



LandPKS

Training Manual

African Technology Policy Studies Network (ATPS)



LandPKS Mobile App

Training Manual



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The African Technology Policy Studies Network (ATPS) is a transdisciplinary network of researchers, policymakers, private sector actors and the civil society promoting the generation, dissemination, use and mastery of Science, Technology and Innovations (STI) for African development, environmental sustainability and global inclusion. In collaboration with like-minded institutions, ATPS provides platforms for regional and international research and knowledge sharing in order to build Africa's capabilities in STI policy research, policymaking and implementation for sustainable development.



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1. Introduction

This training manual has been developed to assist users to learn how to use the LandInfo App for collecting information on soil and climate characteristics in order to make informed decisions on agricultural production and sustainable land management practices. Users will be taken through a brief description, functional abilities and step-by-step learning process of the LandInfo App.

2. Description of the LandPKS App

The LandInfo App is a mobile technology application produced from the Land Potential Knowledge System (LandPKS). The App allows individuals and organizations to use a smart mobile phone to determine land potential at a specific location based on local and global knowledge and information about the potential of similar types of land (i.e. land with similar climate, soils and topography). The LandInfo App currently operates on google android and iOS platforms, connected to a more sophisticated web tools that can be accessed via personal computers and linked with other decision tools.

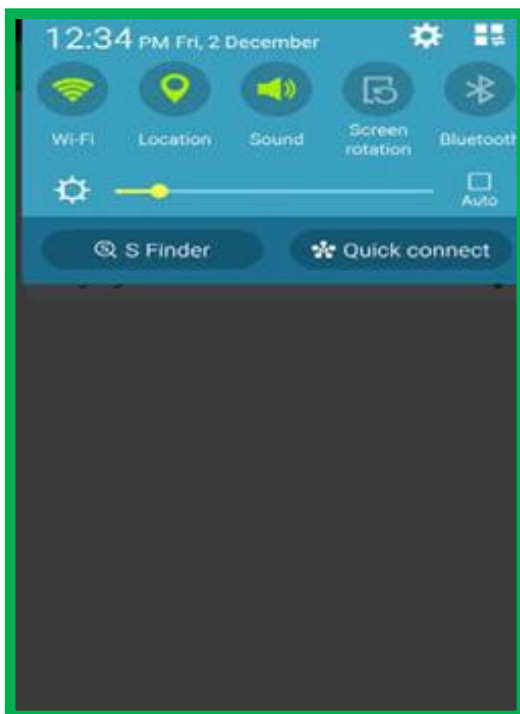
Tapping into recent advances in cloud computing, digital soil mapping, Global Positioning System (GPS) enabled camera phones, the LandInfo App allows users to enter point-specific information about soil texture, topography and easily observable soil properties and in turn obtain site-specific data including temperature, rainfall, estimated amount of water the soil can store for plants, and growing season length.

Field data are captured into the LandInfo App by two ways. First, a field of observational assessment of the land cover type, use, slope, slope shape, occurrence of soil erosion, runoff and soil conditions is conducted and data is inputted into the App. Second, in order to examine the soil texture, up to 1 meter depth of soil is excavated showing the different layers and types of soil layers.

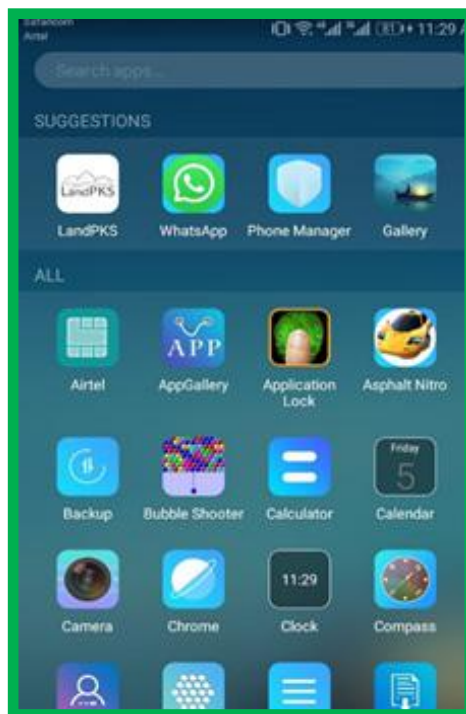
3. Functional abilities of the LandPKS mobile app

Users of the LandInfo App will have the opportunity to provide data to feed into the app through a iterative series of feedbacks, observations and field soil testing. Together with additional information on local management practices, this information will be used to provide a set of site-specific management options, with an indication of potential production choices, productivity and erosion risk. Users will be trained on how to accurately use the application to provide and obtain data. The illustration below provides detailed slides of the interfaces of the LandInfo App, the process of data input and expected output.

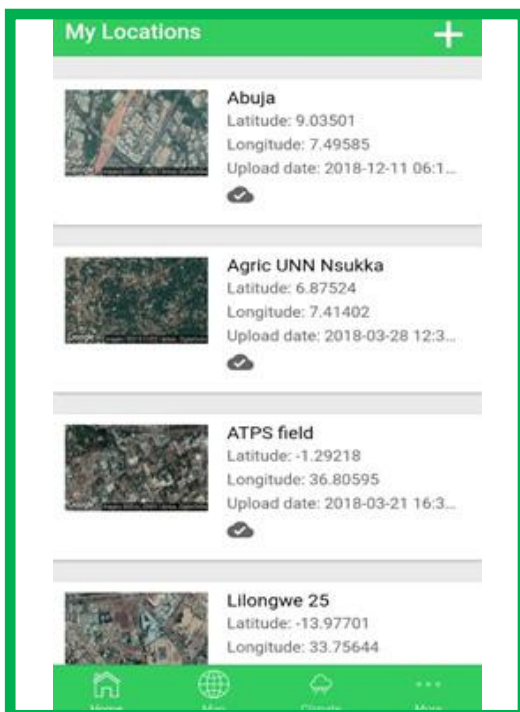
Before you initiate the LandInfo App, always ensure that your phone GPS or Location is active. This is a very crucial step to allow the phone to receive GPS data coordinates from the satellites.



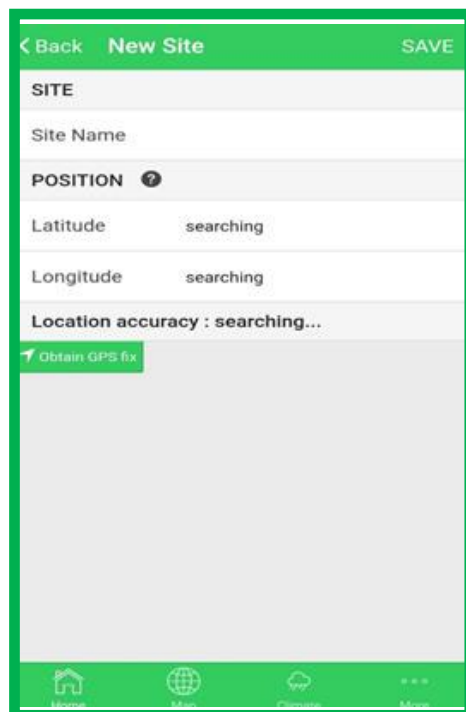
The mobile phone GPS or Location must be switched on prior to starting the app



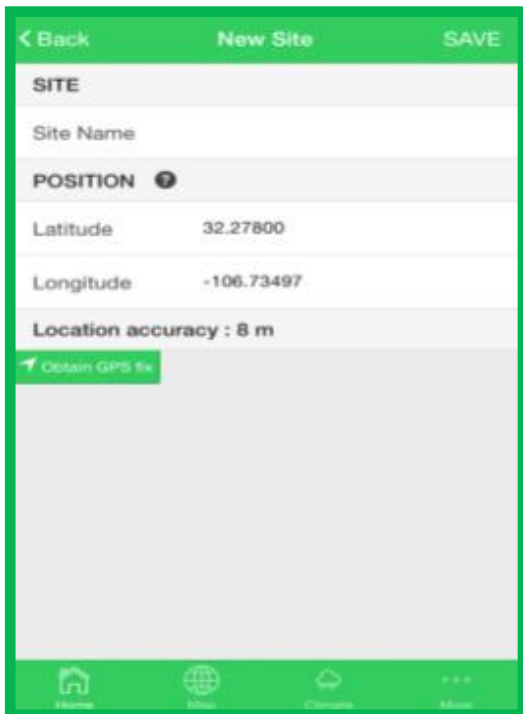
Open the LandPKS app by clicking on the Icon on your smart phone



Create a PLOT by clicking on the plus sign “+” on the top right corner of the screen.



Once you have clicked the “+”, a new plot can be created in the Plot ID.



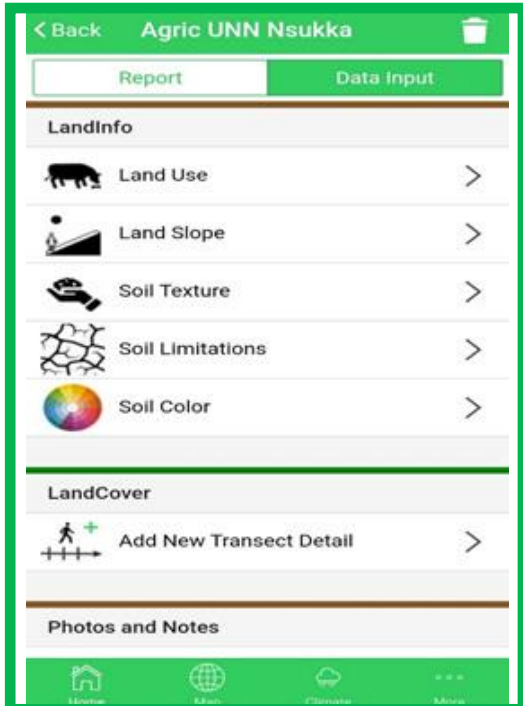
Enter your Site Name. Enter your location. If you do not know your location, select “Obtain GPS”.

You will need to allow the app to access your location by selecting ‘Allow’ when prompted.

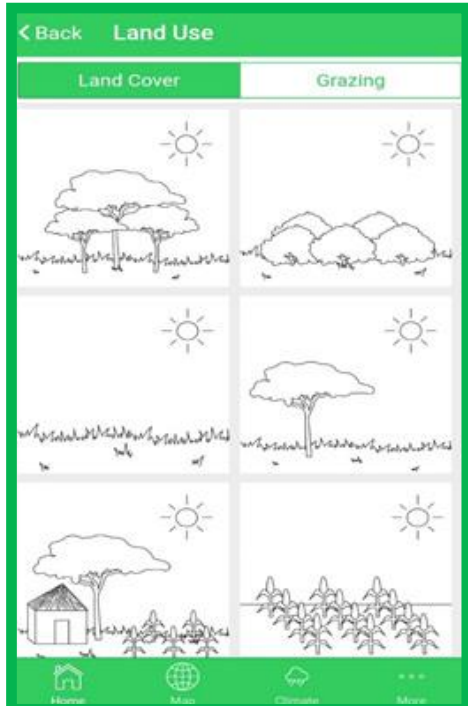
Once your site info has been entered, click ‘Save’ in the upper right-hand corner.

Start entering data by clicking the Data Input Tab. This reveals data input categories for both LandPKS (top), and LandCover (bottom).

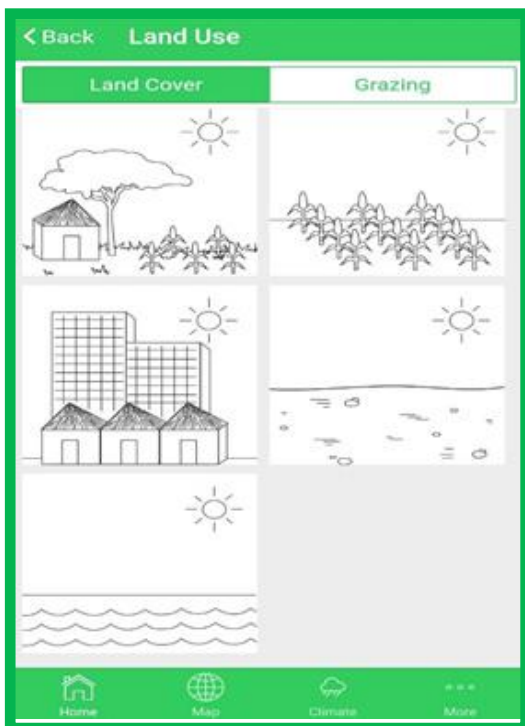
On the Plot ID screen, enter a Plot Name. Tap “Obtain GPS fix” generate the GPS coordinates of the site



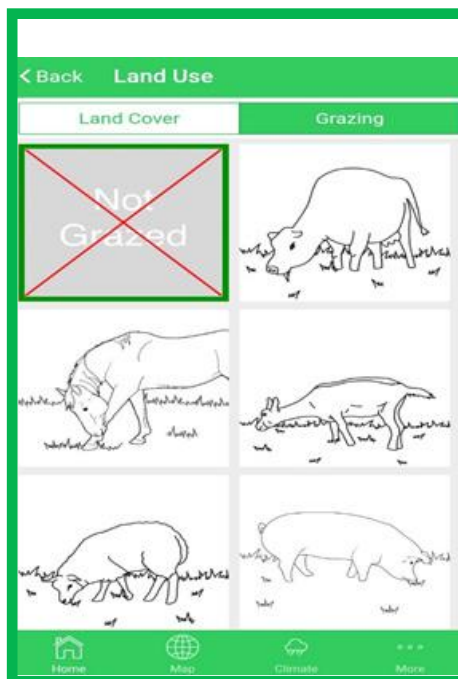
This is the main menu showing a list of land and soil features to be assessed on the selected site.



Land Cover refers to the physical covering of the land you are analyzing and can help you understand how to better manage your land type.

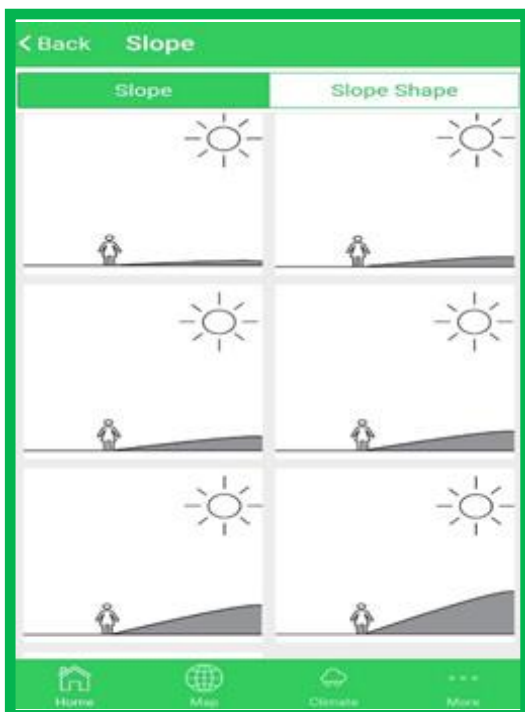


Choose the best match for land cover at the location.

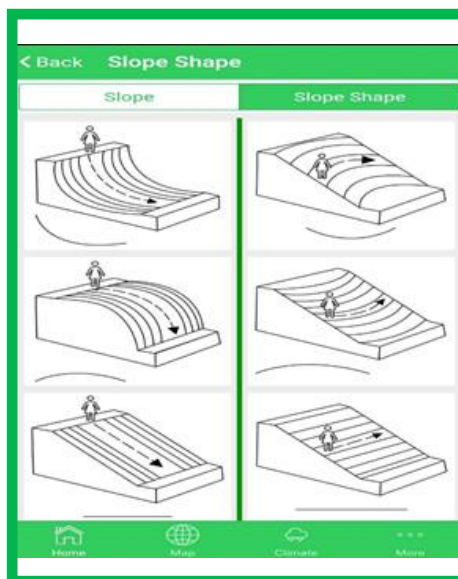


Selecting the icon with the large, red 'X' identifies your site as "not grazed."

If your site is grazed at any time during the year, select which type of grazing occurs at the site (cattle, goat, sheep, mixed species). You can select more than one.



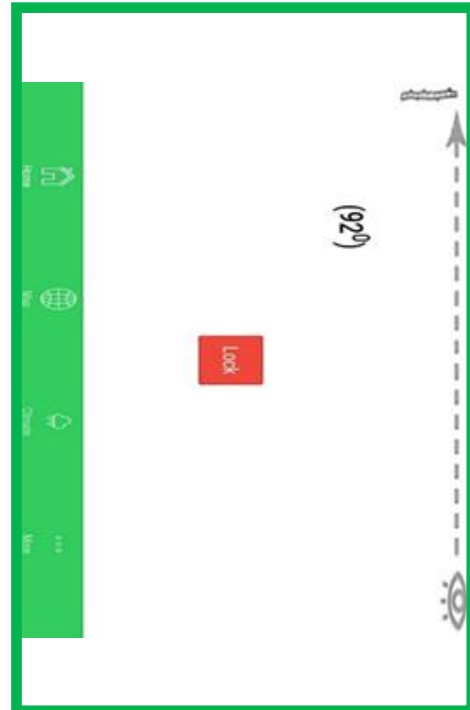
Slope: Choose a slope class OR use slope meter: look ACROSS the slope and align the long edge of the phone with the slope.



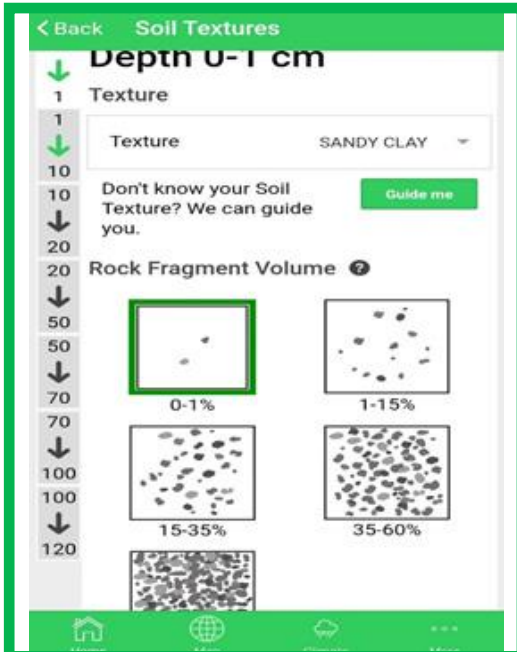
Slope shape: Look DOWN the slope (left) and ACROSS the slope (right) for a 20-50m diameter area around the site.

The Slope screen shows pictorial illustrations of the degree of slopes. Select the slope that most closely matches the average slope in a

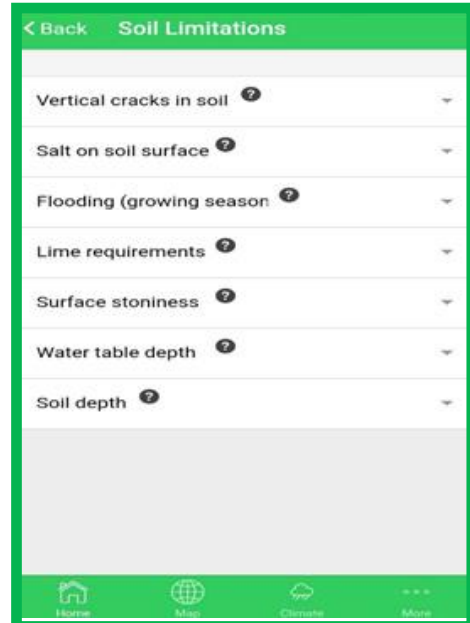
50-meter diameter.



For more accuracy, the in-built clinometer can be used, by gauging along the edge of the phone at a calibration point and pressing the lock button¹.

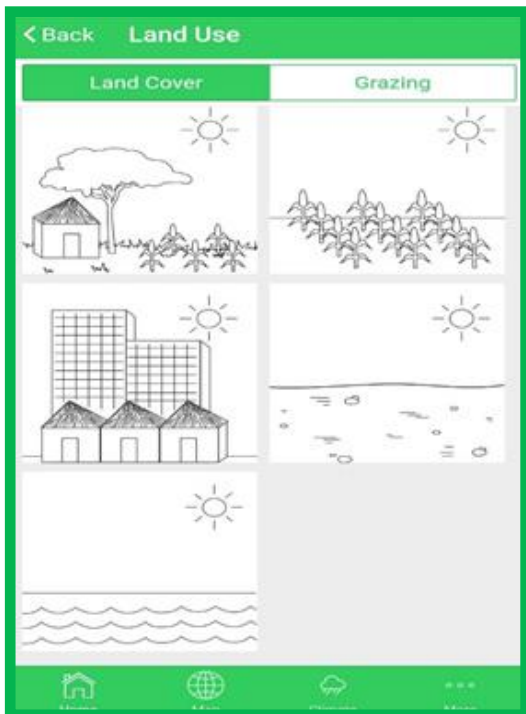


Soil Texture: The amount of soil rock fragment measured on site is compared with the classes of the percentage of rock fragment ranges detailed in the drop-down menu.

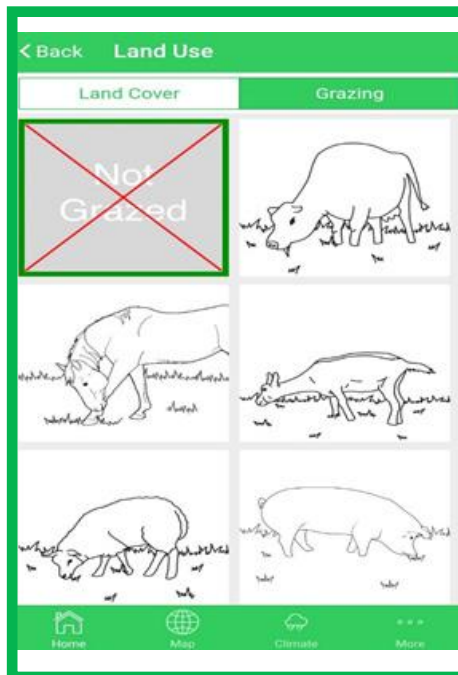


Soil Limitations: User provides information on the existence of deep vertical cracking in the soil profile (i.e. cracking clay) and the existence of salt deposits on the soil surface. Select appropriately using the drop-down arrows.

¹ There are several ways to calibrate a reference point. The easiest is to use a second person and determine where on their torso your eye level is on flat ground (0%). Thereafter, use that spot as your reference to point at when you're on different ends of the slope.

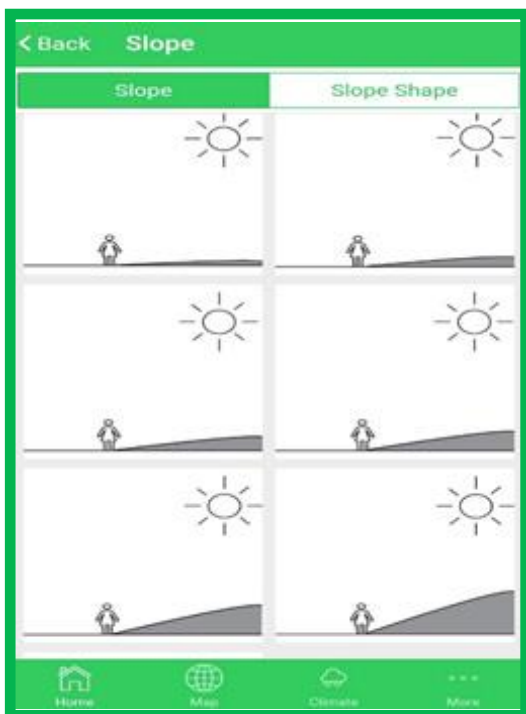


Choose the best match for land cover at the location.

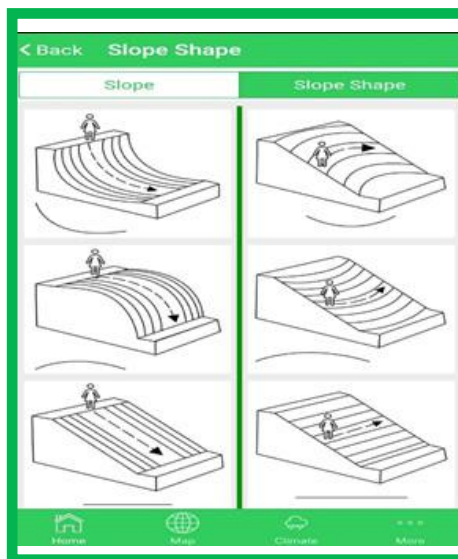


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If your site is grazed at any time during the year, select which type of grazing occurs at the site (cattle, goat, sheep, mixed species). You can select more than one.



Slope: Choose a slope class OR use slope meter: look ACROSS the slope and align the long edge of the phone with the slope.

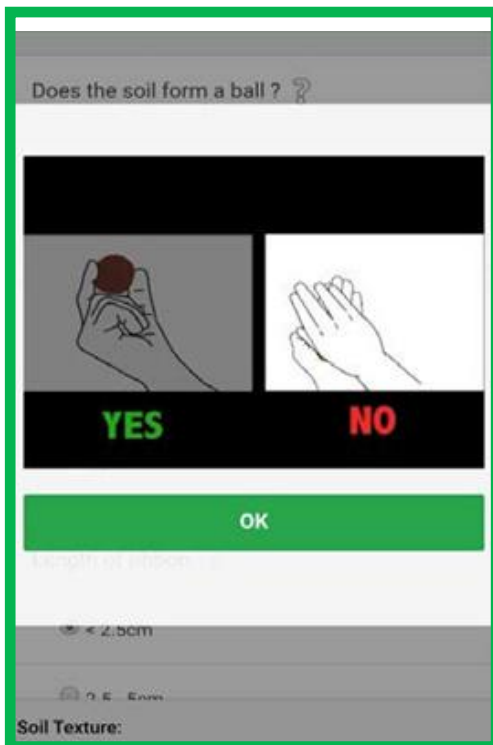


Slope shape: Look DOWN the slope (left) and ACROSS the slope (right) for a 20-50m diameter area around the site.

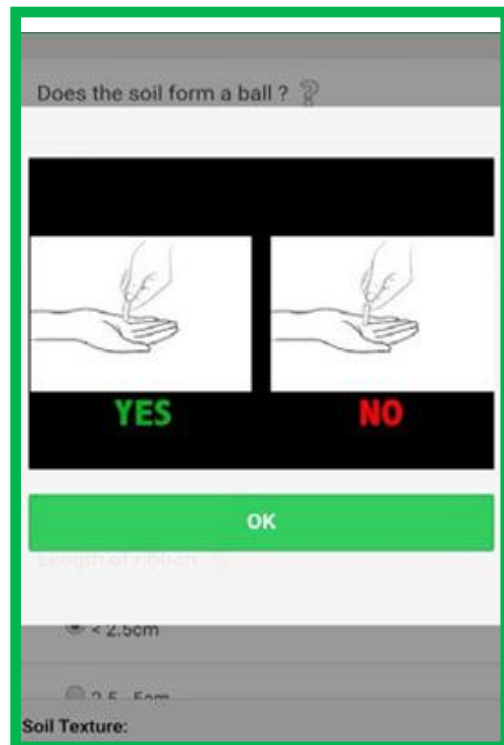
On the Soil layers screen, the soil texture of the surface (0 -1 cm) soil layer is required. Texture for the top 6 layers (to 70 – 100 cm) is strongly recommended.

Rock fragment volume: select the image or % range that most closely matches the proportion of the layer that is filled with material over 2mm in diameter

One this screen, one can be guided through a series of leading questions of indicators to perform soil texture analysis. Follow the key in “Guide me” using the videos linked to the “?”



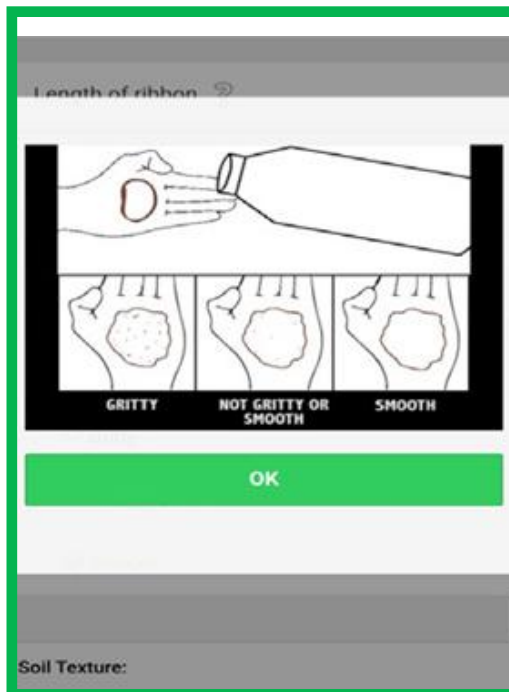
Thoroughly mix a handful of soil with water until it is mud. When you are done, it should have enough moisture to make the surface shine, but not so much that water drips out of it.



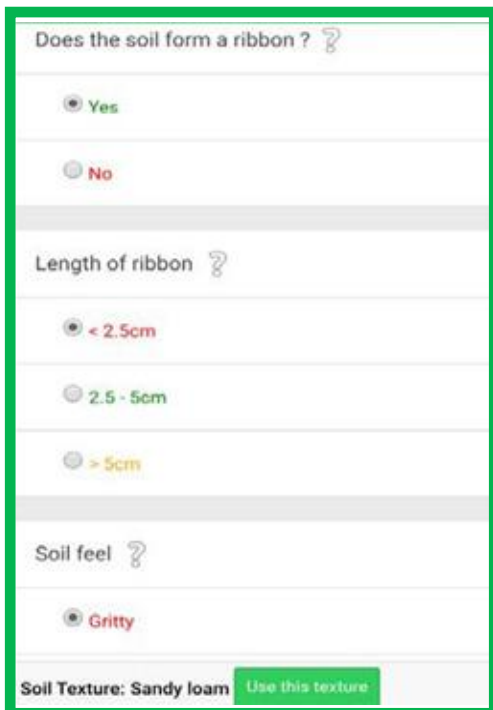
For each question, a short video tutorial is provided to guide users on how to perform soil texture testing. This video slide shows how to form a ball from a soil sample.



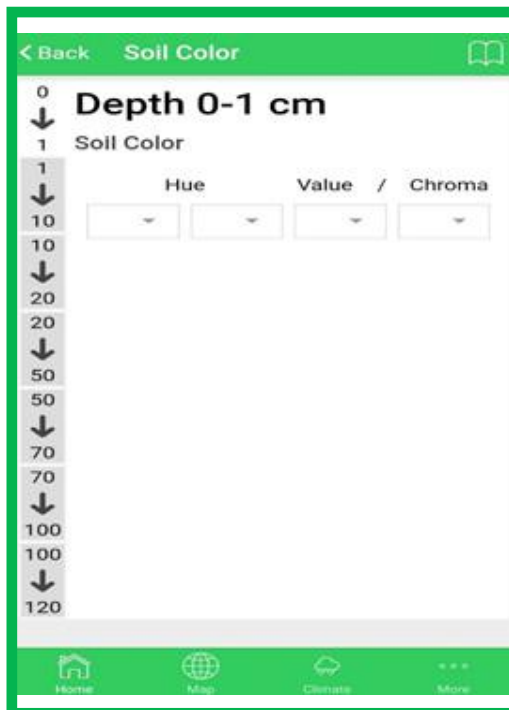
This video slide shows how to make a ribbon from the soil sample, taken into account the length of the ribbon.



This video slide shows how to check the smoothness or roughness of the soil sample.



Once all the question have been answered, the soil texture type will appear at the bottom of the screen



Soil Colour: Use the Soil Color tab to determine the colour of your soil by depth. Soil colour is useful for soil identification and determining other important soil qualities.

Step 1: Prepare soil sample by running dry soil through a sieve. Flatten the pile of soil.

Step 2: Place a colour reference card next to the soil pile.

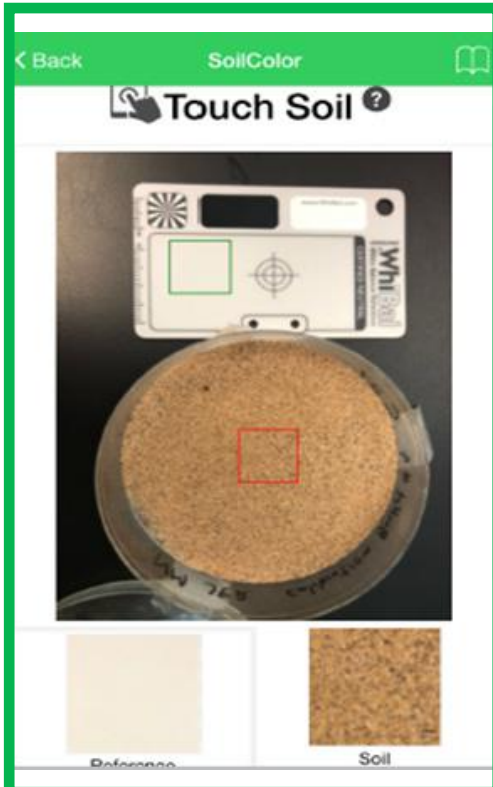
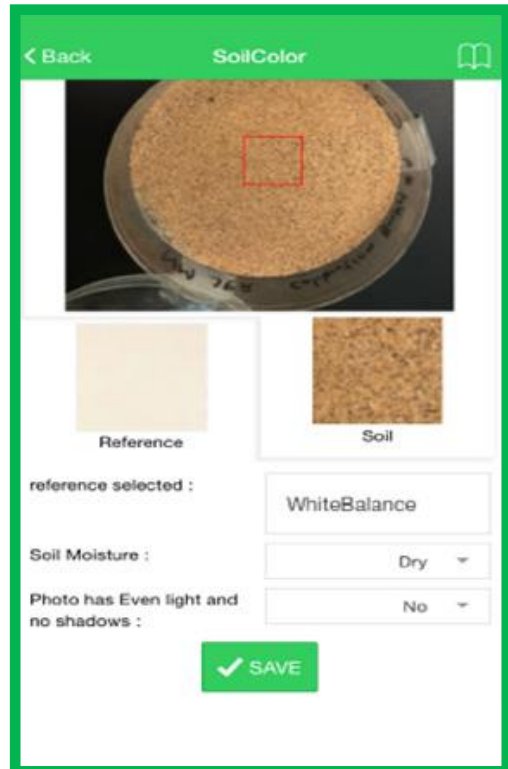
Step 3: In uniform lighting conditions (not direct sunlight), take a photo of the colour card and soil about 10 to 20 cm above. Select Ok.

Step 4: Touch the reference card and then touch the soil sample. Ensure the correct reference card type, soil moisture, and lighting conditions are selected below.

Step 5: Select Save and the soil colour results will appear.

Go to Settings to change reference card type and input source (Camera vs. Manual).

Go to Settings >> Utilities to use Soil Color without creating a plot.



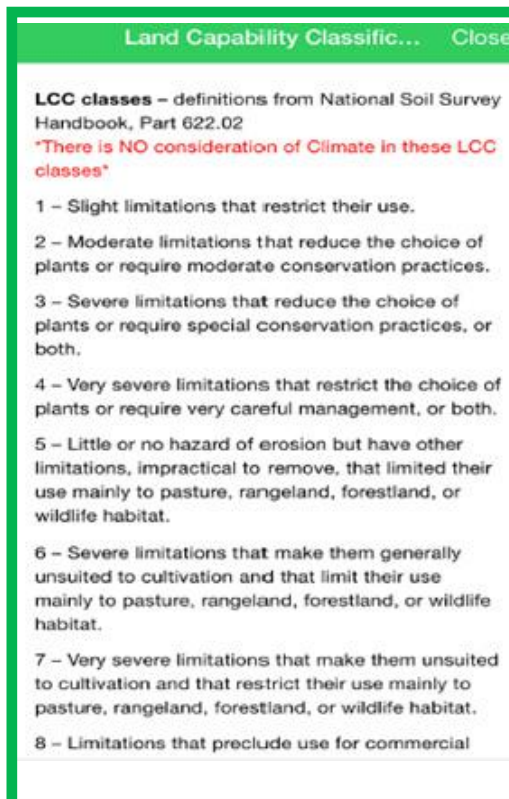
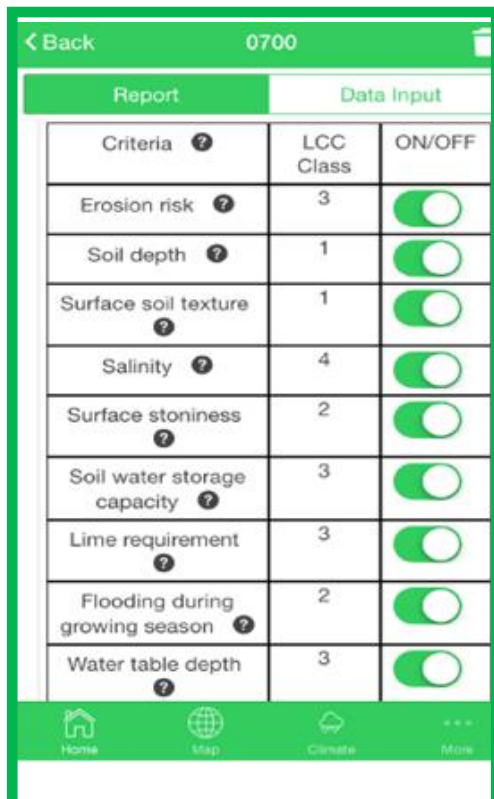
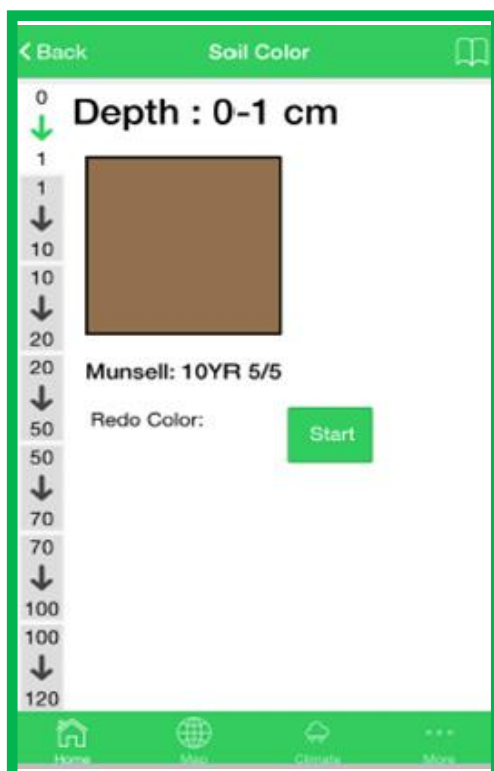
Land Capability Classification (LCC): has been used globally for land evaluation, as it determines land capability and risk of degradation by classifying the land into 8 classes.

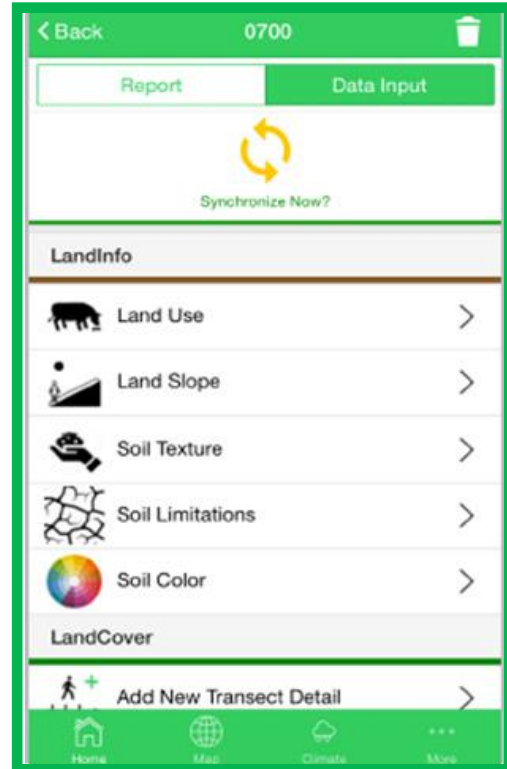
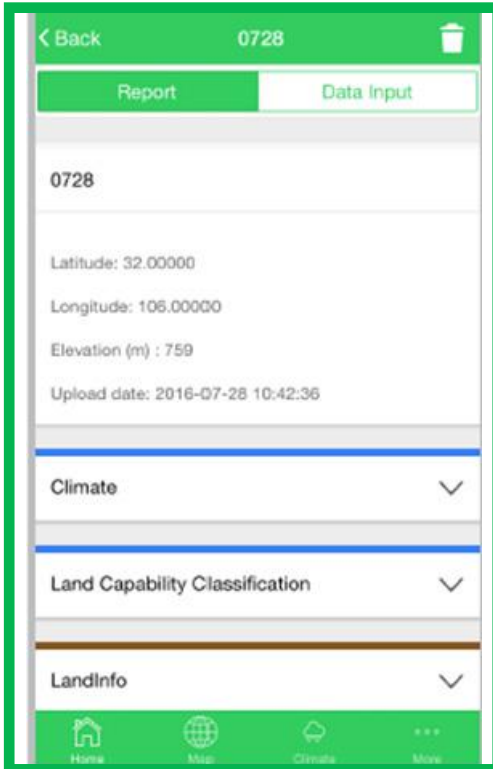
-To generate Land Capability Classification results on the Report page, complete the existing data collection steps including Soil Texture, Slope, and Soil Limitations.

-The first value is the LandPKS-determined LCC class. The number is the overall class, and the letters refer to the sub-class or most limiting criteria; to interpret this, simply click on the question mark for guidance.

-The second value is the user-adjusted LCC. The user can change this value by turning on or off the different criteria. The user-adjusted LCC assists the user to conduct scenario assessment or tailor the LCC score to a specific context.

-To understand each criterion, simply click on the corresponding question marks.





Submit Site: At any point in the data collection process, you can submit your data by clicking on “Synchronize Now” at the top of the Data Input page.

-Synchronization can be done at any point, and multiple times.

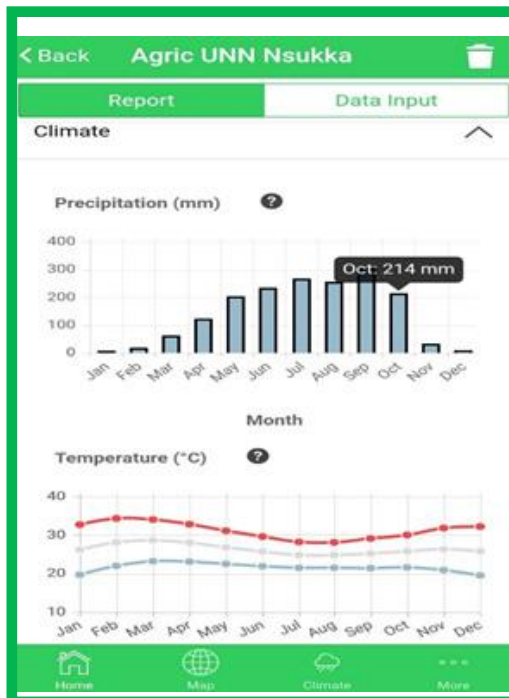
-Once you submit your site, you are still able to modify or add data at any point.

-You can also now access your data on the Data Portal at <https://landpotential.org/data-portal/>

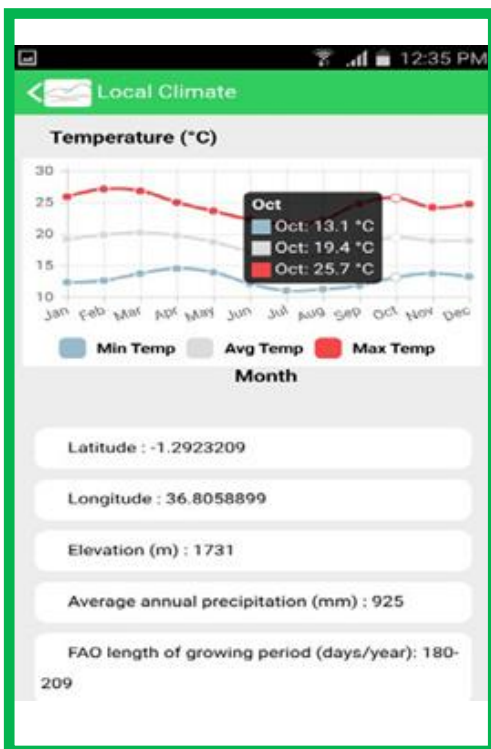
The photo section allows the user to take useful pictorial data for inventory as well as for future monitoring purposes. Use phone’s camera function and built-in compass to take photographs of landscape, soil pit, and soil samples for inventory and future monitoring. The review screen shows all the data input ready to be submitted.



This output will be plotted on the geo-referenced map, showing the results obtained on various site assessed using the LandPKS App



The results will show the climate parameters (average, min and max temperatures, and precipitation for the year) and geographical characteristics.

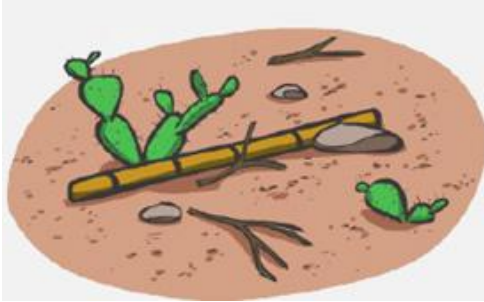


It will also provide information on elevation, soil aridity, length of growing period for the season and soil water content.

LandCover: includes forms for entering vegetation and soil cover data for 20 1m sticks. There are 4 types of data (1-4 below).

-20 minutes total/plot for all 4 methods for experienced users.

-Data can be collected with a meter or a yardstick as appropriate.



Plant and ground cover

2. Basal/Canopy Gaps: This method will tell you what percent of the landscape falls in large gaps between bases and between plant canopies. This data would provide an important early warning indicator of future changes at this site.

- **Gaps between plant bases:** If the stick touches any kind of plant base in any place along the stick, select 'no basal

gap.' If there is no plant base, select the basal gap' icon.

- **Gaps between plant canopies:** If the canopy gap is greater than the length of the stick, select 'canopy gap.' If there is a canopy gap smaller than the length of the stick, select 'no canopy gap.'

- **Note:** plant leaf or stem must be between 10cm and 2m in height. Canopies shorter than 10 cm or taller than 2m are not effective at slowing wind erosion.

3. Plant Height: Plant height data can be used to monitor changes in vegetation structure – or what percentage of the landscape is covered by tall versus medium versus short plants.

1. Plant and Ground Cover- will tell you what percentage of the ground is covered by different types of plants, litter, rock, or not covered at all.

- Select your plot in the main menu. Click'N' to begin collecting data in the North direction.

- Start at your site's center point. Begin walking 5m North in a straight line. Drop the measuring stick randomly in front of you.

- Select '5m' in the app. Select the type of plant and/or ground cover that is present at each notch on the stick. Make sure to record only the plant and ground cover that are above or below each mark on the stick. Aim to be consistent.

- Continue collecting cover data every 5m until the end of the transect (laying down your stick when you stop at 5, 10, 15, 20 and 25 m from the center point).



Basal Canopy

- Use a second stick to outline a box 1x1m in front of the stick.

- Identify the tallest plant part (branch, leaf, or stem) that is within this 1x1m box. Use the second stick to estimate the height of the plant part.

- Identify the height class of this plant part on the leftmost side of the screen.



Plant Height

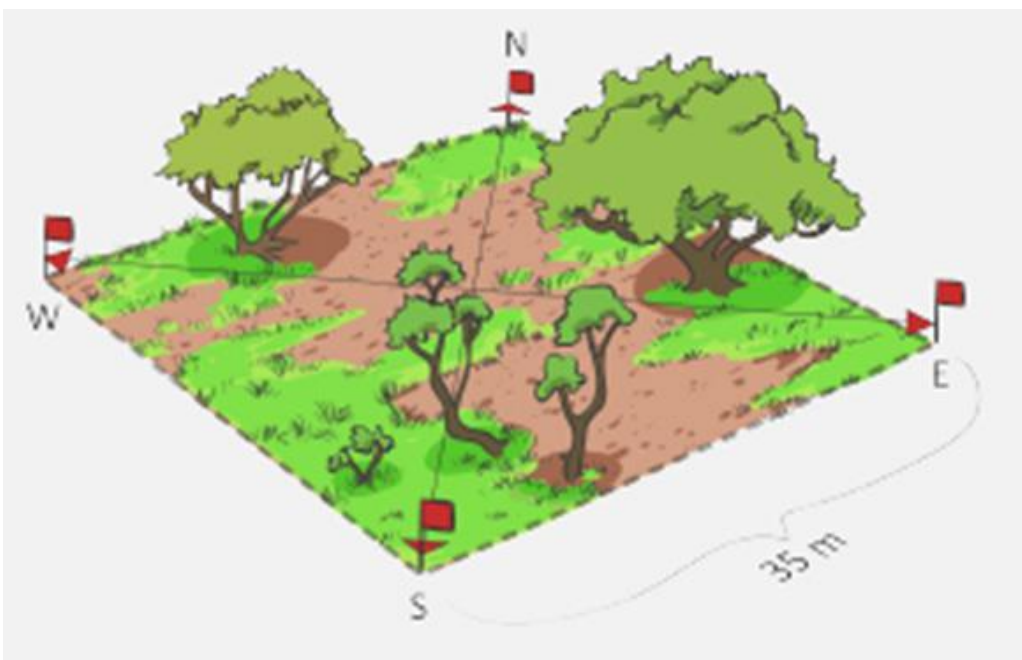
- Use a second stick to outline a square box (1x1m) in front of the stick on the ground.
- Count the number of plants that are rooted inside the plot (the base of the stem is inside the plot).
- Record species counts in the rightmost panel of the 'Height/Gap' tab. You can enter counts for 2 species.

4. Species Density: Plant density data is most useful for measuring changes in the abundance of trees shrubs, and succulents when plant cover is low (less than 5%). This data would provide an important early warning indicator of future changes at this site.

Repeat these steps for each of the three other transects (East, South, West).

Note: You can 'Submit' sites with partial transect data (incomplete transects).

However, if you Submit your data, you will only be able to make edits on the Portal.



Matrix of preferred soil requirements for African crops

A: Arable Crops

S/N	Crops	First best suitable soil	Second best suitable soil	Third best suitable soil
1.	Wheat	Loamy soils	Sandy loam	-
2.	Teff	Dark, heavy clay soils	Andosols (young, shallow soils, weathered from volcanic ash under humid conditions)	-
3.	Sorghum	Shallow soils with high clay content	-	-
4.	Maize	Well-drained loamy soils	Clay and clay-loam soils	-
5.	Barley	Fertile, deep loam soils	Light or sandy loam soils	heavy clays
6.	Millet	Well-drained loamy soils	-	-
7.	Potatoes	Light loamy soils	Sandy soils, which contain little clay or little organic matter	-
8.	Cassava	Deep and well-drained loamy soils	-	-
9.	Beans	Deep, well drained sandy loams soils	Sandy clay loam	clay loam
10.	Rice	Loamy soils and Clay soils	-	-
11.	Lentils	Sandy loam soils		
12.	Yam	Sandy loam soils	Silt loam soil	
13.	Taro	Well-drained, friable loam soils		
14.	Cowpea	Sandy soils	-	-
15.	Oaths	Loam soils		
16.	Sweet Potatoes	Sandy-loam, loam or clay-loam soils		
17.	Sesame	Light clay soils		
18.	Fonio	Sandy or rocky soils		
19.	Peas	Well-drained sandy loam soils		
20.	Chickpea	Sandy or silt loam soils		
B. Permanent crops				
21.	Banana	Well drained loamy soils	Loams and clay loams	
22.	Orange	Fine sand soils		
23.	Avocado	Soil with a clay content between 20 and 40%	-	-
24.	Apples	Well drained sandy loam soils	Well drained sandy soils	-
25.	Water melon	Non-saline sandy loam or silt loam soils		
26.	Moringa	Loamy, sandy or sandy-loam		
27.	Mango	Rich, deep loam soils		

28.	Calabash Gourd	Clay soils	Sandy soils	
29.	Marula	Sandy loam soils	Sandy clay soil	
30.	Balanites	Clay soils	Cracking clay, sandy soils	
31.	Butter fruit	Loamy clay soils	Sandy clay soils	
32.	Carissa	Sandy soils		
33.	Tamarind	Sandy soils		
34.	Acid Lime	Loamy soils		
35.	Mandarin Orange	Deep well drained loamy soils		
36.	Grapes	Well-drained rich loamy soil		
37.	Pineapple	Well-drained, sandy loam		
38.	Papaya	Sandy loam soils	Loam soils	
39.	Baobab	Sandy top soils		
40.	Cumin	Loamy soils		
41.	Lemon balm	Clay and clay-loam soil		
42.	Cabbage	Loamy soils		
43.	Onion	Loamy soils which are deep and well drained		
44.	Cleome	Clay loam soils	Sandy loam soils	
45.	Green pepper	Sandy or sandy loam soils	-	-
46.	Amaranth	Soils that are lower in clay, well-drained soils and deeper soils		
47.	African Eggplant	Well drained loam to sandy loam soils		
48.	Squash	Sandy loams	Clay soils	
49.	Pumpkin	Sandy loam soils		
50.	Okra	Well drained sandy loam soils		
51.	Swiss chard	Sandy loam soil		
52.	Marogo or imfino	Sandy soils	Sandy loam	Loam soils
53.	Beetroot	Deep sandy loams	Deep and well-drained, loose, loamy to sandy soils	
54.	Carrot	Sandy loam soils	Silted loam soils	
55.	Tomato	Deep, well-drained loams soil	Sandy loams and Heavy clay loams	
56.	Garlic	Loamy soils		
57.	Ginger	Loamy soils, rich in organic matter		
58.	Lettuce	Fertile loam soils	Light sandy soils	Heavy clay soils
59.	Cocoa	Sandy-clay mixture	-	-
60.	Chat	Light sandy soil	-	-

61.	Coffee	Sandy-loam soil	Very sandy or clayey soils, the clay content of the soil should be between 15 and 35%	
62.	Cotton	Red and gray loams with good clay subsoil	Sandy soils over clay and sandstone and limestone	-
63.	Tobacco	Light loamy Soils	-	-
64.	Tea	Well drained soils having a good depth	-	-
65.	Groundnut	Sandy soils, well-drained, red-coloured, yellow-red and red, fertile	Sandy loam soils	-
66.	Soybean	Clay and clay loam, soybeans respond well where good drainage is present	-	-
67.	Oil Palm	Loamy soil, well-drained, deep fertile	Loam-clay soil	-
68.	Sugar cane	Sandy loam soils		
69.	Cashew-nut	Sandy soils		
70.	Coconut	Red sandy loam and coastal sandy well-drained soils		
71.	Sunflower	Clay soils, well-drained, high water-holding capacity soils		
72.	Canola	Clay-loam soils		
73.	Guava	Well drained sandy loams to clay loams		
74.	Green Beans	Clay loam and loam soils		

Photo Gallery of past LandPKS App Trainings



Mr. Fredrick Owino, County Directorate official, Department of Agriculture addressing participants during the LandPKS mobile app training in Nakuru County



Participants taking part in the theoretical classroom session



Participants being assisted by ATPS Staff to download the LandPKS mobile app



Participants being assisted by ATPS Staff to download the LandPKS mobile app



Participants of the LandPKS app training in Nkubu, Meru



Participants of the LandPKS app training in Nakuru County

LandInfo App Training Workshop Evaluation Form

Thank you for participating in this training workshop. We would appreciate if you could take a few minutes to share your opinions about the training workshop with us. Your input will help identify ways that we can enhance the learning experience and improve the training workshop to meet future needs.

Please return this form to the facilitator at the end of the workshop. Thank you.



Content of the Training Workshop

1. Please rate the following questions based on the content of this workshop. (Tick appropriately)

		Strongly agree	Agree	Mild	Disagree	Strong disagree
		1	2	3	4	5
a)	The title and description of the workshop clearly convey its content					
b)	The learning objectives and outcomes were clear					
c)	The workshop was engaging and empowering					
d)	Useful visual aids and handouts					
e)	Given the time allowed, the amount of material covered was appropriate					
f)	The program was well paced within the allotted time					

Instruction

2. Kindly provide feedback that will help the instructor evaluate their efforts. (Tick appropriately)

	Excellent 1	Good 2	Mild 3	Poor 4	Needs improvement 5
The instructors were upbeat and friendly					
The instructors were good communicators					
The instructors were knowledgeable on the topics					
The instructors were organized and communicated effectively					
The instructors were attentive to my individual needs and abilities					

LandInfo App

3. Please provide feedback about the workshop LandInfo App. (Tick appropriately)

	Strongly agree 1	Agree 2	Mild 3	Disagree 4	Strongly disagree 5
a) LandInfo App easy to learn					
b) LandInfo App is relevant to my work					
c) LandInfo App results are useful to my work					
d) LandInfo results are easy to interpret					
e) I will use the LandInfo App after this training					
f) Acquired new knowledge from LandInfo training					
g) I will share this knowledge with my colleagues					
h) I will recommend the LandInfo to other extension agents and farmers					

4. Kindly identify top three issues you would like to see in improving the LandInfo App

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The African Technology Policy Studies Network (ATPS) is a trans-disciplinary network of researchers, policymakers, private sector actors and the civil society promoting the generation, dissemination, use and mastery of Science, Technology and Innovations (STI) for African development, environmental sustainability and global inclusion. In collaboration with like-minded institutions, ATPS provides platforms for regional and international research and knowledge sharing in order to build Africa's capabilities in STI policy research, policymaking and implementation for sustainable development.

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