Standard Operating Procedure for Soil Sample Collection and Field Observations

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SOILS4 LIBERIA

SOP v1.0

IITA Transforming African Agriculture | CGIAR | Global Gateway

ISRIC World Soil Information | MATE Hungarian University of Agriculture and Life Sciences

Document control log

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Revisions and Document history

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Abbreviations

AU	African Union
GPS	Global Positioning System
GPX	GPS eXchange format
IITA	International Institute of Tropical Agriculture
KML	Keyhole Markup Language
LiNSIS	Liberia National Soil Information System
ODK	Open Data Kit
ONA	Organizational Network Analysis
QR	Quick Response
S4L	Soils4Liberia
SIS	Soil Information System
SOP	Standard Operating Procedures
SP-ID	Sampling point identifier
SS-ID	Soil Sample Identification
SSU	Secondary Sampling Unit
TSU	Tertiary Sampling Unit
Y/N	Yes OR No

Introduction

The Soils4Liberia project aims to develop an open-source Liberia National Soil Information System (LiNSIS) for baseline assessment of soil health for decision-making in agriculture and land management. The protocol is also expected to support future monitoring of soil health across Liberia. A total of about 1200 sampling points are to be surveyed and characterized across different land use categories and agroecologies in Liberia.

A standardized protocol and SOPs are thus needed to ensure accuracy, consistency, reliability, and repeatability in assessing soil properties and soil quality over time. A comprehensive field survey protocol has been developed to guide implementation. It is important to acknowledge that the protocol and this SOP are true revisions of the Soils4Africa field campaign tools, taking special considerations for the situation in Liberia and in alignment with the Soils4Liberia aims and objectives.

The field survey protocol clearly outlines required materials and pre-field preparations. It provides detailed guidance on safety and security considerations, navigation to sampling locations, and criteria for accepting or rejecting a site as a valid sampling point. The protocol also includes step-by-step instructions supported by illustrations on soil sampling techniques using appropriate tools, sample labelling and bagging procedures, and recording observations on soil surface characteristics, landform and terrain, land use and land cover, as well as land and water management practices. Guidance is also provided for handling special field conditions.

Building on and simplifying the field protocol, this Standard Operating Procedure (SOP) has been developed to provide clear, step-by-step instructions for field operations under Soils4Liberia. The SOP covers essential activities before field deployment, detailed procedures for soil sample collection and recording observations, and post-field responsibilities upon return. It also provides a practical guide for completing electronic data entry forms using ODK Collect, ensuring accurate and standardized digital data capture.

You will need the following equipment and materials

- ✓ An Android tablet (specification provided in the instruction manual).
- ✓ A tool for navigating in the field (A GPS device is recommended and when available; otherwise use the MAPS.ME app downloaded on your tablet).
- ✓ A soil auger marked with coloured tape at 20 and 50 cm from the tip.
- ✓ Two (2) 10-liter plastic buckets or basins of different colour.
- ✓ A 5-liter plastic jerry can for water.
- ✓ 1-liter (min. 23 x 15 cm; 9 x 6 in.) sturdy plastic bag and 1- litre cloth bag, one of each for each soil sample
- ✓ Use paper or cloth bags only for the pesticide residue samples
- ✓ Duplicate soil sample label (QR codes) for each soil sample.
- ✓ Plastic pouches (min. 5 x 7 cm) for the labels

- ✓ Jute bags (50 kg)
- ✓ Permanent markers (2)
- ✓ Power supply (reserve batteries, power bank or other)
- ✓ Knife (with vane or blade of 20cm approx.)
- ✓ Stapler (handheld) and sufficient staples

Before going to the field

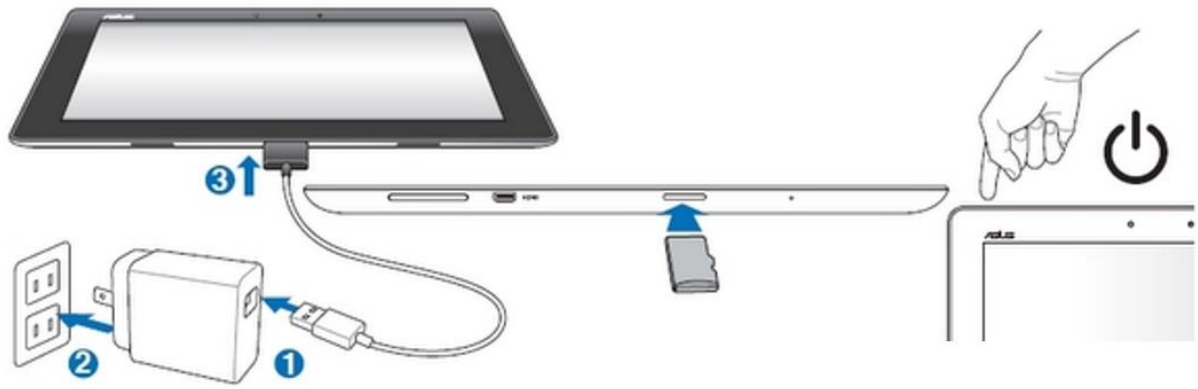
1. Procedure for powering up ("booting") and shutting down the tablet

Follow the steps below to boot up the tablet.

- ✓ Press on the Power button at the right hand side of the screen, to power up the tablet.
- ✓ To conserve battery power, it is recommended that the "Sleep" mode be used to shut down the tablet if it is likely to be restarted within two hours (for example, during the day when carrying out interviews).
- ✓ If the tablet will not be used in the next two hours it is better to use the "Shut down" option.

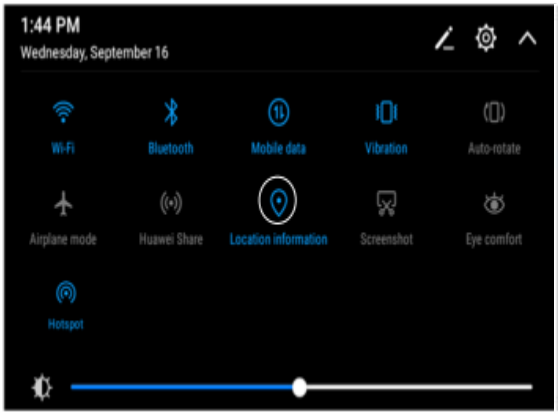
2. Managing Batteries and Power with your Tablet

To charge the battery in the tablet, connect the AC adaptor power cable.
A battery which is completely discharged will take about one hours to charge to 100% of its capacity, and approximately two hours to become fully charged. If the tablet is switched on and is being used while it is charging, it may take up to five hours for the battery to become fully charged.



3. How to turn on Location (GPS):

- Swipe down from the top of the Tablet Home Screen to view the status bar.
- Tap on the Location icon to activate it. The icon will change colour when activated.



Capturing accurate GPS Coordinates

- Do not pick GPS coordinates under cloudy/dark weather
- Do not move the tablet whiles GPS is reading
- Always stand in the middle or in front of the structure to pick the GPS coordinate
- Never pick GPS coordinates under a shade, shed or roof
- Stretch out the tablet with the screen fully exposed to the sky when taking the GPS

Location Accuracy Settings

- Open your device's Settings
- Tap on **Location**.
- Tap on **Advanced** >> **Google Location Accuracy**.
- Turn on **Improve Location Accuracy** on

4. Install Android software and ODK forms

To use the Soils4Liberia ODK field survey form you initially need to install the following applications on your Android device (tablet):

- ✓ ODK Collect (to georeference, time stamp, and log in your soil sample and record field observations)
- ✓ QR and Barcode scanner (to read QR code labels; if not a standard functionality like on older android tablet)
- ✓ MAPS.ME (if you are going to be using your tablet or smart phone for field navigation rather than a separate GPS unit).
- ✓ Ensure to install the ODK collect on the tablet provide and use only for data collection purposes.

You can locate the applications on Google Play by searching for them by name (ODK Collect or MAPS.ME). Note that you will need an Internet connection for this.

Once you have installed the software on your Android device, the form can be accessed through a QR code which will be shared with you by your supervisor.

When you get the QR code, open the ODK Collect App, Click on the setting (icon 'S') in the top-right of the screen. Select 'Add project' and scan the QR code. You will automatically have access to the "*S4L Sample Collection_Standard*" form; select the latest version. Also in this directory, you will find other relevant forms that need to be completed for the survey.

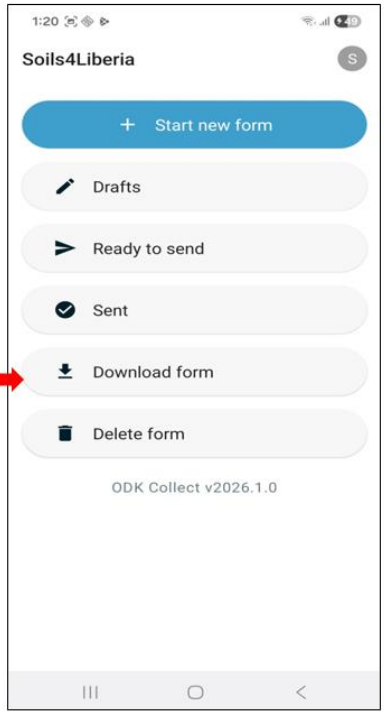
You can also generate the form QR code for use by another tablet. To do this:

- Open ODK Collect on the tablet you have already configured
- Click on the icon in the top-right corner of the screen
- Select ‘settings’
- Select ‘Project management’
- Select ‘Reconfigure with QR code’
- Select ‘QR Code’
- You can screenshot the QR code or click on icon on the top-right corner to send the QR code by email or WhatsApp.

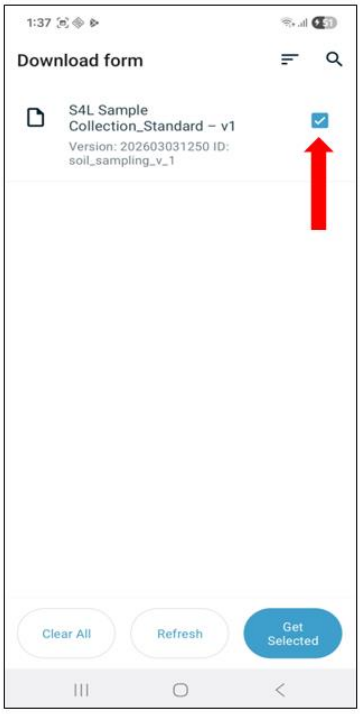
This allows you to download blank forms for use on your Android device. It also allows you to save any completed forms to a database on the server. To download the blank ODK Soil sample form to your device, follow these 3 steps:

1. Open ODK Collect

2. Start new form



3. Get Selected (Form)



5. Print soil sample labels (duplicate QR codes)

If not already printed, you will need to print soil the sample labels. Use 300 g/m paper for this (A4 cardboard paper). These are generated as machine-readable QR code based on a SS-ID (or unique soil sample ID). The QR codes will be provided by IITA.

The reason for having a unique machine-readable label is to be able to decisively track any given soil sample that is collected from the field, through the subsequent laboratory processes, and into the corresponding databases. The reason why they are in duplicate is that later one label remains with the soil sample to be stored and one label goes with the sample to be transported to the lab in Monrovia.

Duplicate SSID labels should go with every soil sample that is collected. The duplicate label needs to be put in the small plastic pouch (ziplock bag) for keeping it dry and it is recommended being done before going to the field. You can already apply the duplicate label to the sampling bags before going to the field, if preferred. We are double bagging, so apply the duplicate label on the outside of the first (inner) plastic bag, on the inside of the second (paper or cloth) bag.

6. Upload sampling locations as waypoints to your GPS or MAPS.ME

First, download and install MAPS.ME app on your phone/tablet (you need internet access). You will be able to do this using the Play Store on your phone (https://play.google.com/store/apps).

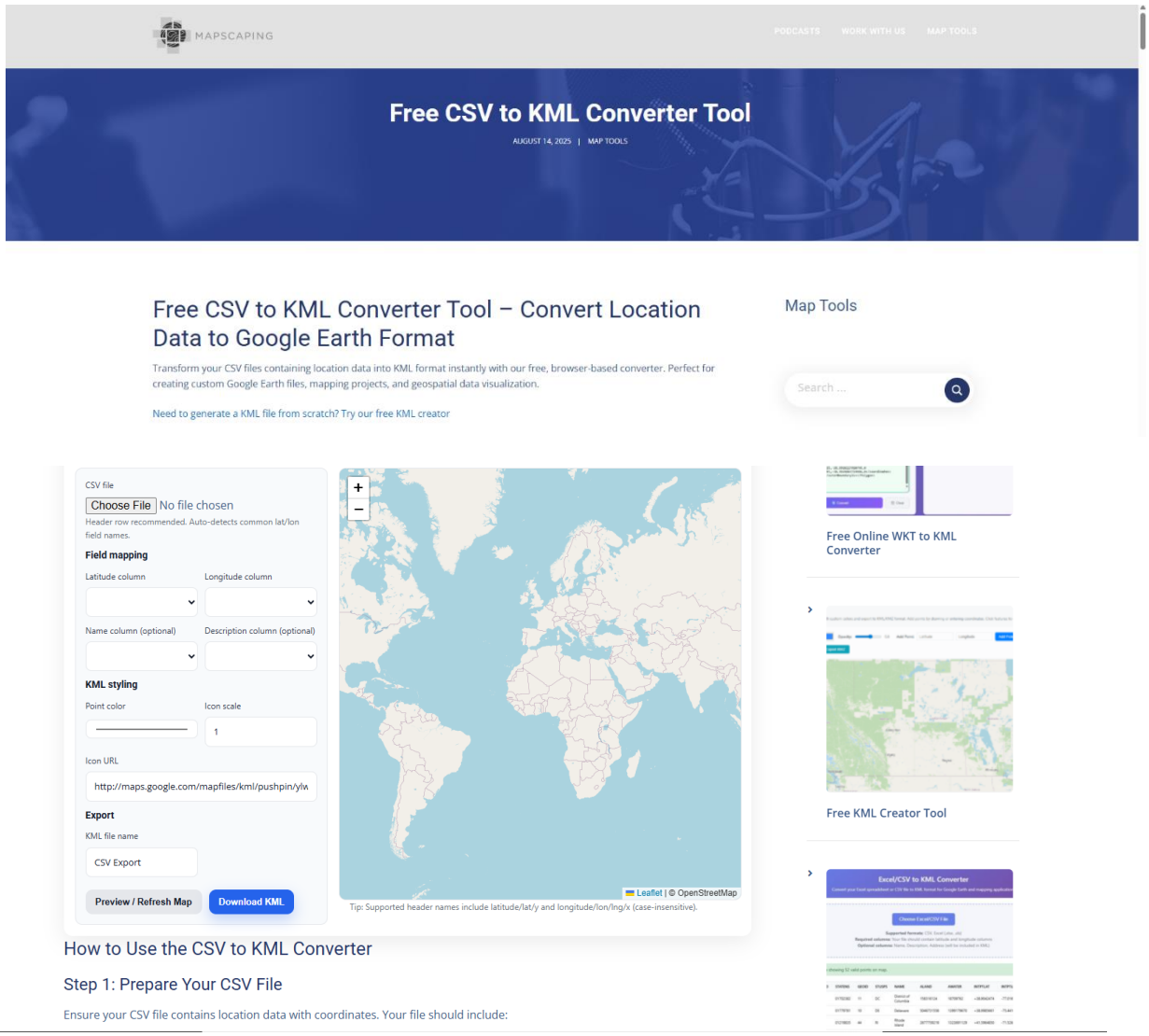
- *Click to open MAPS.ME.*
- *Click on the 3 horizontal bars*
- *Click on ☰ and then select "Download Maps".*
- *Name Liberia will appear, and then download the map.*

- Click Download. In this way you have successfully downloaded the country map. You only need to do this once. Ensure your location is enabled on your device. You can do this on the settings of your phone/tablet.
- Select ☰ and choose "Terrain" as map layer.
- Also, download the file containing the coordinates of the sampling locations and save on your phone (you need internet access for this). You will receive the file as an email attachment from the SDMT or your Supervisor. The file will be in CSV

format. This file format need be convert to KML for use in MAPS.ME, or GPX format for use in hand held GPS device.

Procedure to Convert CSV to KML /GPX using online software (Internet Access)

Website: https://mapscaping.com/free-csv-to-kml-converter-tool//



Steps: Click “Choose File” and select your CSV file

The tool automatically detects common column names like:

Latitude: lat, latitude, y, y_coord

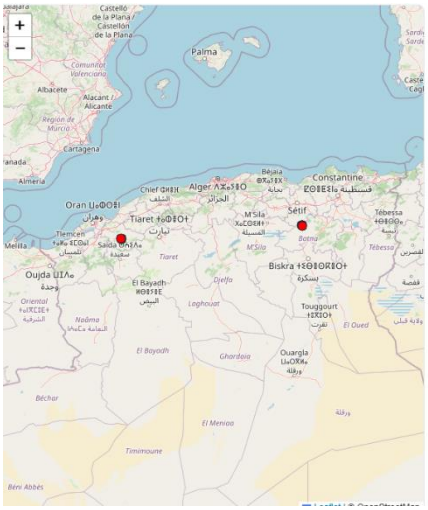
Longitude: lon, lng, longitude, x, x_coord

Name: name, title, label, id

Select Name Column: (Optional) Choose descriptive labels for map points

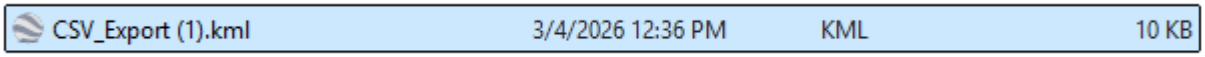
Point Color: Choose from any color using the color picker

Click “Preview / Refresh Map” to see your data plotted on the interactive map

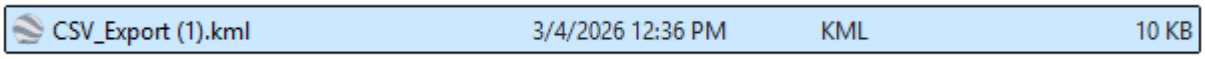


Verify all points appear correctly positioned

Click “Download KML” to save your file. It saves with the extension



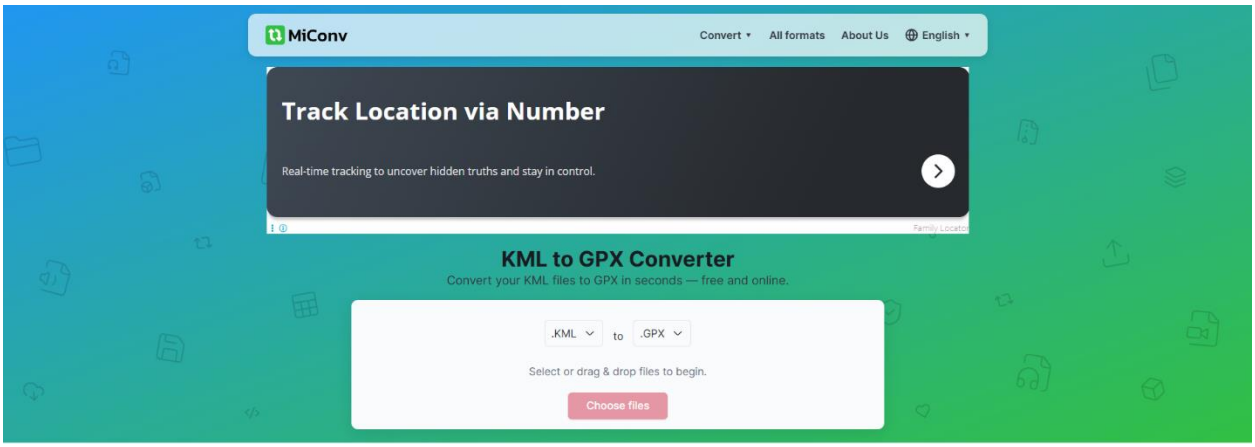
Copy from the computer and paste the KML file into the phone/tablet (Used download folder)



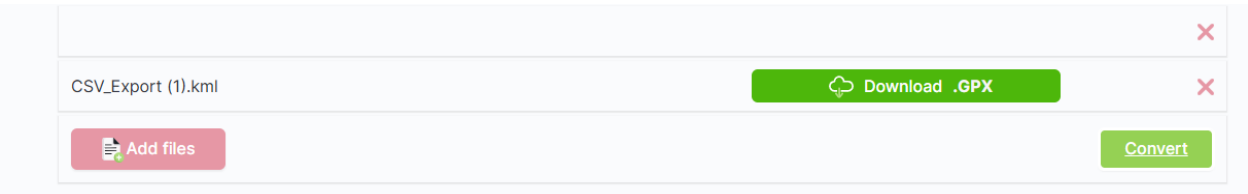
Convert the KML to GPX

Website: https://miconv.com/kml-to-gpx/

Steps: Click the “Choose files” button and upload your KML file



Choose “GPX” as the output format, then click “Convert”.



- Click to open the KML file containing the coordinates of the sampling locations which you have saved on your phone/tablet. Click on the file, some options to open the file will pop up (depending on the types of apps you have installed on your phone/tablet)
- Click on open with MAPS.ME. The app will open, and a message will pop "Bookmarks loaded successfully! You can find them on the map or on the bookmarks Manager". The message will disappear in less than 20 seconds.
- The points will be displayed by their name, which will be coordinate of the sampling point. For example on the MAPS.ME. interface when you click on the point the sample location name will appear. (LR001-2-1).

The files provided as GPX format it will be loaded into the GPS device.

Loading GPX file into handheld GPS device

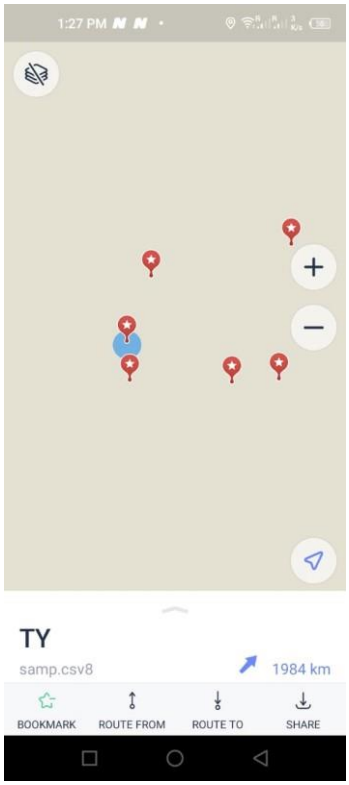
- You may need to connect your GPS device to the computer by using the GPS transfer cable
- Copy the downloaded GPX file from the computer to the GPS device
- Windows Explorer on the computer system, select the Garmin folder, and paste the GPX file into the GPX folder

Manual loading of points into a handheld GPS device (CSV file format)

- You may need to enter the coordinates of the points you have been assigned into your handheld GPS device particularly if for one reason or the other you lose the already saved points in the field. Do the following to manually enter the coordinates one after the other
- Power on your device and wait while it searches for a signal. Press the menu button to access the main menu
- Press the "Select" button to move to and select "Mark Waypoint."
- Select the "Location" field and select the coordinates you want to enter (Make sure the coordinates are in the same format used by the GPS. If not in the same format, you can change the coordinates format under "Position format" in "Settings" on your GPS device)
- Press "Done" when you have finished entering the fields and save with the sample ID, e,g. LR003-3-4
- Make any other changes you desire, such as notes or elevation, and click "Done" or "Go" (depending on your device) to save the changes

Navigate in the field using MAPS.ME app

- Open the MAPS.ME app
- Select in the menu bar and click the file name to open
- Select the point you want to navigate to. A screen will appear as in the example below (left)



- Click on "Route To". A line connecting your location with the selected point appears (see the picture above, right), select Car or walk

- Select car if you are far away from the point (>500 m) and the distance is motorable otherwise select A start bar will appear, click on "START" and begin navigating. Follow tracks in the field rather than cutting through the bushes. The app will indicate whether you are getting any closer.

Navigating using a handheld GPS device

Navigating using handheld GPS device follows the same steps irrespective of the type of GPS device. Now that you have loaded all points assigned to you on the GPS device, travel to a known location closest to the point. Switch on the GPS device as soon as you are about to be in doubt of your direction. An example of how to navigate using Garmin Etrex 10 device is provided below. The GPS can be used while still in the car to indicate the direction and distance to a point, but the instructions are intended particularly for navigating in the field when on foot or going by motorcycle.

- On the GPS device, scroll to "Waypoint Manager" and select the waypoint manager

- Select any of the points you wish to go to (Advisable to do the points closer to you first)
- A new page will appear with the 'Go'

highlighted and showing the coordinates of the point. Select the "Go" and follow the arrow (move in the direction the arrow points). Direction and distance to the point are indicated. If the distance is still large it is advised to find and use existing foot paths that bring you nearer to the point and navigate directly to the point, traversing the fields, when the point is in sight (within 50 – 100 m, for example

You can use the arrow keys on the device to zoom in and out for ease of navigation. Your device will either make a sound (Arrive at the point)

or read "0 m" when you are at the

point for sampling. Please take the soil samples as soon as the distance

to the point is 10 m or less

<u>How the field sampling points are organised</u>

For each 2x2 km^2 sampling cluster 21 field sampling points are provided. That is, for each of the seven (7) 1-ha sampling units three (3) sampling point locations are provided each identified by the sequential number 1, 2 or 3 (e.g., LR101-1-**1**, LR101-1-**2**, and LR101-1-**3**). The

seven (7) 1-ha sampling units are likewise identified by a sequential number from 1 to 7 (e.g., LR101-**2**-1). The first four (4) 1-ha sampling units are considered in first instance. The 1-ha sampling units with sequential number 5, 6 or 7 are backup locations and only to be considered if one of the four 'original' sampling units are rejected. That is, the 1-ha sampling unit with sequential number 5 is considered as the first alternative for the rejected point. The 6th 1-ha sampling unit is considered only if a second point of the original four is rejected, and the 7th 1-ha sampling unit is the alternative point location for the third point rejected from the original four. The same principle applies to the three (3) field sampling points for each of the 1-ha sampling unit. Start with point 1, and only move to point 2 and subsequently point 3 if the field sampling point is rejected.

In the field – Navigating to the sampling point location and getting permission for conducting the survey

Before collecting any soil samples, familiarize yourself with the overall sampling area and the people living there. In most instances it will be helpful to introduce yourself to the local authorities and communities to inform them about the purpose of the soil survey you are conducting and to get their approval. In case points are located on privately owned land you will need to seek permission to enter and collect soil samples and survey data.

It is generally helpful to assess how close you can get to the Secondary sampling unit (SSU) by car (safely). Park the car in a safe area. If the distance to the sampling point locations is far, record the location where the car is parked as waypoint on your GPS device or on your phone using Maps.me, for ease of finding your way back to the car after the field survey has been concluded. If you had already observed that the distance to the sampling point locations is far from where the car will likely be parked, you should arrange for transport by motorcycle. You move to the first field sampling point of the 1-ha sampling unit that you have targeted, before considering field sampling point 2 and 3.

Further suggestions for navigating in the field are provided in the instruction manual.

Accepting/Rejecting the sampling point

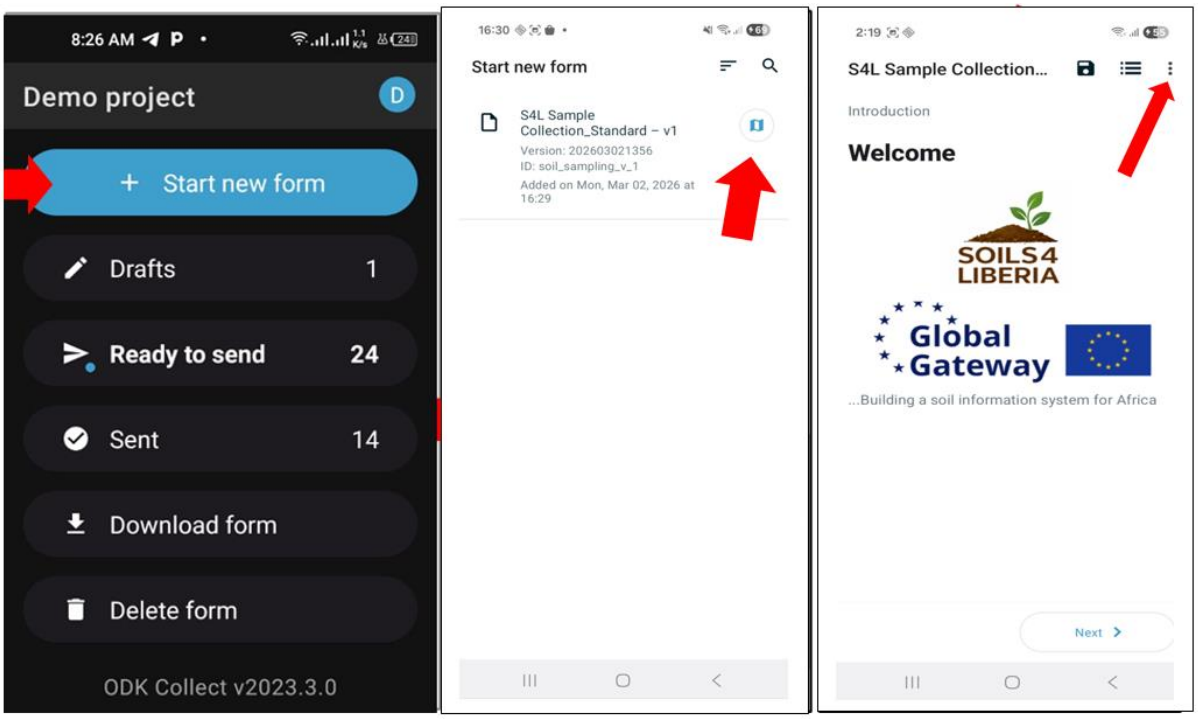
You arrive at the sampling point location once you are within 10 meters of the designated location. At this point you will need to determine whether it is a valid sampling point, and either accept or reject it and indicate the reason for rejecting in case it is not a suitable point.

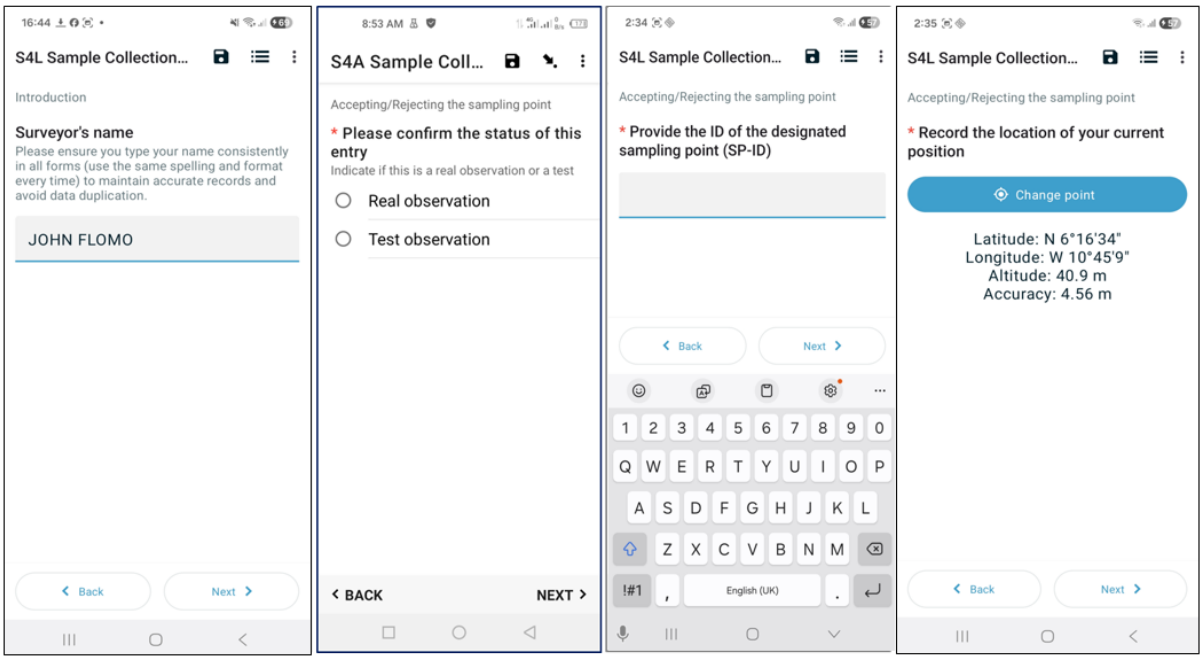
It is possible that you are not able to reach the designated sampling because of impassable terrain, obstructions you find on your way, or access is denied. In that case you record the coordinates of the current location, the distance to the designated sampling point location and the reason why the point cannot be reached.

Recording of the acceptance or rejection of a point is done using the ODK form. The steps are indicated in the diagram below.

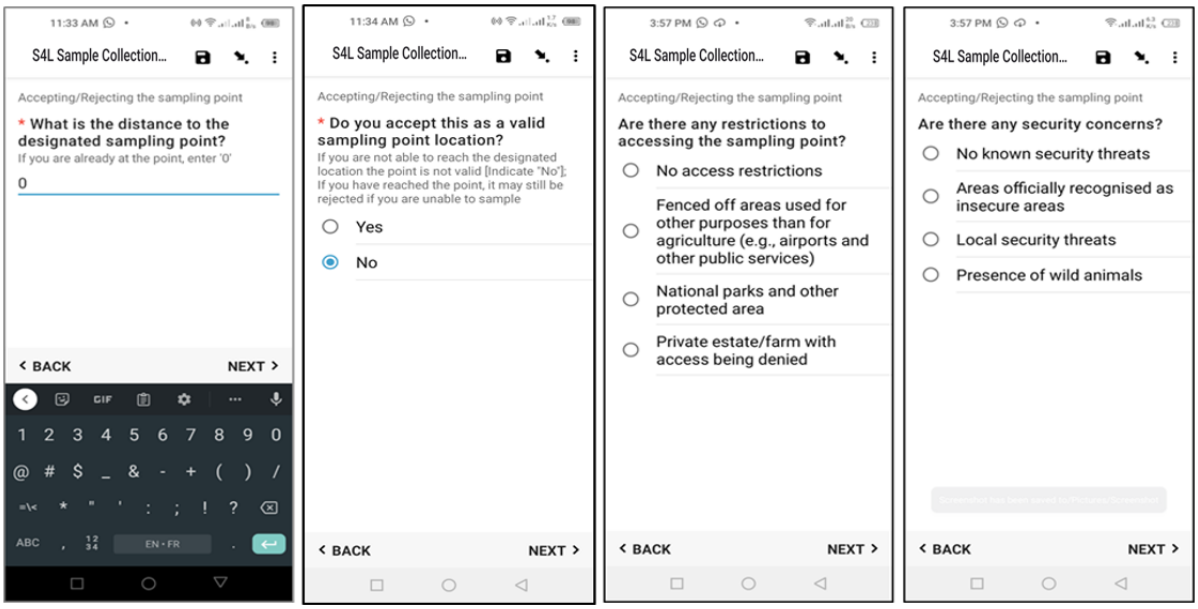
- *ODK Collect opening screen and option to select → Start new form*
- *Select form 'S4L Sample Collection_Standard'; Ensure you download the latest version.*

- *ODK Collect – Your name? Please ensure you type your name consistently in all forms (use the same spelling and format every time) to maintain accurate records and avoid data duplication.*
- Indicate if this is a real observation or a test
- Select country
- *Record the location of your current position*
- *Provide the ID of the designated sampling point (SP-ID)*

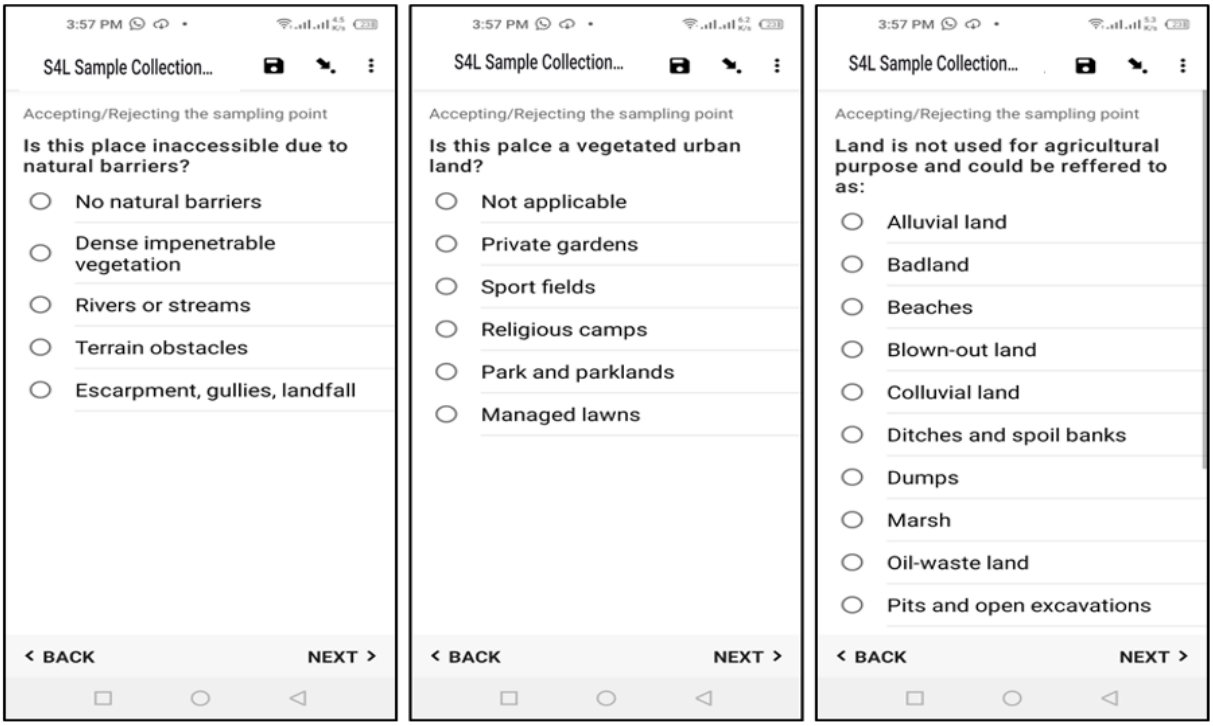


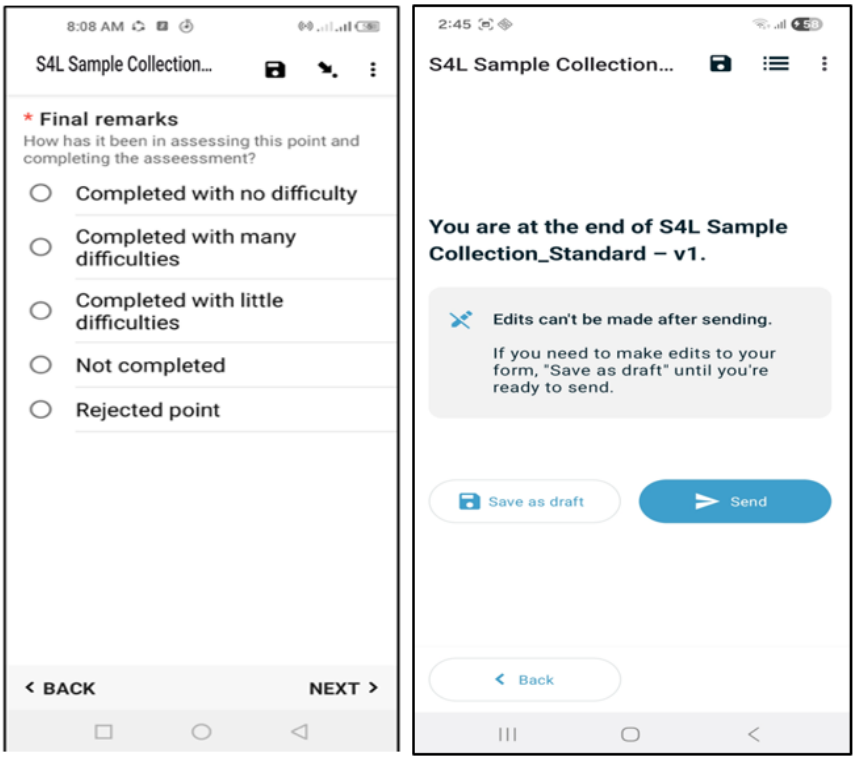


- *What is the distance to the designated sampling point?*
- *Do you accept this as a valid sampling point location? "If you are not able to reach the designated location the point is not valid [Indicate "No"]; If you have reached the point, it may still be rejected [If YES move to the next section; if No move to the next screen]*
- *What is the reason for rejecting the sampling point? (See the list of options and select the appropriate)*



- *"If you have not reached the point, take a picture from your current location in the direction of the designated sampling point. If you have reached the point, take a picture either vertically down or to the side, whichever illustrates best the reason for rejecting the point".*
- *Final remarks –select "rejected point"*
- *"No further data needs to be recorded for this site" → Safe Form and Exit*





Observations on soil layers and soil sampling

Several observations need to be recorded on the soil layers; this is done based on the soil taken out using the auger. There are three layers on which observations need to be made. The first layer, which is from 0- 20 cm corresponding to the topsoil. The second layer is the 20

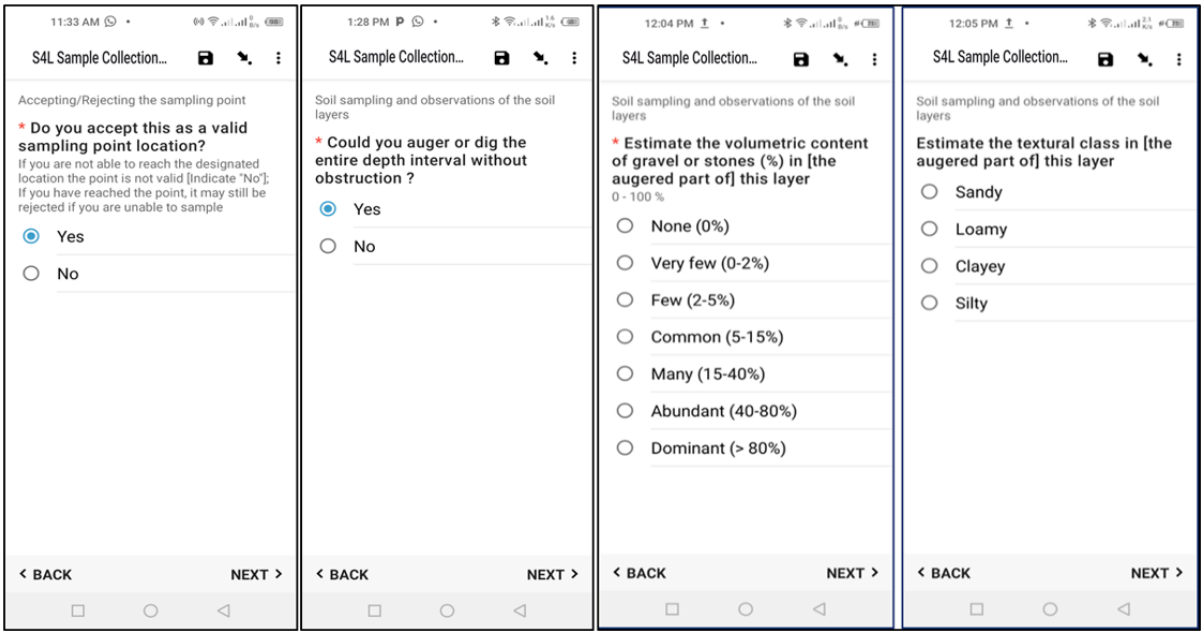
- 50 cm depth which is the subsoil layer, and the third layer is the depth beyond the 50 cm soil depth. In each of the layers, the following soil observations are recorded:

- Percent gravel or stones
- Basic textural class
- Soil matrix colour (dominant colour)
- Presence/absence of mottles
- Soil depth (in case of restrictions in soil sampling)

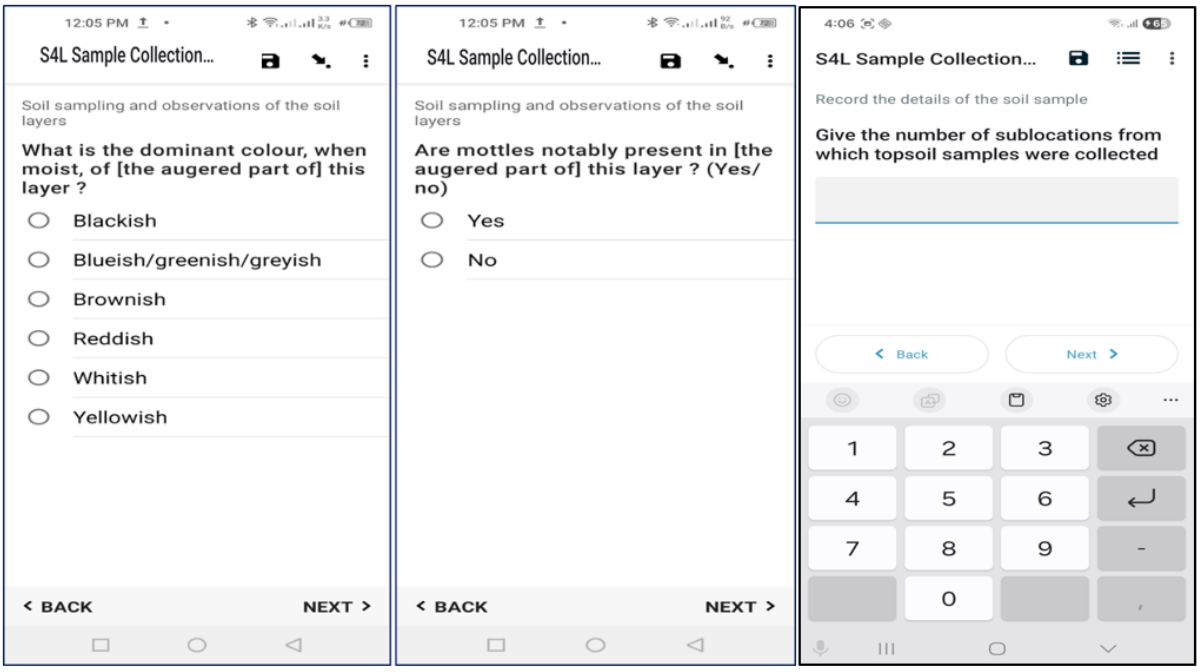
All the above data are expected to be provided for each layer except when a restriction occurs. For instance, if restrictions occur within the 0-20 cm, you are not expected to fill in the 2nd and 3rd layers and if restrictions occur in the 2nd layer you are not expected to fill in the 3rd layer.

The designated sampling point location that you have arrived at is the centre of the sampling plot and this is point where the observations on the soil layers are done in principle but could also be done on any of the sub-locations of the sampling point.

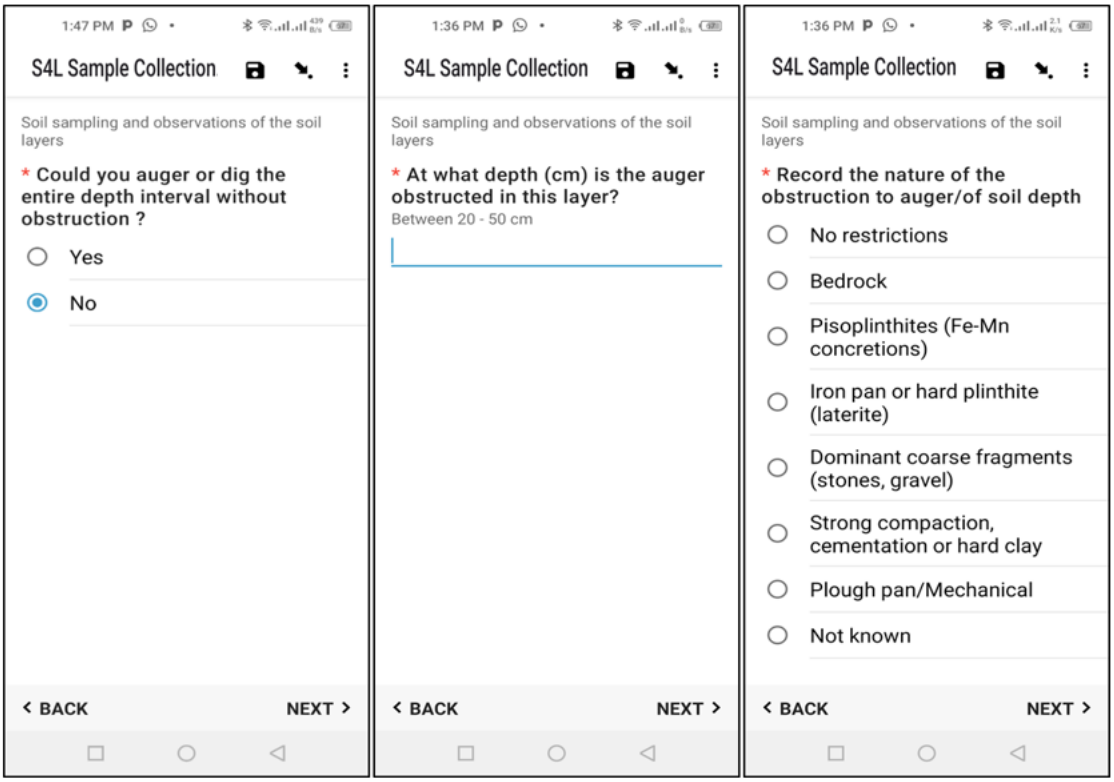
Note, while doing the observations, the soil taken from the 0-20 cm and the soil taken from the 20-50 cm layers are taken apart and put in the respective buckets to be part of the composite soil samples of the topsoil and subsoil layers. See further the section on 'Taking composite soil samples'.



For each soil layer the question will be asked whether you have been able to auger the entire depth interval and if "Yes", you will be asked to provide the stoniness, the textural class, the dominant colour of the soil matrix, and to indicate the presence of mottles.



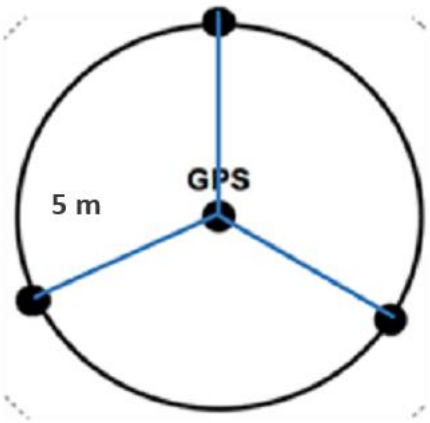
If you have not been able to auger the entire depth interval you will be asked to indicate the depth at which the restriction occurs (in cm) and indicate the nature of the depth restriction. This is repeated for subsequent soil layers.



Take composite soil samples and label them

Once you have completed the description of the soil layers, you will proceed taking top- and subsoil samples from the other three sublocations. The soil sample is a composite soil sample with subsamples taken from four sublocation as outlined in the graph below. The soil samples are taken using the soil auger has explained in the instruction manual.

Proceed taking samples from the points located at the circle with a radius of about 5 m from the centre point at equal distance from each other:



- At the centre of the plot use your marked soil auger and take a sample of the topsoil (0-20cm)
- Take the subsoil sample (20-50cm) following instructions from the instruction manual
- From the centre point take three steps in the direction of one of the legs of the Y frame and take a topsoil sample and put in the plastic bucket named “topsoil” and take a subsoil sample and place it in the other bucket named “subsoil”
- Repeat the procedure for the other two remaining sub-sample locations (from the centre point take three steps in the direction 120° from the direction of the previous sub-sampling location - either clockwise or anti-clockwise and then do the last sub-sampling point)
- Place all the (0-20 cm) topsoil sub-samples into the same plastic bucket and mix them thoroughly.
- Do the same for the (20-50 cm) subsoil samples, in a separate bucket.
- Place ~500 grams of well-mixed (0-20 cm) topsoil soil into a plastic sampling bag and seal or close; put the plastic bag in the paper or cloth bag (double bagging principle) and write the Sampling Point ID (SP-ID) together with dash T (“- T”, indicating ‘topsoil’) in block letters on the outside. Add a duplicate QR code as Soil Sample-ID to the bag (unless the bags are pre-labelled).
- Repeat the procedure for the subsoil sample: place ~500 grams of well-mixed (20-50 cm) subsoil soil into the plastic bag and seal. Put the put the bag with the sample in a paper or cloth bag and write the SP-ID together with “- S” (to indicate ‘subsoil’) clearly readable on the bag; add a duplicate QR code as the soil sample ID.
- Do not seal the 2 (top & subsoil) sample bags just yet, as the QR code labels will need to be scanned in with the Soil sample ODK form (see below).

Note that under dry conditions it is often useful to wet the auger location with a small amount of water before collecting the samples. Depending on soil texture and the moisture of the soil being collected, wetting can be repeated as soil is recovered from an auger hole. Make sure that you clean the soil auger before taking samples at any (sub-) sampling location to avoid that subsoil of the previous location is mixed with the topsoil sample of the current location

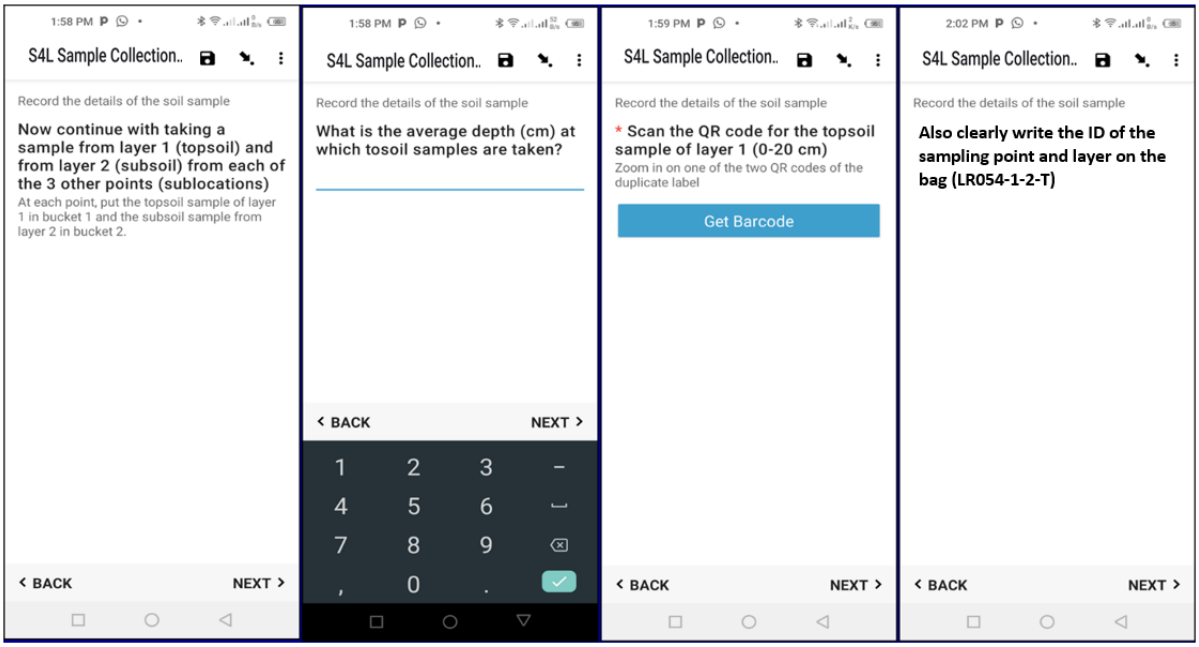
Record your samples using the "S4L Sample Collection_Standard" ODK form

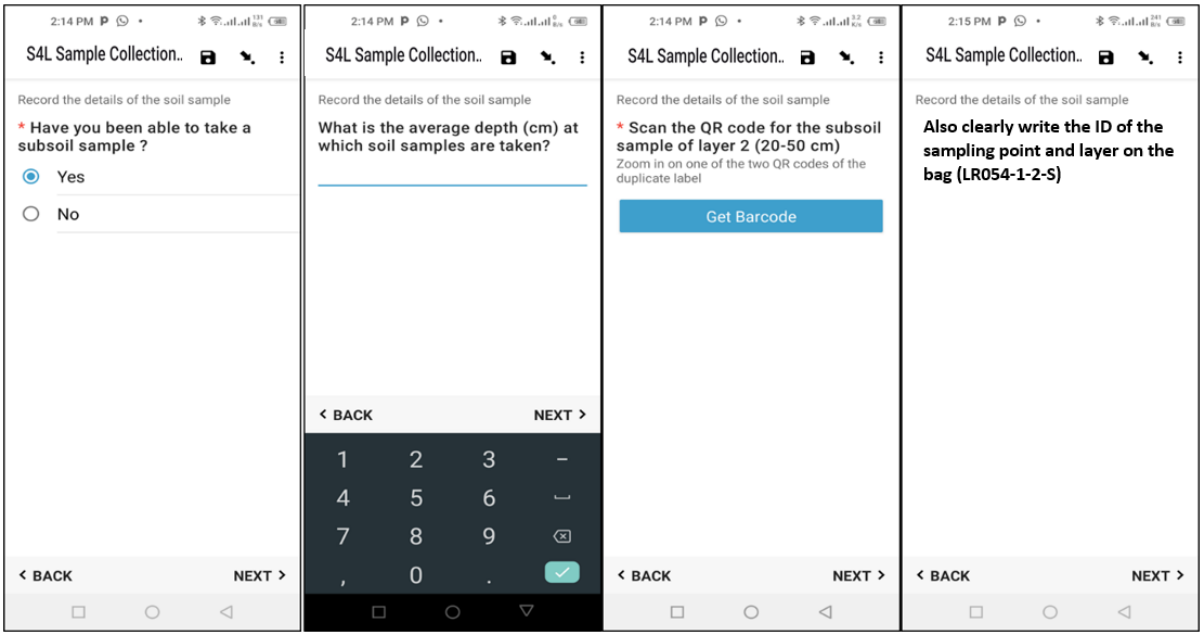
The S4L Field Survey ODK form is intended to allow you to record a uniquely identified, georeferenced, and time-stamped soil sample into the Soils4Africa database.

For any valid sampling point, a topsoil sample is taken at least and the corresponding QR code should be read. If there are depth restrictions

If it is not possible to take a subsoil sample, indicate such in the ODK form and skip to the net screen.

- *Indicate the average depth at which samples are taken in case there are depth restrictions*
- *Scan topsoil sample label (zoom in on one of the two QR codes of the duplicate label)→ Get Barcode*
- *Write the ID of the sampling point on the bag*
- *Have you been able to take a subsoil sample → Y/N (if Y go to next screen, if N skip to next section)*
- *Indicate the average depth at which the subsoil samples are taken*
- *Scan subsoil sample label (zoom in on one of the two QR codes of the duplicate label)→ Get Barcode*
- *Write the ID of the sampling point on the bag as indicated on the screen*
- *Close the sample bags*





Observations on soil characteristics (drainage)

For the soil characteristics we observe the drainage condition which is determined by the presence of mottles within the soil profile. The drainage condition is recorded by class and is determined by the colour of the soil matrix and depth at which mottles occur. It is explained in detail in the instruction manual and a brief description is provided in the form so that correct option can be selected.

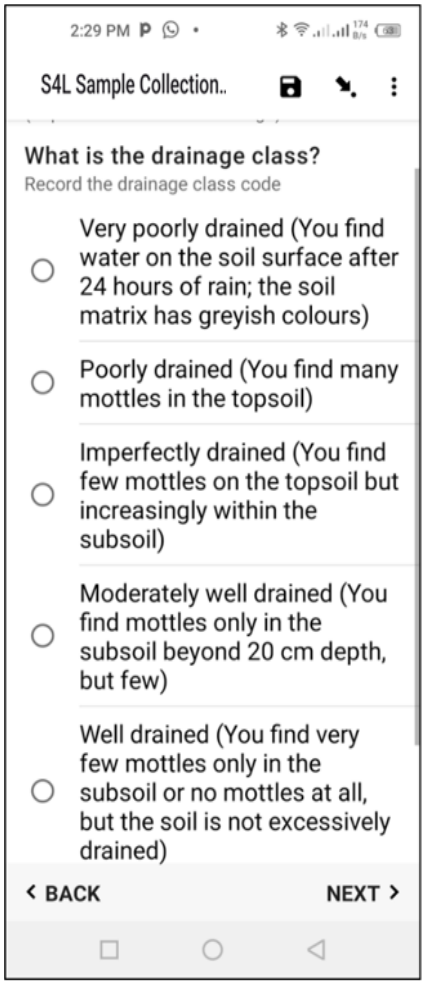
Observations on site characteristics (soil surface and terrain)

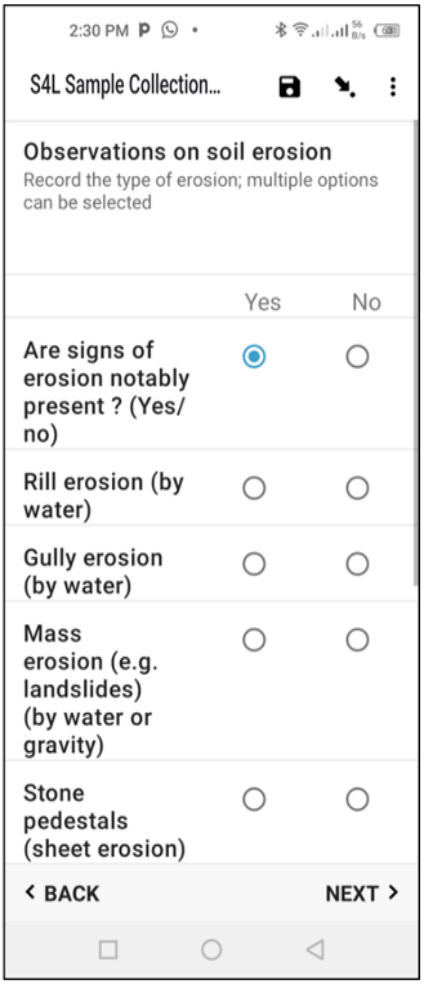
The observations refer to soil erosion, stoniness, slope condition (steepness and slope convergence) and landform. The observations refer to either the type (i.e., for erosion) or the degree or severity (in case of stoniness) which is based on the percentage surface cover. The window of observation will be different for the various type of observation. Pictures are taken to provide pictorial evidence and confirmation of the data entered.

Record observation on soil erosion

Observations on water and wind erosion are recorded. For water erosion, it is the type of erosion that is recorded. Sheet erosion refers to soil that is removed and transported over

the surface as a sheet of water is left out because it is very hard to determine in the field. Instead, we have included 'stone pedestals' and 'stone pavement' as observational categories. Details are provided in the instruction manual. Stone pedestals or stone pavement as well as erosion rills should be observed in the area within a 16m radius from the centre of the plot. For 'gully erosion' it qualifies if gullies are observed within a 36m radius from the centre point. If there are quite big and deep gullies within the SSU (the one ha surrounding the sampling point) it qualifies as well.





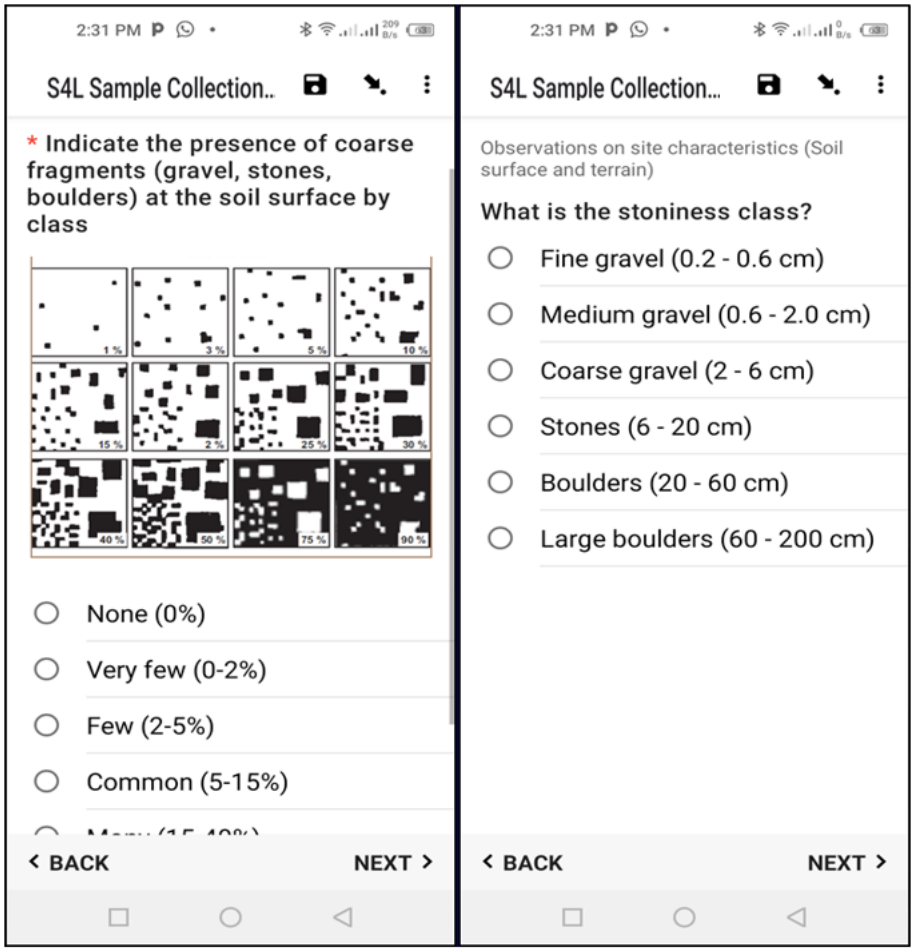
Record the types of erosion that are observed in the direct surrounding in the ODK form

- *Record the type of erosion; multiple options can be selected*
- *Indicate whether there are clear signs of wind erosion (Y/N)*

Record observations on surface stoniness

For stoniness we only observe the cover percentage for stones, boulders, and large boulders; that is for coarse fragments larger than 6cm in diameter. You consider an area of approx. 800m^2 (area with a radius of ~16m) to get positive confirmation of the presence of stones and estimate the cover percentage. For boulders and large boulders, you may even consider the area within a 35m radius to get confirmation of its presence and to get a reliable estimate of the surface cover percentage.

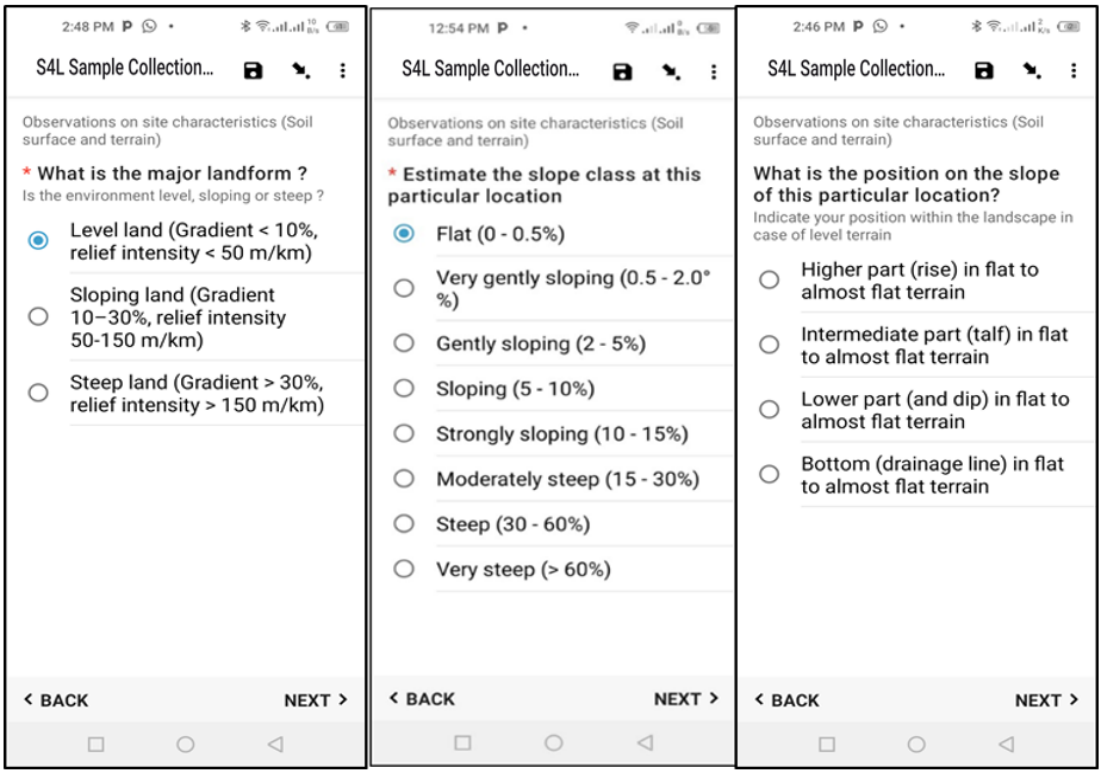
- Record the stoniness class in the ODK form
- *Record the stoniness class (only one value can be entered)*

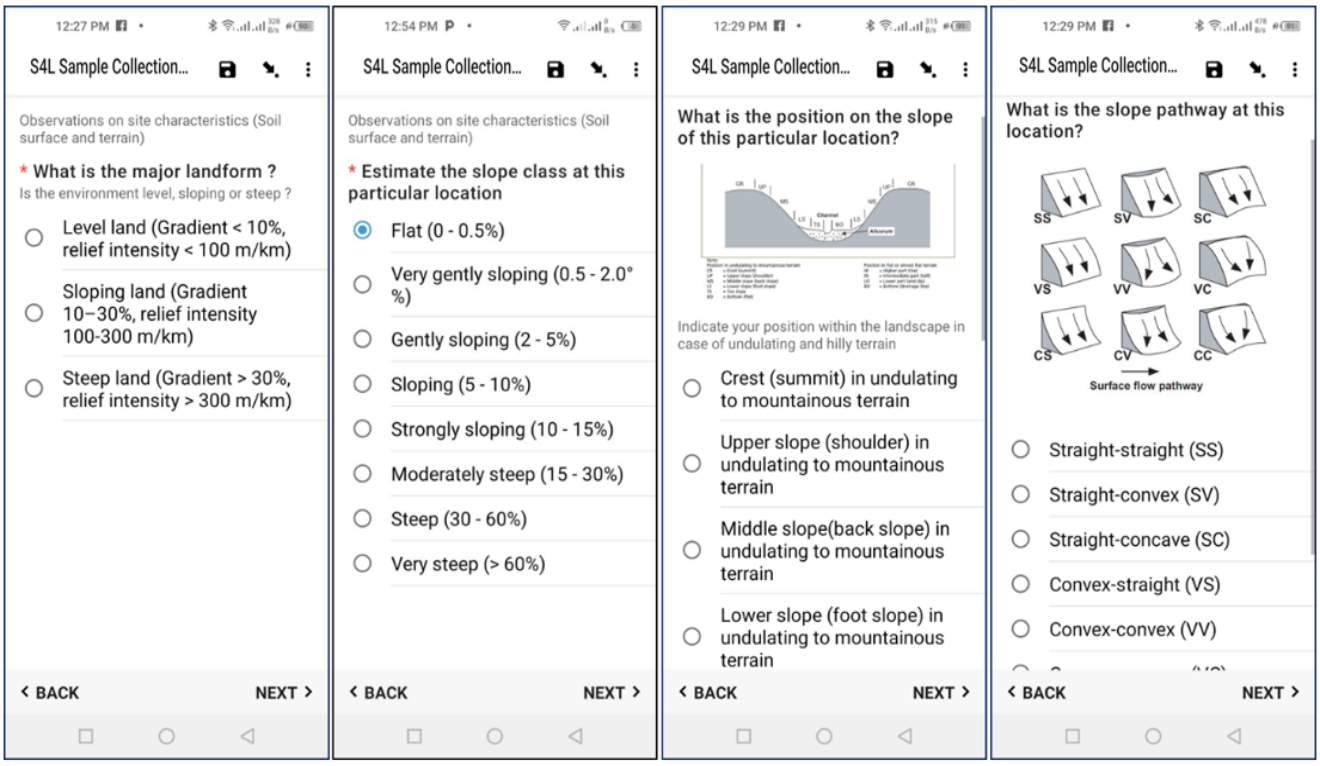


Record slope condition and landform

The slope steepness is recorded as the slope class of the dominant slope within a one-acre area (circular area with a ~35m radius). The same window of observation is used for the observation of slope convergence. The landform refers to a wider area. For hilly terrain, the position within the landscape is recorded

- *Indicate the major landform → (only one value can be entered)*
- *Indicate the slope class of the dominant slope*
- *Indicate your position within the landscape*
- *Choose the slope pathways that apply to the area under observation in case of undulating and hilly terrain.*
- *Take vertical, horizontal, and perpendicular pictures of the soil surface*



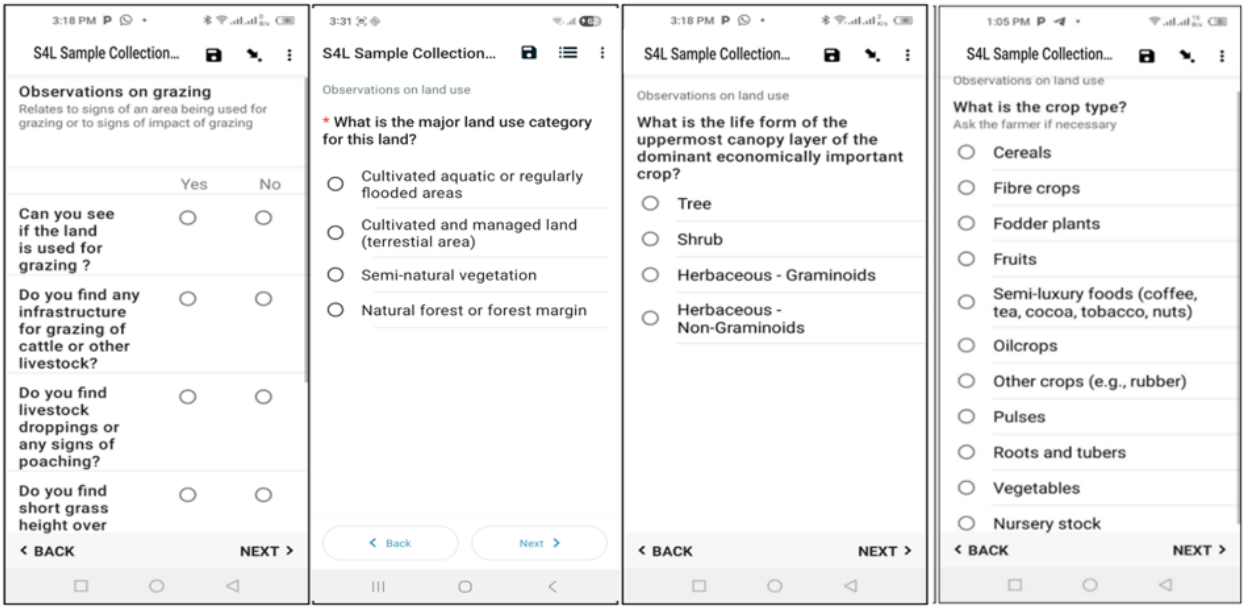


Observations on land use and land cover

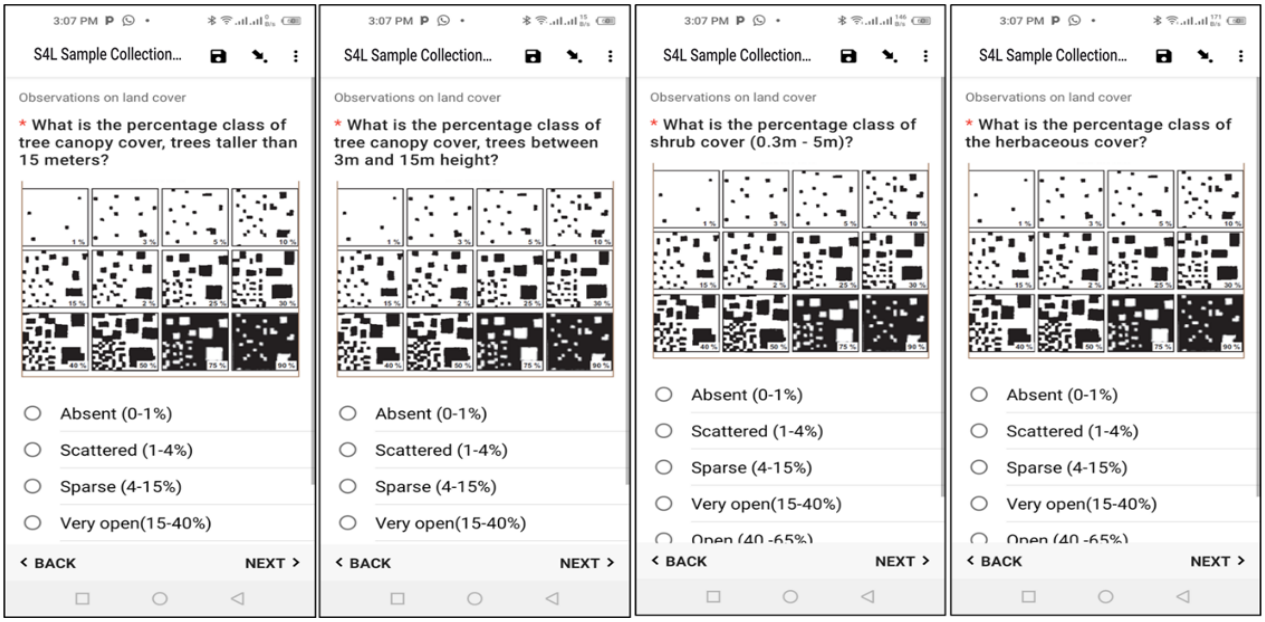
Observations on land use are made on a different scale from the scale at which observations are made on the soil or soil profile (i.e., the TSU, or the circular sampling plot encompassing 25m^2). Rather the secondary sampling unit (SSU) provides the window of observation for land use and land management practices. However, a 1-ha area might be difficult to oversee in some cases, and therefore the area of about 1000m^2 in size, surrounding the sampling point

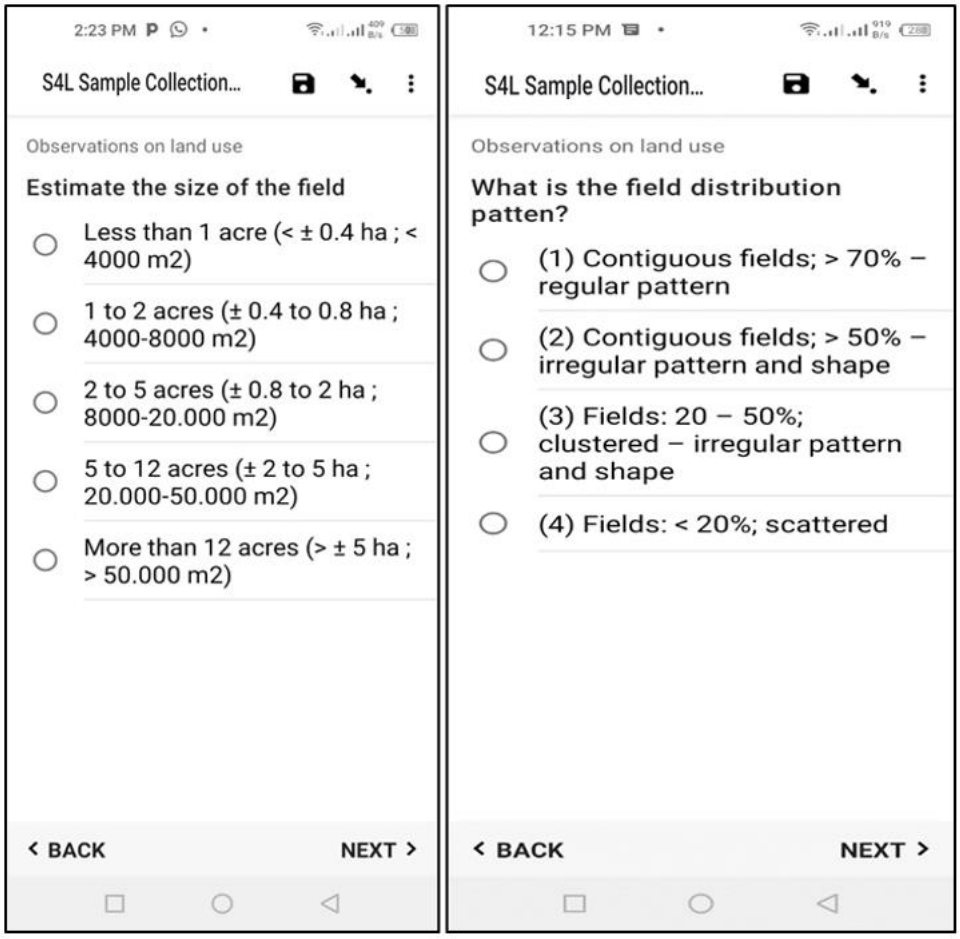
location might be used as a window of observation for practical purposes. This corresponds to a circular area with a radius of 17.8, let's say about 20m.

- Record the percentage class of tree canopy cover, trees taller than 15m, and also for trees between 3m and 15m in height.
- Record the percentage class of shrub cover
- Record the percentage class of the herbaceous cover
- Indicate if there is any sign of grazing
- Indicate the major land use category for this land
- Record the life form of the dominant, economically most important crop



- Indicate the crop type
- Indicate the field size and the field distribution pattern



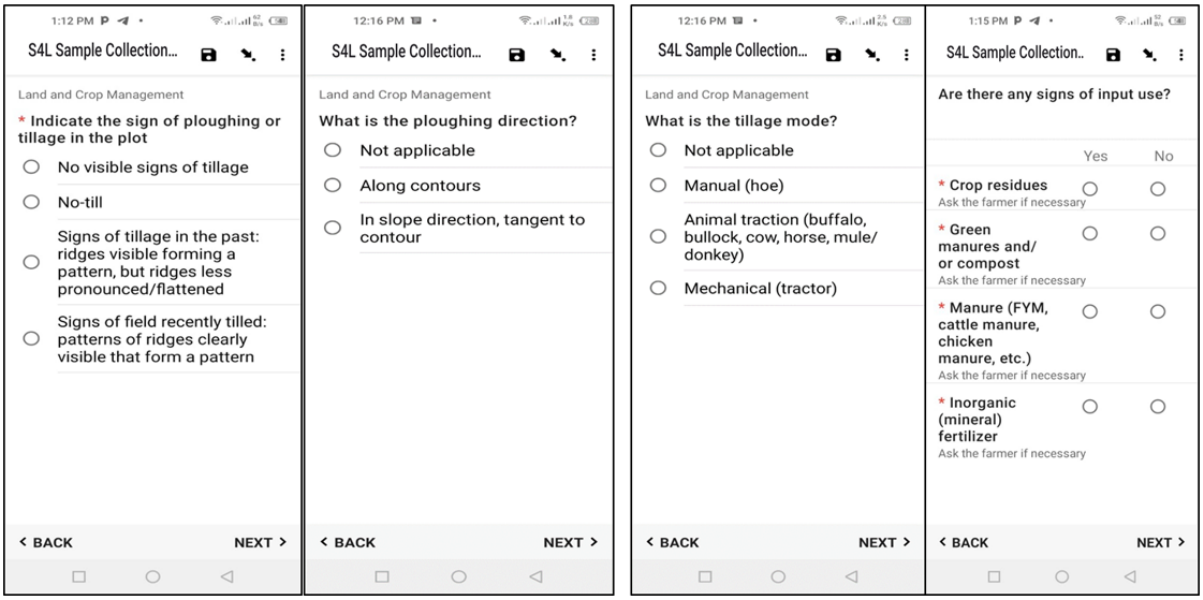


Observations on land and water management

Land and crop management

Land management data is collected about land preparation; information on crop management is about the use of input. Both provide information on land use intensity, though not very specific. For these two classifiers, the information can be obtained by observation in the field.

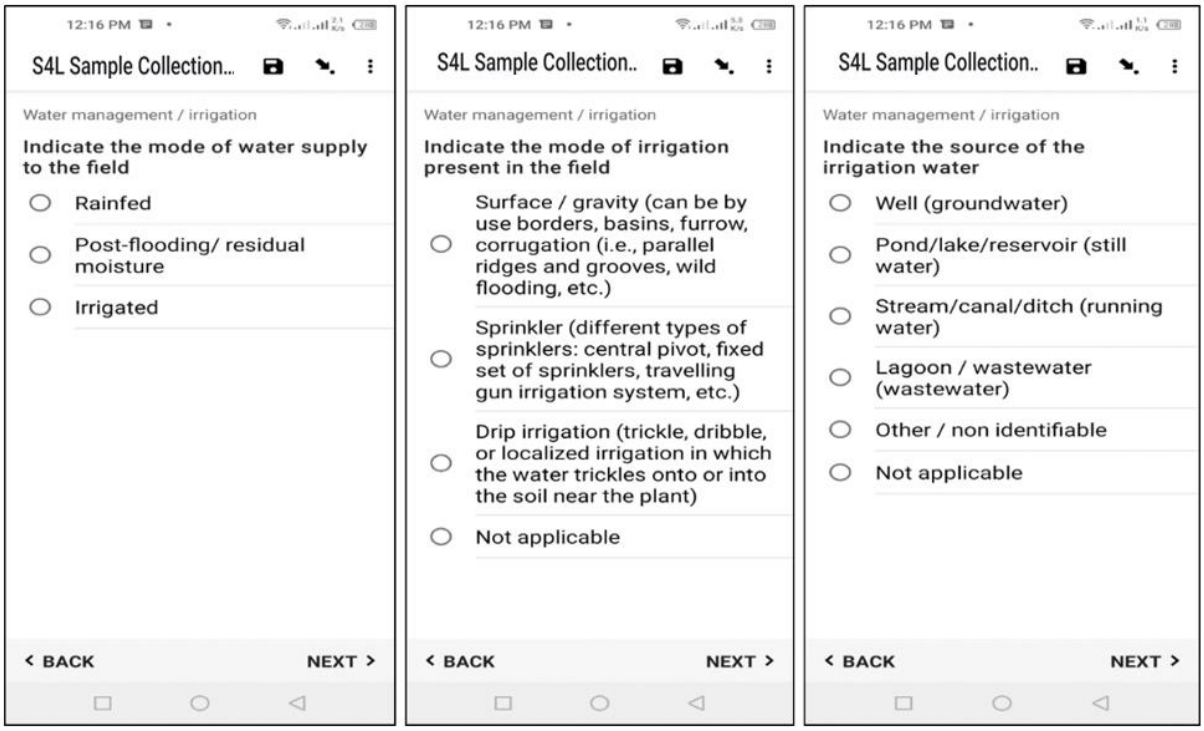
- Indicate the sign any sign of ploughing or tillage in the plot
- What is the ploughing direction?
- What is the tillage mode?
- Indicate if there are any signs of fertilizer use within the plot



Water management/ irrigation

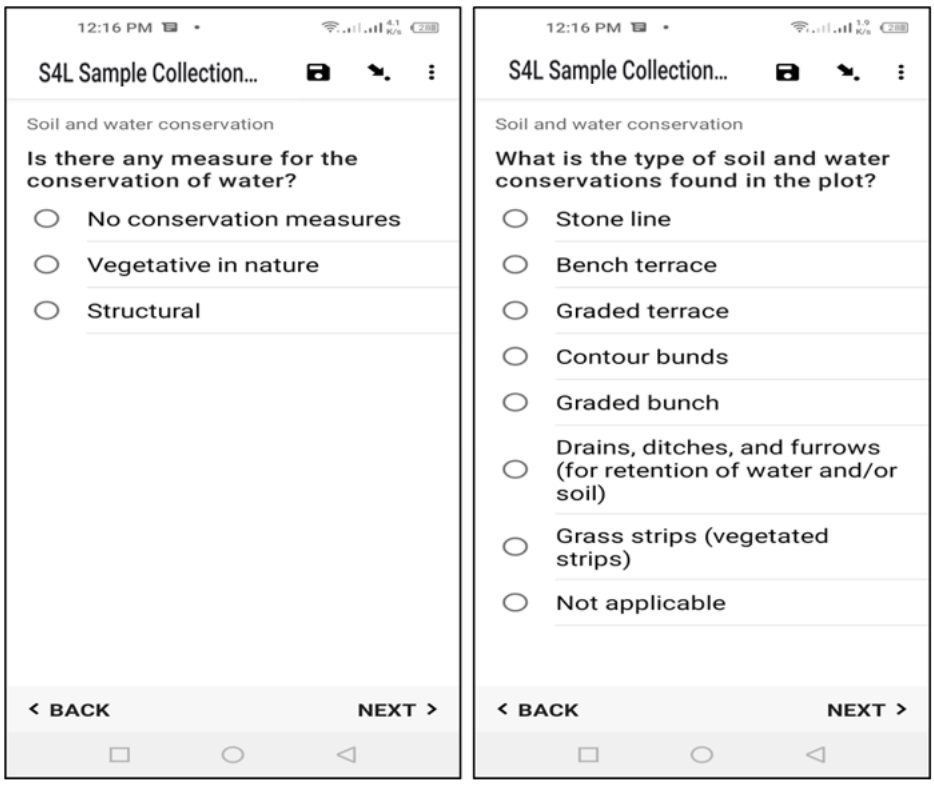
Water management applies to the 'cultivated and managed terrestrial areas'. It does not apply to the (semi-)natural vegetation areas and for the cultivated aquatic areas, the water management is inherent in this type of land use and does not need to be further specified. This section deals with cultural practices related to the water supply to the crop.

- Indicate the mode of water supply to the field, mode of irrigation, and the source of the irrigation water



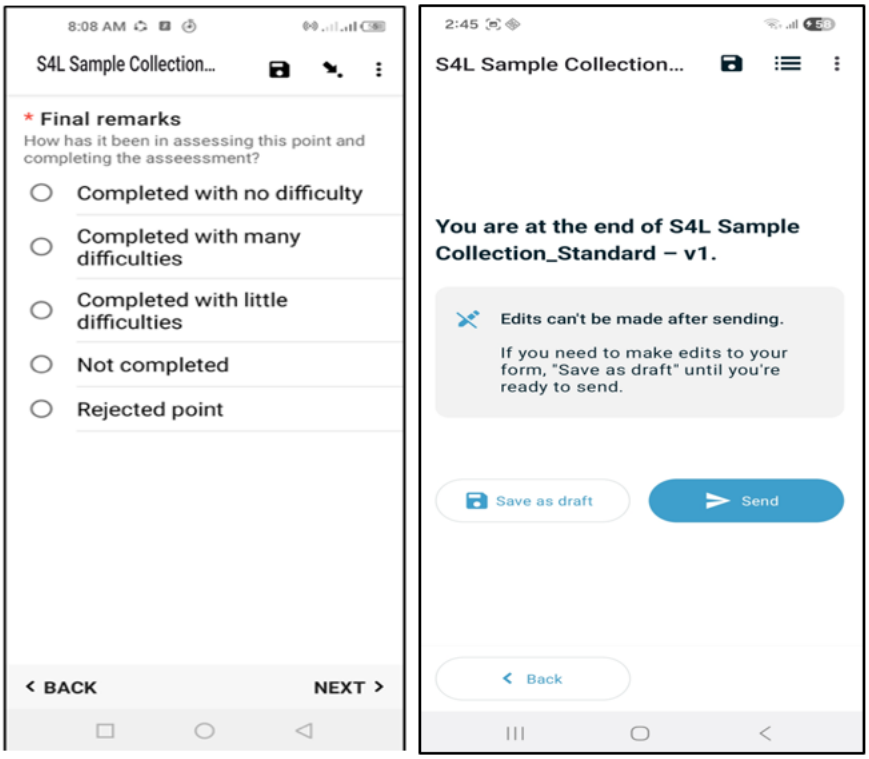
Soil and water conservation

Recording of soil and water conservation measures applies to the cultivated and managed terrestrial areas and to 'cultivated aquatic and temporary flooded' areas. The distinction is made between vegetative and structural measures. Vegetative measures make use of planting barriers (vegetative strips), life fences, and wind barriers, whereas structural measures involve mechanical work to modify the slope, construct banks, dig ditches, and other measures that change the physical appearance of the land surface. Conservation measures that have to do with agronomic practice and farming methods are not included, because these are difficult to observe directly in the field.



Close and move to the next point

- Select the appropriate remark in the final remark section. Please note only one option can be selected.
- Ensure the 'Mark form as finalized' is selected.
- Click 'Save Form and Exit'
- Close the ODK collect app and move to the next point



Back from the field

Login your samples to the database

- Once you are back from the field or at a place with an Internet connection, you should upload all of your saved forms to the ONA server. All you need to do is to open ODK and then select “Send Finalized Form” from the main screen of ODK. This will prompt you to upload the saved forms on your device.
- Our recommendation is to upload your saved forms as regularly as your Internet access in the field/office permits every day.

Alternatively,

1. In **ODK Collect**, go to **Settings** → **General Settings**.
2. Go to **Access control** → **User Settings**.
3. Tap **Auto Send**.

The next step is to prepare the samples for transport to the UL lab.

- First, air-dried the samples in an open and clean environment but not directly under the sun
- Ensure the labels and the barcodes are intact
- Once the samples are properly dried, pack them properly and send them to your supervisor for onward transport to the University of Liberia.