

Rural Land Administration
Level-III
Based on March 2022, Version-II
Occupational Standard



**Module Title: Performing Adjudication, Registration
and Certification for Legal Cadaster**

LG Code: AGR RLA3 M08 LO (1-3) LG (21-23)

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Introduction to the Module

This module covers the knowledge, skills, attitudes, and professional code of ethics required to perform adjudication, registration and certification activities for rural legal cadaster in Ethiopia.

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LG #20

LO #1- Preliminary procedures

Instruction sheet 1

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Tools and equipment,
- Source of data and information
- Public information and awareness (PIA)
- Land administration committees (LAC)
- Landholders legal evidence document
- Local parcel boundary marker
- Area of jurisdiction delineation
- Landholders and parcel identification

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify tools and equipment
- Describe source of data and information
- Perform public information and awareness (PIA)
- Establish land administration committees (LAC)
- Identify and collect landholders legal evidence document
- Identify local parcel boundary marker
- Organize and participate on area of jurisdiction delineation
- Identify landholders and parcel identification

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Information Sheet -1

1.1 Tools and equipment

The following tools and equipment items are essential to be fulfilled for effective and efficient implementation of rural cadastral. The number of each item depends on the number of teams.

Table 1.1. Tools and equipment

Type	Tools and equipment
HW	<ul style="list-style-type: none"> ▪ PC (8 GB RAM, 400 GB HDD, i7 CPU, 24" LCD screen, W-10 OS) ▪ A3 flatbed scanner ▪ High speed A4 scanner ▪ LCD projector ▪ Photocopier ▪ UPS ▪ Handheld GPS ▪ Digital cameras ▪ Large format plotter ▪ High speed laser printer ▪ External hard discs ▪ Internet stick
SW	<ul style="list-style-type: none"> ▪ Office software licenses ▪ Quantum GIS software ▪ Anti-virus software ▪ Power Geez software
	<ul style="list-style-type: none"> ▪ Generator + long cables ▪ Furniture ▪ Desks ▪ Chairs ▪ Lockable cupboards Shelves Shelves

MISC	Office equipment <ul style="list-style-type: none"> ▪ Desk lamps ▪ Paper trays ▪ Litter bin ▪ Electric extension cables ▪ Stapler and staples ▪ Paper cutter
	Field equipment <ul style="list-style-type: none"> ▪ 50 meter tapes ▪ Map boards with clips ▪ Scales ▪ Pens& pencils ▪ Erasers ▪ Back packs for field teams ▪ Field boots ▪ Sun hats ▪ Umbrella hats
Consumables	<ul style="list-style-type: none"> ▪ Writable discs
	Printer cartridges for: <ul style="list-style-type: none"> ▪ Wide format plotter ▪ A3 high speed laser printer
	<ul style="list-style-type: none"> ▪ A4 plain paper ▪ Thick paper for parcel maps ▪ Roll paper for large format plotter ▪ Folders for document storage
	Materials for public display <ul style="list-style-type: none"> ▪ Plastic sheet for shelter ▪ Nails ▪ Wood ▪ Clipboards ▪ Sticking fluids (glue) ▪ Clear plastic sheets

	<ul style="list-style-type: none"> Fuel for cars & generators Service & maintenance for vehicles and generators
Transportation	<ul style="list-style-type: none"> Motorized and non-motorized
Base map	Field maps (FM) <ul style="list-style-type: none"> Prepared from ortho-rectified image with suitable scale

1.2 Source of data and information

There are two types of data or source of information identified for systematic rural land registration activities:

- i) **Primary data/ information;** are gained through direct connection or face to face interviews. E.g. to undertake adjudication/verification and registration process for individual land parcels boundaries such data/ information are employed in the presence of;
 - Claimants of individual parcels,
 - Neighbors,
 - A member of the Kebele Land Administration and Use Committee, (KLAUC)
 - Members of the community or elders.
- ii) **Secondary data;** are gained from written documents or evidences. Such as;
 - First level land holding certification
 - Green book
 - Other documents (tax receipts)

There are three main approaches for the selection and collection of attribute data source and information depending on the status of the existing registry from the first level certification (only attribute data).

The attribute information for the kebele is updated using the following steps:

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- a) **If no registry books are available;** all existing information regarding the kebele (meeting notes, taxation etc) is gathered. Field registration form used / No existing registry: There are limited or no parcels in the kebele that are already registered in the kebele registry book. It might also be that a registry book exists, but that it has been decided to register all attributes in the field from scratch anyway due to unreliability of the existing book. In both cases, all details are written down on the field registration form, and all this information is then entered into the attribute table for the parcel in a shapefile in QGIS. The attribute information will at a later stage be entered into a registry book, and the attribute table will be transferred to cadastral database software.
- b) **If registry books are available;** kalegobay papers (minutes from meetings between a land holder and a woreda/ kebele expert regarding the holding rights and borders of a parcel) are collected. These papers will reflect any official changes (e. g. due to inheritance) for a holding or a parcel. The kalegobay are then used to update the registry books of the kebele, so that they contain the most recent information at woreda/ kebele land administration level. From the initial meeting notes, different application forms for transfer of holdership (e.g. due to inheritance), subdivision etc are available at the woreda office. The design of these differs between woredas. Field registration form used / Limited existing registry: A first level cadastral registry exists (e.g. in the shape of a registry book), but does not have full information. It is digitized (put into computer tabular format, preferably in cadastral database software). A cadastral register printout is then used in the field to check the current status together with the use of a field registration form, where additional information and any changes compared to the printout are noted. Any changes in the data in the existing cadastral register is then corrected in the digitized cadaster (using the field registration form), and any additional information from the form is keyed into the cadastral database. The data encoders that digitize the field map only enter the parcel ID texted on the map in the shapefile, preferably together with the registry book number. The existing registry book is thereafter updated and completed.
- c) **If a digital cadastral register exists;** it is updated by going through all transactions in the registry book and make the needed updated in the cadastral register. Printed out

cadastral database used / Up-to-date registry exists: A cadastral register is printed out and used in the field. The encoders receive no separate field registration forms. The only information they key in is the parcel ID texted on the map in the shapefile, preferably together with the registry book number.

1.3 Public information and awareness (PIA)

Creation of awareness on the land registration and certification program at all levels to all key stakeholders is an essential ingredient to successful implementation of the whole process. Therefore, there must be properly designed public information and awareness implementation strategy. The PIA strategy document shall be followed strictly and implemented accordingly. The PIA activities can be systematically organized for internal and external KIA. The PIA campaigns should also be conducted pre, during and post adjudication. Woreda Administration

Political commitment from the Woredas is essential for successful implementation of the cadastral work. The Woreda officials have to be aware of the reasons for land certification and of the progress of the work. This can be achieved by organising information dissemination workshops, training sessions and/or events and by distributing written information materials. Experience sharing between the Woredas should also be facilitated.

i. Woreda office experts

Practical commitment from the relevant Woreda office experts is indispensable for successful implementation of the cadastral work. The Woreda offices experts have to be aware of the reasons for land certification and of the progress of the work because they act as key information agents sharing information about land issues to the community. Increased awareness is achieved by organising trainings, information dissemination workshops or events and by distributing written information materials. Experience sharing between the Woredas should also be facilitated.

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ii. Kebele Administration

The kebele administration is the grass-root institution working as a link between the community and the Woreda. The kebele administration has to be carefully capacitated to disseminate information and to mobilize the community. Increased awareness and capacity is achieved by organising trainings, meetings, information dissemination workshops and/or events and by distributing written information materials. Experience sharing between the Kebeles should also be facilitated.

iii. KLAUCs

The Kebele Land Administration and Use Committees are to be in operation prior to the fieldwork. If not, the KLAUC must be elected and put into operation before the start of the field work. Active participation of the KLAUC in the field is irreplaceable. One of the benefits of the endorsed method of land surveying is that it is participatory and the KLAUCs work as the representatives of the community. The KLAUC has to be trained and capacitated to fulfil their role in a responsible manner. The content of the training is the regional land proclamation and directives and their roles and responsibilities. They should also be trained in the practical procedures of the work. The KLAUCs work on side of the kebele administration in informing the community about certification process and land issues in general. Experience sharing between the different KLAUCs should also be facilitated.

iv. Group of community

The community has an essential role in the land certification process. Their commitment and active participation is necessary and to ensure that the community has to be informed and capacitated. This can be achieved by organising public meetings, target group discussions and by distributing written materials.

Targeted public meetings and information provision have to be a continuous activity. After the regional, Woreda and kebele level pertinent institutions and the KLAUCs have been trained and informed; the information is disseminated within the community. The public meetings are

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chaired by Woreda land administration staff but where possible, the members of the KLAUC will provide explanations and advice. With a participatory method of approach, the experts give a more detailed explanation and elaboration about the planned survey work and the importance of the registration and adjudication work in establishing credible and legally binding tenure security.

Also other means of information dissemination such as radio, posters and leaflets can be used. Dissemination of information, advice and instructions will closely follow local guideline and customs. The overview map image as well as topographical maps will also be used to explain the process for the community.

v. Vulnerable groups

The definition of a vulnerable group is Woreda/kebele specific and addressing these groups has to be based on an analysis and understanding of the local situation. The active participation of women in the work of KLAUCs and in the community meetings has to be encouraged. Target groups meetings for women that address the specific concerns of women have to be facilitated. Focus group discussion and meetings should also be facilitated to other vulnerable members in a community.

1.4.Kebele land administration committee

The committee has the duty and responsibility for administering the land found in the kebele, run the decision of land use through participation of public and collaboration with the woreda branch office authority. Kebele land administration committee (KLAC) performs the following tasks;

- Provide community oversight of the cadastral process
- Accompany field teams (one member per team)
- Verification of field data entry in the field form
- Facilitate dispute resolution
- Disseminate information about the on-going land certification activities and about the benefits of land certification to the community

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Land administration and use committee to be established at kebele level shall, in collaboration with the professional assigned by authority in kebele. Experts are facilitated and assisted the community to elect their committee.

Therefore the committee members must fulfill the following;

- Discipline, responsible and punctuality
- Ability to read and write
- Free or not assigned by kebele administered tasks

The KLAC has to be trained and capacitated to fulfill their role in a responsible manner. The content of the training is the regional land proclamation and directives and their roles and responsibilities. They should also be trained in the practical procedures of the work.

The KLACS work on side of the kebele administration in informing the community about certification process and land issues in general. At least one member of the KLAC works as a member of the field team. Experience sharing between the different KLACs should also be facilitated.

1.5. Landholders evidence legal document

The legal format is readied as evidence of legal agreement reached among adjoining landholders. The attribute information for the kebele is updated using the following steps:

- a) If no registry books are available; all existing information regarding the kebele (meeting notes, taxation etc) is gathered.
- b) If registry books are available; kalegobay papers (minutes from meetings between a land holder and a woreda/kebele expert regarding the holding rights and borders of a parcel) are collected. These papers will reflect any official changes (e. g. due to inheritance) for a holding or a parcel. The kalegobay are then used to update the registry books of the kebele, so that they contain the most recent information at woreda/kebele land administration level. From the initial meeting notes, different application forms for

transfer of holdership (e.g. due to inheritance), subdivision etc are available at the woreda office. The design of these differs between woredas, but an example is shown in the following figure.

- c) If a digital cadastral register exists; it is updated by going through all transactions in the registry book and make the needed updated in the cadastral register.

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ክፍል 12

በወረዳ በስራት የተገኘ የደብዳቤ መጽሐፍ ይመዝገባል። ጥያቄ ውሳኔ መስጫ ቅጽ

በተጨማሪ የሰብአዊ መሬት ስራተኛዎች ስራዎች መመሪያ ስራዎች ቀጥሮ 133/98 ስንቀስ 16 በተደነገገው መመሪያ የመሬት ደብዳቤ መጽሐፍ የመመሪያ መጽሐፍ በወረዳ/የሰብአዊ መሬት ስራ ስራዎች ውሳኔ መስጫ ቅጽ

የውሳኔው ቀጥሮ 171/131/2007

ክፍል 1 የሰብአዊ መሬት ስራ የቀደም ባለደብዳቤ ዝርዝር መገለጫ የሰብአዊ መሬት/ቅጽ/ ስራ ባለደብዳቤ መሬት ስራዎች ስራዎች

1. የመመሪያው የቀረበበት ቀን 12-06-2004

2. በወረዳ የተረጋገጠ የመሬት ስራዎች ማረጋገጫ ደብዳቤ ቀጥሮ _____

3. የሰብአዊ መሬት /ቅጽ/መሬት/ ዝርዝር መገለጫ _____

3.1 ስም አብነት የሰብአዊ መሬት ስም አብነት ስም አብነት ክፍል 03 ዞን ገብ
 መሬት የተደረገ ቀጥሮ 171/131/2007

3.2 ስም አብነት የሰብአዊ መሬት ስም አብነት ስም አብነት ክፍል 03 ዞን ገብ
 መሬት የተደረገ ቀጥሮ 171/131/2007

3.3 ስም _____ የሰብአዊ መሬት ስም _____ የሰብአዊ መሬት ስም _____ ክፍል _____ ዞን _____
 መሬት _____ ቀጥሮ _____

4. የቀደም ባለደብዳቤ/የሰብአዊ መሬት/ዝርዝር መገለጫ _____

4.1 ስም አብነት የሰብአዊ መሬት ስም አብነት ስም አብነት ክፍል 03 ዞን ገብ
 መሬት የተደረገ ቀጥሮ 171/131/2007

4.2 ስም _____ የሰብአዊ መሬት ስም _____ የሰብአዊ መሬት ስም _____ ክፍል _____ ዞን _____
 መሬት _____ ቀጥሮ _____

ክፍል 2 ስራዎች የተገኘበት ይኒታ

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Fig. 1.1. An application for inheritance of a parcel

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To follow these steps is of utmost importance for the success and validity of the new second level registration. At present, the registry book is generally the legal bearer of information in the kebeles. This means in practice that it has to be recently updated and that any digital registers must carry exactly the same information. After the second level registration is finished, both the registry book and the digital cadastre must be updated with all changes encountered in the field. To perform these updating steps before starting the work in a kebele is therefore mandatory!

1.6. Local parcel boundary marker

General boundaries principles will be applied to demarcation and adjudication in rural areas. Land holders must ensure that the boundaries of their land are clearly marked on the ground. If the land holder is not completely sure about all of his/her boundaries, he/she is encouraged to discuss the issue with the neighbours and/or the Kebele Land Administration Committee prior to the demarcation to facilitate the process. It is the land holder(s) responsibility to clarify the boundaries marking his/her plots prior to the commencement of the demarcation process. The surveyors' role will only be to verify and map what is already there and what is in dispute. Holders must satisfy themselves that in those instances where the surveyor has to make ground measurements, he/she is measuring to the agreed boundary corners. Include;

- Fences,
- Tracks
- Stone,
- Footpaths
- Trees
- Plants
- Walls,
- Ditches
- Hedges,
- The bank of a river

1.7. Area of jurisdiction delineation

1.7.1. Acquiring imagery

The acquired digital images for the demarcation must have a resolution of not more than 50 cm, must be ortho-rectified and properly geo-referenced. The acquired images should be verified and certified by EMA. The Regional Offices will receive ortho-rectified images from appropriate institutions

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1.7.2. Baseline Data

Before any demarcation work is undertaken in a registration area, socio-economic baseline data will be compiled. Existing maps (topographic and administrative), a suitable scale (1:5,000 – 1:10,000) of aerial photographs or satellite images will be prepared for overview and planning purposes. The scale of the planning maps should be adapted to the size of the kebele.

1.7.3. Kebele Boundaries delineation

Before the field work begins in each region, it should be necessary to decide how to delimit and produce map showing the registration Kebele boundaries as per the relevant regulations. However, in some cases the kebele boundary will be known by the surveyed parcel boundaries (i.e. each land holder knows which Kebele the parcel is in). Where surveyed parcel boundaries do not show the kebele boundary, the Kebele boundary should be surveyed by handheld GPS supported by control points and/or by plotting on the image using visible features.

The Woreda is obliged to produce a report about the Kebele- and common land boundaries. If the outcome of the report is not satisfactory, the activities have to be repeated. The approximate kebele boundary can be found in files delivered by e.g. the Central Statistics Agency, but it has been found that they are very approximate. For the purpose of selecting the area to print, the borders have been found to be unreliable. It is therefore strongly recommended to follow these steps:

- a) Extract the approximate kebele boundary from the CSA database.
- b) Use the approximate kebele boundary to obtain the needed background images (aerial or satellite).
- c) Display the approximate boundary and the images for the woreda- and kebele expert. Adjust it to follow their suggestions.
- d) Print out the Kebele overview map.
- e) Send a surveyor together with the kebele expert to walk the boundary and to demarcate it with a handheld GPS.

- f) Import the waypoint coordinates from the border demarcation. To QGIS and adjust the borders where it is needed. The maximum error of the boundary compared to the final boundary obtained from the field work should not be more than 100m.
- g) Base map is printed at large scale preferably 1:2000 to 1:500.

1.7.4. Preparation and printing of field maps

The field map printout for parcel demarcation must be not smaller than 1:2,500 for rural land cadastre, otherwise it is difficult to see the details. In areas where there are details that are dense and difficult to see (e.g. in peri-urban areas), scales of up to 1:1,000 can be used. An overview map showing the field map distribution in the kebele should be printed in a suitable scale. Before proceeding with the map printing, make sure that the kebele project in QGIS is prepared as described in previous chapters.

1.8. Land holders and parcel identification

1.8.1. Parcel Boundaries

Landholders must ensure that the boundaries of their land are clearly marked on the ground in agreement with the adjoining landholders. The surveyors will mark what is clearly visible on the ground on the Field Maps. Tape measurements can be used where boundaries cannot be clearly seen on the field map because of poor visibility due to trees or other obstacles. If the land holder is not completely sure about all of his/her boundaries, he/she is encouraged to discuss the issue with the neighbors and/or the Kebele Land Administration and Use Committee prior to the demarcation to facilitate the process.

1.8.2. Disputes

Land holders must try to resolve all disputes before the process begins no matter if these are about holding rights or boundaries. If it is not possible to resolve the disputes, those land parcels will be recorded as disputed during the field process and the 2nd level certificate issuance might be delayed. Disputes that cannot be solved during field work will be passed to the KLAUC for later resolution, supervised and followed-up by Woreda experts to avoid forgotten cases.

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1.8.3. Adjudication of rights and right holders

The adjudication of the rightful landholders and types of rights should be identified and recording of information in the FRF will only be in the names of the rightful land holders. To verify the rightful landholders both existing legal documents such as green books and tax receipts as well as local people can be used as sources of information. If the current land holder is different from the legal holder, then procedures for updating the register are encouraged to be performed before adjudication. If this is not possible, the procedures should start as soon as possible after the adjudication took place. For new land-holders the normal procedure of registration is applied.

Self-check-1

Name..... ID..... Date.....

Part-I

Write “True” if the statement is correct & “False” if the statement is in correct. (3 points)

1. Primary data/ information are gained from written documents or evidences.
2. Secondary data are gained through direct connection or face to face interviews.
3. The community has an essential role in the land certification process.
4. General boundaries principles will not be applied to demarcation of rural areas.
5. Fences, Stone, Ditches and Trees are local parcel boundary marker.

Part-II

Match the following tools and equipment (5 points)

I		II
..... 1)	Base map	A) Stapler and staples
..... 2)	Consumable	B) Map boards with clips
..... 3)	Software	C) Scanner
..... 4)	Office equipment	D) Ortho-rectified image
..... 5)	Field equipment	E) Quantum GIS software
..... 6)	Hardware	F) Printer cartridges

PART-III

Short answer (5 point)

1. Describe public information and awareness implementation strategy.
2. Explain general boundaries principles and local boundary maker types.
3. List kebele Boundaries delineation methods.

LG #21

LO#2- Field data collection

Instruction sheet 2

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Field data collection
- Adjudication
- Boundary demarcation using orthophoto
- Recording textual data
- Regional field registration forms

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Perform field data collection
- Apply adjudication
- Conduct boundary demarcation using orthophoto
- Perform recording textual data
- Understand regional field registration forms

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Information Sheet -2

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2.1. Field data collection

‘Demarcation of land’ is normally completed at the same time as ‘adjudication/verification and recording of details’. This provides for the identification of individual land parcel boundaries and holders of individual parcels, in the presence of :-

- 1) A member of the Kebele Land Administration and Use Committee,
 - 2) Neighbors,
 - 3) Members of the community (if needed),
 - 4) A team leader,
 - 5) A surveyor, and
 - 6) A data recorder.
- The ‘General boundaries’ principles will be applied to demarcation and adjudication in rural and peri-urban areas.
 - Surveyors will simply mark parcel boundaries as identified on the ground and image onto the field map and give each land parcel a unique identification number.
 - If new parcel identification numbers are required, they will be allocated as a block of numbers for each field team. This will enable the surveyors to keep a simple check on the parcel numbers as work proceeds. New numbering is required if there are no existing IDs in the kebele or if the existing ID system is decided by the Woreda or region to be replaced (e.g. if the existing data is of poor quality).
 - To ensure that the land holder is uniquely identified, he/she will be identified with as many names as possible, e.g. by adding the grandfather name. If both the husband and the spouse are registered, it will also reduce the risk of identification errors. Neighbours are also used for identification.
 - It is the land holder(s) responsibility to clarify the boundaries marking his/her plots prior to the commencement of the demarcation process. The surveyors’ role will only be to verify and map what is already there and what is in dispute. Holders must satisfy themselves that in those instances where the surveyor has to make ground measurements, he/she is measuring to the agreed boundary corners.

- Any person who has a legal right to the land (or their legal representative) should be present during the adjudication and demarcation process. For example, if a land holder is married, it is recommended that the husband and spouse are both present. The land holder(s) will then point out the boundaries to the surveyor, who will ‘walk’ the boundary and mark these clearly onto a field map in the presence of the holder(s).
- The neighbours and the Kebele Land Administration and Use Committee member should also be present to verify the claims of the holder. No formal measurement is necessary unless boundaries are unclear or concealed by vegetation, in which case tape measures will be used. If Green Books (or equivalent) exist, they should be shown by the land holder(s) during the surveying procedures.
- Holders of multiple land parcels as shown in 1st level certificates must identify each parcel separately as the team move systematically from parcel-to-parcel throughout the kebele.

On each working day, the teams responsible for identifying boundaries will go together with the Kebele Land Administration and Use Committee member. The field team will carry the following equipment: -

- 1) The relevant image sheet on a hard board (map sketching case)
- 2) Field data form
- 3) Pencil (for field demarcation)
- 4) A permanent marker pen (preferably blue or red)
- 5) A tape measure of at least 50 m
- 6) Handheld GPS (only for identifying the parcel location)
- 7) Ruler (scale)
- 8) Digital camera with accessories (battery, memory card etc)
- 9) Bag for carrying the equipment.

2.2. Adjudication

- a) Land holders will show the parcel boundaries to the field team. This will be witnessed and confirmed by the neighbors sharing boundaries with the demarcated parcel, plus a representative from the Land Administration and Use Committee.
- b) Any documents held, including 1st level certificates or other documents, must be presented to the Kebele Land Administration and Use Committee member and the field team. The essential information in any presented document is entered in the field data form by the data recorder. If a photo ID (e.g. in the book of holding) is provided, this must be confirmed to be showing the holder(s).
- c) Land holders with 1st level certificates; the following details in the certificate should be recorded on the field data form:
 - ✓ The holding book reference number as given on the front cover.
 - ✓ The neighbours listed in the holding book are used to verify that the parcel location and holder is correct.
 - ✓ All holder names as well as the total number of parcels in the holding is also taken from the certificate (if this information exists) and written in the field data form.
- d) If no documentation exists, witnesses and neighbors are invited to attest to the holders claim.
- e) If more than one certificate is presented for the same parcel, the certificate that was issued first is registered. The information in the second certificate is added in the field data form as additional information for further investigation.
- f) Neighbors on all sides will be called to verify that there is no dispute over boundaries or holder rights.

2.3. Boundary demarcation using Orthophoto

The following general steps are used to demarcate rural land using orthophoto based on manmade and natural features and applied on clear boundary when the boundary is unclear or covered by dense forest take a look in detail steps on the operation sheet below.

2.3.1. Demarcation on clear boundary

- 1) The parcel boundaries will be drawn on the field map using the pencil. The parcel will then get a unique identification number (UPIN) by the field team (normally by the surveyor). The UPIN will also be written on the field map inside the parcel boundaries. If a new parcel number is given, it is the smallest unused number in an interval that is given to each team before each working day. The intervals are specified so that there is no risk of duplication. Sequence gaps caused by intervals that are not completed are allowed though. If a team finishes an interval, a new one is given to them before they continue.



Fig. 2.1. Demarcation and attribute data registration

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- 2) Both agreed and disputed boundaries will be recorded on the relevant field map. Disputed boundaries will be annotated on the field map and noted on the field data form. If a border is in dispute, a question mark is written on it on the field map to be able to quickly detect dispute location.
- 3) Demarcation of land will be based on features visible both in the field map and in reality. In marking of boundaries the holders will use boundary markers commonly used in the adjudication areas including boundary tracks, footpaths, ditches, fences, trees, plants and stones.
- 4) If two parcels are divided by a public footpath, gully or other feature wider than one meter, that area should be confirmed by the Land Administration Committee member if it should be registered as common land, divided by the two neighbors or included in one of the neighboring parcels. It should also be registered together with a parcel if servitude exists (e.g. the right for others to use a footpath that crosses the parcel).
- 5) Some tape measurements and scaling on the ground will be necessary in order to mark parts of boundaries that either are not visible on the field map, are newly demarcated (e.g. when boundaries are changed to allow for public access) or are obscured by overhead vegetation. If measurements have to be made in slopes, the surveyor has to re-calculate the slope distance to horizontal by using simple techniques, e.g. using ratios between objects measured on the ground and in the field map or by holding the tape horizontal and measure the distance in intervals. With a ruler, the correct distance can then be used to draw the object on the correct place in the image.



Fig. 2.2. Tape measurement



Fig. 2.3. Scaling on FM

- 6) It is important that all measurements have to be controlled. This is done by measuring the distance from the demarcated point to another object that is visible in the field map. The

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distance on the ground should then be confirmed by the distance on the field map (measured with the ruler).

- 7) In very rare situations, it might be impossible to demarcate a parcel corner even by using repeated measurement tapes, due to the absence of nearby objects visible in the image. This might be the case e.g. in densely forested areas. In this case, other techniques (e.g. the use of total stations) have to be implemented. This alternative should only be used if there is no other way to get a reasonably accurate position (around the meter), since it is very time- and resource consuming to re-visit a site with the needed equipment. The team leader shall immediately report such situations to the project manager in order to be able to plan the additional terrestrial surveying effectively.



Fig. 2.4. Measurement on dense forest

- 8) If a parcel is found to be impossible to demarcate on the map due to severe disputes or visibility problems, the registration is not performed. If the parcel has no reliable existing ID, a parcel number is reserved for the parcel for the postponed demarcation. This to be able to use consecutive or similar parcel numbering within a certain area. If demarcation is not possible in an area containing several parcels (e.g. covered by a forest), the quantity of parcels affected are determined together with the Land Administration and Use Committee, and an interval covering the expected maximum quantity is reserved for the postponed demarcations.

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- 9) When completed, the field map will show individual land parcels and their respective UPINs as shown in the following image:



Fig.2.5. Parcel borders drawn on a field map

- 10) To improve the possibility of detecting wrongly written parcel IDs, it is possible to write the registration number of the holding/parcel book (“green book” if it exists. This is a number that can be found in the holding book of the land holder, and is usually seven digits.



Fig. 2.6. Holding/parcel book number written under the parcel ID.

11) The advantage with this is that in case of doubt about a written parcel ID, the registry ID can be used as an extra check. If a database table is connected that contains the registry ID, it can be checked against the registry ID from the map.

2.3.2. Demarcation of parcels where the borders cannot be seen in the image

In some cases it is difficult to see the borders in the image and at the same time identify the features on the ground. If this only concerns one or two of the border corners, it can simply be solved by using the measurement tape from the other corners or some other identifiable objects. However, if it concerns most or all of the points, it is a big problem. These situations mainly occur in some specific types of locations;

- In deep and vast forests,
- On meadow,
- Wet or grasslands with very few features in the image and on the ground.



Fig. 2.7. Unclear boundary

A field map appears to be forested common land...but is in fact divided into several parcels.



Fig. 2.8. Seasonal wetlands in Fogera (upper part of the image).

The borders are often clearly marked on the ground but very difficult to see in the image.

i. Tools and equipment:

- Field Maps (Orthophoto),
- Measurement Tape/ Meter,
- Scale Ruler,
- Pencil or Pen,
- Hand Held GPS.

ii. Hand Held GPS (HHGPS) celebration

This is needed to compensate for differences between the coordinate system of the handheld GPS and the map, where the GPS uses a standard Adindan coordinate system and the map uses the EMA version. It also partly compensates for the current atmospheric disturbances and satellite constellation errors. If we use them within the coming 30 minutes, we can reduce the absolute error to less than 3 meters in normal situations. After this, the satellite movement in the sky will create new constellations which will slowly increase the error.

- a) Calibrate HHGPS coordinate system based on the Field Map.
- b) Find two objects in the field map that are sharp and clearly defined both in the image and on the ground. Preferably it should be objects on the ground with a clear sky visibility (bridges, flagpole foundations, footpath crossings etc).
- c) The objects should preferably be in the same field map, but if it is not to be found, a neighboring field map will be OK.
- d) Start the handheld GPS and keep it on for at least 10 minutes before the measurements and measure the object for at least 10 minutes. If the GPS has an averaging function it should be used.
- e) Plot the coordinates in the field map (using a ruler to get the exact position) and draw a GPS correction line between the plotted point and the real location of the object. They normally differ with 1-5 meters.
- f) Repeat the process on the second object and check that the GPS correction lines have a similar size and direction. If not, repeat the measurements for the points.

2.4. Recording of textual data

When a parcel is demarcated, the data recorder will record the details land records for registration using Field Registration Form (FRF). A uniform FRF should be used by all woredas/kebels. The content of FRF includes the following column headings/attributes:

- Unique parcel identification number (UPIN):
- FRF Number, Field Map Number, Team Number and Date of registration.
- Evidence for holding: Temporary certificate and other evidence.
- Holding type.
- Means of acquisition
- Year of acquisition
- Fertility
- Current land use type
- Encumbrances
- Dispute
- Name, age and relation of holder(s)
- Signature of holder(s)
- Name and address of guardian
- Number of families living and depending on the parcel
- Name and signature of the land administration committee and the team leader to authenticate the information listed on field form.

Example of Regional Unique parcel identification number (UPIN) in Ethiopia: based on;

- i. Parcel based, and
- ii. Holder based land registration.

1) Parcel based Unique parcel identification number (UPIN):

This is for parcel based cadastral system for all regions except Amhara region.

- Region (two digits),
- zone (two digits),
- Woreda (two digits),
- Kebele (three digits) and
- parcel identification number (five digits)

(Region code + Zonal code+ Woreda code + Kebele code + Holding number + Parcel number).

- Region code (type= Alphabetic text; 2 digits: OR, BG, TG, SP... 2 letter of your region).
- Zone code (type= Numeric; 2 digits: 04, 06, 01,05)
- Woreda code (type= number; 2 digits; 01, 02, . . .)
- Kebele code (type= number; 3 digits: 001, 002,)
- Parcel number code (type = number; 5 digit: 00001, 00002,)

Example for Benishangul, Oromia, SNNP... has 14 digits: BG010100100001

2) Holder based Unique parcel identification number (UPIN):

Whereas for Amhara has 15 digits in the following manners;

(Region code + Zonal code+ Woreda code + Kebele code + Holding number + Parcel number).

- Region code (type= Alphabetic text; 2 digit: AM)
- Zone code (type= Alphabetic; 2 digits: AA, BB, CC,)
- Woreda code (type= number; 2 digits; 01, 02, . . .)
- Kebele code (type= number; 3 digits: 001, 002,)
- Holding code (type = number; 4 digit)
- Parcel number code (type = number; 2 digit: 01, 02,)

Example of Amhara Region.....AMEE001010001/01

2.5. Regional field registration forms

The contents of the field forms in different regions and Woredas might have slight differences, and are adapted to the decision of the region where the surveying is made. In the table below, the contents from all different trial Kebeles are listed.

FULL NAME	EXAMPLE	EXPLANATION
Survey date	21/02/2005	Ethiopian date used
Field sheet	127	
Team number	2	
Signed	Yes	Attribute sheet signed by land holder, team leader and LAC representative
Parcel ID	00024	
First level certificate	10124563	
Other evidence	Yebelun	
New Parcel	Yebelun	Parcel that is not registered before
Date of issue	12/05/1997	
Ownership type	Yegil	
Current land use	Heresha, annual crop	
Land fertility	Lemui, mekakelegna	
Encumbrance type	Menged	
Dispute type	Yebelun	
Means of acquisition	Wursi	
Date of acquisition	23/02/1989	Ethiopian date used
Additional information	Yebulun	Parcel info from the field that does not fit in any other column
Land holder(s)	Kenenisa Bekele	
Land holder(s) gender	M	
Family size	15	
Guardian name	Yebulun	
Guardian address	Yebulun	
Number of parcels	5	
Neighbours	N Tirunesh Dibaba E Haile Gebreselassie S Meseret Defar W Abebe Bikila	Only in Amhara region

Fig. 2.9. Field data form contents used in the trials.

Fig.2.10. Field registration form in Ilu woreda, Oromia.



RELA TRIALS - SNAP REGION - PARCEL FIELD FORM					
ZONE	Gurage	Woreda	Median	Kibele	Wolenebet
FIELD SHEET NUMBER	21	FIELD TEAM NUMBER	4	Ethiopian Date	18/10/2009
GREEN BOOK NUMBER	1010229	OTHER EVIDENCE	YES / <input checked="" type="checkbox"/>	OTHER EVIDENCE TYPE	
PARCEL NUMBER	03/123	NUMBER OF PARCELS IN HOLDING	9	Status of Fertility	B
OWNERSHIP TYPE (i.e. individual, communal)	807d	ADDITIONAL INFORMATION	YES / <input checked="" type="checkbox"/>		
ENCUMBRANCES	YES / <input checked="" type="checkbox"/>	ENCUMBRANCE TYPE		Current Land Use	አገዛዝ
DISPUTE	YES / <input checked="" type="checkbox"/>	DISPUTE DESCRIPTION			
DETAILS OF PEOPLE WITH AN INTEREST IN THE PARCEL					
We hereby acknowledge that the information we provided about this land parcel is true.					
	NAME	SIGNATURE	STATUS		
HOLDER 1	አማራ ስርዓት ገገጽ	አማራ ስርዓት ገገጽ	ገገጽ		
HOLDER 2	አማራ ስርዓት ገገጽ		ገገጽ		
HOLDER 3	አማራ ስርዓት ገገጽ		ገገጽ		
HOLDER 4	አማራ ስርዓት ገገጽ		ገገጽ		
HOLDER 5	አማራ ስርዓት ገገጽ		ገገጽ		
HOLDER 6	አማራ ስርዓት ገገጽ		ገገጽ		
HOLDER 7	አማራ ስርዓት ገገጽ		ገገጽ		
HOLDER 8	አማራ ስርዓት ገገጽ		ገገጽ		
HOLDER 9	አማራ ስርዓት ገገጽ		ገገጽ		
HOLDER 10	አማራ ስርዓት ገገጽ		ገገጽ		
HOLDER 11					
HOLDER 12					
GUARDIAN DETAILS					
GUARDIAN ADDRESS					
Kibele LAC MEMBER	አማራ ስርዓት ገገጽ	አማራ ስርዓት ገገጽ			
RELA TEAM LEADER	አማራ ስርዓት ገገጽ	አማራ ስርዓት ገገጽ			

Fig.2.11. Field registration form from Meskan woreda, SNNPR.

የመስከ መረጃ ማሰባሰቢያ ቅጽ (_____ ወረዳ / _____ ተበላ)

አጠቃላይ መረጃ

የክልሉ ቁጥር _____ የክርታ ቁጥር _____

የይዞታ/ግን ማህያ ቁጥር _____ ልክታ የተከሰቱበት ቀን (ዓ.ም/ወር/ቀን) _____

የይዞታው አይነት

<input type="checkbox"/> አይዞታው የሆነ	<input type="checkbox"/> የጋራ	<input type="checkbox"/> የወል
<input type="checkbox"/> የማንኛውም	<input type="checkbox"/> የግል	<input type="checkbox"/> ሌላ

የይዞታ ማስረጃዎች

<input type="checkbox"/> ማስረጃ የሆነው	<input type="checkbox"/> የድርጅት ትኬት	<input type="checkbox"/> የይዞታ ማረጋገጫ ደብተር	የይዞታ ማረጋገጫ ደብተር ቁጥር
<input type="checkbox"/> የተከሰቱ ደረሰች	<input type="checkbox"/> ጌታዊ የይዞታ ማረጋገጫ		

አጠቃላይ

ከልሳ የተገኘ መረጃ ማረጋገጫ

☐ የተሰጠበት ☐ የልተሰጠበት ☐ አልሰ

የአይዞታው (ዎች)

ዋግዚት

ገንዘብ ቀበሌ/ቀጥ

መሬት አጠቃቀም

_____ ስፋት _____

<input type="checkbox"/> ቅጣት ስጠል	<input type="checkbox"/> ባር	<input type="checkbox"/> ጠፍ መሬት
<input type="checkbox"/> አጠቃቀም ስጠል	<input type="checkbox"/> ደን	<input type="checkbox"/> ሌላ
<input type="checkbox"/> ግጥሚያ	አጠቃላይ	

የበደረሰ ደረጃ

<input type="checkbox"/> መረጃ የለም	<input type="checkbox"/> መካከለኛ	አጠቃላይ
<input type="checkbox"/> ከፍተኛ	<input type="checkbox"/> ገንብተኛ	

አገልግሎት በመስጠት _____ በመስጠት _____

በሰሜን _____ በደቡብ _____

ተጨማሪ መረጃ

የዋግዚት አገልግሎት _____

<input type="checkbox"/> የለም	<input type="checkbox"/> የአገር ማገዝ	<input type="checkbox"/> የውሃ መስመር
<input type="checkbox"/> መረጃ የለም	<input type="checkbox"/> የመስጠት መስመር	<input type="checkbox"/> የውሃ ማፋሪያ ስሪ
<input type="checkbox"/> ሌላ	<input type="checkbox"/> የአልክ መስመር	<input type="checkbox"/> የመስከ ስሪ

አጠቃላይ

ቅርንጫፍ

<input type="checkbox"/> የለም	<input type="checkbox"/> የይዞታ ደንብ	አጠቃላይ
<input type="checkbox"/>	<input type="checkbox"/> የደንበር ጥያቄ	

ሌሎች _____

ፈቃድ

የአይዞታው _____ የስልክ መሬት _____

የመሬት አስተዳደር ኮሚቴ ሊመገባል _____

Version 20150327

Fig.2.12. Field registration form from Amhara.

Self-check-2

Name..... ID..... Date.....

Part-I

Write “true” if the statement is correct and “false” if the statement is in correct. (2 point)

1. Demarcation must not be complete at the same time as adjudication and recording of details.
2. Land holder or their legal representative should not be present during the adjudication and demarcation process.
3. Land holders will show the parcel boundaries to the field team.
4. The parcel boundaries will be drawn on the field map using the pencil.

Part-II

Choose the correct answer from the given alternatives (2 points)

1. Identification of individual land parcel boundaries and holders of individual parcels, in the presence of?

A. Neighbors	C. Member of the community
B. KLAUC	D. All
2. The field team will carry?

A. FRF	C. Ruler
B. HHGPS	D. All

PART-III

Short answer (10 point)

1. List and describe contents of the field registration format (FRF)
2. Describe UPIN based on parcel and holder based expression.

Operation Sheet 2

2.1. Measurements of parcel boundaries when partially viewed.

i. Tools and equipment:

- Field Maps (Orthophoto),
- Measurement Tape/ Meter,
- Scale Ruler,
- Pencil or Pen
- Hand Held GPS.

ii. Procedures:

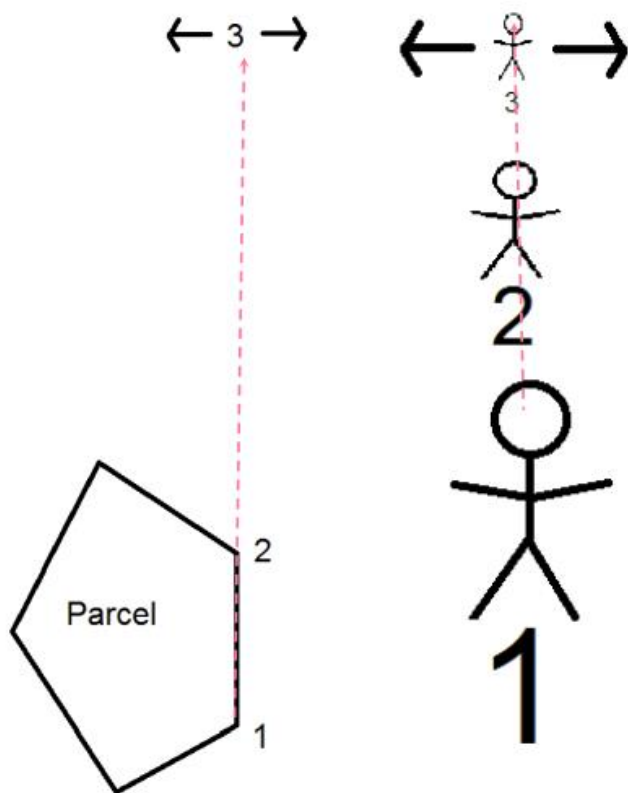
Step-1: HHGPS calibration.

Step-2: Parcel boundary partially viewed is measured.

In the figure below, the stone fence ending (A) and corner (B) are measured. The objects locations in the image are marked with triangles and the plotted coordinates from the GPS with circles.



- 1) Mark all parcel corners that are visible in the image and confirmed on the ground. For the remaining corners that we cannot see in the image, and where the visibility around the parcel is good (e.g. cropland or meadows), we now proceed as follows:
- 2) Find an object that is located anywhere on the border of the parcel. The object should be visible in the image as well as on the ground. The object could be;
 - A large rock,
 - The corner of a crop field or
 - The crossing of a footpath etc. It should now be treated as a border corner.
- 3) Make a small cross in the image on the selected object (1 in the figure below). Let one person remain standing on this point.
- 4) Move to the next parcel corner where the border turns from the straight line. Let one person remain standing on the point (2 in the figure below).
- 5) Now a surveyor moves with the handheld GPS to a position (3 in the figure below) which is following the straight line from person 1 and 2. The distance should ideally be at least four times the distance between 1 and 2, and should have a reasonably clear sky visibility (not under trees). Person 1 and 2 should stand fixed on their points, but person 1 should now shout to person 3 to move left or right until person 3 is exactly in the line of person 2, as viewed from person 1.



- 6) Person 1, 2 and 3 should be on a straight line. 3 is moving left and right, guided by 1 to find his position in the straight line. In the image example, person 2 is standing on the parcel corner. Person 3 (with the GPS) should move a little to the left in this example picture.
- 7) Measure the location 3 with the handheld GPS (check that you have the right coordinate system). It is enough to read the coordinates in the display (no point has to be stored). Preferably, measure at least 1 minute so that you see that the coordinates are not fluctuating.
- 8) Plot the coordinates from the GPS on the field map for point 3 using a ruler to get it exact (displayed with a star in the figure below).
- 9) Look at the GPS correction lines that you made for the reference points. Now draw a line (marked in red below) from the plotted GPS point with the same direction and distance as the correction lines. Be sure to get the right direction. Look at the reference points, the line should go FROM the plotted point TO the image detail. The corrected GPS point is now marked with a circle, and corrected for the coordinate system shift.

- 10) The green line in the figure below now shows the corrected direction of the border point.
- This line is only to illustrate the direction in the figure. It is not needed in the real work



- 11) Use the 50 m measurement tape and measure the distance from 1 to 2. Plot it on the field map in the direction from 1 to 3 with the measured distance by using a ruler



- 12) The point 2 is plotted in the direction of 1 to 3, using the border distance on the ground (37.15 m in this example).

2.2. Measurements of parcel boundaries in a dense forest.

i. Tools and equipment:

- Field Maps (Orthophoto),
- Measurement Tape/ Meter,
- Scale Ruler,
- Pencil or Pen
- Hand Held GPS.

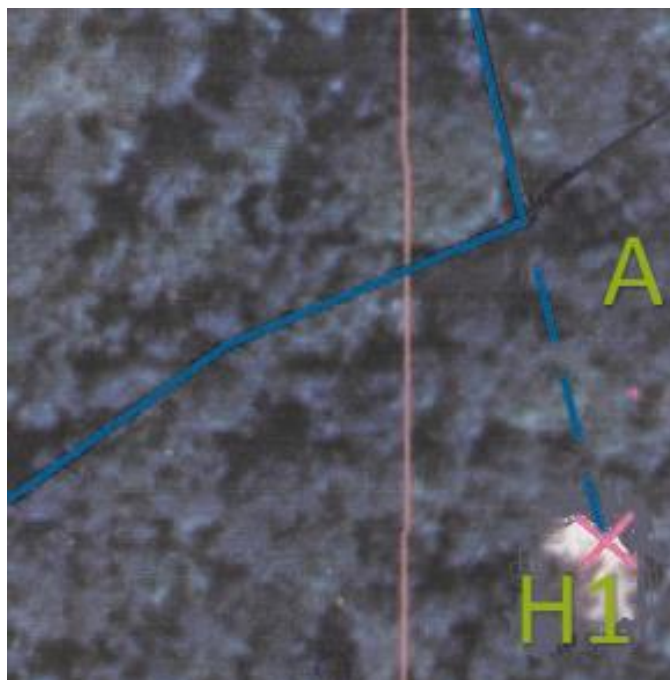
ii. Procedures:

Step-1: HHGPS calibration.

Step-2: Parcel boundaries in a dense forest are measured.

To find a starting point for the border measurement, choose method in the following priority order:

- If possible, start from a border corner that is visible in the image and on the ground.
- If this is not to be found, start anywhere on a straight border line at a place that you can identify in the image (e.g. a boulder), and treat it as a border corner.
- If e.g. a footpath (with reasonably clear sky for the GPS measurement) is crossing the border we can see it in the image, but we do not know in the image where on the footpath the border is crossing it. To solve this, measure with the GPS where the footpath is crossing the border. Find the place in the map by adding the measured GPS correction line to the GPS coordinates and plot that place on the map as a help point. From the help point you find the closest distance to the footpath and put the point there, since we know that the GPS measurement took place on the footpath.
- If even this is impossible to do, try to locate a place that is in the sightline of one of the borders with an identifiable feature. This will be our first help point (H1 in the figure below).
- If you only find an open place (without features) in the line of sight, use the GPS technique (including the GPS corrections) to mark a help point there.



- A help point H1 is marked in an open space in the line of sight along the chosen border.
- ✓ **To demarcate the next point, the priority order is as follows:**
 - 1) Find the parcel corner (B) on the ground and in the image (see figure below).
 - 2) If it is not visible, find a detail along the border that is visible in the image. The detail should be as far away as possible from the first point to minimize the angular error in our traverse.
 - 3) If no point could be found along the border, continue in the line of sight to find a feature that is visible in the image.
 - 4) If no feature is found, use the GPS and plot a help point (H2 in the figure below) somewhere along the border or behind it (following the line of sight). Remember to add the GPS correction line to the plotted point. The location should be on a straight line, as far as practically possible from the first border corner (that we already demarcated), but preferably within “measurement tape distance” from the second border corner.
 - 5) If you start from a help point behind the first parcel corner, measure the distance between the help on the ground with the measurement tape. Then measure the distance to the second border point (as long as the border line is straight).

- 6) If a second help point was used, also measure the distance from that to the second border point as a control.
- 7) Now use the measured distances, the help point(s) and a ruler to plot the parcel corners.



- 8) Since the method uses GPS measurements where the errors are not minimized by the proportion of triangles, it is especially important to check the loop misclosure by checking the distance between the first and last point on the ground and in the image.

2.3. Measurements of parcel boundaries on a plain.

i. Tools and equipment:

- Field Maps (Orthophoto),
- Measurement Tape/ Meter,
- Scale Ruler,
- Pencil or Pen
- Hand Held GPS.

ii. Procedures:

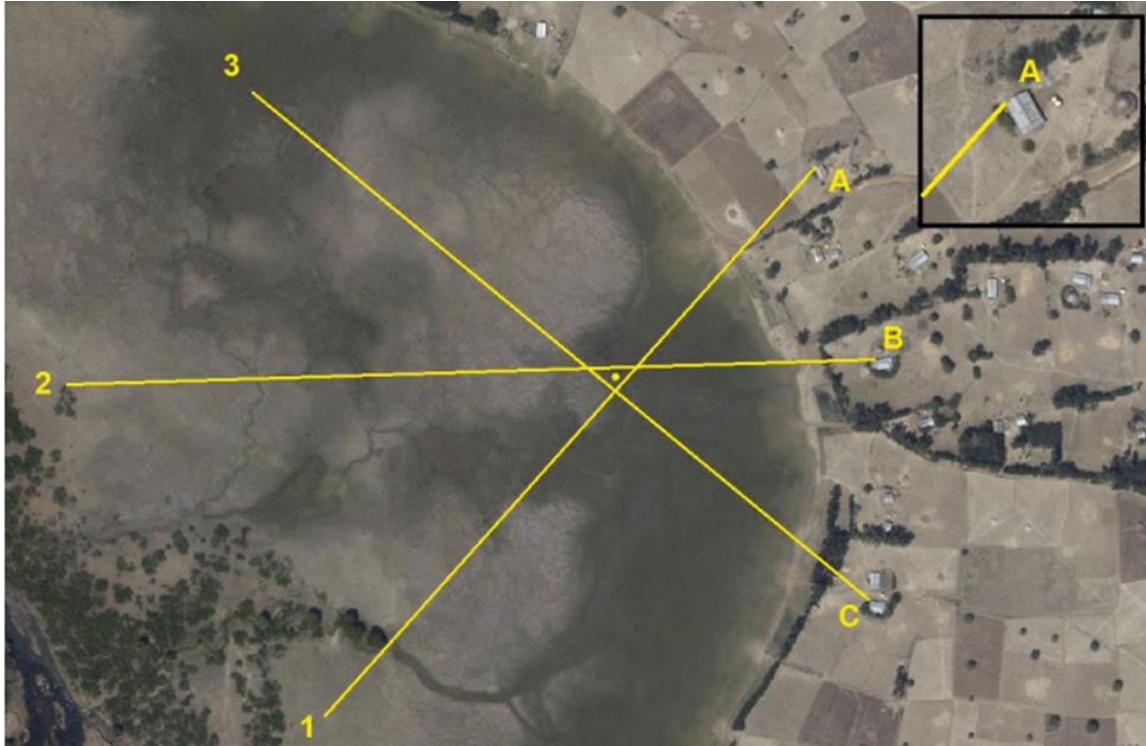
Step-1: HHGPS calibration.

Step-2: Parcel boundaries on a plain are measured.

If a parcel is situated on a plain, several hundred meters from any reference point, a starting parcel corner point could be established by the following method:



- Determine the GPS correction line by measuring with handheld GPS on defined details as described before.
- 1) Find three additional reference objects that are well spread around the parcel and easily identifiable on the image as well as on the ground. House corners or poles are suitable objects. They do not need to be measured with the GPS.
 - 2) Put one person or object on the reference points if they are not clearly identifiable.
 - 3) Put a person or object on the selected parcel corner.
 - 4) Estimate the distance from the parcel to the object A. Try to find a place which is at least double that distance, but on the other side of the parcel (this to keep the error down by using the proportion of triangles principle). Now walk so that the parcel corner and the reference object A are in the exact line of sight.
 - 5) Measure the point with handheld GPS, apply the determined GPS correction line and plot the help point 1 on the field map.
 - 6) Repeat the process for reference point B and C to create help point 2 and 3.
 - 7) Draw help lines (light pressure and with a pencil so that they can be erased later) with a ruler between the point pairs A-1, B-2 and C-3.
 - 8) The three lines will now form a small triangle, normally with the corners 2-3 meters from each other. Plot a point in the centre of the triangle. This is now the plotted and corrected parcel corner, which can be used as a reference for other corners. Erase the help lines to finish the process.



- Plotting of parcel corner without using measurement tape (e.g. on fields when there are long distances from the reference points).

LAP Test-2

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Apply and Perform adjudication/ ascertainment and mapping of right to land in case of unclear boundary. (Duration 6hr)

Tools and equipment:

- Field Maps (Orthophoto),
- Measurement Tape/ Meter,
- Scale Ruler,
- Pencil or Pen
- Hand Held GPS

Task-1: Measure parcel boundaries when partially viewed.

Task-2: Measure parcel boundaries in a dense forest.

Task-3: Measure parcel boundaries on a plain.

LG #22

LO#3- Office data processing

Instruction Sheet 3

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Handover field document
- Scanning
- Geo-referencing
- Digitizing
- Quality assurance and control
- Public Display and Hearing
- Registration
- Certification
- Tenure Documentation
- Updating of land Register

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Perform the handover field document
- Apply scanning
- Perform geo-referencing
- Perform digitizing

- Apply quality assurance and control
- Operate public display and hearing
- Apply registration processes
- Develop certification
- Perform tenure documentation
- Aware of updating land register

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below.
3. Read the information written in the information Sheets
4. Accomplish the Self-checks
5. Perform Operation Sheets
6. Do the “LAP test”

Information Sheet -3

3.1.Handover field document

In principle Field registration Forms and Sketched Field Maps shall be recognized and stored in systematic archives.

- a) Field officers shall hand over the registration forms and sketched field maps to the Woreda Land Registration Expert / Data Encoder.
- b) The Data Encoder has to verify that information has been collected as per the desired format and standards (number documents, quality and contents).
- c) The Data Encoder shall create a filing and storage system.

3.2.Scanning

The scanning operation can be performed for Field Registration Format (FRF) and Field Map (FM).

3.2.1. Scanning field registration forms (FRF)

All scanning is to be done in A4 or A3 format, black and white, or colour (if stamps or signatures are in blue ink), density of 300 dpi and output format .pdf.

3.2.2. Scanning of sketched field maps (FM)

This step is depending on the model and type of scanner that is used. However, regardless of scanner type, the following general remarks can be mentioned:

- The scanner should have a sufficient scanning area to support A3 format and scan in colour with high resolution.
- If QGIS is used for georeferencing, the image format TIFF should be used, since it combines a high image quality with embedded georeferencing information. If Kebele Digitizer is used, the JPG format should be used.

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- The scanned image should be stored in the Image Files \ Scanned Field Maps directory for the current kebele.
- The file name should be Woreda_Kebele_Field map XXXX_Team Y. The words Woreda and Kebele are replaced by the current location, XXXX is replaced by the Field map number, which is expressed with four digits. E.g. 7 becomes 0007, 67 becomes 0067 and 3451 is still 3451. Y is the number of the team that demarcated the map in the field (not the name of the office encoder's team). The latter due to that sometimes encoders digitize other teams' maps due to the workload situation. We are interested in who actually did the field work. A name example could be Meskan_Wolensho 2_Field map 0045_Team 3.
- Colour scan and the highest resolution should also be selected, and afterwards the image should be rotated so that North is upwards. If the resolution is selected as DPI, 300 are enough for our purpose.

3.3. Geo-referencing

3.3.1. Preparing the sketched field map for geo-referencing in QGIS

First take the sketched field map and make circles around the grid crosses that are closest to the four corners of the map. In the following figure, they are called 0, 2, 6 and 8 (QGIS by default start geo-referencing point IDs with 0). After that, we need to mark four grid crosses in the middle of all sides as well as one in the middle.

To facilitate error searching, we will also keep the selected crosses on three vertical and three horizontal lines. This means that circle 0, 1, 2 shall be on the same horizontal line, as well as 3, 4, 5 and 6, 7, 8. At the same time, circle 0, 3, 6 as well as 1, 4, 7 and 2, 5, 8 should be on the same vertical line.

After selecting the four corners there is some flexibility, since there is no grid cross exactly halfway between the map corners. We can therefore select the grid cross to the immediate right or left of the middle. It is known that grid crosses displayed on top of dark areas (e.g. forests) or especially if a pendrawn parcel border hides the grid cross, it is difficult to find the exact centre

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of the cross during georeferencing. We should therefore select the grid crosses that has a bright, even background if possible.



Fig. 3.1. A bright, even background (without pen lines) gives the best accuracy.

We should therefore look at the image and select the best contrast location for point 1, 3, 4, 5 and 7 in the figure below. They still have to form a horizontal and vertical line, so we then have to evaluate which combination that gives the best contrast for the grid crosses (and no pen lines crossing them). The four possible combinations are H1_V1, H1_V2, H2_V1 and H2_V2.

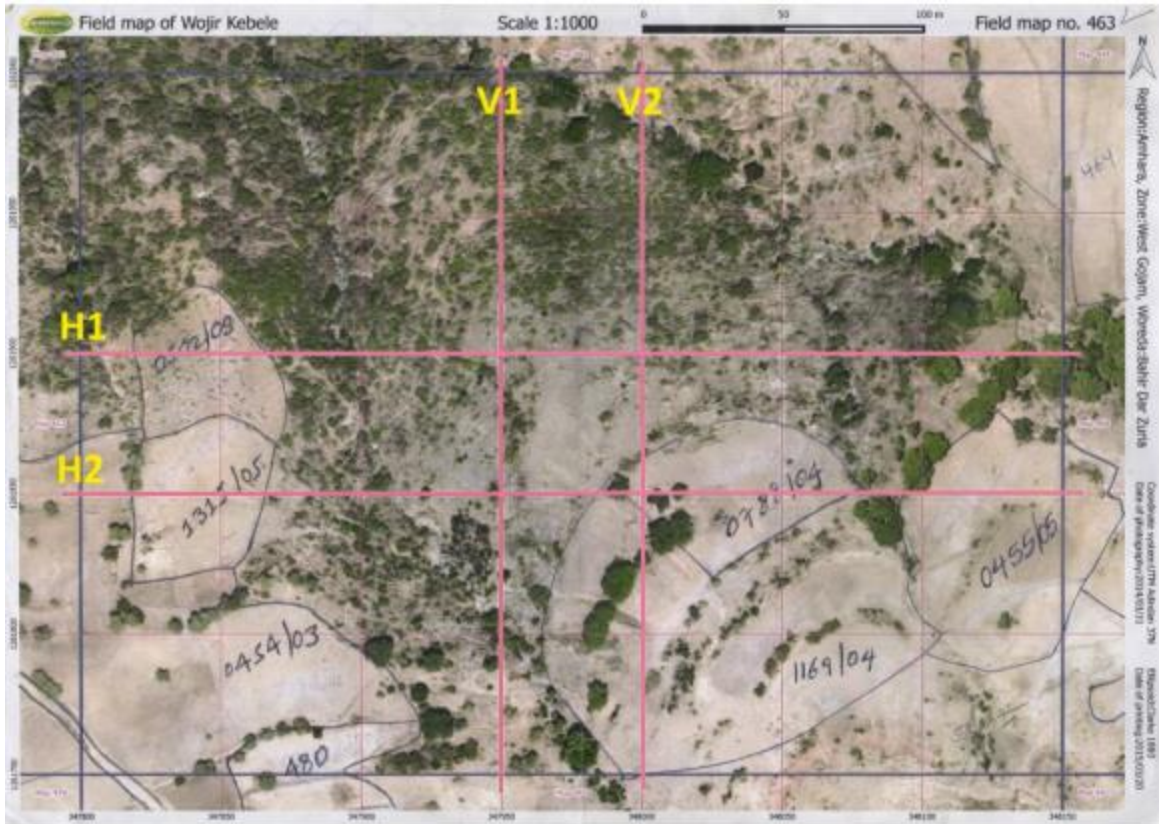


Fig. 3.2. The four possible line combinations.

In the example below, it is visible that the combination 1b, 3b, 4b, 5b, 7b gives a light background for almost all grid crosses and still keep the vertical and horizontal line.

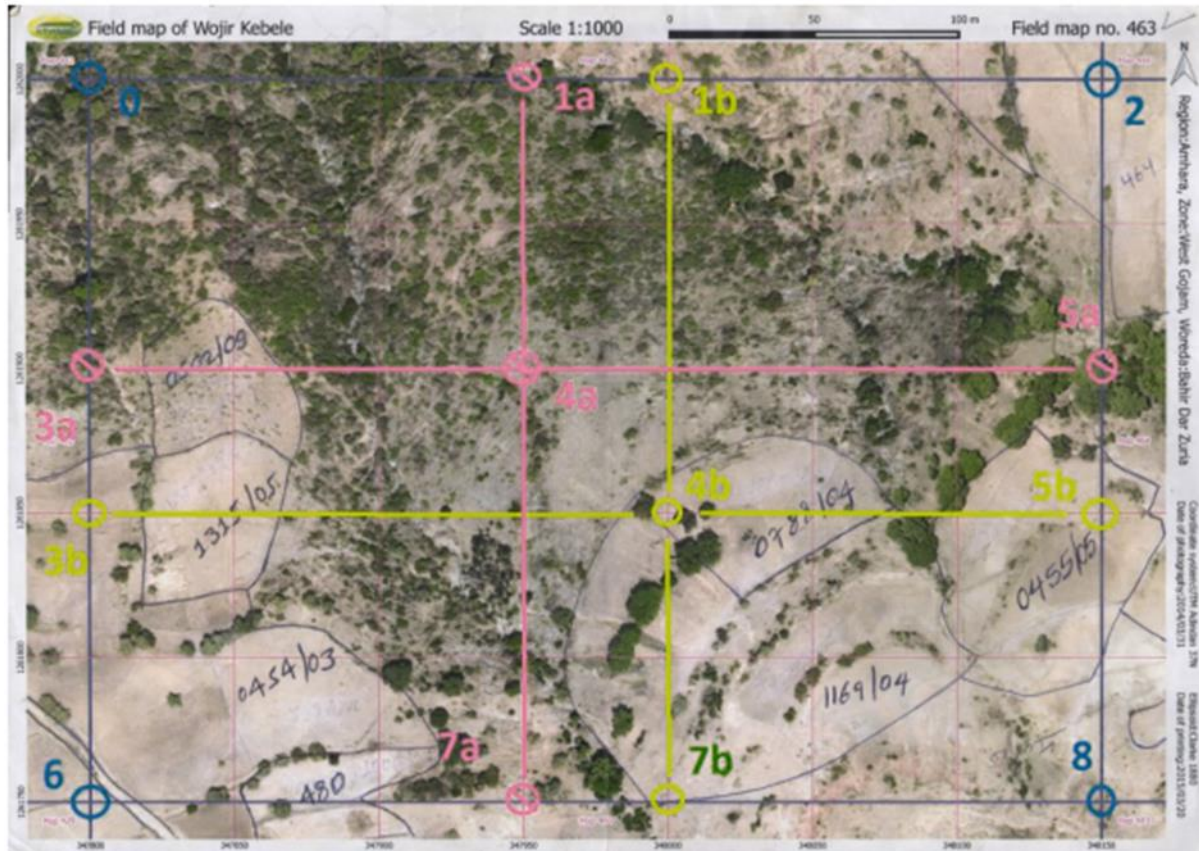


Fig. 3.3. The selected grid crosses combination.

Finally, the selected grid crosses are circled with a black pen.



Fig. 3.4. Location of selected grid crosses.

Make a table of the coordinates of the circled grid crosses as shown in the example below (Easting should come first). Check the Easting coordinates by starting from each grid cross and go down to the coordinate value. The Northing is found by going left in horizontal direction from the circled grid cross until you reach the coordinate. All coordinates will normally be visible on the scanned image, but it is easier to use the map since it has a better overview.



Fig. 3.5. Easting 347800 and Northing 1261750 for a grid cross.

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A list could then look similar to the table below. After getting experience within this, it is possible to do the geo-referencing directly on the screen without the table. We are now ready for the scanning!

Circle ID	Easting	Northing
0	425600	970900
1	426000	970900
2	426300	970900
3	425600	970700
4	426000	970700
5	426300	970700
6	425600	970400
7	426000	970400
8	426300	970400

Fig.3.6. Example of table of circled grid cross coordinates.

3.3.2. Geo-referencing of sketched field maps

After a field map is scanned, it is available as a digital image. However, the computer has no idea about where the field map area is located. To give this information, we click on a number of grid crosses in the map and give their coordinates. The software can then orient the map and locate it in the project coordinate system. If we digitize details in the map after geo-referencing, they will then have the correct coordinates in the project system.

3.3.3. Testing the general quality of the printed map

Use a ruler and measure the distance between the four grid crosses close to each map corner. Using A3 and 1:1000, the horizontal distances should be exactly 350 mm and the vertical 250 mm (calculate distances for other combinations). Check all four distances (top-down-left-right). If they are not correct, it is normally the cause of a toner drum malfunction in the printer, so in that case notify the printer staff that the drum needs to be replaced.

3.4. Digitizing Using Quantum GIS

If there are some serious map distortions (e.g. due to mechanical problems in the scanner or printer, or if the scanned paper printout is damaged), or if Kebele Digitizer is not available, the geo-referencing should be done in QGIS.

- **Pre-requisites**

- ✓ A scanned image in TIFF format.
- ✓ Circles around selected grid crosses in the image, following a certain layout.
- ✓ A coordinate list of selected grid crosses created.
- ✓ A QGIS project opened, with all previously described mapping adapted settings, including the Adindan / UTM zone xxN (xx=36, 37 or 38) coordinate system.

- **Digitizing**

To digitizing parcel boundaries;

- The parcels are then digitized to form polygons by using the Quantum GIS software.
- The Quantum GIS area calculation function is used to obtain areas of all digitized parcels.
- The UNPIN (parcel ID) of each parcel is entered as an attribute to each digitized polygon. More information is added to the attribute table (from the field registration forms) to make information displays and analysis possible graphically.
- After an area is digitized, the shape file that is created is added to a common kebele map file as a new layer. The newly imported parcels that are adjacent to the parcels existing on the map are carefully checked for gaps and overlapping. This is aided by e.g. making the new layer visible/invisible, and to have a different color on the new parcels before they are confirmed and integrated. Larger discrepancies between old and new adjacent parcels are checked in the images to verify the error source. If the error could not be detected with 100% certainty (together with the responsible surveyor if needed), a re-survey has to be performed in the field.

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- The attribute table containing parcels and calculated areas is copied to Microsoft Excel and sorted to search for multiple existence of unique parcel IDs (double numbering). If multiple IDs are found, the Orthophoto printouts are first checked. If the error remains, it is sent back to the field for verification and correction.

After demarcation is conducted (simultaneously textual data recorded) the office work is started through two ways.

- ✓ Digitizing the data in QGIS (spatial and attribute data) for NRLIS system is not implemented.
- ✓ Inter to the MASSRAGE by deferent role (for non-spatial data) and QGIS-Plugins (for special data).

The data processing is under taken through deferent ways one is through QGIS software in worded NARLAIS (National Rural Land Administration Information System) is not implemented and the second one is through MASSREGE (Mass Registration) in area NARLAIS system is implemented.

- ✚ In the first case the document is scanned, Geo-reference digitize, encode the attribute data and make ready for any Geo-processing application and query (refer module five in detail).
- ✚ In the second case field data will be entered into system by dedicated data entry staff in the local office by using MASSREG. The data entry process in MASSREG implements the double entry approach in which field registration form data is encoded and crosschecked twice by two different data entry operators. When it comes to spatial data which is the core aspect of Second Level Land Certification (SLLC), it processed using the plugin integrated in QGIS applications which are running on computers. The QGIS option allows GIS users to scan field maps that are produced by adjudication teams and use it for screen digitalization.

3.5. Quality assurance and control

In this stage the reason to applying quality control is to make sure the data should be reliable and representative of real world, specifically

- ✓ Complete data (for special and non-special data)
- ✓ No line duplication(for special data)
- ✓ No gaps of geometry(for special data)
- ✓ No open polygon(for special data)
- ✓ No overlap polygon(for special data)
- ✓ No duplication of UNPIN(for special and non-special data)

Quality control should also consider the following activities in addition to the above criteria;

- ✚ Follow up the boundary demarcation process in order to assure the exact representation of reality on the ground, especially the parcel that demarcated using tape measurement and similar parcel color on field map.
- ✚ Checks daily, whether all parcel boundaries are demarcated systematically or not.
- ✚ Check all parcel boundaries are closed or not.
- ✚ Check the demarcated parcel boundary before being traced over with pen.
- ✚ Assure the consecutiveness of UNPIN to avoid duplication.
- ✚ Cross check UNPIN on the field map with field registration form.

3.6. Correction of Textual Data

Correction of the textual data is classified into the following two categories:

3.6.1. Minor Correction:

Refers to the data which are incomplete or with minor mistakes that occurred when filling in the Field Registration Form (FRF) during field adjudication and demarcation.

These corrections do not call for a new FRF to be filled in.

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The following two types of corrections are defined under this category:

- ✓ Spelling mistakes and some incorrectly recorded data.
- ✓ Misspelling of names (i.e. first, second or grandfather's name);
- ✓ Incorrectly recorded data such as sex, age, etc.
- ✓ Incomplete information.
- ✓ Tenure type/type of holding;
- ✓ Photo ID;
- ✓ Holding ID number;
- ✓ Means and years of acquisition;
- ✓ Land use type; and
- ✓ Soil fertility
- ✓ Signature.

3.6.2. Major Correction:

These are corrections required when change of the current registered owner for a particular parcel or holding is required or when all the information entered in the FRF is incorrect. These types of corrections call for a new FRF to be completed in the field. Cases might be many but examples may include the following:

- ✓ When two or more parcels are incorrectly recorded as one parcel. This may occur if a parcel is recorded as a multi-part polygon, or if a Parcel ID is accidentally duplicated.
- ✓ When one parcel is registered as two or more parcels
- ✓ A complete transfer of holding for a parcel supported with proper documentation;
- ✓ If the landholder's information filled in the FRF is completely wrong or missing; whatever the category of non-special data the data has to be corrected (the detail of the correction presented in module five). But in case of NARLIS system during data entry the system itself controls the minor errors and mistakes.

3.7. Public Display and Hearing

In this process, all committee invites the community residents to a public display and hearing, where everyone has the opportunity to look into the data and question, if necessary, results. This process gives the final approval to the results of the registration process. Disagreements inevitably arise when registering land. Neighbors may argue over exactly where a boundary lines. Boundary markers may get moved or lost. People who are not present during the initial registration process may disagree with the results. Many other problems and disputes could arise. Resolving such disputes can be complicated, expensive and time-consuming and can delay the land certification process. The public hearing procedure speeds up the process and gives as many people as possible certainty over their land tenure as quickly as possible. It is transparent and involves the whole community, leading to trust in the system. Where land holders have any objections, they must complete an objections form.

The following procedure is followed during the public display period:

- a) After demarcation and adjudication/verification is complete, the Claimants list and parcel maps (printed out in the scale 1:5.000) will be made available for public inspection in the kebele.
- b) Every claimant of the kebele must verify that the information on the list has been recorded correctly against the correct parcel and that all the information concerning their land is true.
- c) In case of any mistakes or omissions, the claimant must request the Kebele Land Administration and Use Committee for an Objection/correction form which must be completed.
- d) The Kebele Land Administration and Use Committee will be available to assist reading the provisional records and maps.
- e) Kebele Land Administration and Use Committees will advise the claimant on how the objections are to be resolved. This may take some time in certain cases.
- f) After corrections have been made and any objections have been addressed, the temporary list will be adjusted.
- g) The period for objections and corrections will last for 1 month.

- h) Provisional printouts from data transferred into the data management system will be displayed in public for one month.
- i) A public hearing is arranged, where everyone has the opportunity to look into the data and question, if necessary, results. This process gives the final approval to the results of the registration process.
- j) A provisional adjudication/verification record will be prepared and displayed when the kebele teams have demarcated all land parcels in the kebele and when the committee has heard and considered the claims of all persons for all land parcels.

3.8. Registration

Registration includes wide steps on operational manual including the data processing steps because analog based registration in the field, encoding the field map in the computer (QGIS), coding and plotting on the field map, converting it to digital form (scanning, digitizing), join both (spatial and non-spatial data), put to public display and hearing and finally correcting based on the public comment, whether the NARLIS system or during NARLIS system the completion of this kind of work is considered as registration.

3.9. Certification

Certification becomes after all the process, and it is the process of providing a license for land holders that would create confidence for better land developments. This follows three principles the first one is mirror principle, curtain principles and insurance principle. Then certificates provide security of tenure and currently it is important for collateral.

3.10. Tenure Documentation

There are a lot of documents, which are input for certification like tax receipt, first level certificate, will document, court decision etc.... this input is an evidence of tenure for land holders. After the certification, there are deferent kinds of transaction that make change the title, so that the new title certificate provided to new holder the copy of that new title will document in the office. The canceled title is also being documented. Therefore all the history file has to be documented in hard copy as well in the in the proper place.

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3.11. Updating of land Register

Updating is the most important part of sustaining cadaster and land registration because there is transaction (inheritance, or succession, will, lease, donation, etc...). So the land holder will change their title after land registration, that need to up-to-date the data in the book of register (in analog case) or database in (in case of digital data) or WORLIS that process is called updating of land record. This process should keep and maintain through all life of the cadaster unless the data will die.

- ✓ Application for the updating of the land registry records shall be submitted to the Woreda land administration office, through KLAC and the Kebele LA expert.
- ✓ Notification (public hearing [including public display] and claims) at the KLAC office if needed.
- ✓ If there are no claims or after they have been solved the application is processed at the Woreda land administration office.
- ✓ Then, a new landholding certificate issued. The hard-copies of the land register (at woreda and kebele levels) are updated correspondingly.
- ✓ A copy of the new landholding certificate is delivered to the land holder; another copy is kept in archives at the woreda land administration office.

Self-check-3

Name..... ID..... Date.....

Part-I

Write “true” if the statement is correct and “false” if the statement is in correct. (2 point)

1. Spelling mistakes are attributes of Minor correction
2. When two or more parcels are incorrectly recorded as one parcel is handling by minor correction.
3. Public display process gives the final approval to the results of the registration process.
4. Land certification process provides a license for land holders.
5. Check all parcel boundaries are closed or not is not a quality control task.

PART-II

Short answer (10 point)

1. Explain about the benefit of rural land certification.

2. Explain about tenure documentation and updating.

Operation Sheet 3

3.1. Scanning sketched field maps

- ✓ Scanner preparations.
- ✓ Before the scanning of sketched field maps (parcel borders demarcated with pen) is started, check that the scanner driver has been properly installed on your computer (only needed once).
- ✓ If not, follow these installation steps for Mutek ScanExpress A3 USB 600 Pro scanner as an example.
 - i. Before you start, connect the scanner to the power socket, but do NOT connect the USB cable to the computer.
 - ii. Insert the installation CD; it will automatically start the installation software.
 - iii. Choose Scanner driver, then select English and push OK.
 - iv. Push Next three times (in the three following windows), and finally push Install. The driver software will then be installed.
 - v. When the installation is finished, you are requested to restart the computer. Push Finish to restart it.
 - vi. When the PC is fully restarted, connect the scanner to the computer through the USB cable. Then connect the scanner to the power source. The scanner should now install itself automatically.
 - a. Check that the PC is started and attach the scanner through the USB cable. The scanning software will then start automatically. For future use, it is enough to open the scanner lid to start the scanning software.



Figure 1. The scanner software



- b. Click on the Settings button  and check that the settings are as in the figure below.



Figure 2. The Settings window.

- c. Open the File name dialog  and first go to your project kebele directory. Then go to the subdirectory Image Files and finally Scanned Field Maps. Then name the file Woreda_Kebele_Team*_Map፳ (* replaced by team number, ፳ replaced by map number, e.g. ADA'A_ADULALA_Team1_Map1). Underscores are used between the words, and no spaces are used (Team 1 becomes Team1).

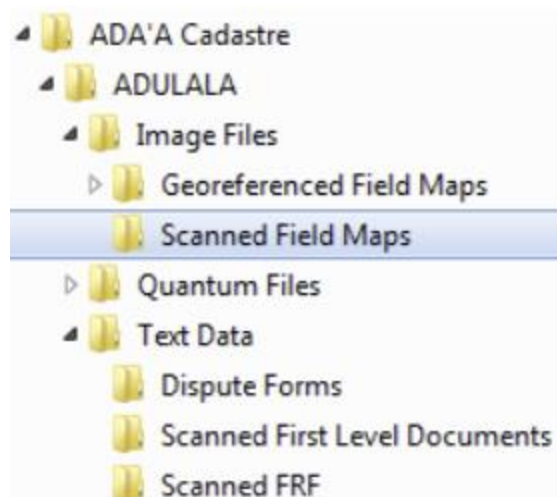





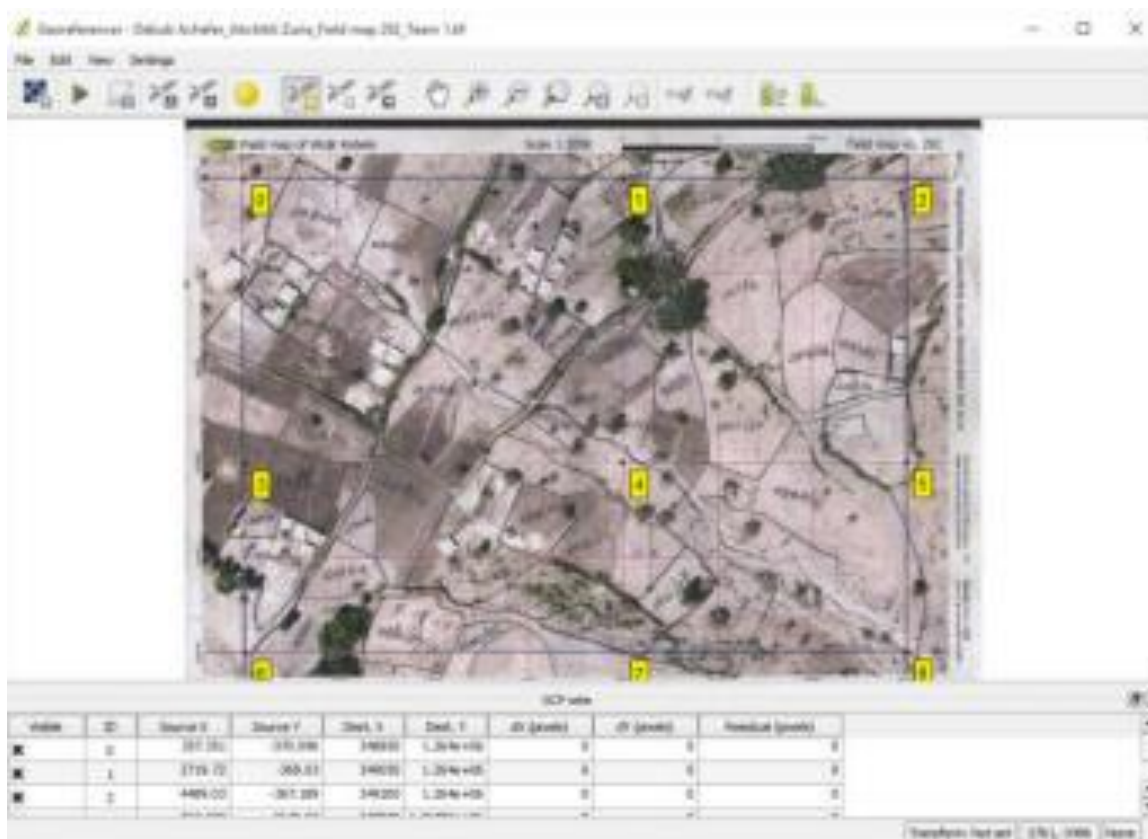
Figure 3. The directory for the scanned field maps.

- d. The file format must be TIFF, otherwise the georeferencing will not work!
- e. When the settings are finished, click on  to save them and return to the scanner window.
- f. Click on  to start the scanning. Wait until the scanning is finished and Microsoft Picture Viewer has opened. Rotate the picture if needed so that North is up. Take out the picture from the scanner to be able to see where North is. Close Picture Viewer when you are finished.
- g. If sketched field maps (parcel borders demarcated with pen) are scanned daily before being finished (as a backup), they are called e.g. ADA'A_ADULALA_Team1_Map1a, the next ...1b etc. The final scan of the finished sheet is only called ADA'A_ADULALA_Team1_Map1 (no letter at the end).

Operation Sheet 4

4.1. Geo-referencing function

- ✓ Choose Raster, Geo-referencer and Geo-referencer in the main menu.
- ✓ In the new Geo-referencing window, push  to select the scanned image, which should be found in the subdirectory Image Files\Scanned Field Maps in your project kebele directory if the scanning was performed correctly.
- ✓ If the coordinate system is asked for, choose Adindan / UTM zone 37N in the quick list (zone 36 in the far West and 38 in the far East of Ethiopia).
- ✓ Now the image should be displayed on the screen in the Geo-referencing window



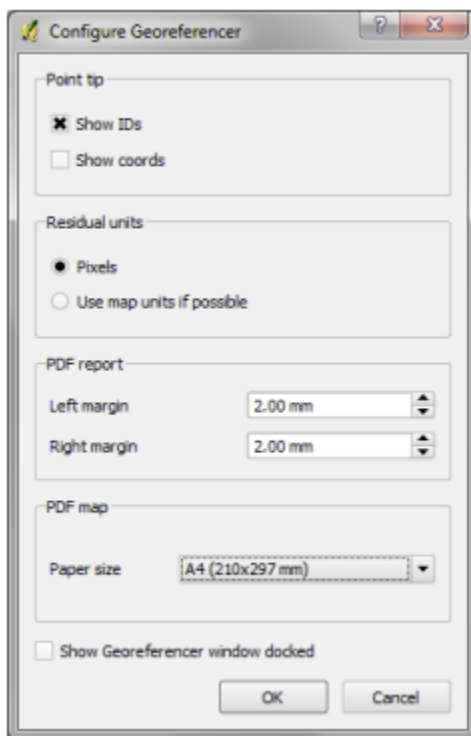
The Geo-referencing window.

- ✓ Select View, Panels and mark GCP table to see the coordinate window.





Activation of the panel GCP table.

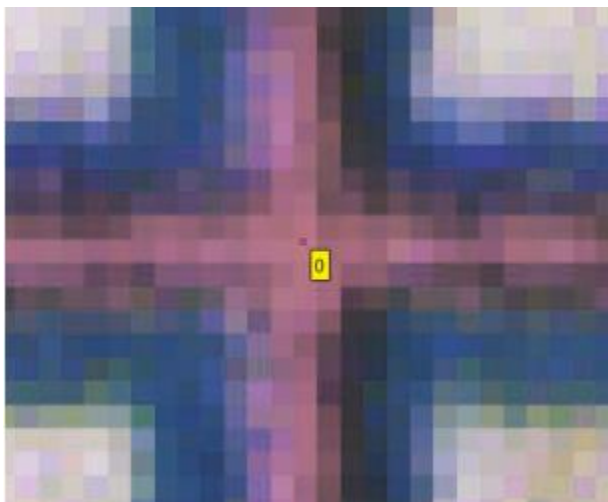
- ✓ Then select Settings and Configure Georeferencer. Check that the settings are as in the figure below (change them otherwise) and click OK.



Configure Georeferencer window.

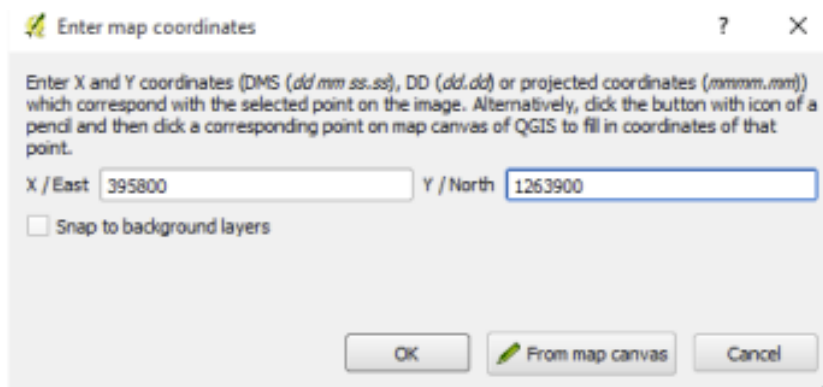
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- ✓ Click with the  button to zoom several times on the grid cross with the circle in the upper left corner. It is important to zoom in very close to the grid cross to be able to mark it exactly. Now select the  button and click exactly in the middle of the grid cross.



Marking of the centre of a grid cross.

- ✓ You will then be asked to give the GCP coordinates. They are found in the paper table that was created from the selected grid crosses during the preparation stage of the scanning. The coordinates should be entered with Easting before Northing. After clicking OK, the coordinates should appear in the GCP table.





Enter map coordinates

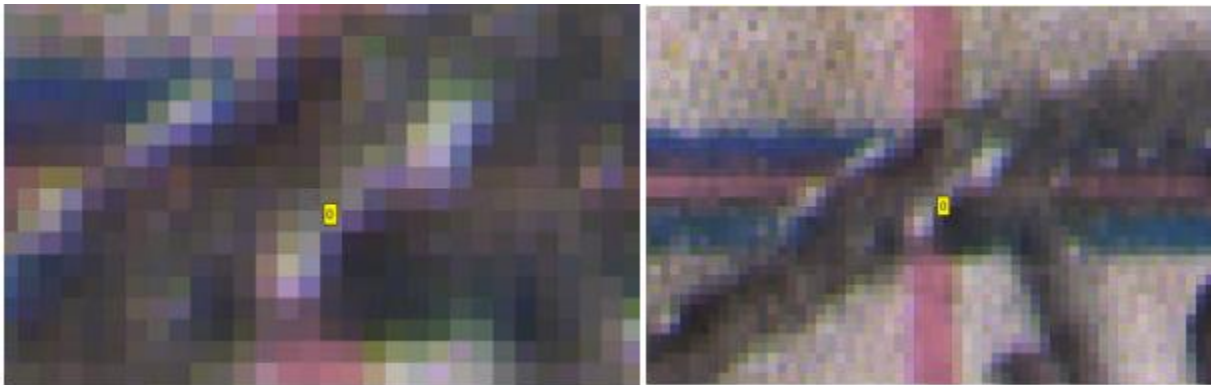
Enter X and Y coordinates (DMS (dd/mm.ss.ss), DD (dd.dd) or projected coordinates (mmmm.mmm)) which correspond with the selected point on the image. Alternatively, click the button with icon of a pencil and then click a corresponding point on map canvas of QGIS to fill in coordinates of that point.

X / East Y / North

☐ Snap to background layers

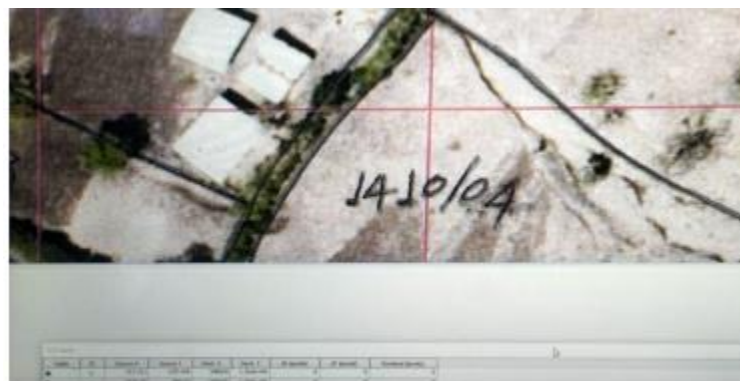
Enter map coordinates interface.

- ✓ Zoom out to see the whole image by clicking on  . Then zoom in to the next circled grid cross (number one), select the  button and mark exactly in the middle of the cross. Give the GCP coordinates as described before, and continue for all circled grid crosses. Be very careful to enter the right coordinates and to select the right grid cross.
- ✓ In some cases (e.g. if the grid cross is covered by a pen line) it is better to zoom out a bit to see exactly where the cross centre should be marked



Zooming out for a better demarcation of the cross centre.

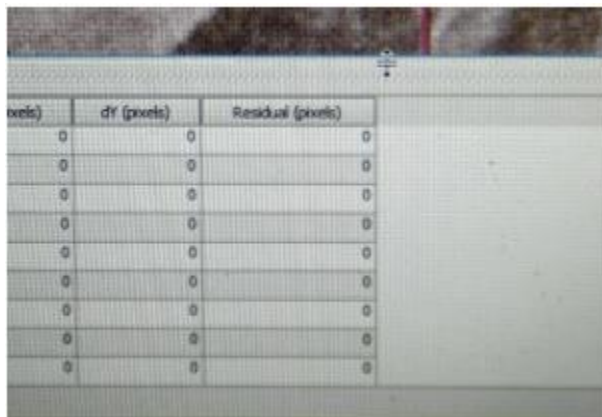
- ✓ When all nine (0-8) selected grid crosses are measured, we will now adjust the GCP table. If the table is not attached to the bottom of the screen, click on the top bar of the table, hold down and move it to the bottom of the screen. When a gray field appears at the bottom of the screen, release the button. The GCP table should now fill the lower part of the Geo-referencer window.





Moving the GCP table.


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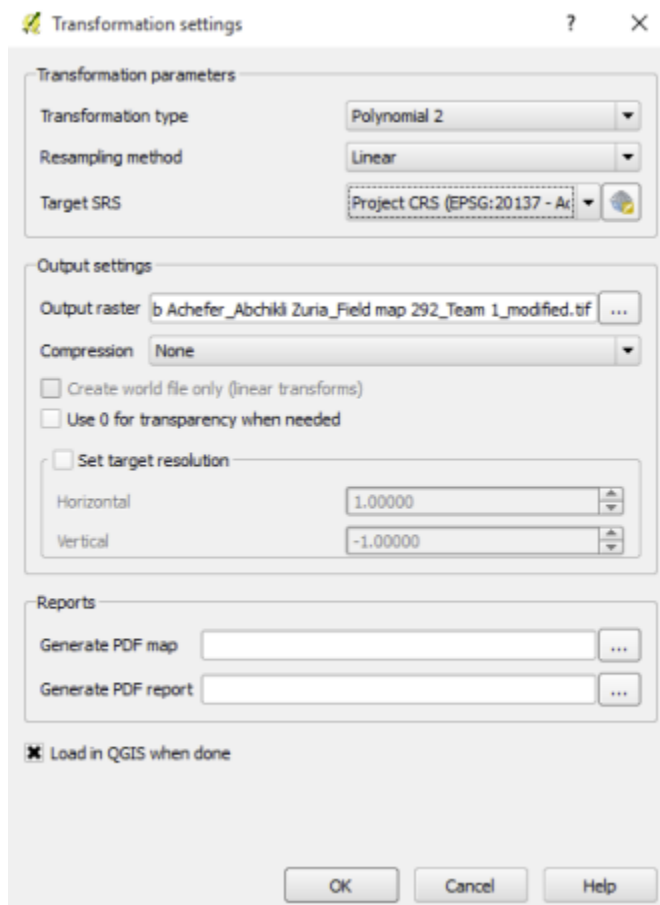
- ✓ The table should now be adjusted so that we see all nine reference point lines (but not more). Go to the top sideline of the table until the mouse cursor changes (see figure below). Click, hold down and adjust the height of the table to view all the nine lines, and finally release.



Adjusting the table height.

- When all checks are performed, click on Settings and Transformation settings (or use the  button). Set Transformation type to Polynomial 2. This means that a second degree polynomial equation is used to transfer the coordinates. This makes it possible to use out nine points to correct local deformations (e.g. due to exposure from wind, water and sunshine) of the scanned image if the deformations not too big.
- During the geo-referencing process a new image is created, and each pixel (smallest part of the picture) is moved from the old image to a new location in the new image. This is called Resampling. To keep maximum contrast for linear objects, the linear method should be selected if available in the scanning software.
- Compression of the image might result in format problems with some software, so it should be set to NONE.
- Click on the Output raster  button and accept the image name without changing anything. This will mean that you will create a corrected output file which has the same name as the input file but with “_modified” added to the name. This file is rotated so that north is exactly straight up on the image, and also has reference information built into it. Then click on OK.

- Then click on the Coordinate system  button. Choose Adindan / UTM zone 37N (or 36-38 if used locally) in the quick list and click on OK.
- ✓ Finally check that the box Load in QGIS when done is marked, and click on OK.




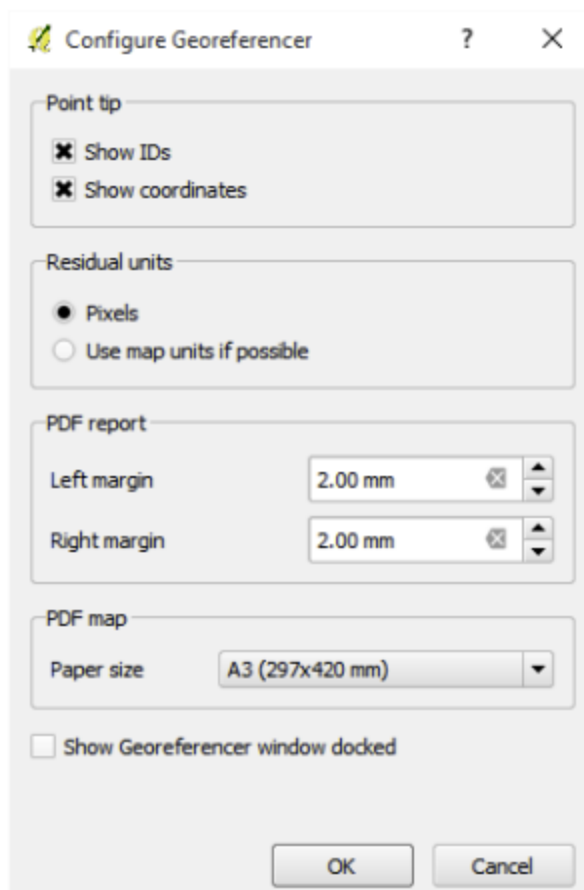
The Transformation settings window.

- ✓ After adjusting the transformation settings, different values (instead of zeros) should now be visible in the Residuals (pixels) column.
- ✓ Click twice (with a few seconds delay) on the column Residuals (pixels) in the GCP table. It should now be sorted with the highest residual first. If the highest value is less than two, the geo-referencing will normally be performed without trouble. If the highest error is higher than three pixels, there is normally an error in the point demarcation or in the entered coordinates.

on/off	id	srcX	srcY	dstX	dstY	dx[pixels]	dy[pixels]	residual[pixels]	
	3	364.00	1496.78	425600.00	970700.00	1.66	-1.55		2.27
	1	2716.15	288.65	426000.00	970900.00	1.69	-1.24		2.09
	0	354.31	311.78	425600.00	970900.00	-1.47	1.24		1.92
	4	2732.80	1467.07	426000.00	970700.00	-0.98	0.88		1.32
	8	4535.96	3213.22	426300.00	970400.00	1.02	-0.73		1.26
	5	4511.63	1444.00	426300.00	970700.00	-0.87	0.79		1.17
	7	2757.52	3237.15	426000.00	970400.00	-0.80	0.38		0.89
	6	388.96	3267.01	425600.00	970400.00	-0.15	0.30		0.34
	2	4496.01	265.57	426300.00	970900.00	-0.10	-0.07		0.12

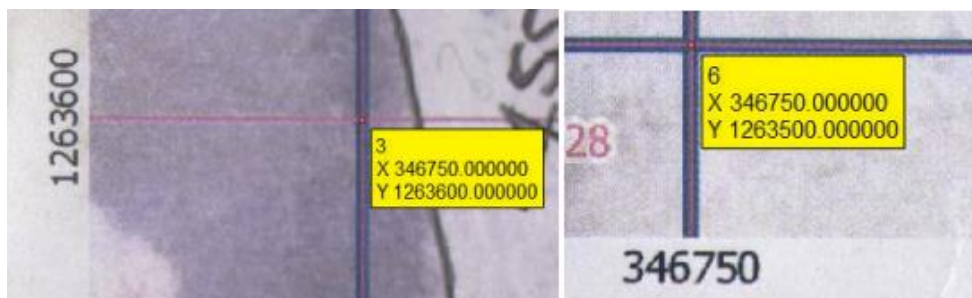
The GCP table with residuals.

- ✓ Points that are totally wrong in GCP coordinates or marked very wrong on the screen can be deleted by selecting  and clicking on the erroneous point to delete it both on the screen and in the table. The point then needs to be re-measured before we can continue. Be aware then that all points after it in the table order will shift numbers. This will not affect the calculation or the result though.
- ✓ To check the ground coordinate values, Choose Settings, Configure georeferencer and mark the Show coordinates box.



The Configure georeferencer window.

- ✓ First we have to check that the Northing values are correct for the points to the left. Zoom in and compare the grid and the yellow box for the Northing value for the three points to the left. Then repeat it for the Easting values by checking the three points at the bottom. If they are OK, we now know that at least the left and bottom points have the correct coordinates.



Comparing the entered coordinates (yellow box) with the printed grid coordinates.

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- ✓ Now check the coordinates so that 0, 1, 2 has the same North coordinates. Repeat for 3,4,5 and 6, 7, 8. Then check the East coordinates for 0, 3, 6 to be the same. Repeat for 1, 4, 7 and 2, 5, 8. If there is any error, click in the table and correct the value. Before clicking anywhere else after this, push the Enter button (otherwise the change will not be registered). It is a great advantage to have the paper map (not only the computer screen) in front of you during this process.



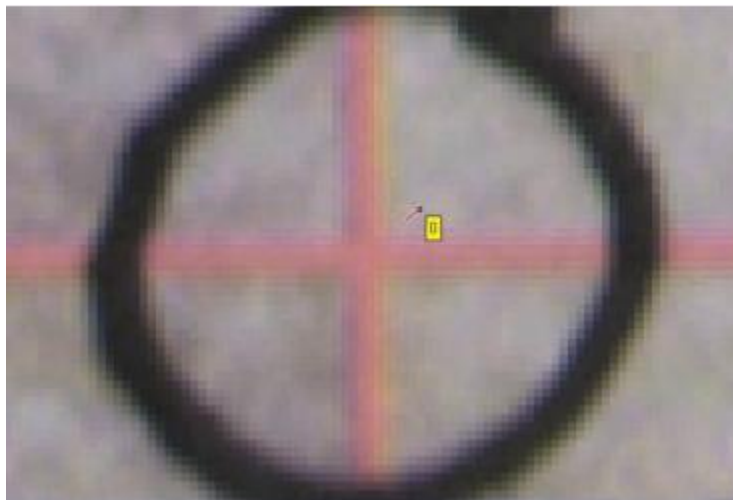
The entered coordinates displayed in the image.

- ✓ In the new versions of QGIS, large values are displayed in scientific format (e.g. 1.3245 e+07) in the GCP table. To see such a value in normal format, just hold the mouse button over the cell, or click in it.

1.26385e+06
1.26385e-1263850

Scientific number format in the table.

- ✓ To check the image demarcation (that we really clicked in the centre of each grid cross), zoom in to a random grid cross on the screen so that you clearly see the red grid line (like in the figure below).




Example of a zoomed in grid cross, with an obvious demarcation error.

- ✓ Now click on the ID column head slowly twice, so that the ID numbers are sorted.


ID /
0
1
2
3

- ✓ Double-click on the first row (with the value zero), and it will zoom in to that point. Check carefully that the marked point is in the middle of the cross. Remember that we want the best possible demarcation in the middle of the cross, not the smallest residual!



- ✓ If the point is close but clearly needs to be moved, push the  button, click on the wrong point and hold down the mouse button. Then move the point to the right place and release the button. Check the residuals again to see that the largest residual is has a lower

value than before. If not, double-click on the largest row to automatically zoom in to that and correct it.

- ✓ Remember that the point should ALWAYS be marked in the centre of the grid cross, even if it gives a smaller residual to move it a little outside the centre. If the residual becomes a little larger when it is moved to the middle of the grid cross, it is a sign of the paper map being a little deformed (normally due to the exposure to wind, sun and water). This deformation will be corrected only if the point is marked in the middle of the cross. In practice it means that if the residual is larger than one it should be checked, but if it is slightly larger and the point is clearly marked in the middle (with the correct GCP coordinates), we can proceed and let the georeferencing adjust the paper deformation.
- ✓ When the residuals are OK, push the  button to start the process. A progress indicator will show when the new modified image is created. Finish by closing the Georeference window. Answer Yes on the question to save the GCP points (there is a spelling error in the QGIS message, since P in GCP means point, the following word point is unnecessary). The GCP file is important if we need to repeat the geo-referencing, or if it has to be analysed.
- ✓ When coming back to the main QGIS window, check that the scale bar and that the coordinates under the image look realistic. Choose File, save project and we are now ready for the geo-referencing accuracy test before we can start the digitizing.

Operation Sheet 5

5.1.Steps to perform parcel map (certificate) printing

Parcel map preparation is the stage that we prepare our final out for printing. Once we are sure that we have finished quality assures, merging, and styling of our map, we start to prepare layout for printing. To do this we will open the print composer function in QGIS, which provide us with simple interface for preparing our printout.

[..\..\..\FTC\Assosa ATVET Fast track Course Training all documents\ScreenRecorder\Parcel Map Preparation and Printing.wmv.](#)

LAP Test-3

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Perform the scanning, geo-referencing and parcel map production and printing operation you are required to perform the following tasks within 10 hours.

Task 1: Perform field map (FM) scanning

Task 2: Perform Geo-referencing operation

Task 3: Operate parcel map preparation and printing.

Reference Material

Book

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Hanstad T. (1998). “Designing Land Registration Systems for Developing Countries”. American University International Law Review 13, no. 3. American University Washington College of Law.

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