



Federal Republic of Nigeria
National Bureau of Statistics Abuja, Nigeria
GENERAL HOUSEHOLD SURVEY - PANEL
FARM AREA MEASUREMENT COMPONENT



INSTRUCTION MANUAL

MARCH 2013

FARM AREA MEASUREMENT EXERCISE ON A PLOT OF FARM

INTRODUCTION

There are three common ways to measure plot size for farm households – use of rope and compass, use of a GPS device and farmer self-reported plot size. In this exercise, we implement all three measures on a subsample of plots from the GHS-Panel plot roster. Rope and Compass method of measuring plot size is the objective measurement of land size, usually referred to as the gold standard. For the purpose of this exercise, we start with the farmer self-reported measurement, followed by the rope and compass measurement and we finish by measuring the plot with a GPS device. To conduct the rope and Compass measurement, the **Enumerator** and the **Crop Farmer/Crop Farm Manager** should walk along the edges of the plot to identify the boundary and obstacles. A team of at least three (3) persons is required for this exercise.

The materials that you will need for use in this exercise are:

1. Documents and implements:

- Farm Survey Form (FS1)
- Field Manual
- Ranging Poles
- Rain Boots
- Cutlass / Machete
- Pegs
- Measuring Tape
- Writing Materials e.g. Pen, Pencil, etc.

2. Pieces of Equipment:

- Global Positioning System (GPS)
- Ultra-micro PC with compass and rope area calculation program
- Prismatic Compass

Form FS1: It is a form design for recording farm identification and measurements.

Field Manual: This includes:

- (a) Procedures for plot area measurement using rope and compass method (page 5)
- (b) Procedures for area calculation using the Ultra Modern PC device (page 7)

- (c) Using the GPS device:
 - a. Navigation and Setup of the GPSMAP62 device (page 9),
 - b. Using the GPS for area calculation (page 12),
- (d) Instruction for completing form FS1 (page 14).

Ranging Poles: The minimum number of poles required is three (3). The first pole should be erected (positioned) at the **starting point (position A)**. **This first pole must not be moved until the measurement is complete.** The second pole should be positioned at first bend point (position B). The third pole should be stationed at the second bend (position C). Both the 2nd and 3rd poles can be removed after use and put in the next positions of measuring distance and degree between two interval-points, and so on. This is to be done until arrival at original position A.

Rain Boots: A pair of Rain Boots should be provided to each member of a team.

Cutlass / Machete: Each team should be provided with a sharp Cutlass or Machete for cutting bushes at the edges of the plot to be surveyed.

Pegs: Pegs are needed for holding the tape rule (rope). They are also used for identifying the location of each point distinctly. The first peg should be erected by the side of positioned survey pole to hang the tape rule. This tape rule would be stressed to reach the other positioned peg by the side of erected pole for distance reading.

Measuring Tape: This is a distance measuring instrument marked in metric-units (segment). Each team needs a measuring tape with at least thirty (30) meters long.

Writing Materials: These materials can include pen, pencil, etc.

GPS device: This is a device used for computing plot area and its perimeter based on track information.

Ultra-micro PC with compass and rope area calculation program: This is a device used for computing plot area and closing error after capturing distance measurements (meters) and bearings (degree) of a plot.

Prismatic Compass device: This is a device used for capturing geographic bearings in degrees (0^0). Ideally, each team will have two (2) prismatic compasses. The model type of this device should be a flip cover with a pinhole through which the bearing is read.

SAMPLE:

TYPE	STATE			
	BENUE	KOGI	OSUN	OYO
No of Plot	248	80	75	94
No of Team	4	2	2	2
No of Person Needed	12	6	6	6
No of days per Team	22	14	14	17
Prismatic Compass	8	4	4	4
Ranging Poles	12	6	6	6
Measuring Tape	4	2	2	2
No of GPS Needed	4	2	2	2
Computer Device	4	2	2	2
Note: Each team will measure => 3 plots per day taking travel time into consideration.				

PROCEDURE FOR PLOT AREA MEASUREMENT USING

ROPE AND COMPASS METHOD:

1. Definition:

A PLOT is a part of a field on which a single set of crop farm management practices are carried out i.e. on which a single type of crop mixture is grown. This may be the whole field in which case the field is one plot and should be measured accordingly.

All plots from the selected households will be measured. The plot IDs should be matched to the GHS-Panel PP plot roster using the plot label and crop types.

2. Field staff Requirement:

A Team consisting of at least 3 persons is required. Two persons are needed to hold the edges of the measuring tape respectively and take the bearing and distance measurement while the 3rd person is to ensure that the tape is held straight by clearing any obstacle/obstruction in the way.

3. Area Measurement Procedure:

- a) Identify your starting point and call it **point A**. Usually, point A is the corner of the plot you reach first when coming from the farmer's house. Firmly plant one ranging pole at point A and facing **NORTH**, proceed clockwise to your right to the next corner of the plot. This is point B and the second ranging pole should be placed at that point. At this stage, a team member is stationed at both point A and B. Facing each other with the ranging poles in front, the person at point A should use the compass to line-up the pole at point B and look through the pinhole to take reading. This reading should be recorded on form FS1 in the column marked '**Front Bearing**' on the line for point A-B on the form.
- b) With the assistance of the 3rd Team member, extend the measuring tape from point A to point B with the zero mark held against pole A. When the tape is held straight and taut, read the distance to B and enter this figure in meters in the column marked '**Distance**' on the line for point A-B.
- c) Now, the Team member at point A moves (leaving the pole in position) to point B and lines the compass up with the pole at point A and take reading. Record this reading in the column marked '**Back Bearing**' on the line for point A-B on the form.

- d) Take the 3rd ranging pole and place it at the next corner of the plot after point B, this is point C. Proceed to measure the front compass bearing, the distance and the back bearing from B to C in the same way that you measured them from point A to point B. Enter the results in the appropriate columns for the line marked B-C on the form. When you are done with the side, B-C, remove the pole at point B and take it to the next corner after C, this is point D. Continue in this way from point to point (corner to corner) until you have returned once again to point A, the corner where you started.
- e) Make sure all your readings are entered on the appropriate farm survey form (**FS1**)
- f) Finally, enter the data in the UMPC for computation of plots area and closing error. If the closing error is greater than 5%, then this indicates that the measurement was not done properly and plot should be re-measured.*

**PROCEDURE FOR PLOT AREA MEASUREMENT USING
ULTRA MODERN PC DEVICE FOR COMPUTING PLOT AREA**

First, ensure that form **FS 1** is adequately completed without missing any point and value.

Step 1: Switch on the **DEVICE** by pressing the **POWER BUTTON** for 1-2 seconds.

Step 2: Wait for at least two (2) minutes for allowing the **DEVICE** to initialize and to boot.

Step 3: The **DEVICE** will indicate **READY** before you can start navigating or using.

Step 4: Locate icon “**Shortcut LandCalc**”. Double click on it.

Step 5: Wait for at least two (2) minutes for opening. Click on X box on top corner of right hand to quit “**AVStation viewer**” page. Continue to click X box until “**Land Area Calculation**” appears on the screen.

Step 6: On the Land Area Calculation page the following icons would be seen:

Close form icon in red colour

Modify data icon in red colour

List all States icon in red colour

Add/clear icon in red colour

Step 7: Highlight **Add/clear** icon and click to begin data entry using completed form FS1.

Step 8: On completing data entry from State to No of Sides. Click on “**Save icon**”.

Step 9: Next, click on **“Prepare Details”** to access the total number of sides needed to be entered.

Step 10: Move to **‘Enter Data / Edit field’** in blue colour to enter the data on FS1 to the design appropriately.

Step 11: On completing the data entry, click on **“Enter Data / Edit Data”** in red colour to register the entry on **SN, Angle & Length** rows as appropriate. Click on blue colour ‘row’ to get next row number and continue the entry until the last row is entered.

Step 12: Click on **“Modify data”** to save the entered data.

Step 13: Click on **“Click to calculate Closing Error and Area”** to get the plot Area and its Closing Error. This result can be got by opening **‘List all States’** icon.

Step 14: Click to open **‘List all States’** icon. Locate the most appropriate state name and move right ward to get the computed **PLOT AREA** and computed **CLOSING ERROR in percentage**.

Step 15: Repeat these steps for all plots.

USING THE GPSMAP62 GPS DEVICE

INTRODUCTION:

The Global Positioning System (GPS) is a piece of technology equipment used for variety of activities (navigating, mapping, etc). The advantage of this technology over the old method of farm survey (i.e. compass, pole and tape) is enormous. It is more accurate in measurement, faster, easier and requires less number of people to use.

THE NAVIGATION AND SETUP OF GPSmap62

Firstly, open the battery cage behind the device to load a pair of **Alkaline** (Lithium) **Battery** as appropriate.

Step 1: Switch on the GPS by pressing the **POWER BUTTON** for 1-2 seconds.

Step 2: Wait for at least two (2) minutes to allow the GPS to initialize.

Step 3: Press Page button to locate **Main Menu**. Wait for a second, a new menu that contains **some icons** will be seen.

Step 4: Navigate to locate **set up** and press Enter, a new menu that contains **some icons** will be seen.

Step 5: Navigate to locate “**system**” and press Enter, a list of menu would appear. Review as follows: **GPS** change to ‘**Normal**’, and **Interface** change to ‘**NMEA In/out**’.

Step 6: Press **Quit** returning to the menu.

Step 7: Navigate to locate “**Display**” and press Enter, a list of menu would appear. Review as follows: **Timeout** change to ‘**Stay On**’, and **Battery save** change to ‘**On**’. Etc.

Step 8: Press **Quit** returning to the menu.

Step 9: Navigate to locate “**Page Sequence**” and press Enter, a list of menu would appear. Move to ‘**Add Page**’ and press Enter. Highlight ‘**Satellite**’ and press Enter. Highlight **move**

and press Enter, the satellite would go to Main menu page with red ink. Move '**Satellite**' to the position of interest and Press Enter.

Step 10: Press **Quit** returning to the menu.

Step 11: Navigate to locate "**Page Sequence**" and press Enter, a list of menu would appear. Move to '**Add Page**' and press Enter. Highlight '**Area Calculation**' and press Enter. Highlight **move** and press Enter, the Area Calculation would go to Main menu page with red ink. Move '**Area Calculation**' to the position of interest and Press Enter.

Step 12: Press **Quit** returning to the menu.

Step 13: Navigate to locate "**Page Sequence**" and press Enter, a list of menu would appear. Move to '**Add Page**' and press Enter. Highlight '**Track Manager**' and press Enter. Highlight **move** and press Enter, the Track Manager would go to Main menu page with red ink. Move '**Track Manager**' to the position of interest and Press Enter.

Step 14: Press **Quit** returning to the menu.

Step 15: Navigate to locate "**Units**" and press Enter, a list of menu would appear. Move to '**Distance and Speed**' review as '**Metric**', **Elevation** change to '**Meters (m/mm)**', **Depth** put '**Meters**' and **Temperature** change to '**Celsius**'.

Step 16: Press **Quit** returning to the menu.

Step 17: Navigate to locate "**Time**" and press Enter, a list of menu would appear. Move to '**Time Format**' review as '**24-hour**' and **Time Zone** change to '**Lagos**'.

Step 18: Press **Quit** returning to the menu.

Step 19: Navigate to locate "**Position Format**" and press Enter, a list of menu would appear. Move to '**Map Datum**' review as '**Minna**'.

Step 20: Press **Quit** returning to the menu.

Step 21: Navigate to locate “**Heading**” and press Enter, a list of menu would appear. Move to ‘**Display**’ review as ‘**Numeric Degrees**’, and **North Reference** change to ‘**User**’ and **Go To Line** change to ‘**Bearing (Large)**’.

Step 22: Press **Quit** returning to the menu.

Step 23: Navigate to locate “**Tracks**” and press Enter, a list of menu would appear. Move to ‘**Track Log**’ review as ‘**Record, Show On Map**’, Record Method pick ‘**Auto**’, Recording Interval put ‘**Normal**’ and **Auto Archive** change to ‘**Daily**’.

Step 24: Press **Quit** returning to the menu.

Step 25: Navigate to locate “**Map**” and press Enter, a list of menu would appear. Move to ‘**Orientation**’ review as ‘**Track Up**’.

Step 26: Press **Quit twice** returning to the Main menu.

Step 27: Navigate to locate “**Routing**” and press Enter, a list of menu would appear. Move to ‘**Guide Method**’ review as ‘**Prompted**’, and **Calculate Routes** change to ‘**Pedestrian**’.

Step 28: Press **Quit twice** returning to the Main menu.

Step 29: Press **Power button** to shut down.

Step 30: Keep the **Device** in a safe wallet.

USING THE GPS DEVICE FOR AREA MEASUREMENT

Step 1: Switch on the GPS by pressing the **POWER BUTTON** for 1-2 seconds.

Step 2: Wait for at least two (2) minutes to allow the GPS to initialize.

Step 3: Press **Page button** to locate ‘**Satellite**’. Satellites will continue to appear on the screen as Bar charts as well as on the circuit (**greenish** in colour). On screen top, the **Accuracy level in metre** of the GPS would be seeing at right hand corner-side while the **Coordinates** of the GPS location would be seeing at left hand side (**Latitude & Longitude**).

Step 4: Press **Quit** and return to the list menu.

Step 5: Navigate to locate “**Area Calculation**” using the **Page** button. **START** will be highlighted. Press the Enter button when you are at the starting point and walk around the boundary of the farm plot.

Step 6: **Calculate** will be highlighted on the screen. When you **return** to the original starting point, wait a few seconds and press Enter. Be prepared to record the current track covered.

Step 7: Record the **area in square meter** and then Press Enter to **save Track**.

Step 8: A **menu** would appear indicating “**Enter Name**” on top, followed by the date of the current track. Delete the date and **Enter the name as HHID-PlotID**. For example, if the HHID is 12345 and the plotID is 02, enter the track name as 12345-02. Navigate to “**Done**” and press Enter. The name typed would appear.

Step 9: To find the **PERIMETER**, navigate to “**Track Manager**” by pressing **Page** button. The list of farm plots tracked would be seen according to the name given to each of them.

Step 10: Navigate to highlight the plot of interest and press Enter. The list menu would be seen. Navigate to **View Map** to see the sketch of the movement around the plot. At the top of the screen you will see “**Distance**”. Enter this number as the **Perimeter**.

Step 11: To start a new plot, press **Quit twice** and return to the **Area calculation** by pressing the **Page** button. Repeat **Steps 5 – 10** for each plot until maximum satisfaction is reached.

Step 12: Press **Power Button** to shut the device.

Step 13: Keep the **GPSmap62 Device** in a safe wallet for next schedule.

Upon completion of fieldwork, all track data will be saved on a computer. Do not delete the track information from the GPS device.

HOW TO FILL FORM FS 1

Complete a separate FS1 Form for **each plot** of the selected households.

SECTION A: HOUSEHOLD IDENTIFICATION:

- 1. STATE:** Write the appropriate **Name & Code** in the spaces provided as in GHS-PANEL_AGRIC questionnaire correctly
- 2. LGA:** Write the appropriate **Name & Code** in the spaces provided as in GHS-PANEL_AGRIC questionnaire correctly
- 3. SECTOR:** Write the appropriate **Name & Code** in the spaces provided as in GHS-PANEL_AGRIC questionnaire correctly
- 4. EA:** Write the appropriate **Name & Code** in the spaces provided as in GHS-PANEL_AGRIC questionnaire correctly
- 5. RIC:** Write the appropriate **Code** only in the space provided as in GHS-PANEL_AGRIC questionnaire correctly
- 6. SURVEY YEAR:** Is already printed correctly.
- 7. HHID:** Write the appropriate **Household Identification (HHID) code** in the spaces provided as in GHS-PANEL_AGRIC questionnaire correctly
- 8. Name of Head of HH:** Write the appropriate **Name of Household Head** in the spaces provided as in GHS-PANEL_AGRIC questionnaire correctly
- 9. Completed by:** The person from Head Office that completed this sheet to write his/her **Name, Signature and Date** clearly in each space provide.
- 10. Checked by:** The person that **checked** this completed sheet should write his/her **Name, Signature and Date** clearly in each space provided.

*11. Sheet --- of ---: This is to account for the **total number of sheets used** to complete the exercise on a plot. The boxes provided should be filled **serially** to the last sheet used per plot.*

*12. Time started & Time completed: The spaces provided must be filled as expected in **12-hours format** respectively.*

SECTION B: PLOT IDENTIFICATION

13. Plot ID: Insert the plot ID as in GHS-PANEL_AGRIC questionnaire correctly. The plot ID should be matched to the ID in the roster provided by the plot description and type of crops.

14. Crops grown on plot: Write the names of the crops grown on the plot.

SECTION C: FARM SURVEY RECORDINGS

15. FARMER'S REPORT OF PLOT AREA:

The Enumerator should **ask** the farmer about the size of his plot in relation to the given list of local units. The **source** of this piece of information should be sought for according to the given list. **Record** the number of local unit in the space in front of the AREA. Include 2 digits to the right of the decimal point. **Tick** the appropriate local unit along with the source.

NOTE: "*Land surveyor*" means measurement taken by a professional land Surveyor

16. Point: It contains the clockwise direction of movement on a boundary from a **Point** marked with **survey pole** to another **Point** marked with another **survey pole** which can be arranged in alphabetical order of **A** to **Z**. This is formatted as **From** and **To**. If there are many sides, use the additional lines provided on the back side of the form for extra space.

From: It serves as a **starting point** (first position of the erected survey pole) of the walking direction at the edge of a plot.

To: It serves as a **stopping over point** (next position of another erected survey pole) **while** walking along the edge of a plot usually at a bend location.

NOTE: These two sub-columns should be arranged in alphabetical order until **last point** serves as the **starting point**.

17. COMPASS-Bearing (0^0): It contains **COMPASS-Bearing in degree**. The readings should be done using compass device for both **Front** and **Back** respectively. The compass device should be held directly in straight line to the two erected poles that are directed opposite to each other before reading the **degree** on the device.

Front: It serves as a **bearing (degree) reading from starting point (A) to point B**.

Back: It serves as a **bearing (degree) reading from point (B) to starting point A**.

NOTE: These should be done for all interval-points recorded in degrees according to arrangements in alphabetical order.

18. Distance in Metres: It contains **Distance in Metres**. Record the distance (metre) covered from a point to another point in the provided space. Include 2 digits to the right of the decimal.

19. Computed Perimeter (Metres) =: Record the total distance (Metres) covered while walking **from starting point** to all points at the edge of the plot in returning to the **starting point**. Include 2 digits to the right of the decimal.

20. Computed AREA (Square Metres) =: Calculate the area using CAPI device and record it in square metre in the space provided. Include 2 digits to the right of the decimal.

21. Closing Error = (%): Calculate the closing error using CAPI device and record in percentage in the space provided.

22. GPS READINGS:

A. GPS–Perimeter (Metres)=: Record the total distance covered per plot as the perimeter (**Metre**) in the space provided. Include 2 digits to the right of the decimal.

B. GPS–Area (Square Metres) =: Record the Area (**Sq. Metre**) per plot in the space provided. Include 2 digits to the right of the decimal.

Save the track on the GPS unit. Enter the name as “**HHID - PlotID**”. For example, if HHID is 12345 and PlotID is 02, save the track as 12345-02.

23. GPS ACCURACY: Enter the accuracy in meters. This is provided in the upper right-hand corner on the “**Satellite**” page of the GPS unit.

24. WEATHER CONDITION: Tick the box to indicate the weather conditions at the time of GPS plot measurement.

25. TREE COVER: Indicate whether the plot has trees. There may be no tree cover, some tree cover, or heavy tree cover. This question is asked because tree cover may influence GPS precision.

Complete a separate FS1 Form for each plot of the selected household.