ODK Collect.

Enumeration Subjects

Landmarks

A **landmark** is any other kind of geographical point other than the enumeration subject. Landmarks will never be included in the sample, regardless of validity. Landmarks are generally recorded for context to help users find a sample point and include features like parks, trees, water sources, and official buildings. GPSSample comes with a predetermined list of types of landmarks, but this list can be altered in configuration.

Filterable Fields

Filterable fields refer to specific fields attached to records of collection points. These are fields to which users can apply list filtering during subset/strata definition (before sampling). They include:

- Custom fields *except* text fields
- Sample subset or sample strata
- Recorded location

Sync

Syncing between devices allows them to share data with one another over a Wi-Fi Direct connection. This connection is established between devices running GPSSample and does not require an Internet connection. Sync can be used to transfer configurations and studies from an Admin or to share data between devices running the same study.

User Roles

Enumerators

Most users will be **Enumerators**. Enumerators enter their name on the sign in screen in order to identify themselves in GPSSample's records. These users can:

- Add and delete collection points and landmarks in the study
- Sync data with supervisor devices by making their devices discoverable to Supervisors for sync
- Change their language through device settings

There are some notable functions that Enumerators cannot perform:

- Cannot generate/edit samples from collection points
- Cannot see collection points recorded by other Enumerators
- Cannot directly initiate a sync with a Supervisor or another Enumerator

User Roles

Supervisors

Supervisors are team leaders in charge of collecting data from all Enumerator devices via sync. They can:

- Perform all the tasks of an Enumerator
- Initiate sync with Enumerator devices
- Generate the sample
- Divide sample into auto-generated sublists
- Upload the final study report to the admin-configured server

Supervisor accounts are password protected using the password provided by the Admin during configuration.

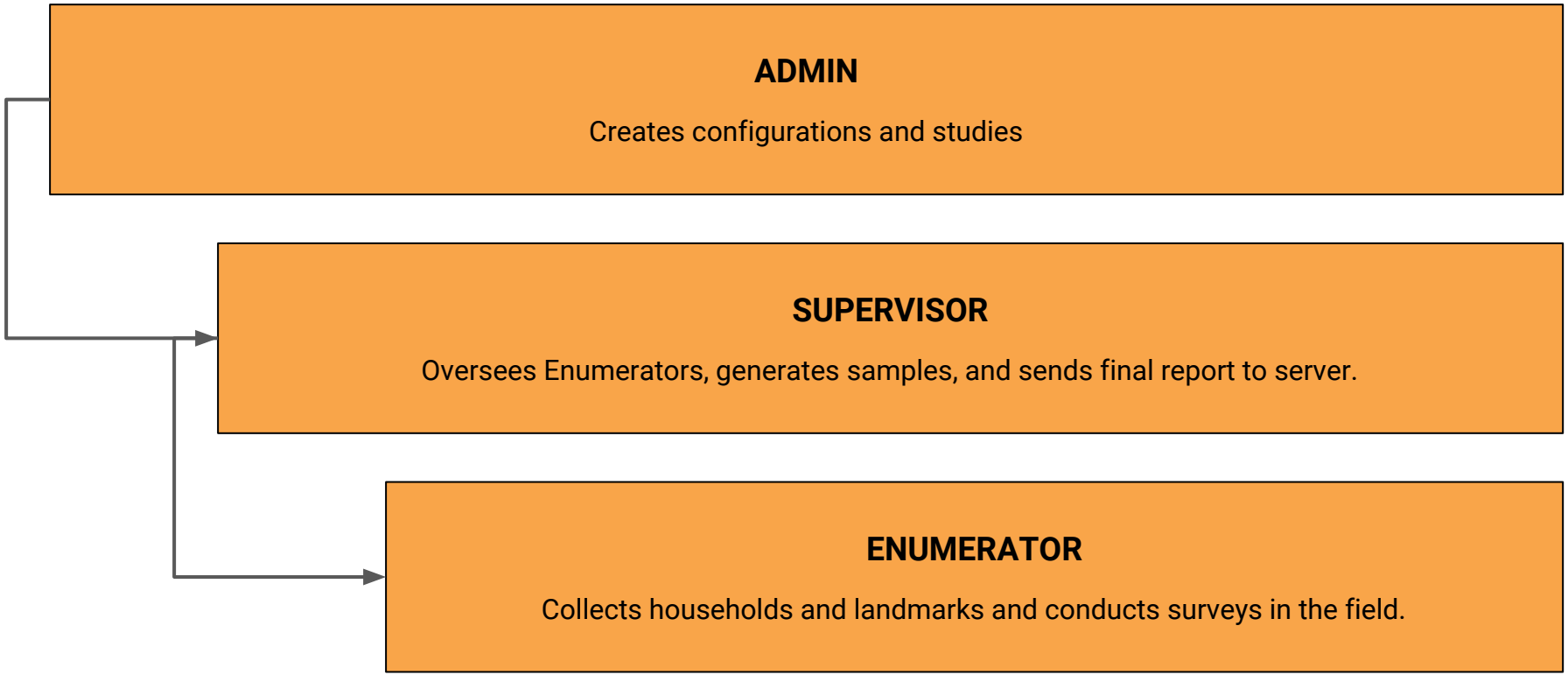
User Roles

Supervisors

Admins are the users who create the configuration and study and sync it out to the other users' devices. When GPSSample is first downloaded and does not have a study to run, the Admin role is the default for any user. Once a study has been created and started, the Admin portal can be accessed from the study sign in screen by pressing "Admin Login" and entering the study password.

Admins do not participate in the study itself in terms of enumeration and surveying. If a person is in the Admin role and also needs to participate in the study in the field, they must sign in separately as an Enumerator or Supervisor to perform those tasks.

User Roles in GPSSample



Getting Started

Admin Workflow

Device Requirements

GPSSample can be used on both mobile phones and tablets running Android.

Required device features:

- Android 5.0 (Lollipop) / API 21 or later
- Wi-Fi Direct

Recommended but not required:

- Camera
- Magnetometer
- Accelerometer

All devices running a study MUST be on the same version of GPSSample.

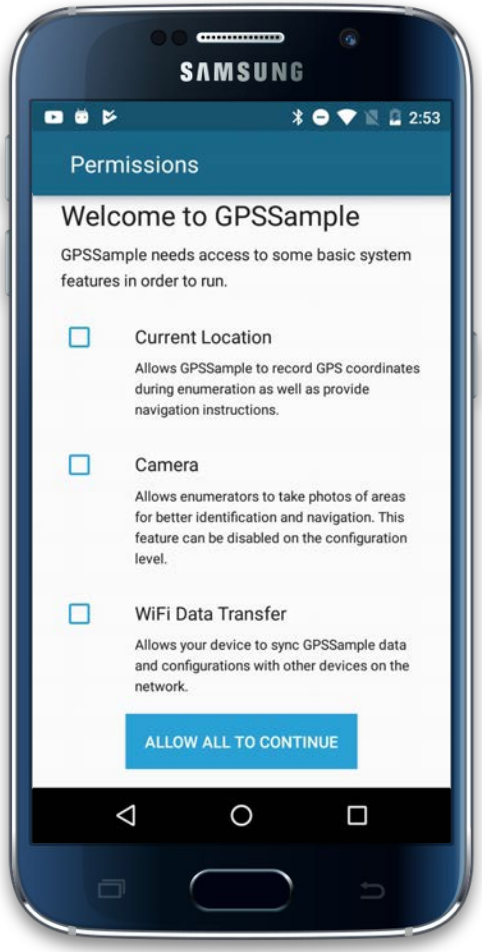
Downloading GPSSample

GPSSample is available directly from the Google Play store.

Additional resources, such as language files, are also available from the GitHub repository.

All devices running a study MUST be on the same version of GPSSample. You should disable auto-update upon download.

Disable auto-update by opening the Google Play store and tapping the hamburger menu icon in the top corner. Go to “Settings” and then go to “Auto-update apps”. Select “Do not auto-update apps” and save. Do this on all devices.



Device Permissions

When you open GPSSample for the first time, you will see a screen prompting you to approve several system-level permissions. All of these permissions -- including access to your current location, camera, and Wi-Fi Direct functionality -- must be granted on every device.

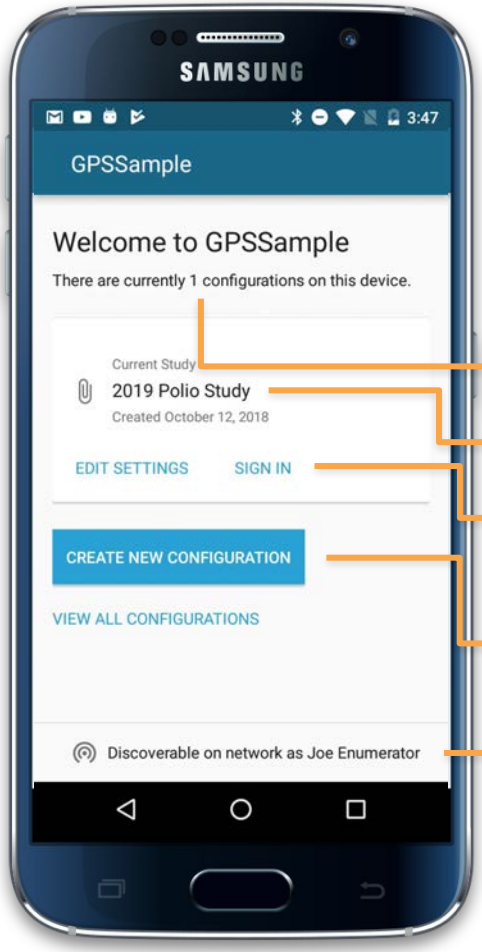
You must grant camera permissions even if you do not intend to use the camera. The ability to take photos can be disabled at the configuration level later on.

Main Screen (First Time User)

Create a new configuration for a new study.

Connectivity status communicates the device's ability to receive configurations and studies from other devices on the network.

Main Screen



This is the version of the Main Screen you will see if you have already created a study.

Total number of configurations on the device

Name of the current study on the device

Go to the study Sign In screen, where Enumerators and Supervisors can sign in.

Create a new configuration or view existing configurations

Connectivity status communicates the device's ability to receive configurations and studies from other devices on the network.

Creating a Configuration

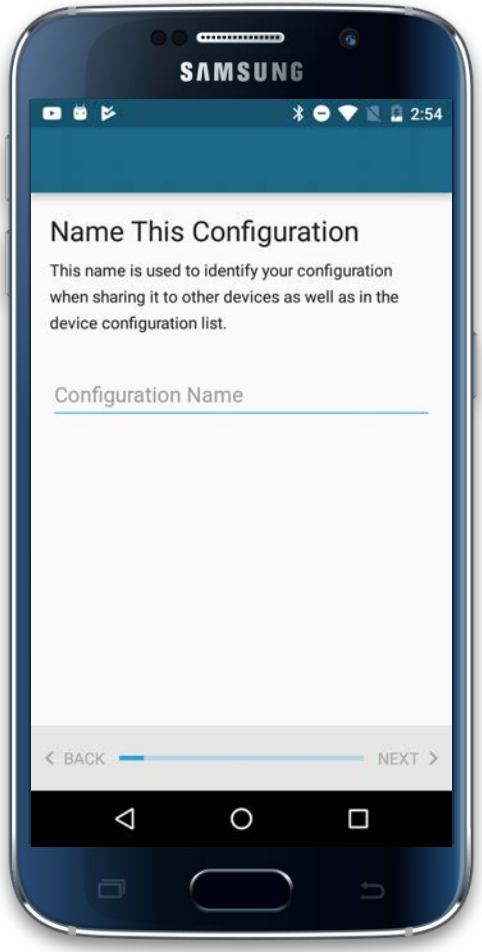
As mentioned previously, the configuration is the framework for a study that contains all the settings you need, including sampling methods and custom fields. Since studies are based off configurations, you must first create a configuration.

To set up a configuration, you must have a Wi-Fi connection. While most of configuration can be accomplished offline, downloading maps for offline use requires Internet connectivity.

What You Need to Start

To start creating a configuration, you will need any these optional files that you want to add:

- Geographical data files with enumeration areas in .json
  - These files use the GeoJSON format
  - You can easily create these files at geojson.io



Name Configuration

The first step of creating a configuration is to give it a name. This name must be unique from other configuration names on the device.

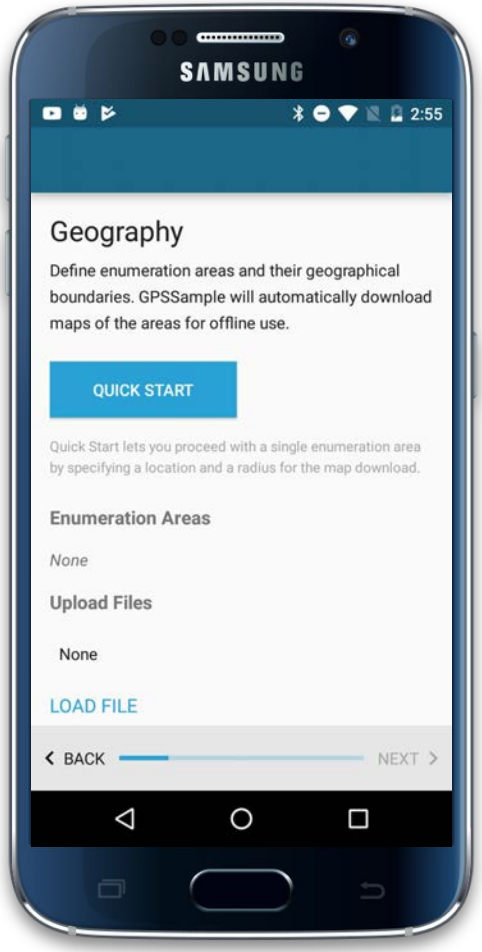
How File Uploads Work

Files can be uploaded to GPSSample in either of two ways:

1. **Upload files from a computer.** This requires a USB connection and access to the device's file system from the computer using a software like Android File Transfer. Files should be uploaded to the directory "/Download".
2. **Upload files from Google Drive.** This will require an Internet connection and Google Drive authentication. Simply select the file you want to import. You can import multiple files from Google Drive, but they must be added one at a time.

Using OSM Map Data

- http://tyrasd.github.io/osmtogeojson/

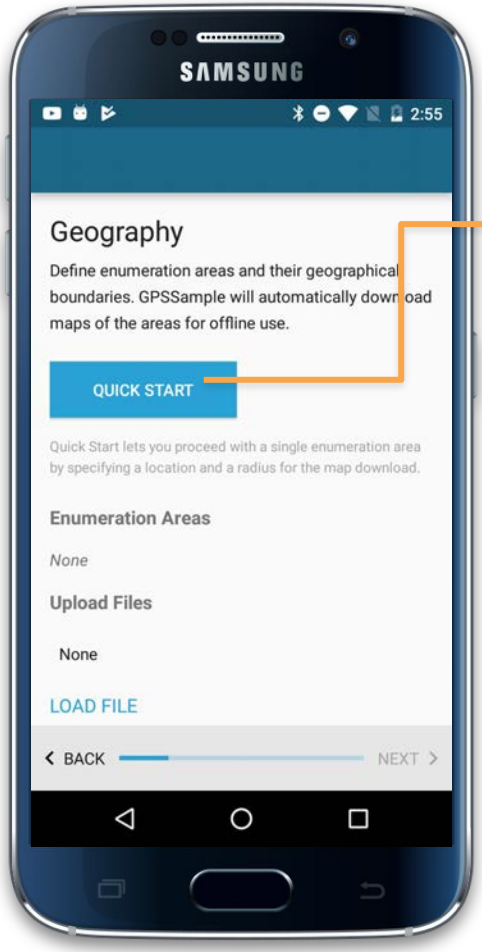


Geography

At this step, you will provide GPSSample with the information it needs to cache the maps for your study's enumeration areas for offline use.

Many studies require map data for a relatively large geographical area, such as a country, which is then subdivided until the final enumeration areas are defined at the smallest level.

GPSSample will use geographical data that you provide to cache maps for offline use on Supervisor and Enumerator devices. If users open the app but are not located within an enumeration area with a cached map, a gray grid will display instead of a map until they enter an enumeration area. **They will not be able to sample points outside an enumeration area.**

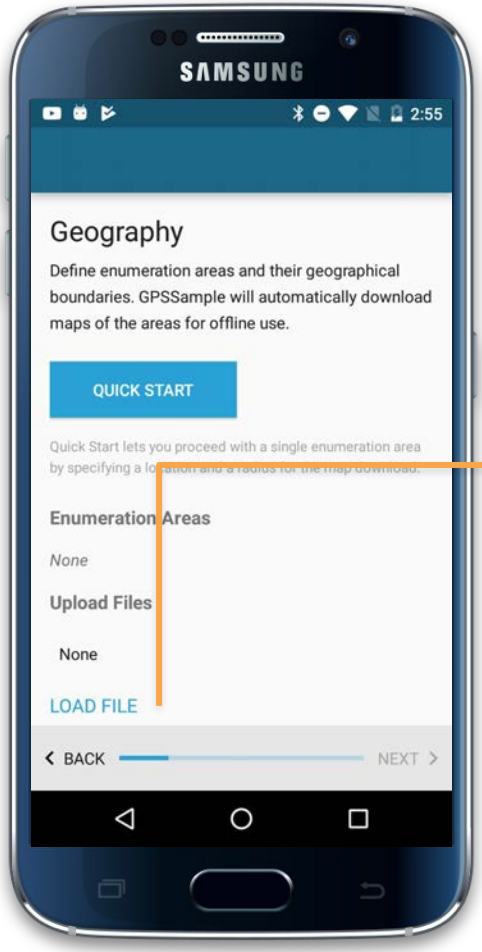


Geography

The **Quick Start** option on this screen is useful for for smaller-scale studies with only one enumeration area. Quick Start allows you to provide a central coordinate and a radius, and will provide guidance to GPSSample for caching the area map for offline use. The map area captured will be a square tile that includes the entire enumeration area.

Quick Start can only be used for a single enumeration area.

Latitudes and longitudes must be entered in degrees.



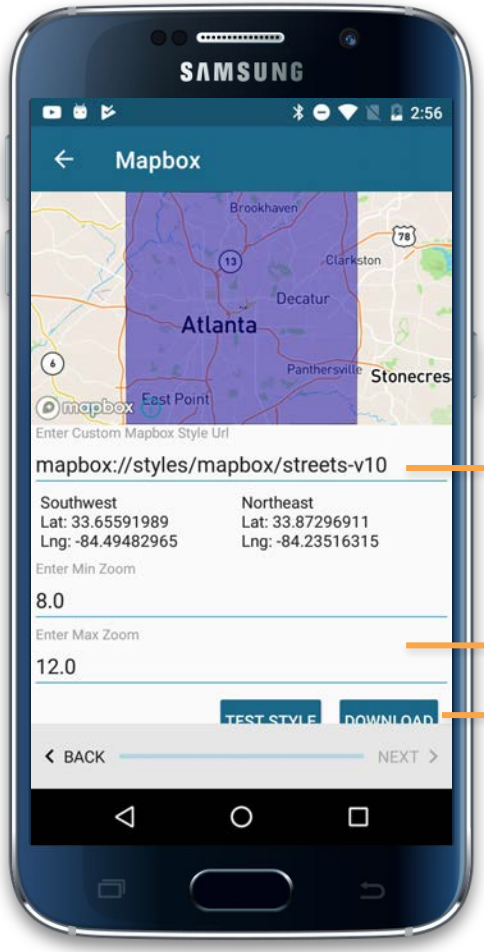
Geography

Geography files in GeoJSON format can be uploaded from a computer with a USB connection or from a Google Drive.

This allows you to upload shapefiles for your enumeration areas that will allow a more precise polygonal boundary to be superimposed on the map tile. This will warn users when they attempt to record points outside the boundary. Any points recorded outside the boundary despite the warning will be marked as invalid for sampling.

Note: Polygons in the GeoJSON files will be used as enumeration areas by default, but will not be visible on the map unless you explicitly add visual properties to each feature such as “stroke” and “stroke-width”.

Geography: Mapbox



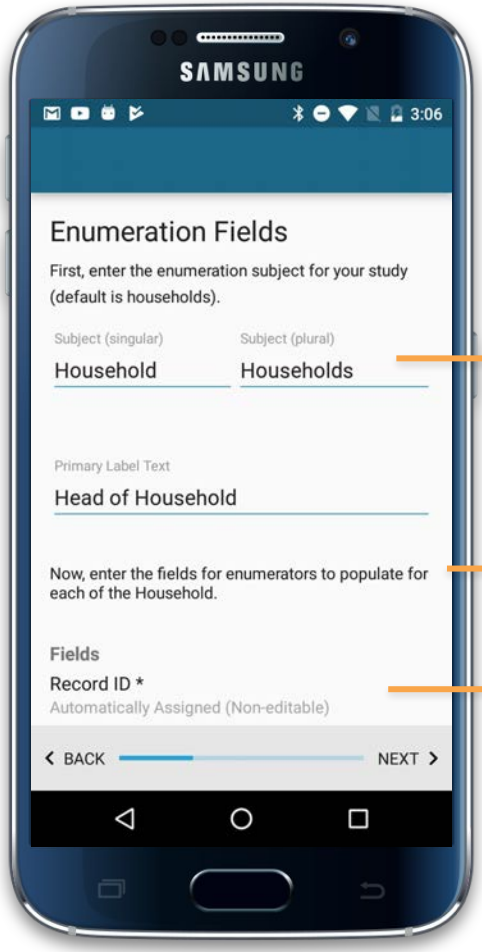
You will now cache your maps for offline use *on this device only*. This information will pass to other devices with the study so that they can cache maps as well.

Enter a URL for a public Mapbox style. You can create custom styles for free in Mapbox Studio, but be sure to set it to “public”. You can also access public styles here.

Min and max zoom tell GPSSample what map zoom levels to cache for offline use. The larger the range and the smaller the minimum zoom, the more device space will be consumed by maps.

Test style lets you preview the custom style URL you provided.

Download will cache the maps on this device only. After download, “Next” will be enabled.



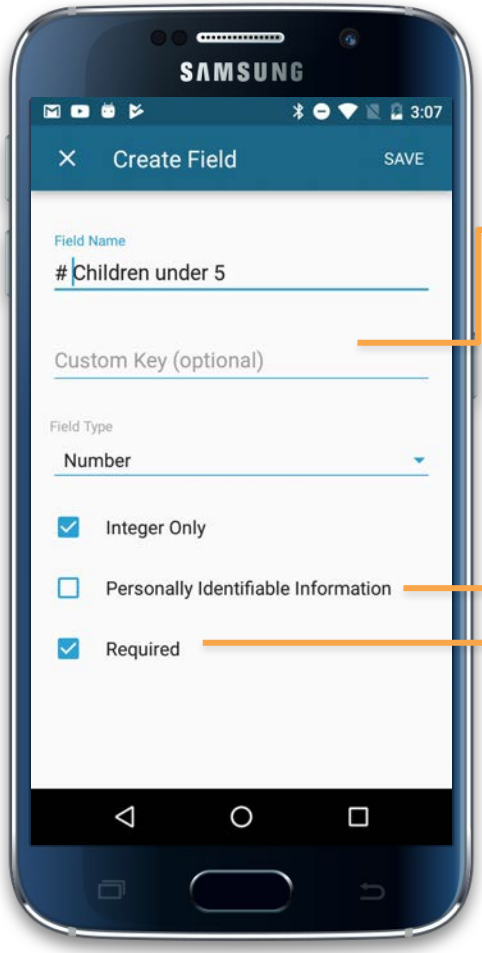
Enumeration Fields

Define the enumeration subject for your study, set to “household” by default. You can then determine what data you want to be collected for each collection point.

Each collection point *requires* a text field designated **Primary Label Text**. In the case of a household as the enumeration subject, this field will generally be the name of the head of household. However, you can change it to any text value that will be useful to your study for the purpose of identifying individual collection points in a list.

By default, the only non-location field collected is Record ID. You cannot alter this field. You can add and delete additional fields.

Enumeration Fields



GPSSample automatically generates database keys in UUID format. If you want to use a different key, you can add your own **custom key**. Enumerators and Supervisors will not see this value; it will apply only to the database storage.

Fields can be flagged as containing Personally Identifiable Information (PII) for security compliance.

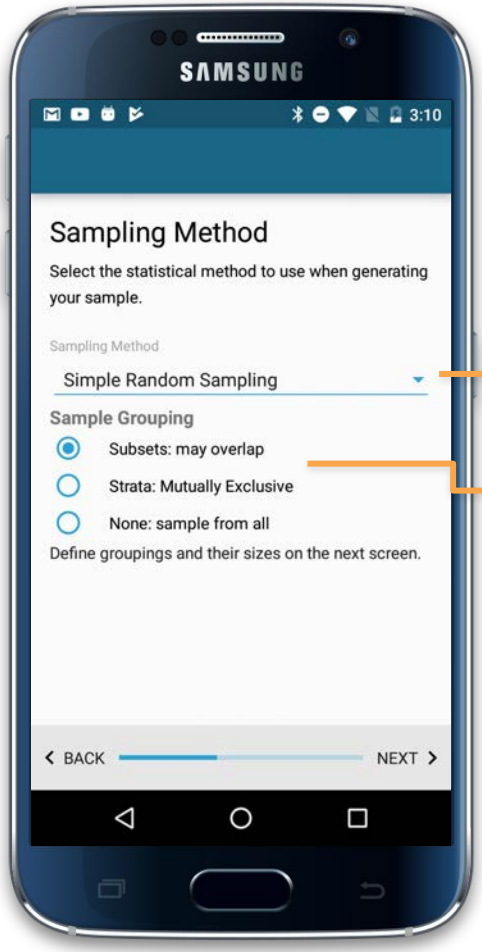
All fields but checkbox can also be designated as required, so that the Enumerator must provide a value before the collection point can be saved as complete and considered valid for sampling.

Custom Field Types and Features

Field Type	Description	Features
Dropdown	A dropdown list of options from which a user can choose one option as the field's value	Mark as PII Mark as required
Number	A numerical value stored as either a float (default) or an integer.	Allow only integers Mark as PII Mark as required
Text	A text field *Not filterable*	Mark as PII Mark as required
Checkbox	A boolean field that can be either checked or unchecked	Mark as PII
Date	A field that allows users to provide input in the form of year, month, day.	Include date, time, or both Option to default to current date and time Mark as PII Mark as required

Enumeration Fields for Filtering

- All filterable fields can be used to filter sample points for assigning to sublists
- Filterable fields can also be used to determine which collection points meet the requirements to be included in the sample



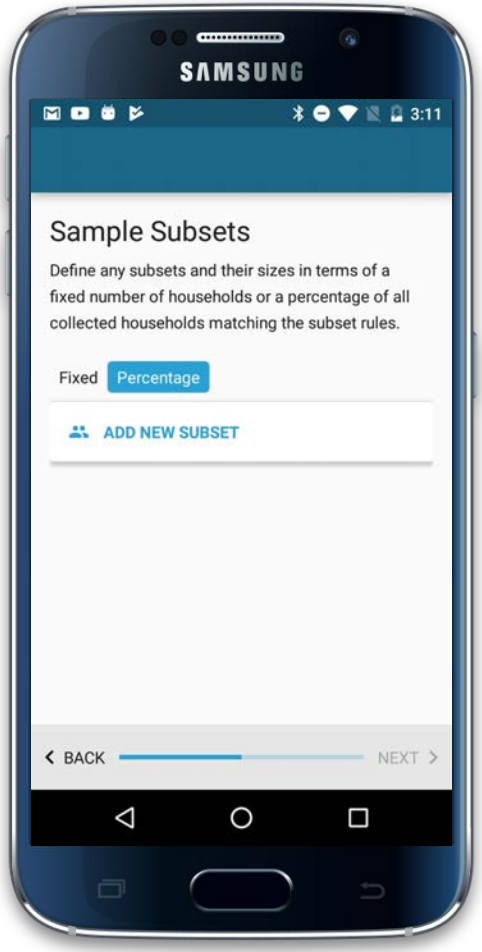
Sampling Method

GPSSample provides two different statistical sampling methods:

- Simple Random Sampling
- Systematic Sampling

In addition to choosing the statistical sampling method, you must choose what kind of grouping you want to use in determining which collection points to include in the sample:

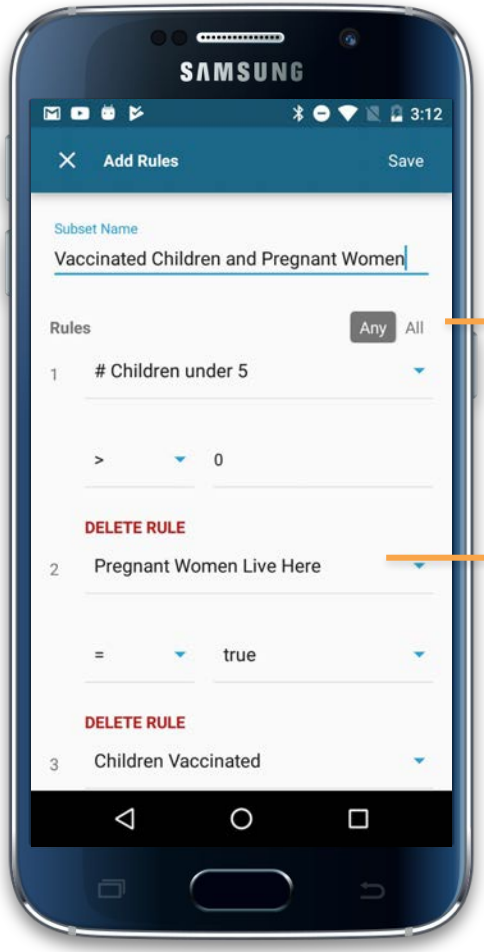
- **Subsets** are groupings which may overlap
- **Strata** are groupings which are exclusive
- **None** means that there are no groups and all valid collection points are eligible for inclusion in the sample



Sampling Method

If you choose to use subset or strata, then the next step will be to define up to two groups. Subsets or strata are defined as a set of rules based on the enumeration fields you created earlier (in addition to the automatically-gathered “Recorded Location” field).

If you choose to work with strata, it is up to you to ensure that your groupings do not overlap.



Sampling Method

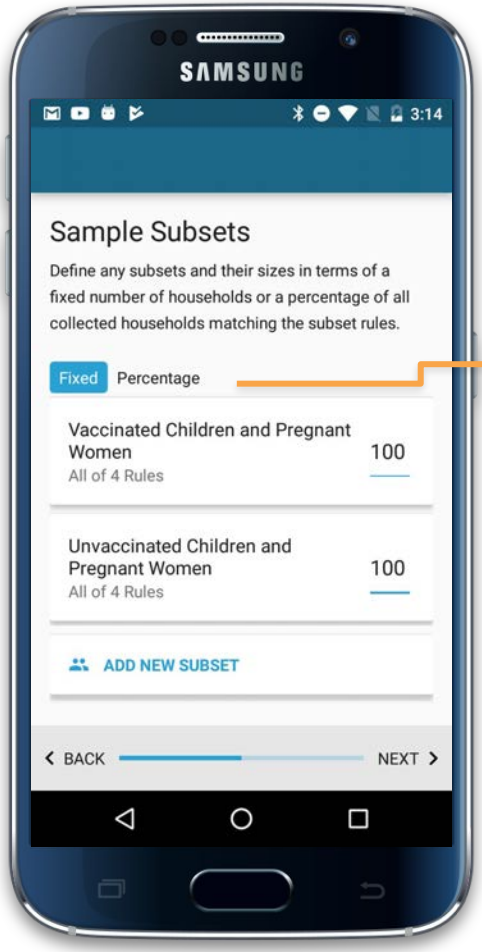
Each subset/strata can be composed of up to five rules.

You must select whether the group includes collection points that follow **any** of the rules or **all** of the rules.

You can create multiple rules based on a single custom field (example: three rules that apply to a dropdown field in order to capture collection points that match any of three values for that field).

Sampling Method: Filtering for Subsets/Strata

Field	Rules	Values
Dropdown	Is Is not	Any of the assigned options
Number	Greater than Less than Equal to Not equal to Greater than or equal to Less than or equal to	Any numerical value
Text	*Cannot be used for rules*	
Checkbox	Is Is not	Checked Unchecked
Date	Is Is not Is earlier than Is later than	Date
Recorded Location	Greater than Less than	Latitude value Longitude value



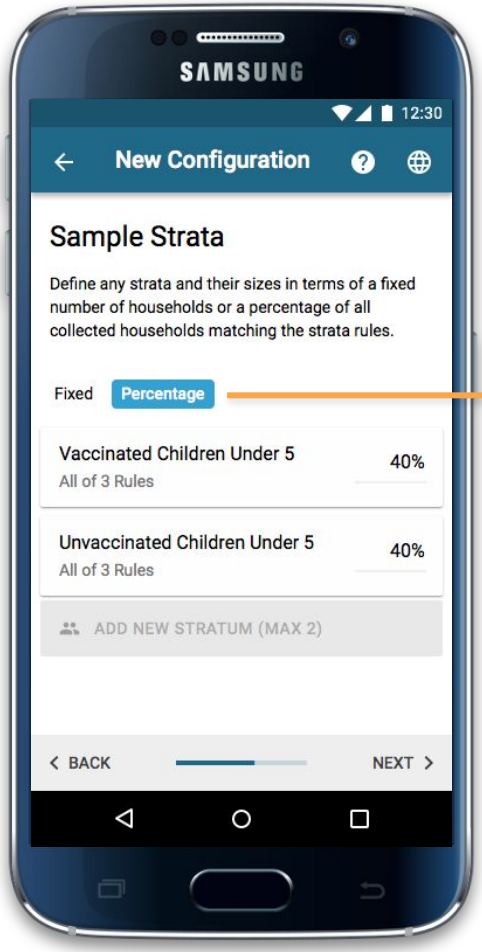
Sampling Method

For groupings of subsets, you must define the size of each subset individually.

You can define the subset size as either a fixed number (e.g. 150 households) or a percentage of the total number of collection points that meet the subset rule requirements (e.g. 20%). All subsets must use the same size unit (percentage or fixed number).

In the case of subset sizes defined as fixed numbers, the total sample size may be smaller than the sum of the subsets due to overlap.

In the case of subset sizes defined as percentages, the percentages will not necessarily add up to 100% for the same reason.

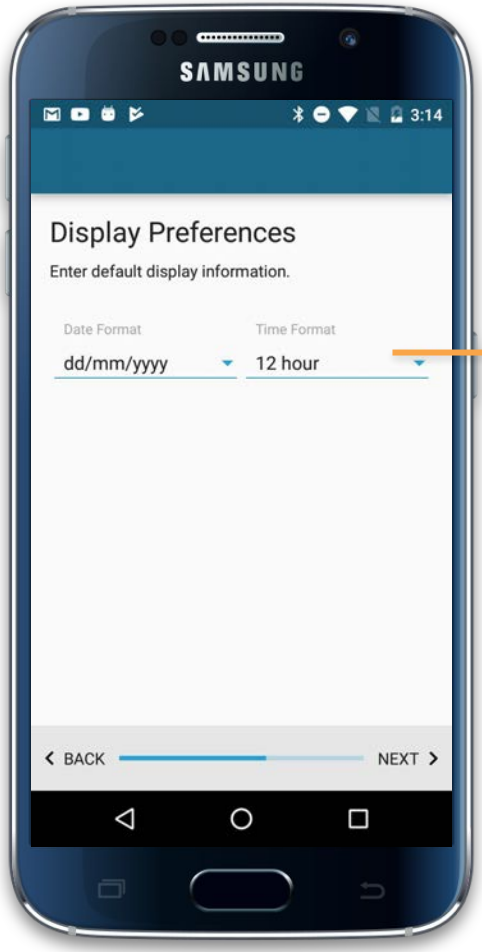


Sampling Method

For groupings of strata, you must define the size of each stratum individually as either a fixed number or a percentage of the total sample composition.

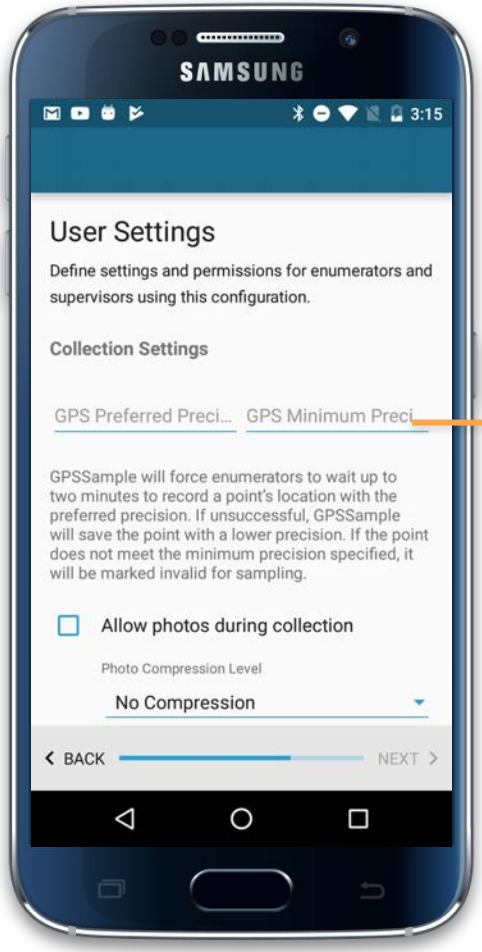
Strata do not overlap, so if strata size are defined as fixed numbers, the total sample size will be the sum of the strata sizes.

If strata are instead defined in terms of percentage of the total sample, you must also define the total sample size as either a fixed number of collection points or as a percentage of the total number of collection points that meet the subset rule requirements.



Display Preferences

Select the date and time formats that you want your data to conform to.



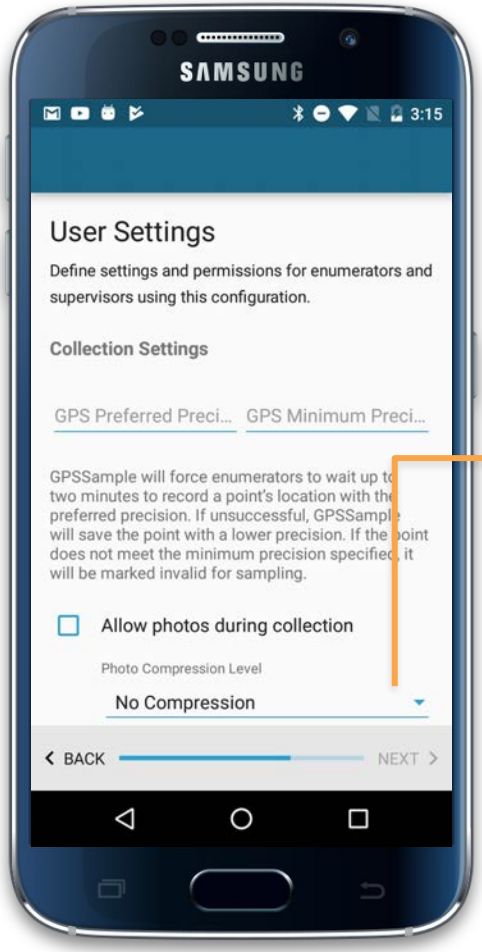
User Settings

GPS Preferred Precision and **GPS Minimum Precision** fields dictate which points have GPS precision that is considered excellent, good, or poor (invalid for sampling).

Any point with a GPS precision that exceeds the **GPS Minimum Precision** specified will be considered valid for sampling; any point with a GPS precision lower than that will be considered invalid and excluded from the sample.

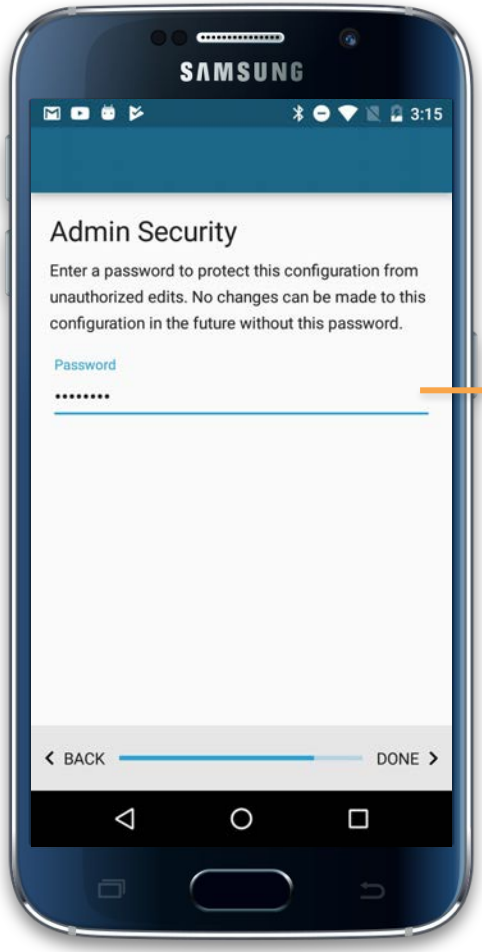
If a point's precision exceeds **GPS Minimum Precision** but does not meet the **GPS Preferred Precision**, it will still be considered valid for sampling; however, it will prompt the user to wait up to two minutes to record the point.

If a point's precision meets the **GPS Preferred Precision**, it will be recorded immediately as valid for sampling.



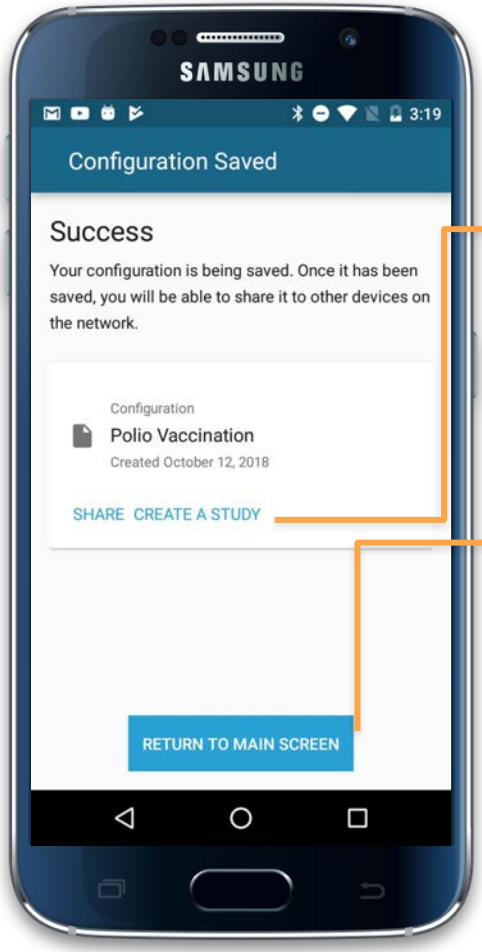
User Settings

If you choose to allow photo capture during enumeration, you must enable “Allow photos during collection” and specify the compression level to use. A more compressed photo will have less detail but require less space on the phone and transfer more quickly during sync.



Admin Security

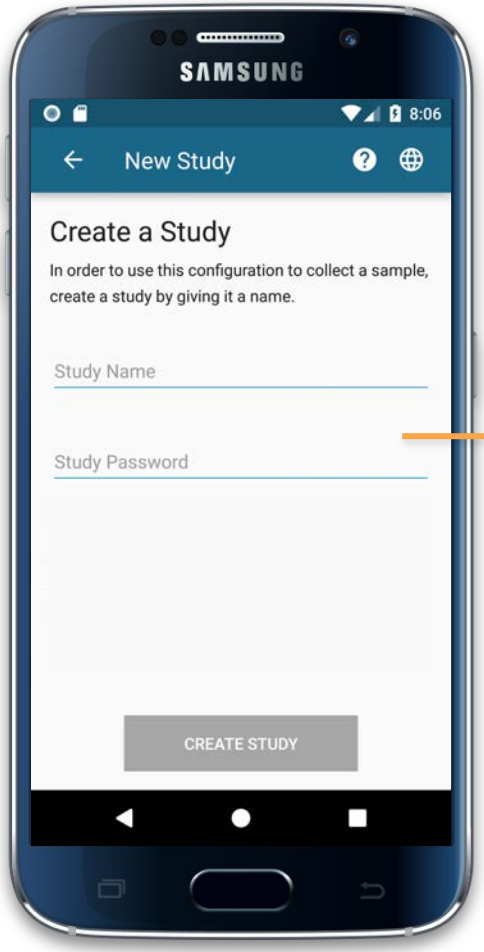
From the study Sign In screen, a user can tap the “Admin” button and enter the admin side of GPSSample by providing this password. This prevents untrained users from making unauthorized or destructive changes to the study. **Keep this password in a safe place; it cannot be recovered if lost.**



Saved Configuration

To use your configuration with a study, you can create a new study.

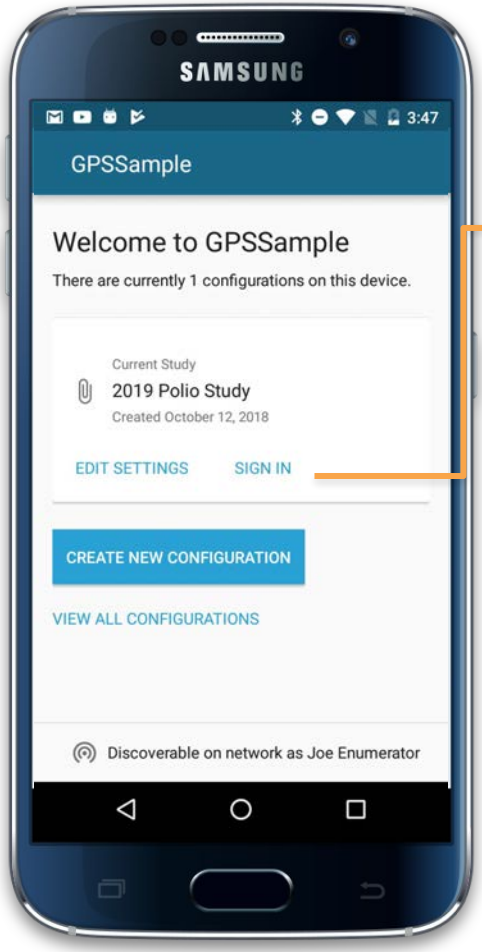
Return to the Main Screen if you do not want to share your configuration or create a study at the moment. You can always take these actions later by accessing the configuration from the “View All Configurations” page (from the Main Screen).



Create a Study

A study only requires two things: a unique name and a password. The study password functions as an supervisor password once the study has begun. From the study Sign In screen, a user can tap the “Supervisor” checkbox and enter the supervisor side of GPSSample by providing this password. This prevents untrained users from making unauthorized or destructive changes to the study. **Keep this password in a safe place; it cannot be recovered if lost.**

After saving your study, you will be taken to the Sign In screen for the study. If you wish to share it with other devices, sign into Admin and tap “Share”

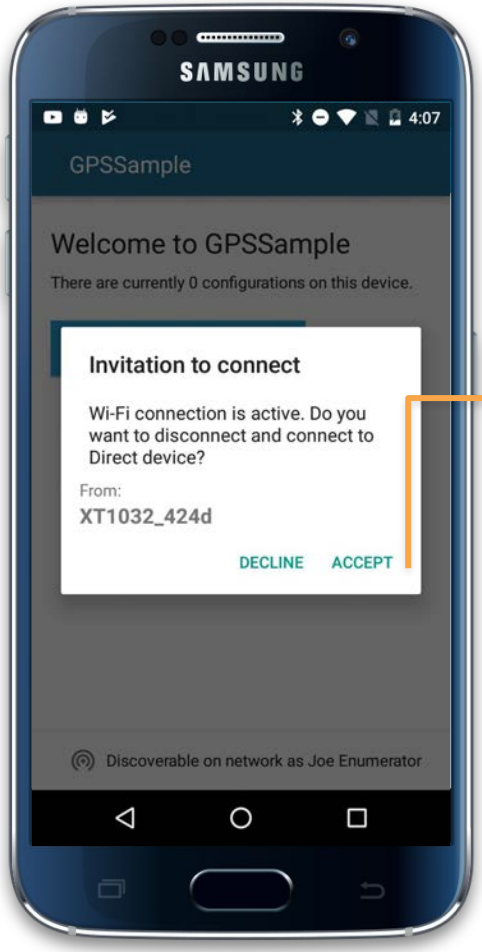


Starting the Study

Now that you've created a configuration with a study and shared it, you can start the study on this device from the Main Screen by tapping "Sign In" on the study card.

Sharing a Study

- Share a study from the Admin main screen by tapping “Share” on the study card
- Select the devices in range of Wifi Direct that you want to send it to. These devices should have GPSSample open to the Admin main screen as well and display a “discoverable on the network” status that shows their network name
- Tap the names of the devices to send the study. You can send a study to multiple devices, but you must send them one at a time
- Make sure to sign in as an Enumerator on each device and cache the offline map tiles before moving out of range of a Wifi connection
- To change the name of a device as it appears on Wifi Direct, see the instructions here

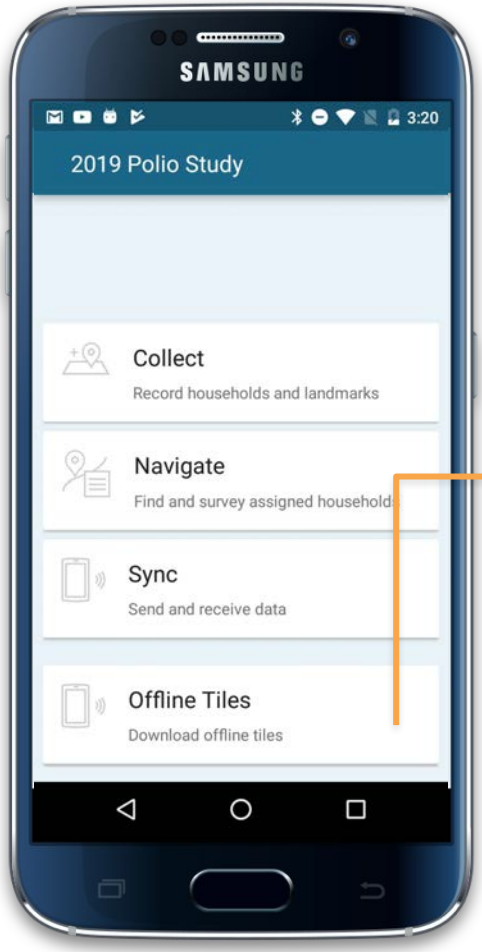


Receiving a Study

Users logged in as Admins can receive studies and configurations when GPSSample is open to the Main Screen. Tap “Accept” when you see the invitation to connect from another device.

Upon receiving a study, an Admin user can run it immediately. No further action needs to be taken to prepare the study to run.

If there is an existing study on the device before the new study is transferred, you must delete that study before you can receive a new one.

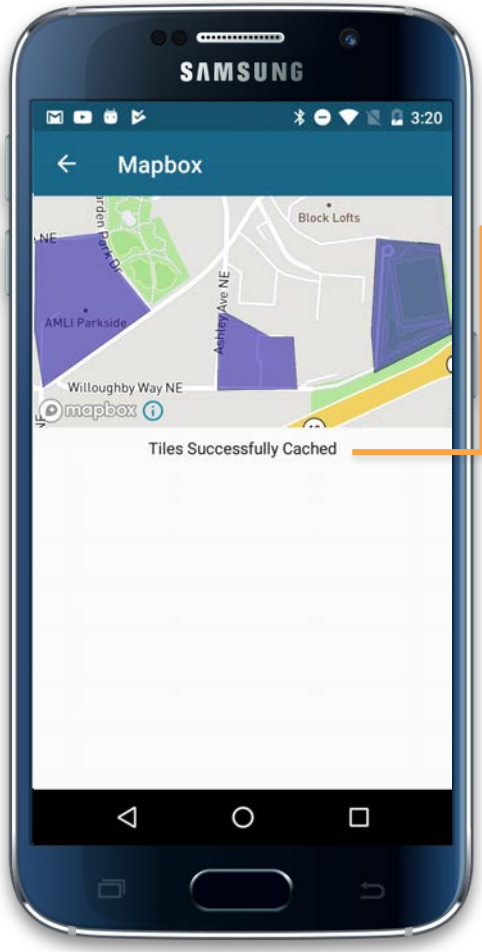


Cache Maps for Enumerators

If your enumerators may be operating outside of a reliable internet connection, it is important to cache their maps for offline use first

On each device that enumerators or supervisors will be using, sign into the study. It does not matter what name you use. Do not check the “Supervisor” checkbox.

Go to “Offline Tiles” on the Enumerator main screen



Cache Maps for Enumerators

Stay on this screen until you see the maps appear under the purple shapes and the text reads “Tiles Successfully Cached”

Unless you clear the memory of the phone, this operation only needs to be done once. Enumerators and Supervisors who subsequently sign in to the study with different names or roles can use the cached maps.

Complete this step for every enumerator device.

Google Accounts for Supervisors

- Make sure that all Supervisor phones are successfully authenticated with the Google account where you want the study data to upload.
- At the end of the study, when supervisors are uploading final reports, they will use this Drive. It is a good idea to provide them with credentials as a back up, in case they are logged out of the Google account.

Troubleshooting

Deleting an Old Study

Since you can only have one study on a device at a time, you must delete the old study before you can create or receive a new one.

If you have collected any data in the study that is not safely backed up, be sure to sign in as a Supervisor while connected to Wifi and go to “Upload Final Report” to send the database to Google Drive.

To erase the study, you must clear GPSSample’s data. Exit GPSSample, then find the icon in your device’s app library. Tap and hold the icon for a second, and then you will see the option “App Info” appear in the top left of your screen. With your finger still holding the app icon, drag the icon on top of “App Info”. A new screen will open with information about GPSSample. Go to Storage, and then select “Clear Data”.

Once the operation has completed, you can reopen GPSSample and create or receive a new study.

Offline Map Won’t Download

The range of acceptable values for minimum and maximum zoom levels are 1.0 and 16.0, respectively.

Maps will not download if the file is larger than the amount of space available on the device. To estimate the size of the area you are trying to download, use this tool.

Changing Device Name on Network

To change the device’s name as it appears on the network for Wifi Direct syncing, go to the phone’s Settings > WiFi > WiFi Direct, then tap the overflow menu in the top right corner and select “Rename Device”.

Forgotten Study Password

If you have forgotten the password for a study, you cannot sign in as an Admin. Passwords cannot be recovered through GPSSample, so it is important to store them in a safe place outside the app.

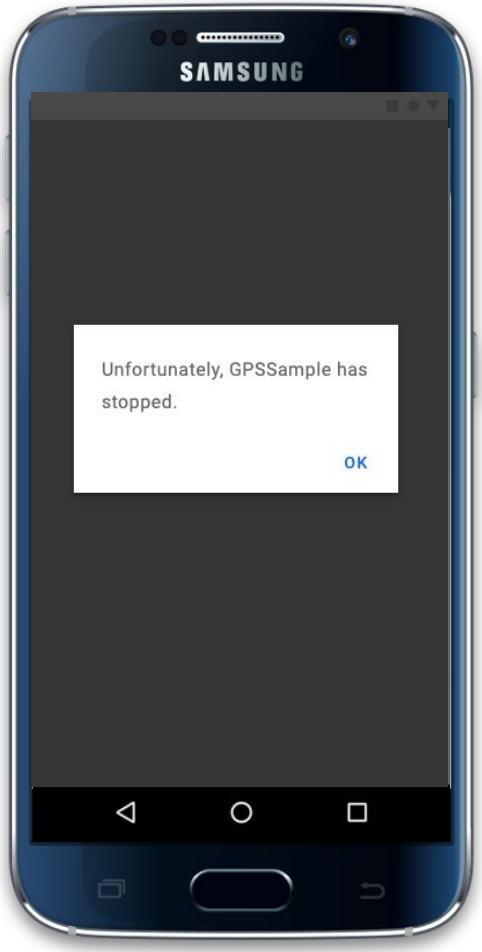
If you cannot recovery your study password, it is best to ensure that you have backed up your study data to another device or uploaded the final report to the configured server; then, you can delete the GPSSample app off of the device and re-download the application to access the Admin side of GPSSample.

Using the Database Files

After your study is complete and the results have been uploaded to Google Drive, you will have three files named “study_database”, “study_database-wal”, and “study_database-shm”. These are SQLite database files and can be read and manipulated with standard SQL queries.

In order to read these files, you may need to manually add the .db file extension. You can do this by simply renaming the file “study_database” to “study_database.db” and confirming any system warnings.

To open and execute SQL queries on the database, open “study_database.db” in a database browser for SQLite. We recommend DB Browser for SQLite, which is free and has good support for all standard computer operating systems.



GPSSample Has Stopped

When you see the app close unexpectedly with the message “Unfortunately, GPSSample has stopped”, tap “OK” and reopen the app.

Your saved work is still there, but any work in progress may have been lost and need to be redone.

If this issue is occuring frequently, your phone is running out of working memory. Try closing out every other app in the background.

Additional Support

GPSSample is an open-source project maintained by the community and by Task Force for Global Health. The project is hosted on GitHub here.

If you notice a software issue within GPSSample, or if you want to suggest a feature that could make the app better, please submit an Issue on our GitHub repository. If you would like to contribute as a developer, you can fork the project there as well.

For further questions and support, contact the GPSSample team at mobileGPSSample@gmail.com.