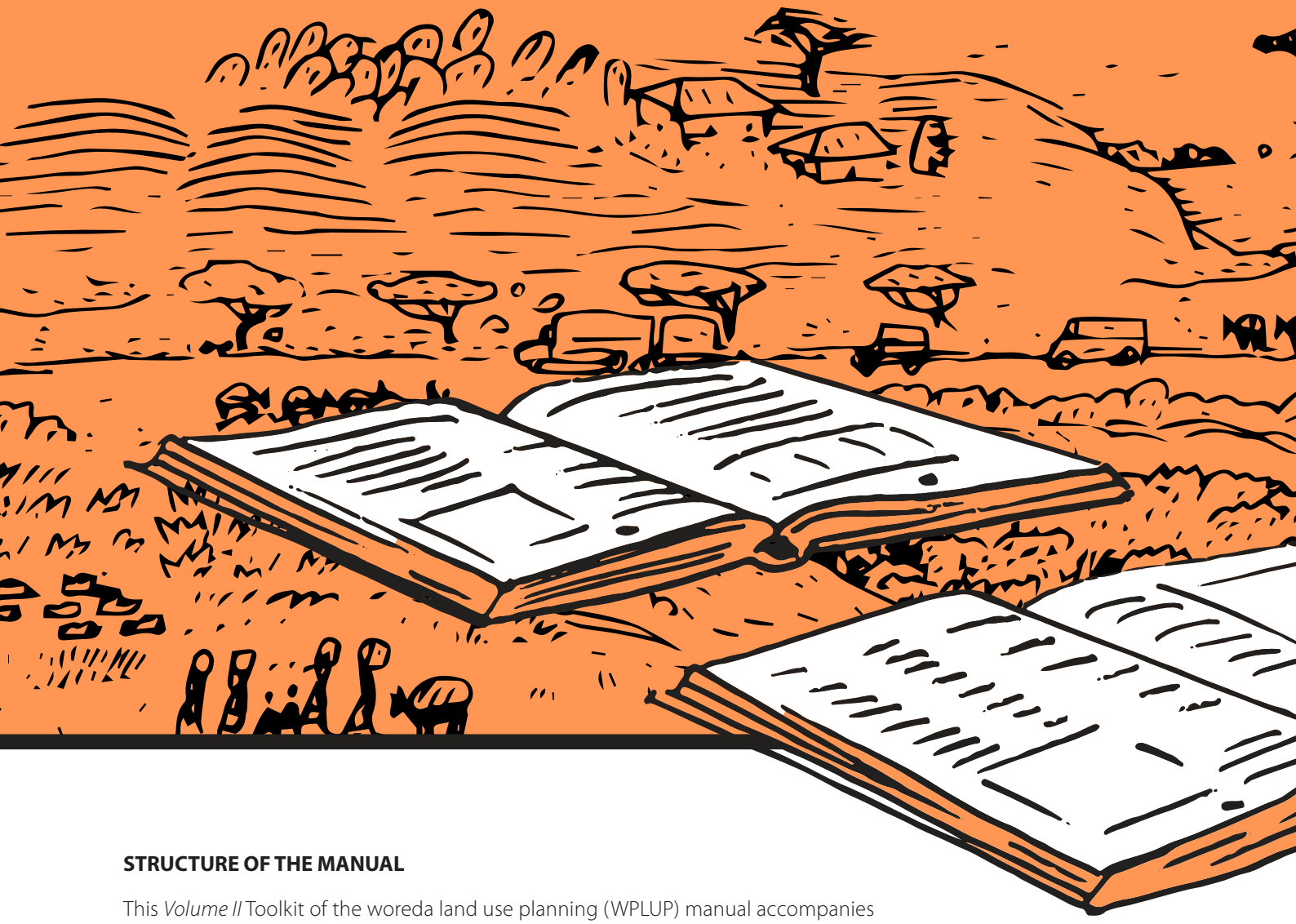
WORKING DOCUMENT

VOLUME II: TOOLKIT-WORKSHEETS

WOREDA PARTICIPATORY LAND USE PLANNING (WPLUP) IN PASTORAL AND AGRO-PASTORAL AREAS



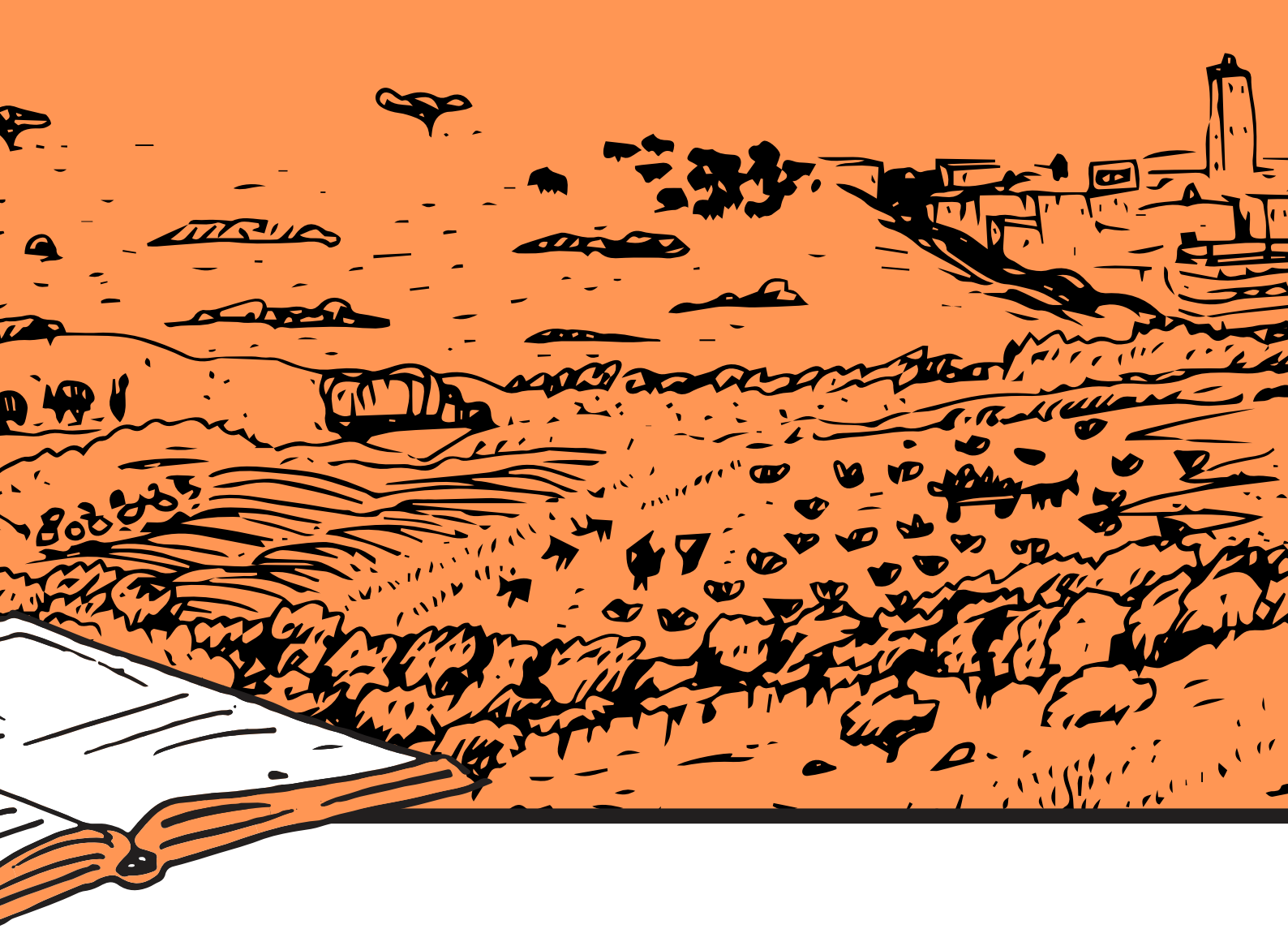
STRUCTURE OF THE MANUAL

This *Volume II* Toolkit of the woreda land use planning (WPLUP) manual accompanies Volume I, providing Worksheets that guide the implementation of each step in the WPLUP process. The tools were tested and refined during the piloting of the WPLUP manual in Chifra woreda, Afar region. All the tools are meant to be implemented by the WPLUP Team, in a participatory way including local community representatives and other stakeholders.

In *Volume I*, each step references the number of a Worksheet found in this volume. It is recommended to follow the whole WPLUP process through from beginning to end. However, this may not be possible due to limited time and resources and the reader will need to prioritise the tools and processes that provide the most important sets of information for each individual WPLUP and its objectives.

This Toolkit is a working document and will continue to be refined and improved as WPLUP is implemented. The Rural Land Administration and Use Directorate welcomes your input and feedback as a contribution to this.

Design by Federico Pinci. Illustrations by Aldo di Domenico.



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VOLUME II: TOOLKIT-WORKSHEETS

Rural Land Administration and Use Directorate
Ministry of Agriculture, Addis Ababa, Ethiopia

November 2018

ACRONYMS

A/LU	Agriculture and land use
AfSIS	Africa Soil Information System
ATA	Agricultural Transformation Agency
C/F	Coordination and facilitation
CAP	Community action plan
CIFOR	Centre for International Forestry Research
CRP	Collaborative research program
CSA	Central Statistics Agency
CV	Coefficient of variation
DCP	Data collection point
DRM	Disaster risk management
EIAR	Ethiopian Institute for Agricultural Research
EthioSIS	Ethiopian Soil Information System
FDRE	Federal Democratic Republic of Ethiopia
GCS	Geographic coordinate system
GIS	Geographic information system
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GPS	Global positioning system
ILC	International Land Coalition
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
JWPLUP	Joint woreda participatory land use plan
L&W	Land and water
LCC	Land capability classification
LDSF	Land Degradation Surveillance Framework
LGP	Length of growing period
LUA	Land use alternatives
LUP	Land use planning
M&E	Monitoring and evaluation
MoA	Ministry of Agriculture
MoUDG	Ministry of Urban Development and Housing
MoWIE	Ministry of Water, Irrigation and Electricity
NDVI	Normalised Difference Vegetation Index
NGO	Non-governmental organisation
NLUPC	National Land Use Planning Commission
NTFP	Non-timber forest product
PCDP	Pastoralist Community Development Project
PCQ	Point-centred quarter
PET	Potential evapotranspiration
PIM	Policies, Institutions, Markets
PLUP	Participatory land use plan
PRA	Participatory rural appraisal
PRIME	Pastoralist Area Resilience Improvement and Market Expansion
PSNP	Productive Safety-Net Program
PRM	Participatory rangeland management
RDC	Rural development center
RLAUD	Rural Land Administration and Use Directorate
RR	Rangeland resources
SDC	Swiss Development Cooperation
SRG	Soil reference groups
SWOT	Strengths, weaknesses, opportunities, threats
TLU	Tropical livestock unit
UTC	Universal traverse mercator
WPLUP	Woreda participatory land use plan
WRA	Woreda resource-sharing agreement

CONTENTS

SECTION 1

SECTION 2

WORKSHEET 1-1

Hold an internal woreda government meeting to confirm the main stakeholders

OBJECTIVE

The objective is for you and your colleagues to **clarify the need for a Woreda Land Use Plan**, and identifying who are the main stakeholders that should be involved in developing the WPLUP.

ANTICIPATED OUTPUTS

The outputs of this meeting will be the summary/minutes of the meeting, and a **list of main stakeholders to contact and invite** to the stakeholder meeting which will follow.

PARTICIPANTS

All woreda staff should be invited to this meeting so that all are made aware of the process of developing a WPLUP, why it is necessary and how they can contribute.

GUIDELINES FOR THE MEETING

1. As this is an internal woreda meeting, it can be held in the woreda administration offices. **Agree on a suitable day and time** for the meeting.
2. **Send out invitations** to the participants of the meeting at least one week before the meeting date. In this letter explain what the meeting is about, and why their contribution is important. You can also distribute a soft copy of this Manual to the participants encouraging them to read it before the meeting.
3. During the meeting you need to **include the following**:
   - A *discussion on why it is important to have a WPLUP*, and why this needs to be participatory.
   - A *summary of the steps* to be undertaken as described in the Manual.
   - A *discussion on who should be included* in the planning process. A list of key stakeholders should be written up.
   - A discussion on what may be some of the *key issues* to take into consideration in the WPLUP.
   - The development of a *timeline for producing the plan*.
4. **A summary of the main points** discussed in the meeting, any decisions made, the timeline and next steps should be shared with the participants within one week after the meeting.

BOX 1-1.1 WHY IT IS IMPORTANT TO INCLUDE ALL WOREDA SECTOR STAFF IN THIS FIRST MEETING TO DISCUSS THE WPLUP

A good land use plan needs to be multi-sectoral and multi-stakeholder ensuring that all current and potential land uses are considered and all those who have an interest, role or responsibility, in these different land uses have an opportunity to contribute to the land use plan, which will feed into the annual development plan of the woreda. Therefore, all woreda staff from different sectors should be included in the meeting.

WORKSHEET 1-2

Hold a meeting with key stakeholders to confirm who should be included in the land use planning process

OBJECTIVE

The objective is for you to confirm that **all relevant stakeholders have been identified** and will be included in the woreda land use planning process.

ANTICIPATED OUTPUTS

The outputs of this meeting will be: i) a **confirmed list of main stakeholders** to involve in the participatory land use planning process; together with a short explanation of who is doing what; and how land and natural resources are used in the woreda; ii) a **draft list of members of the WPLUP Team;** and iii) an agreed set of **objectives for the WPLUP**.

PARTICIPANTS

Participants will include representatives from the different stakeholder groups, as identified in the previous meeting, plus any others that have been identified since then.

GUIDELINES FOR THE MEETING

1. **Identify a suitable venue, day and time** for the meeting.
2. **Send out invitations** to the participants of the meeting at least one week before the meeting date. In this letter explain what the meeting is about, and why their contribution is important.
3. During the meeting you need to **include the following**:
   - A *discussion on why it is important to have a WPLUP*, and why this needs to be participatory.
   - A *summary of the steps* to be undertaken as described in the Manual.
   - A discussion on *who should be included* in the planning process. Share the list of key stakeholders identified in the previous meeting, and discuss whether any further stakeholder groups need to be added.
   - A discussion on what may be some of the *key issues* to take into consideration in the WPLUP.
   - A *discussion on the objectives* of the WPLUP (see Box 1-2.1)
4. **Share a proposed timeline** for producing the plan.
5. **A summary of the main points** discussed in the meeting, any decisions made, the timeline and next steps should be shared with the participants within one week after the meeting.

BOX 1-2.1 EXAMPLE OBJECTIVES OF THE WPLUP

The **objectives of a WPLUP will depend upon the priorities of the different stakeholders** including the local communities. It is suggested that the number of objectives should be not more than six.
Examples of objectives include:

- To improve pastoral and agro-pastoral livelihoods in the woreda.
- To reconcile conflicts and pressures on land between different land users including pastoralism, agriculture, commercial investment, conservation, urban growth etc.
- To improve the productivity of the land including rangelands through reversing land degradation, clearance of bush encroachment and invasive species, rehabilitation of rangelands, sustainable land management etc.
- To improve the commercialisation of the livestock sector in the woreda.
- To identify areas for investment by government and NGOs in the development of pastoral and agro-pastoral livelihoods.
- To establish a community conservation area integrated into the pastoralism land use system.
- To re-plan and consolidate scattered settlements.

WORKSHEET 1-3

Carry out awareness-raising meetings and discussions on WLUP development with different stakeholder groups

OBJECTIVE

The objective is to **let different stakeholder groups know** about the woreda participatory land use planning process, which will take place and the opportunities of getting involved.

ANTICIPATED OUTPUTS

The outputs of these meetings will be a **general awareness established amongst stakeholders** of the planned land use planning process and activities, and who will be participating in these. A summary of the meeting will be made and any decisions documented.

PARTICIPANTS

Ideally, an awareness-raising meeting will be held with each stakeholder group, though it may be possible to combine some of these.

GUIDELINES FOR THE MEETING

1. **Identify a focal person for each stakeholder group** to be invited to the meeting. This person should be willing to share information from the meeting and between you and the stakeholder group, and help mobilise members of the stakeholder group for other meetings etc. *Agree with each focal person a suitable venue, day and time for a larger meeting.* Ask the focal person to invite around fifteen members of the group to attend a meeting about the land use planning process and/or other activities.

2. **Organise the meeting with the focal person.**
   During the meeting you need to *include* the following:
   - A *discussion on why it is important to have a woreda land use plan*, and why this needs to be participatory.
   - A *summary of the steps to be undertaken* as described in the Manual.
   - The *timeline for producing the plan* (including an opportunity for feedback from each stakeholder group), and the opportunities to be involved.
   - A discussion on what may be some of the *key issues* to take into consideration in the woreda land use plan.
   - A *presentation on what are the objectives of the WPLUP* for feedback and discussion.

3. **A summary of the main points discussed** in the meeting, any decisions made, the timeline and next steps should be shared with the participants within one week after the meeting.

WORKSHEET 1-4

Establish a woreda PLUP team

OBJECTIVE

The objective of this activity is to **identify a WPLUP Team**, which is representative of woreda stakeholders and also capable of producing a comprehensive WPLUP.

ANTICIPATED OUTPUTS

A team that has capacity to undertake the task and that includes representatives of local stakeholders

PARTICIPANTS

Woreda experts in consultation with focal persons or different stakeholder groups.

GUIDELINES FOR ESTABLISHING A WPLUP TEAM

1 Consultations to decide on members of the Team

The team needs to be representative but also not too big to be unmanageable[1]. The WPLUP Team should include (but not be limited to) the following:

- Woreda Land Administration and Use expert.
- Woreda experts of crop, livestock, and natural resources; soil and water conservation; rural roads; and water development.
- Kebele chairman (or delegated representative) from each kebele found in the woreda.
- Kebele land administration and use expert from each kebele found in the woreda.
- A customary leader from each pastoral group found in the woreda.
- Woman representative from each pastoral group found in the woreda.
- Youth representative from each pastoral group found in the woreda.
- Representatives from other dominant stakeholder groups in the woreda e.g. particular cooperatives/unions, investors, national park managers, and NGOs with long-term presence in the area and who are involved in land use planning or land management activities.

2 Confirmation of team members

Confirm with each stakeholder group who should be included. Overleaf is a list of things that need to be considered by the members of the Team, before they commit to being a member. This list should be discussed with all involved and agreed, to ensure they are willing and able to participate[2].

1 The team will be divided later into sub-teams for different activities

2 Though at least some members of the team need to be able to read and write, it is not necessary for all members to

Roles and responsibilities of the WPLUP Team

Team members will not need to be involved in all activities. For some activities, sub-team groups can be formed. Below are some suggested sub-groups[3].

Sub-group	Role and responsibility
Coordination and Facilitation team	This lead group that is responsible for coordinating the whole process and for facilitating the major meetings (see next action point)
Technical Land Evaluation and Water Team	This team is made up of government and other experts who are responsible for the collection of main scientific data. This should include one rangeland ecologist. It is also useful to have one pastoralist on this team, in order that 'scientific' knowledge can be complemented by local knowledge.
GIS and Mapping Team	This team is made up of government GIS experts. If GIS expertise is not available in the government office, then it will be necessary to employ an expert. This team will be responsible for the production of all GIS maps/layers.
Rangeland Resources Team	This team will be responsible for collecting information on rangeland use and resources. This should be a mixed team of government and local community experts. This team will support the facilitation team in producing the rangeland resource map (see *Worksheet 1-8* and *1-9*).
Agriculture and Other Land Use Team	This team will be responsible for collecting information on agriculture and other land use. This should be a mixed team of government and local community experts. This team will support the facilitation team and work with the rangeland resource team in producing a general land use map for the Woreda.

The WPLUP Team is **responsible for the following**:

- Ensuring that all stakeholders have a *good understanding of what is a WPLUP,* how it is produced, who will be involved in its production, and how it will be used when finalised.
- *Producing a WPLUP that in a participatory manner that reflects the different needs, priorities, and views* of different land users and other stakeholders; and is based on clear, well-researched and well-informed decision-making processes.
- *Developing a workplan and budget* for the WPLUP.
- *Ensuring that the WPLUP is linked to neighbouring WPLUPs* and any shared grazing or other resources are facilitated across woreda boundaries.
- *Ensuring that the WPLUP is incorporated into the woreda's development planning* process.
- *Ensuring that the WPLUP is integrated into higher-level land use and development planning processes* at zonal, and regional levels.

3 **Each member of the WPLUP Team should now read this complete Manual** in order to understand the process that the teams will facilitate.

4 **Organise a meeting between the WPLUP Team** members to ensure that everyone has understood what is required, and how to go about the process[4].

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be able to do this as assistance can be provided by other members and verbal communication or drawings can be used to explain things

3 Extra care is required to establish the all-important Coordination and Facilitation team (as above) and this is explained in more detail in *Worksheet 1-5*

4 If there are illiterate members within the Team who are unable to read the Manual, then ensure that they are provided with relevant and effective assistance

WORKSHEET 1-5

Establish a skilled Coordination and Facilitation sub-Team

OBJECTIVE

The objective of this activity is to **establish a Coordination & Facilitation Sub-Team**, in order to lead the process of developing the WPLUP.

ANTICIPATED OUTPUTS

The **Team established** is expected to have good coordination and facilitation skills (see below).

PARTICIPANTS

The Coordination & Facilitation Team will include the person leading the process at the woreda level and others who are skilled and capable of facilitation, negotiation and knowledge about issues and stakeholders, and facilitating others to do so.

ROLES AND RESPONSIBILITIES OF THE COORDINATION/FACILITATION TEAM

The **Coordination & Facilitation sub-Team** will be chosen from the WPLUP Team members. They are responsible for leading and facilitating the whole process. They need to coordinate all activities and members of the WPLUP Team in order to achieve the planned outputs.
They need to ensure that all sub-Teams carry out their different roles and responsibilities that they have committed to, and/or been assigned to.

The Team will also need to take on the responsibility of **facilitating the main information-collection meetings with communities**. Good facilitation skills (see below) are hard to come by, and it is best if one group of skilled team members takes responsibility for this.

SKILLS OF A GOOD COORDINATOR

A good coordinator is someone who:

1. **Understands the roles and responsibilities** of all members of all sub-Teams and ensures that these are undertaken.
2. **Is able to piece together different information** from different sources, in order to provide a full, overall picture.
3. **Identifies when a work plan is falling behind** and that there is a need for extra resources or change of team members.
4. **Is organised** and methodological, yet patient and supportive.
5. **Has good overall knowledge** of the process and the subject.

SKILLS OF A GOOD FACILITATOR

A good facilitator is someone who:

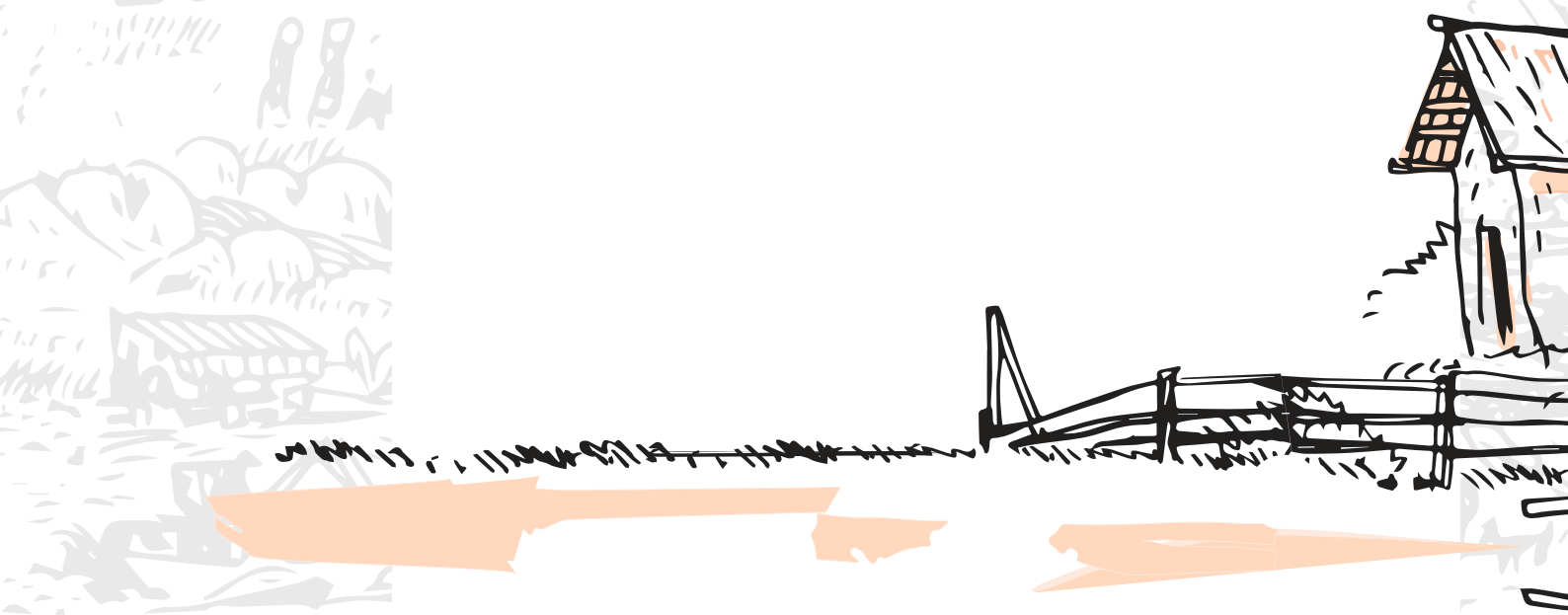
1. **Encourages the participants** to feel relaxed, interested, valued and willing to participate.
2. **Reaches a goal through a process that the participants jointly own**, share and control (i.e. the process is not controlled by the facilitator only assisted by). This may mean the facilitator has to take a different route than originally anticipated.
3. **Keeps the participants focused** on the task at hand, and the topic that has been chosen, whilst not losing opportunities to explore unexpected but relevant subjects.
4. **Shows sensitivity** to the feelings and needs of the participants – adapting the session to accommodate them.
5. **Copes with any power imbalances** within the group. A good facilitator will ensure that everyone has the opportunity to take part in the exercise as much as they would like to, no one feels sidelined or forced to engage.
6. **Ensures that the assignment commences at the right time and is achieved within an agreed timeframe**, without the participants feeling too rushed. If the level of participation begins to drop the exercise should be postponed, as once the interest of participants has gone the value of information is greatly devalued. Ways to reignite interest and commitment will need to be identified.
7. **Encourages dialogue** and discussion amongst and between participants. Listens more than talks.
8. **Knows when it is the right moment to intervene** in an activity or process in order to resolve a disagreement or fill in a gap, without disturbing the flow of the exercise or discussion.
9. **Energises a group or slows it down** as needed.

SKILLS OF A GOOD NOTE-TAKER

A good note-taker is someone who:

1. **Listens carefully** including when several people are talking at once.
2. **Accurately records points raised**, including the main line of discussions and particular quotations.
3. Balances the need to record as much detail as possible, while **keeping up with the pace of the discussions** and information flow.
4. Observes and records the process of the different participatory tools and the specific participation of the different members of the group to see who participates. Observes who 'holds the stick', who dominates, and who are the key informants. **Notices if there is any bias in the group.**
5. **Is able to listen 'between the lines'** for new ideas or unusual perspectives, and for underlying tensions or confusions.
6. **Assists the facilitator by highlighting gaps in information**, points missed and misunderstandings.
7. **Assists with the facilitating** if the facilitator needs help.
8. **Ensures that all the details are collected** such as the names of the participants.

Sometimes *a map copier may be required* for such as the rangeland mapping process.

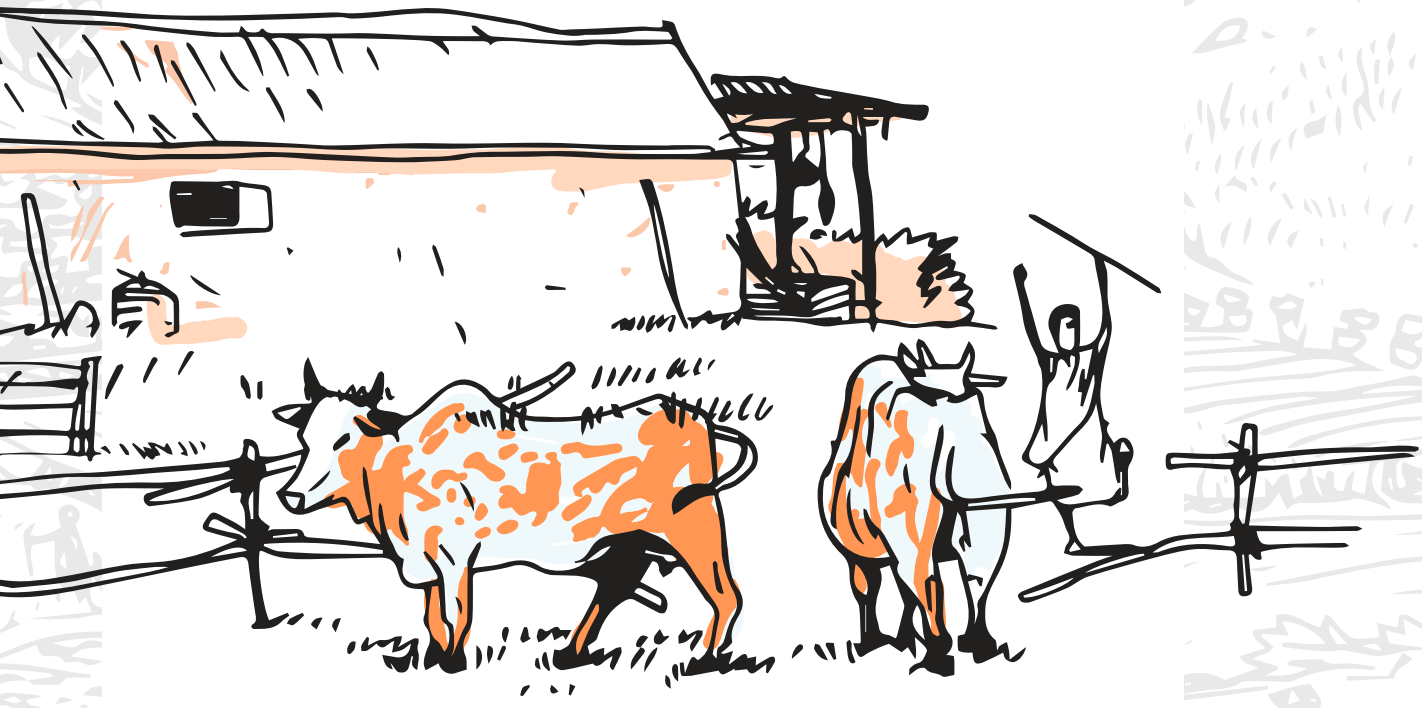


SKILLS OF A GOOD MAP (OR OTHER) COPIER

A good map copier (drawer) is someone who:

1. **Fully understands and interprets** what the community are trying to say through their drawing, in order to assist the note-taker.
2. **Keeps track** of what is being drawn, and in which order, so to be able to identify the features that have been given most importance and also those which may have been missed.
3. **Makes an exact copy** of the map or other diagram as drawn by the community group. This is likely to be on a smaller scale than that drawn by the community but should maintain its accuracy.

If the sub-Team members do not have the above skills, then training will be required, either by another Team member or by an external expert.



WORKSHEET 1-6

Suggested budget

BUDGET	Cost per unit	Unit	Number	Total ETB	Notes
ACTIVITY COSTS					
Activity 1.1 Internal woreda government meeting	No costs N/C				Internal office meeting
Activity 1.2 Stakeholder meeting	80	1 day	20 persons	1,600	
Activity 1.3 Awareness raising by govt staff in kebeles etc	140	Person/day	10 persons/day	1,400	2 persons, 5 days for travel into kebeles
Activity 1.4 Establish WPLUP Team	N/C				Desk work
Activity 1.5 Establish facilitation sub-team	N/C				
Activity 1.6 Preparation of finances	N/C				
Activity 1.7 Develop Team workplan	40		35 persons	1,400	Approx 35 people in WPLUP Team, but later this is split to sub-Teams, 1 day meeting
Activity 1.8 Meeting on rangeland unit with rangeland leaders at woreda level	40	3 day	10 person	1,200	1 day and 2 days travel
Activity 1.9 Second meeting on rangeland unit	140	5 days	30 person	21,000	2 days with 2-3 days preparation/travel
Activity 1.10 Digitising information from rangeland map	11,000	Unit/fuel	1	11,000	10,000 Birr for GPS unit. And verification of information on ground–fuel etc.
Activity 1.11 Preparing equipment				40,000	Depending on what equipment required
Activity 2.1 Make woreda base map	N/C			0	Assumption that woreda already has this as GIS
Activity 2.2 WPLUP Team meeting	40		35 persons	1,400	
Activity 2.3 Collect data and analyse	140	15 days	35 persons	73,500	The WPLUP Team will be split into sub-Teams and each team will be working in parallel to collect information according to their given assignments
Activity 2.4 WPLUP Team Meeting	40		35 persons	1,400	
Activity 2.5 WPLUP Team Meeting	40		35 persons	1,400	
Activity 2.6 Meeting to identify and analyse problems and solutions with community land users	140	4 days	60 persons	33,600	2 days with 2 days travels average
Activity 2.7 WPLUP Team Meeting	40	3 days	35 persons	4,200	
Activity 2.8 Produce Map	N/C				

BUDGET	Cost per unit	Unit	Number	Total ETB	Notes
ACTIVITY COSTS					
Activity 2.9 Consider Rangeland Issues	N/C				
Activity 2.10 Write Plan	N/C				
Activity 2.11 Stakeholder meeting to present draft of WPLUP	140	4 days	80 persons	44,800	2 days with 2 days travels average
Activity 2.10 Woreda meeting	80	1 day	20 persons	1,600	
Activity 3.1 Write M&E plan	80	1 day	5 persons	400	
Activity 3.2 Write budget	80	2 days	5 persons	800	
Activity 3.4 Write workplan	80	2 days	5 persons	800	
Activity 3.5 Submit to regional government	N/C				
Activity 3.6 Copying and printing	2000	lump sum		2,000	
Activity 3.7 Meeting all woreda part of grazing unit	140	4 days	20 persons	11,200	2 days travel and 2 day meeting
Activity 3.8 Meeting of shared rangeland users and woreda	140	4 days	40 persons	22,400	
OTHER COSTS					
Communication and stationary	4000	lump sum	1	4000	
Staff time	N/C				It is assumed that woreda staff will carry out these tasks as part of normal duties. However there may be the need to employ some specialists to carry out specific tasks, which would be an additional cost
Transportation	N/C				It is assumed that woreda vehicles/ motorbikes will be used and costs for fuel have been factored in to budget for activities above, however there may be the need for car rental, which would be an additional cost
TOTAL (ESTIMATED)				**281100**	

Note: This budget is included for guidance only and will require revision according to local needs These are estimated costs based on prices in 2017 – these should be checked at the time of the planning process

WORKSHEET 1-7

Example of workplan

Step/Action	ACTION POINTS/STEPS	RESPONSIBLE BODY	TIME OF ACTIVITY	PLACE OF ACTIVITY
PHASE 1 – PREPARATION				
STEP 1	**Facilitate initial discussions and agreement on the need for a land use plan**			
1.1	Hold an internal woreda administration/government meeting to confirm that all stakeholders have been identified (*Worksheet 1-1*)	Woreda land administration and use office and other woreda staff		
STEP 2	**Carry out stakeholder analysis**			
1.2	Hold meeting with main stakeholders (*Worksheet 1-2*)	Woreda land administration and use office, regional/zone land experts, and main stakeholders		
1.3	Carry out awareness raising and discussions on the WPLUP development process with different stakeholder groups (*Worksheet 1-3*)	Woreda land administration and use office and key stakeholders		
STEP 3	**Establish the WPLUP Team**			
1.4	Establish the WPLUP Team with members (*Worksheet 1-4*).	Woreda land administration and use office and other WPLUP Team members		
1.5	Establish a skilled Coordination/Facilitation Sub-Team (*Work sheet 1-5*)	Woreda land administration and use office and other WPLUP Team members		
1.6	Check for adequate finance, availability of vehicles, meeting rooms etc., produce budget (*Worksheet 1-6*)	Coordination/Facilitation (C/F) sub-Team and other WPLUP Team members		
1.7	Develop workplan for the planned activities based on this template giving roles and responsibilities (*Worksheet 1-7*)	C/F sub-Team and other WPLUP Team members		
STEP 4	**Identify and map traditional rangeland management unit if present and the relationship between the unit and the woreda(s)**			
1.8	Hold meetings with local customary leaders and livestock experts (refer to *Worksheets 1-8* for details to accomplish this task)	Rangeland Resources (RR) sub-Team, customary leaders, livestock experts		
1.9	Carry out a participatory mapping of rangeland resources (*Worksheet 1-9*)	RR sub-Team, GIS and Mapping sub-Team, customary leaders, livestock experts, rangeland users reps		
1.10	Transfer map information to GIS (*Worksheet 1-10*)	RR sub-Team, GIS and Mapping sub-Team, customary leaders, rangeland users reps		
STEP 5	**Prepare equipment and materials required**			
1.11	Prepare equipment (*Worksheet 1-11*)	C/F sub-Team and other WPLUP Team members		

Step/Action	ACTION POINTS/STEPS	RESPONSIBLE BODY	TIME OF ACTIVITY	PLACE OF ACTIVITY
PHASE 2 – PRODUCING THE WOREDA PARTICIPATORY LAND USE PLAN				
STEP 6	**Collect and analyse biophysical and socio-economic data**			
2.1, 2.2	Prepare a Woreda base map and stratify woreda land use planning units (*Worksheet 2-1* and *Worksheet 2-2*)	C/F sub-Team and other WPLUP Team members		
2.3	Hold a meeting to decide on methods and tools used to collect information required (and as below). In all cases a land capability classifcation should be carried out) (*Worksheet 2.3*)	C/F sub-Team and other WPLUP Team members		
2.4, 2.5	Consider how to use participatory tools and take account of gender (*Worksheet 2-4*, *Worksheet 2-5*)	Technical L&W sub-Team and rangeland users reps		
2.6	Land capability classification (*Worksheets 2-6a*, *b*, *c*, *d*)	Technical L&W sub-Team and rangelands users' reps		
2.7, 2.8	Land use and resource mapping and/or natural resource mapping (*Worksheet 2-7*) and Hazard mapping (*Worksheet 2-8*)	Agriculture/Land Use (A/LU) sub-Team & RR sub-Team		
2.9	Seasonal calendar (*Worksheet 2-9*)	A/LU sub-Team & RR sub-Team		
2.10	Transects (*Worksheet 2-10*)	A/LU sub-Team & RR sub-Team		
2.11	Trend analysis or timeline (*Worksheet 2-11*)	A/LU sub-Team & RR sub-Team		
2.12	Comparison of vegetation changes (*Worksheet 2-12*)	GIS and Mapping Team		
2.13	Rangeland vegetation inventory (*Worksheet 2-13*)	RR Team		
2.14, 2.15	Mapping of mobility and livestock routes (*Worksheet 2-14* and *Worksheet 2-15*)	RR Team & GIS and Mapping sub-Team		
2.16	Survey and semi-structured interview (*Worksheet 2-16*)	C/F sub-Team		
2.17	Resource benefit analysis (*Worksheet 2-17*)	RR Team & A/LU sub-Team		
2.18	Livestock population census (*Worksheet 2-18*)	RR Team & A/LU sub-Team		
2.19	Agonomic data (*Worksheet 2-19*)	A/LU sub-Team		
2.20	Stakeholder, instituion and relationship mapping (*Worksheet 2-20*)	RR Team & A/LU sub-Team		
2.21	Review of legislation, policy, local and customary laws and institutions, plus the knowledge of local land users of these (*Worksheet 2-21*). Consolidate the different research reports and maps produced	C/F sub-Team		

Step/Action	ACTION POINTS/STEPS	RESPONSIBLE BODY	TIME OF ACTIVITY	PLACE OF ACTIVITY
2.22	Prepare current land use map (*Worksheet 2-22*).	C/F sub-team, RR Team, A/LU Team, GIS and Mapping sub-Team		
STEP 7	**Identify and analyse problems and solutions with land users**			
2.23, 2.24	Hold a meeting of the WPLUP Team to identify and analyse different problems related to land use and land use planning e.g. Problem Tree exercise (*Worksheet 2-23*) and Ranking Different Problems (*Worksheet 2-24*)	All WPLUP Team Members and community representatives		
	Carry out follow-up consultations and meetings	C/F sub-Team		
2.25,2.26, 2.27, 2.28	Identify different options for solutions for the problems identified e.g. Solution Tree (*Worksheet 2-25*), Ranking Alternative Solutions (*Worksheet 2-26*), Scenario Planning (*Worksheet 2-27*), SWOT Analysis (*Worksheet 2-28*)	All WPLUP Team Members and community representatives		
2.29, 2.30, 2.31, 2.32	Check that mainstream issues have been considered such as conflict issues (*Worksheet 2-29*), livestock issues, carrying capacity (*Worksheet 2-30*), mainstreaming DRM (*2-31*) and participatory settlement assessment (*2-32*)			
2.33	Carry out an exercise to discuss and rank local land user's preferences for different land uses in the Land Use Units. This should also consider how such land uses contribute to overall development goals (*Worksheet 2-33*)	All WPLUP Team Members and community representatives		
STEP 8	**Formulate and write the WPLUP**			
2.34	Have a meeting with the Woreda Team and check that you have all information that you require for writing the plan (*Worksheet 2-34*)	C/F sub-Team and other WPLUP Team members		
2.35, 2.36, 2.37	Prepare WPLUP (*Worksheet 2-36* with Index (*Worksheet 2-37*) considering rangelands issues (*2-35*)			
2.38	Produce a woreda land use map (*Worksheet 2-38*)	C/F sub-Team, GIS sub-Team		
2.39	Organise meeting for feedback (*Worksheet 2-39*). Revise the Plan according to feedback provided at the meeting.	All WPLUP Team members and key stakeholders		

Step/Action	ACTION POINTS/STEPS	RESPONSIBLE BODY	TIME OF ACTIVITY	PLACE OF ACTIVITY
PHASE 3 PREPARING FOR IMPLEMENTATION OF THE WPLUP				
STEP 9	**Develop monitoring and evaluation system**			
3.1	Implementation, promotion and enforcement of plan (*Worksheet 3-2*)	C/F sub-Team and other WPLUP Team members		
3.2	Develop M&E system and activities (*Worksheet 3-1*)	C/F sub-Team and other WPLUP Team members		
STEP 10	**Prepare a budget and workplan for the implementation of the Plan**			
3.3	Develop a pilot program and workplan (*Worksheet 3-3*)	C/F sub-Team and other WPLUP Team members		
STEP 11	**Present and finalise**			
3.3	Submit Plan to Region land administration and use office and other stakeholders	Woreda land administration and use office		
STEP 12	**Prepare Joint woreda PLUP and Resource-sharing Agreement (WRA) (if appropriate)**			
3.4	Develop joint woreda PLUP and WRA between woreda that share resources (*Worksheet 3-4*)	C/F sub-Team and other WPLUP Team members		

WORKSHEET 1-8

Hold a meeting with customary leaders and livestock experts to identify and map distribution of resources in and across woreda

OBJECTIVE

To **understand whether there are communal grazing areas and other rangeland resources in the woreda**, and whether these are shared with neighbouring woredas.

ANTICIPATED OUTPUTS

A **participatory map (and short report) showing the approximate distribution of rangeland resources** including grazing areas in the woreda and neighbouring woredas (if shared). This activity is to provide a rough initial understanding of rangeland resources including grazing distribution – more standard detailed mapping will be carried out in a later step.

PARTICIPANTS

Participants should be rangeland users including customary leaders and other livestock experts. If it is known already that some rangeland resources are shared with neighbouring woreda(s) then it would be appropriate to invite customary leaders and others from those woredas too. This should be a fairly small meeting with not more than 20 people participating.

The Rangeland Resource Sub-Team should lead this activity, but other WPLUP Team members can join if thought appropriate e.g. the Technical Land, Soil, Water Survey Sub-Teams.

GUIDELINES FOR THE MEETING

1. **Carry out a short planning** with pastoralist and/or agro-pastoralist customary leaders to identify what grazing and other rangeland resources are found in the woreda and to what extent these are shared with and/or extend to neighbouring woreda(s). Discuss who should be invited to the larger meeting to map out rangeland resource distribution and use. Check what maps already exist and if a rangelands map has already been produced by the community and/or an NGO.

2. **Organise the meeting** to identify and roughly map out the distribution of resources within and shared across neighbouring woreda. The meeting should not take more than half a day. Things to think about include:

   - **Participants** – These should include pastoralist and agro-pastoralist customary leaders from within the woreda, and also from any woreda who shares resources; government and other livestock experts from the local area; representatives of other pastoral groupings including women and youth. It should be made clear to the participants whether any per-diems will be paid or not.
   - **Place and time** – Identify a suitable time and place for the meeting, including organisation of any necessary transportation for participants, and refreshments.
   - **Invitation** – Ensure that participants are invited well in advance of the meeting (at least one week) so that they can make necessary arrangements to attend.
   - **Equipment** – The mapping of rangeland resources can be carried out on flip-chart paper. The objective is to produce a rough map of grazing (wet and dry season) and other rangeland resource (e.g. water, minerals, forests) in the woreda and across the woreda(s) if shared. It is not necessary at this stage to provide details and to digitise the map. More detailed mapping will be carried out in later Steps with a larger group.

3. At the start of the meeting **explain the objective of the meeting** i.e. to *roughly map out the different rangeland resources* in the woreda, and in neighbouring woreda(s) if these are shared. This map will be used as a starting point for more detailed mapping of rangeland resources with participants at a later date. This information will be used within the woreda land use planning process that will take place over the next month or so.

4. **Ask participants to draw** the grazing areas, water, minerals, forests etc. on the flip-chart paper and/or several flip-chart pages taped together if it is believed that the area is large and resource use complex. *Map any key landmarks to help identify the rough locations of these resources*. It is important however to *draw any resources that are shared with neighbouring woreda(s)* (and the names of those woredas). Ensure that the map is labelled with a key showing meanings of any symbols etc. Note down the names of participants.

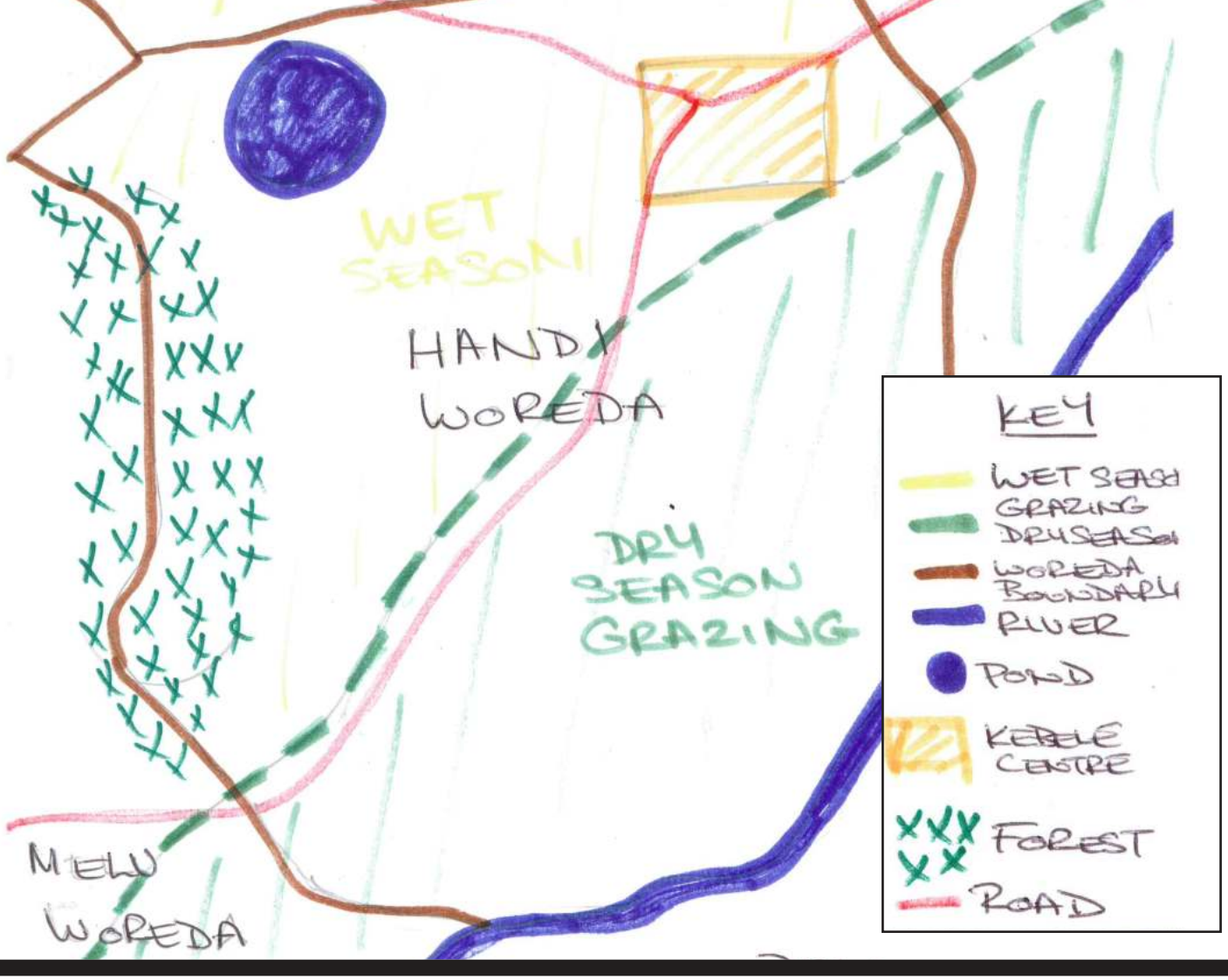


Figure 1-8.1 Map of hypothetical woredas showing shared dry season grazing area and forest area across woreda boundaries.

5. Once the map is completed, explain to the participants once again that a more detailed mapping of rangeland resources will be carried out as a next Step.

6. Following the mapping meeting, **call a meeting of the rest of the WPLUP Team** to share results. The results will indicate what rangeland resources are found within the woreda boundaries and whether any are found in neighbouring woreda(s). This will indicate whether your own WPLUP can proceed alone, or whether you need to work with neighbouring woreda(s) to ensure that any shared resources link up. By the end of this meeting you should be clear as to the steps forward and who should be invited to the next Step, which is a more detailed mapping of rangeland resources. Depending on the distribution of rangeland resources this may or may not include neighbouring woreda(s).

Remember!
Any discussions or points raised should be documented by a note-taker.

WORKSHEET 1-9

Carry out a participatory mapping of rangeland resources with customary leaders and other rangeland users[5]

OBJECTIVE

To produce **a more detailed map** showing the distribution of rangeland resources including grazing areas, water, minerals, forests etc. within the woreda, and in neighbouring woreda where resources are shared.

ANTICIPATED OUTPUTS

A **detailed hand-drawn map (plus short report)** showing the distribution of rangeland resources including grazing areas in the woreda and across neighbouring woreda (if shared).

PARTICIPANTS

Participants will be rangeland users including representatives from customary institutions and others involved in pastoral and agro-pastoral activities including herding, water collection, NTFP-collection, herb collection, firewood collection, agriculture etc. If it has been identified in the previous steps that resources are shared with neighbouring woreda), then representatives from these woreda should also take part in the exercise. Depending on how many woreda are taking part in the exercise the number of participants may be more than 40.

To carry out Participatory Rangeland Resource Mapping the following steps should be followed:

1. **Agree who should take part in the mapping exercise**
   Discuss with the community including customary leaders who will represent different stakeholder groups, in order that there is good representation from the community but not too large a group that it is unmanageable. Also find out whether men and women can carry out the exercise together or whether separate mapping activities need to be conducted. If men and women regularly meet and discuss issues together in the community, then there is little reason to separate them. Whatever approach is taken, it is vital that both women and men have an equal opportunity to contribute.

5 This section draws from the Irwin, Cullis and Flintan (2015).

2 Agree where and when the mapping exercise should take place

Decide with the community when and where the mapping exercise should take place. It is preferable to carry out the mapping when the temperature is cool – in the early morning or late afternoon. However, wherever possible the mapping should be completed in one day, as it is disruptive to the process to break overnight and it is difficult to protect the map from disturbance. Normally, the map will be drawn on the ground. This can be done using chalk on a concrete surface, or with a stick on an area of flat soil. It is important that the area is flat and clear of debris or vegetation; there is plenty of space to walk around and to properly view the drawing; the area is protected from livestock or children who might disturb the map; and it is sheltered (from wind, sun, and rain). It is also helpful if the site has a view over the area or part of the area that is being mapped. Participants are likely to get less distracted if the mapping location is some distance from their homesteads. Visit the site prior to the day of the mapping exercise to ensure that it is suitable.

3 Hold an introductory meeting

Organise an introductory meeting for the mapping participants from the community. At this meeting, the mapping team should:

- *Introduce the mapping process*, explaining why mapping has an important role within PLUP and how/where it fits in. The mapping activity should be introduced as part of a longer-term process that will ensure the continued use of, and access to, resources and the rangeland for local communities;
- *Provide the group with information* about participatory mapping and the process of undertaking it. Explain how much time and effort and what resources are required;
- *Confirm the most convenient time and place* for the mapping to be undertaken, and clarify transport and refreshment/meal arrangements;
- *Introduce the mapping facilitation team* and begin to build a relationship with the community members;
- Check the appropriateness of taking photographs and/or filming the mapping process.

4 Prepare the mapping equipment

The final step in preparing for the mapping is to *ensure that all the right equipment is to hand*. This includes:

- Tools for clearing the site, including a brush to sweep off any debris. If the site is unshaded, then it would be of benefit to put up plastic sheet to provide shade;
- A "mapping kit" of items that can be used to map on the ground and to supplement what the community themselves can find to use. This can include items such as string, ribbon, chalk, different-coloured soils, coloured card and pens, stones of different sizes, and other items such as sticks, grass, and leaves;
- Flipchart paper and coloured pens for copying the map;
- Notepad and pens;
- A camera for taking photos of the mapping process and of the final map, and/or video equipment.

Plate 1-9-1 Communities mapping rangeland resources as part of woreda land use planning process

5 Print out the rangeland resource-mapping checklist

At the end of this Worksheet there is a mapping checklist provided. This should be printed out and used in the field to ensure that all items are in place and that all necessary activities are undertaken.

6 Start the mapping

The activity should begin with a short opening ceremony that reflects normal customary practices. Time should also be given for clarifying the objectives and the mapping process – it may be the case that a participant has joined the group late, and therefore they need to be updated.

The facilitator will ask the community to begin to create a map of rangeland resources. It is good practice to start the mapping exercise with an activity that is relatively easy, so communities quickly understand what to do. A simple and clear question helps the participants to take immediate control over the content of the map: for example, "*Can you show us (map) the main landscape features in your area?*" If the community are having difficulty, the facilitator can assist by suggesting a prominent feature such as a ridge, river, or forest edge, and then encouraging the identification of other, related features. This helps the participants to orientate themselves and to scale down landscape features to the mapping site.

The community participants may need encouragement initially to use twigs, stones, pebbles, leaves, ashes, charcoal, string, or even animal dung to represent rangeland resources, supplemented by items provided in the "mapping kit". However, once started, experience shows that they will quickly take control of the mapping and be inventive with the use of materials that are locally available.

Once the key features have been mapped, the facilitator asks the group to map specific information in line with the first objective of the mapping exercise. For example, this may be to show the key natural resources that the community use. In such a case the mapping group might identify and display different grazing and browsing areas, water sources, grass harvesting areas, and permanently cropped fields. The group can provide site-specific and increasingly detailed information relevant for livestock management, e.g. information such as where browsing and plant species are found, where mineral soils or springs and salt licks are located, or areas that they associate with animal disease. Ensure that seasonal use of resources is illustrated. In order to ensure that all rangeland uses and users are represented, the facilitator should ask about different groups, e.g. "*Have you shown the resources that pastoral women use?*"

Experience shows that it is better practice not to start with a boundary around the area. Doing so may limit the development of the map to those resources and features within the boundary, and other resources used by the community outside the boundary may then not be mentioned or included. If, however, the mapping group insists on drawing a boundary first, then the facilitator will have to try to ensure that its presence does not mean that resources outside it are ignored.

7 Make a legend for the map with appropriate symbols and colours

To finish the rangeland resource map, the community should make a legend that clearly describes the different features of the map, using symbols and colours. The facilitator should ensure that they use the same symbol and colour for all features of the same type e.g. using twigs for forest patches, and stones for settlement. The map-copier should try to use these same symbols and colours on the paper map.

8 Note all the accompanying discussions

The note-taker will record all the discussions that go on while the map is being created. Most of the information will be generated by the checklist of questions read by the facilitator, but it is also important to record additional issues, debate, and facts of interest that arise during the exercise. The note-taker should also try to record who is speaking and who is mapping. Where there is disagreement, the note-taker should record the different points of view, including which group of users has which set of views. When names of places are given, the map-copier and note-taker should try to record them correctly, but the need for detail should not mean that discussions already in flow are disturbed. It may be necessary to wait until the mapping exercise is completed before such details are noted and any gaps are filled.

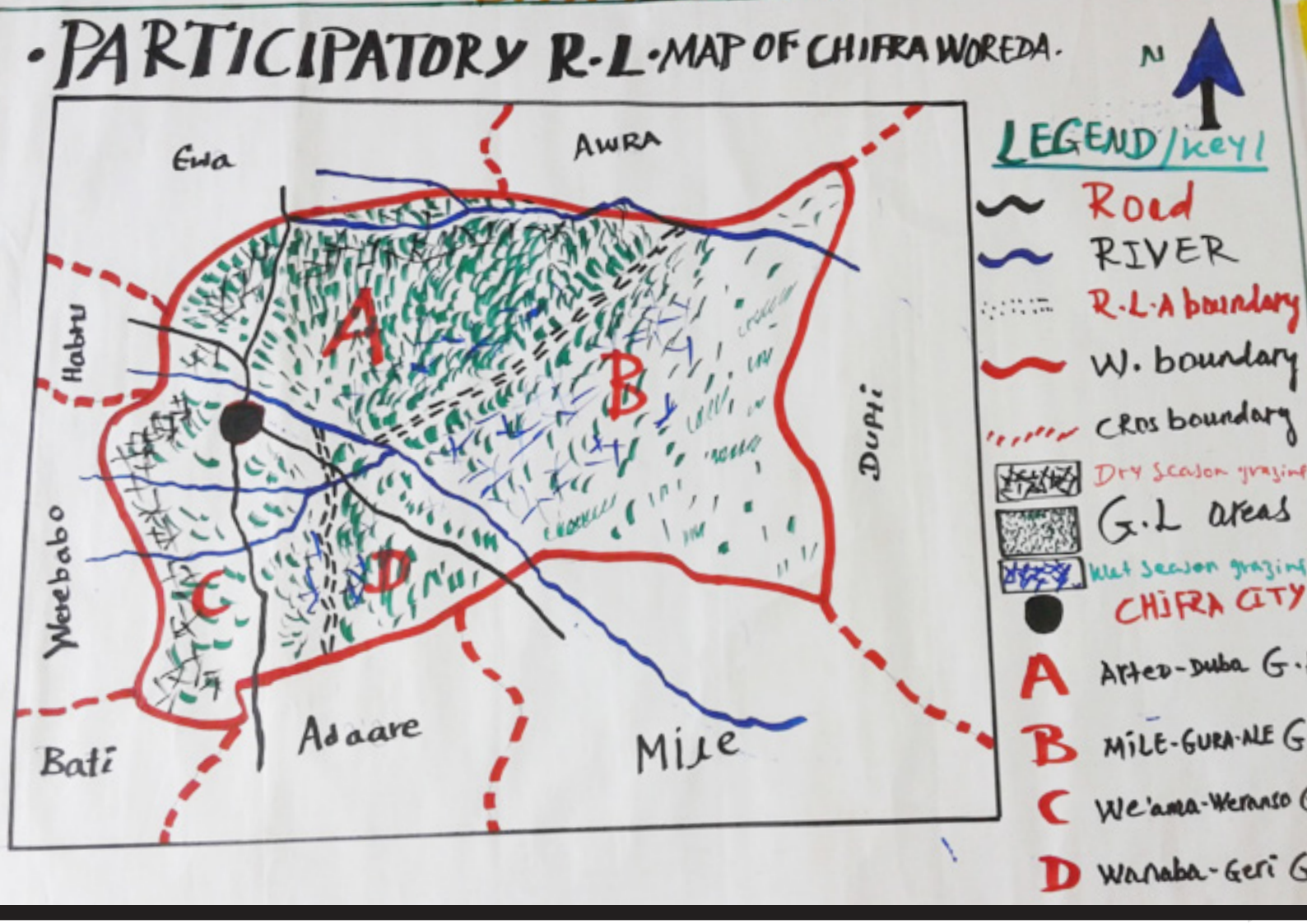


Plate 1-9.2 The major grazing units in Chifra woreda

9 Adding boundaries, borders, and land use divisions

In Step 4 above, it was advised that the boundaries of a village, or other unit of focus, should not be drawn too early on in the mapping process. However, for the purpose of defining the shared grazing area, the boundary should now be drawn. The boundary (and indeed the map itself – see below) will need to be discussed and confirmed with the wider community, local government, and neighbouring groups. Neighbouring groups in particular may dispute the boundary and therefore, following the mapping exercise (and before the map is used for any official purpose), a process of negotiation and consensus building may be needed to reach settlement and agreement. It may be appropriate to show the boundary as a dotted line, implying that there is movement across it.

10 Complete the map

The following details should be included on the participatory rangeland resource map (or on the back of the map):

- Date that the map was created;
- Place that the map was created;
- Names of the mapping team;
- Names of the community members who prepared the map;
- North should be indicated on the map, but the orientation of the map as drawn by the community should not be changed to align with north.

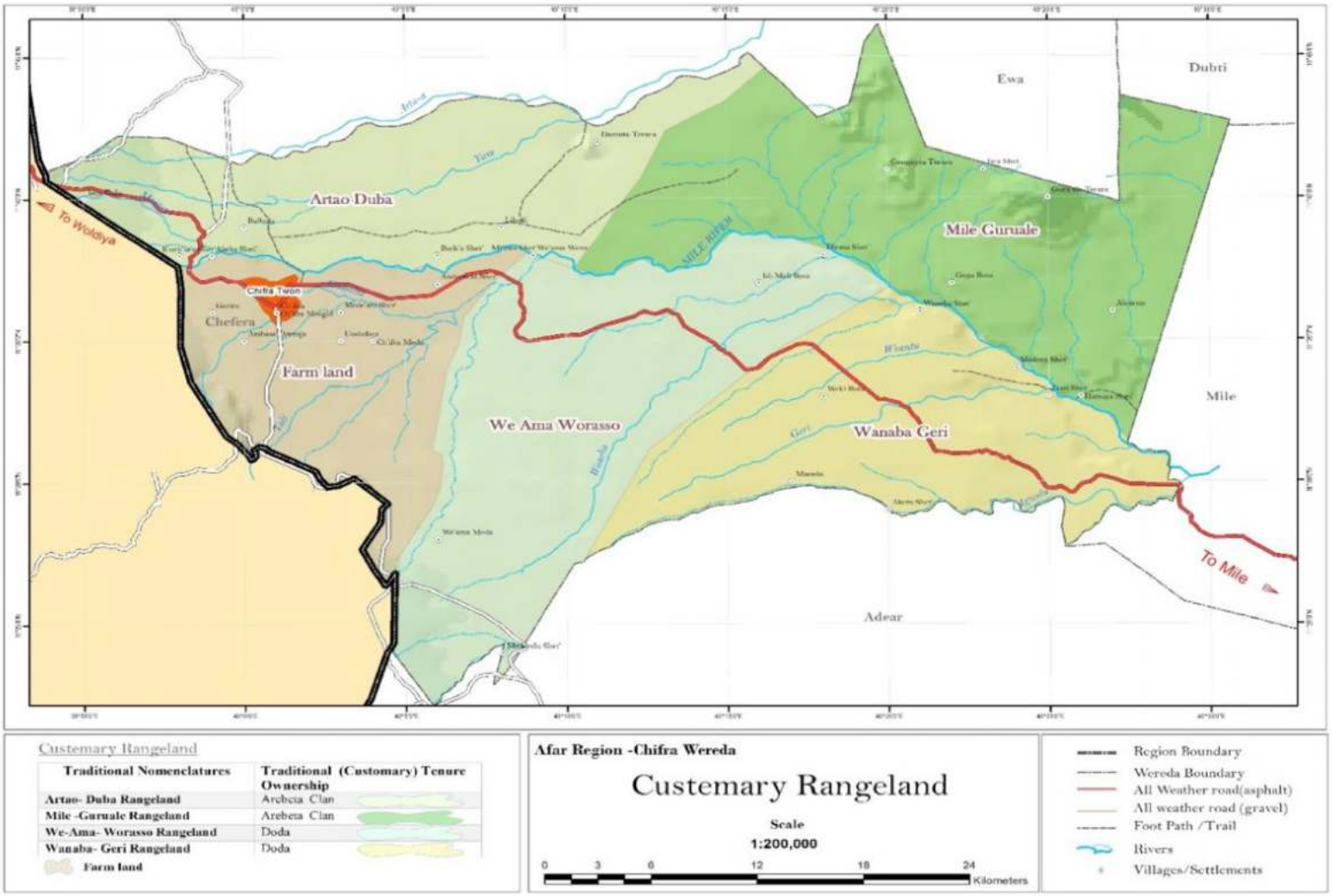


Plate 1-9.3

Additional copies of the rangeland resource map can be made on A3 (or A4) paper – this can be done either through a scan and reduction or by hand-copying. These smaller maps can then be easily included in reports. Any duplication should ensure that the original features and details of the map are retained.

Once the paper map is finalised, it should be checked by the participants, or at least a sub-group of participants, before being presented to the larger community (in the next step). Against the mapping checklist at the end of this section, ensure that all steps in the mapping process have been completed.

11 Organise a feedback meeting

A community feedback meeting should be organised as soon as possible after the mapping exercise in order to present the map to the community and other stakeholders. It may be that this meeting results in some additional information and in relatively few major disagreements. If, however, major inaccuracies are found that result in increasingly heated disagreement, it is recommended that the meeting be allowed to continue to completion and/or that a sub-group meets to reconcile any outstanding issues. It is important that the final rangeland resource map has the broad approval of the community, including both leaders and the majority of the people.

12 Write the report

The mapping report can follow this structure:

Rangeland mapping report	
1	**Title page with** - date - author - contact details
2	**Acknowledgements**
3	**Introduction**
4	**Field site details** - Date - Name of community - Location - Main type of livelihood system - Names of participants and sex - Names of the mapping team and associated roles and responsibilities
5	**The primary and secondary objectives of the mapping exercise**
6	**Copy of the map** A scale copy of the map and a photograph of the original map as drawn by participants (Try to take a photo of the map from birds-eye-view i.e. vertically perpendicular to the ground) – perhaps standing on top of a vehicle to do so.
7	**Notes of the discussions that accompanied the mapping** Where the mapping has more than one objective, it is important that this information is presented, reflecting the points raised by the participants.
8	**Notes on disputes** This section of the report should document any disputes or disagreements that arose from the mapping exercise, and how the disputes were resolved.
9	**Notes on levels of participation** A short reflective section is useful on the selection process of participants and levels of participation, including particularly engaged or particularly troublesome community members.
10	**Conclusions and next steps** End the mapping report with any conclusions and proposed next steps, including an associated timeline.

13 Return the map to the community and share with other stakeholders

It is important that at least three scale copies of the map(s) are returned to the community, together with an equal number of copies of the mapping report and photos taken. This could be done through an official community meeting where the map is received by the community leader(s).

CHECKLIST

for rangeland resource mapping

GETTING STARTED

Introduction

- ☐ All team members understand the objectives of the mapping exercise.
- ☐ A checklist of questions to be answered has been produced by team.
- ☐ A mapping 'kit' of materials for use by the community is available.

The facilitating team

- ☐ the team has at least three members.
- ☐ The team includes both men & women.
- ☐ All the team has been trained in mapping & participation techniques.
- ☐ All the team has read the mapping guidelines.
- ☐ Team roles are identified (mapping facilitator, drawer & note taker).
- ☐ All the team speak the local language (if not, a translator has been provided).
- ☐ At least one team member comes from the local area.

Approaching the community

- ☐ the local government offices are aware & approve of the activities & objectives.
- ☐ Local elders/ leaders are aware & approve of your activities & objectives.
- ☐ You have clearly stated to the community who you would like to participate in the mapping process. This should reflect your objectives & be socially representative. The group should be at least 6 people.
- ☐ Separate meetings/mappings have been organized for men and women.
- ☐ The arrangements for the exercise are clearly stated for the participants including time needed, payment (or not), refreshments and transport.
- ☐ An appointment for the mapping exercise is made.

MAKING THE MAP

The mapping process

- ☐ The team is introduced to the community.
- ☐ The objectives of the mapping are clearly explained to the community.
- ☐ A discussion is carried out on what should be displayed on the map and at what scale.
- ☐ The mapping is started with a simple question such as: What are the main physical features of the area?
- ☐ The woreda boundary is added after the map was completed (not at start).
- ☐ All resources are mapped including those near by/far away (depends on your objectives).
- ☐ All places & names are clearly labeled.
- ☐ A legend for symbols is provided.
- ☐ A discussion is carried out during the mapping based on checklist/questions.
- ☐ All participants contribute equally.
- ☐ Participant interest in the exercise is maintained.
- ☐ Time is given for questions from participants.

NOTE TAKING

- ☐ Clear & DETAILED notes are available of all discussions including questions and answers.
- ☐ Issues of debate & facts of interest are noted.
- ☐ All notes are typed up & a copy attached to the paper map for future reference.

COPYING THE MAP

- ☐ The community has given permission for the map to be copied.
- ☐ A copy of the map has been made on flipchart paper (or larger) as drawn by the community (i.e. no changes in direction of map or details/symbols)
- ☐ A legend for symbols is provided.

CLOSING THE ACTIVITY

- ☐ The participants are thanked.
- ☐ A discussion takes place about the importance of the map and its benefits/opportunities.

WORKSHEET 1-10

Transfering data from participatory map to GIS

OBJECTIVE

To **produce a standard GIS map** of rangeland resources replicating the participatory rangeland resource map as drawn by the local community.

ANTICIPATED OUTPUTS

A **standard GIS map** of rangeland resources as used by community members in the Woreda.

PARTICIPANTS

The mapping team from the previous exercise, representatives from the community who took part in the mapping exercise, and the GIS sub-team.

There are different methods that can be used to transfer the information collected in the participatory rangeland resource map. Depending on resources, tools and for example, the quality of internet connection available to you, you can **choose one of the following methodologies**:

1. **Physical measuring of key landmarks on-the-ground or use of a topographic map**

   If you have access to GPS measuring tools, then a simple though time-consuming method of transferring information from the hand-drawn map to GIS is by going out into the rangeland with community members to the different features drawn on the map and **taking GPS readings of the 3-dimensional location data** (latitude, longitude coordinates and elevation) of their location. *These can then be entered into the GIS system* and a map produced.

   Topographic maps can also be used to identify natural and man-made features. Most communities use at least some natural features as their borders: rivers, hills, roads etc. These can easily be found on 1:50,000 topographic maps, and boundary points and lines that coincide with these features can easily be transferred onto a final map. These features were of course accurately surveyed when the topographic map was being produced, and therefore do not need more field surveying work. This saves on the costs and time of land use planning.

BOX 1-10.1 FIELD SURVEYING

Each boundary point that cannot be given coordinates directly from the base map must be surveyed by taking its coordinates in the field using a hand-held GPS. The survey team will need a rough idea of the location of these points before leaving for the field. Field surveying involves the following steps:

- **Identify points** that need to be surveyed.
- **Collect the GPS readings** of points/line data.
- **Transfer coordinates** onto the topographic base map.

Collect point/line data using GPS is simple. Although each GPS device has its specific characteristics, there are number of general rules:

- Get to know the user's manual and test and calibrate the device with the right datum of the country and units of measurements either in degrees or Universal Traverse Mercator (UTM) before starting the field work. If you are working in Geographic Coordinate System (GCS) the Datum of Ethiopia is GCS_Adindan and if you are working with the Projected Coordinate system the Datum is Adindan_UTM_Zone_36N (30°E to 36°E), Adindan_UTM_Zone_37N (36°E to 42°E) and Adindan_UTM_Zone_38N (east of 42°E).

  Note: *It is a very important step to calibrate before using any GPS devices and GIS software otherwise the readings you collected will take you elsewhere on the globe out of your woreda.*

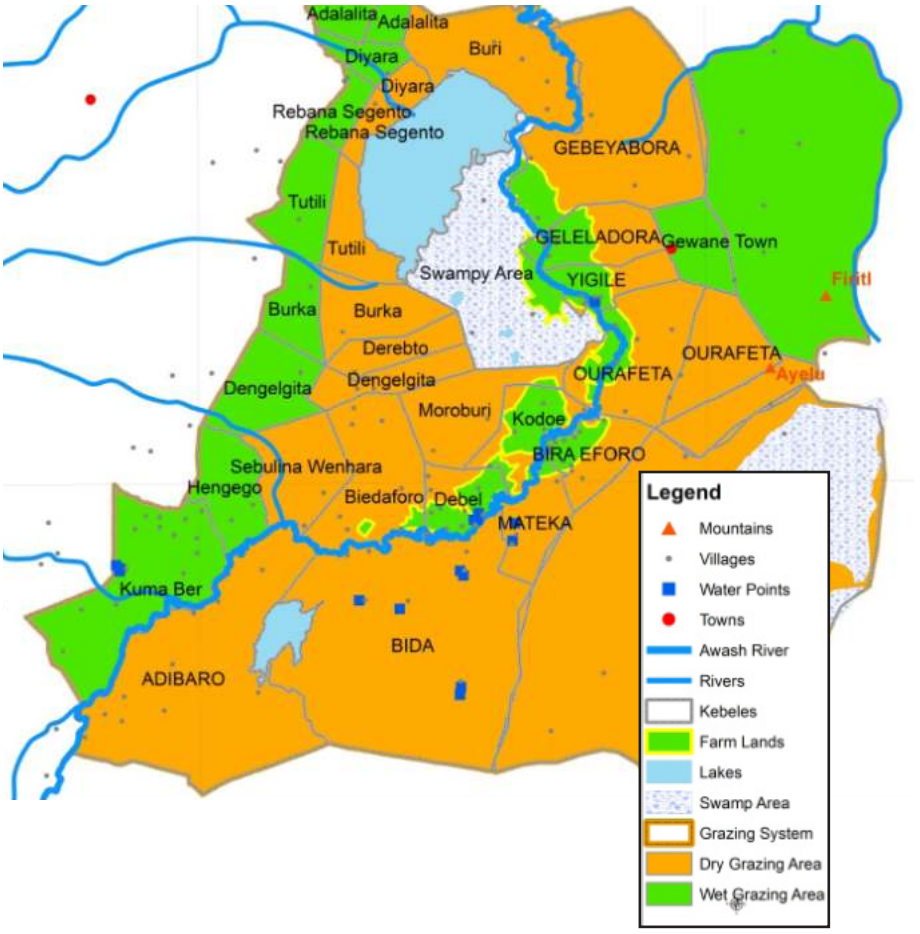
- If vertical obstacles interfere with the satellite signal, look for an adjacent spot not too far away.
- *Make at least two or more readings for each point* to eliminate unwanted errors.
- *Annotate/label the coordinates* of each point in a separate notebook and on the GPS.

The transfer of GPS readings onto a topographic map involves the following steps:

- Transfer of the longitude reading on the horizontal coordinate scale of the map.
- Draw a vertical line through the transferred point.
- Transfer the latitude reading onto the vertical coordinate scale of the map.
- Draw a horizontal line through the transferred point.
- The intersection of the vertical and horizontal line represents the geo-referenced (X-Y) point on the map.

It is important to transfer surveyed points onto the topographic base map before the surveyor leaves the area.

Source: Tanner et al., 2009 (modified)



Plates 1-10-1, **Figure 1-10-2:** Sample community maps and digitised map for Gewani-Geleallo rangeland system

Other boundary points such as big trees, ponds, smaller access roads or footpaths cannot be identified on existing topographic maps. Sometimes they can be found on larger scale maps if these are available, or on aerial photographs, satellite images (e.g. Google Earth), and the information is then transferred onto the official 1:50,000 maps, again without the need for field surveying. If these features or marker points cannot be identified on existing maps, photos or images, a field visit is needed to carry out formal surveying to geo-reference the features by taking their coordinates from the field using a hand-held GPS.

When boundary lines or points cannot be identified on a topographic map or photo, field data collection can be done using **handheld GPS** through a field survey (see box below). This system *identifies geographic coordinates of adjoining points or vertices of line features using a set of satellite signals*. Most devices have the capacity to survey also boundary lines. The precision required depends upon several factors (e.g, the type of GPS) and can vary from a few centimetres to some tens of metres. For the purpose of land use planning, which normally covers a large area and does not require the subsequent placing of precise markers or other physical indicators, a level of accuracy of some five to ten metres is sufficient and can be obtained with a cheap handheld device.

2 Transferring information via a satellite image of the same area

Landsat imagery for Ethiopia is found at *www.globis.usgs.gov* free of charge. Spot 5 images an be obtained from the Ethiopian Mapping Agency and/or it can be purchased from Spot 5 imagery suppliers. Transfer the information from the paper map to GIS through the use of a satellite image by carrying out the following steps:

- If small enough, *convert the community hand drawn map to a digital format* by first scanning the resource map and creating a jpg or pdf file and making it ready to be digitized further in a GIS environment. If the hand drawn map is too big to scan, then stick on the wall and photograph it perpendicularly.
- *Acquire a high-resolution (2-5 meters) satellite image* covering the respective woreda and neighbouring woreda(s) area.
- *Organise a small workshop* with some key community representatives who took part in the participatory mapping process, explaining to them that the workshop's objective is to transfer the information from the paper map into a digitised/computerized map.
- With the participants, *lay the satellite image next to the hand-drawn map* on a table so that community members can see both maps. Work with them to find at least six key features on the satellite image that match key features on the drawn map. To avoid horizontal shift in the geo-referencing process, these reference points should be well distributed throughout the whole area of the map.
- *Geo-reference the key features* by finding their exact location on the satellite image. Read the coordinates from the satellite image and write them on the community map. Once the six key features have been identified then identify and map the remaining features and resources as drawn by the communities.
- Some details on the community map may not be easily located on the projected satellite image, so then it is necessary to *visit the location* of the features in the field to take their GPS readings. There should also be some spot-checking of GPS readings of particular features in the field – to cross-check that they are the same GPS readings that were generated through the workshop.
- *Enter the GPS readings into a GIS programme such as ARC-GIS* to produce a map of rangeland resources in the area (Scale 1:50,000-100,000). Produce a draft map for comparison with the community drawn map.

Plate 1-10-2: Community members using satellite images to locate key features in rangelands ©PRIME/USAID Kelley Lynch

3 Use of Google Earth to obtain GPS readings of key features

If you have access to a reasonably good internet connection, then you can use Google Earth to obtain the GPS readings of key features which the community members have drawn on the paper map. Follow these steps:

- If small enough *convert the community hand drawn map to a digital format* by first scanning the resource map and creating a jpg or pdf file making it ready to be digitized further in a GIS environment. If the hand drawn map is too big to scan, then stick on the wall and photograph it. Print out the scanned version for writing on in the following exercise.
- *Organise a small workshop* with key community representatives who took part in the participatory mapping process, explaining to them that the workshop's objective is to transfer the information from the paper map into a digitised/ computerized map.
- Before the workshop starts, *locate the area of the rangeland that the community mapped on google earth map*, and project this onto a white wall/screen. Paste the community drawn map on the wall next to the projected image – with the map placed/turned-around so that it is in the same direction as the image.

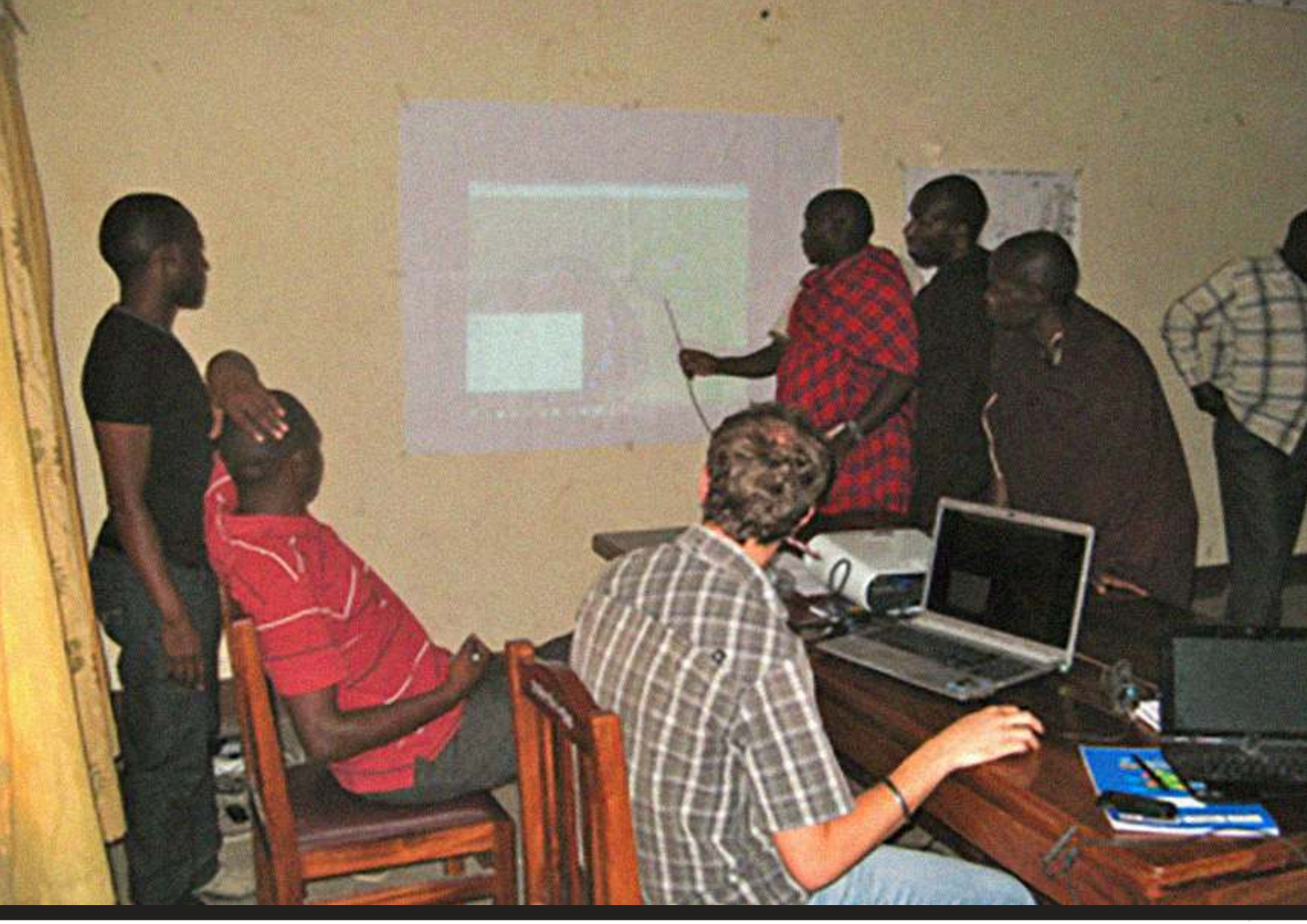


Plate 1-10-3: Maasai pastoralists identifying land marks on satellite images ©Fiona Flintan ILRI/ILC Rangelands Initiative

- With the participants, *locate the key features* and then the details drawn on the paper map including boundaries of different resources, on the projected Google Earth image. When a feature is located on the projected Google Earth image, click on the same feature on the computer screen showing the same Google Earth map, and you will be shown the GPS reading for the feature. Take note of the GPS reading. Continue with this until GPS readings have been identified for all features and details on the community map.
- *Some details on the community map may not be easily located* on the projected Google Earth map, so then it is necessary to *visit the location of the features in the field to take their GPS readings*. There should also be some spot-checking of GPS readings of particular features in the field – to check that they are the same GPS readings that were generated through the workshop.
- *Enter the GPS readings into GIS* environment to produce a map of rangeland resources in the area (Scale 1:50,000-100,000).

When you have entered all the information into the GIS system, print out a map of the information and check that you have everything included from the community's paper map. Once this has been checked, you can move onto the next step. However, you will return to this information, the maps and the GIS layer created at a later stage of the WPLUP process.

WORKSHEET 1-11

Checklist of equipment and materials required

OBJECTIVE

To ensure that all required equipment and **materials are purchased**, borrowed and/or accessed for the WPLUP process.

ANTICIPATED OUTPUTS

A full set of **equipment and other materials required** for the WPLUP process.

PARTICIPANTS

The Technical Land Evaluation and Water Team will be responsible for this task, with input from other WPLUP Team members.

Different types of equipment are required. The following are the main types, together with an indicator of where they can be obtained.

The Team should also have access to a computer, printer and GIS software e.g. ARC GIS. Transport will be required either by vehicle or motorbike.

1 Maps

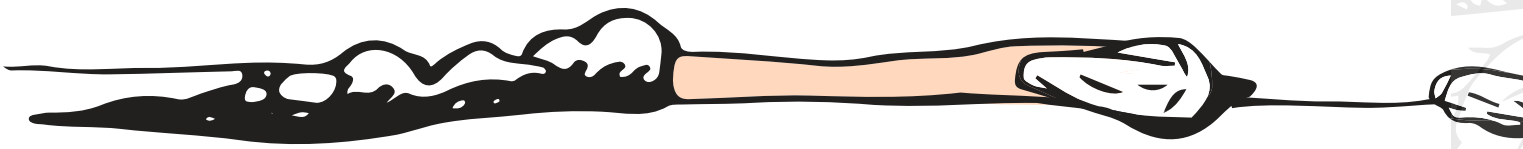
Type of map required	Where can it be obtained?	Approximate cost ETB
1. Topographic map (Scale1:50,000:) of the woreda and neighboring woreda(s)	Ethiopian Mapping Agency	100 ETB
2. Topographic map of the woreda only (Scale: 1:50,000)	Ethiopian Mapping Agency	100 ETB
3. Enlarged aerial photographs of the woreda (as recent as possible)	Google Earth, Ethiopian Mapping Agency	
4. Satellite images of the woreda (as recent as possible)	Internet	
5. Soil maps of the Woreda	Agricultural Transformation Agency	
6. Ground water maps	Regional river basin authorities	

2 Data collection equipment

Type of equipment required	Approximate cost ETB
GPS or mobile phones with GPS facility	12,000/6,000
Clinometer	4,000
Auger	5000
Soil pH measuring kit	1000
2 x 1 metre wooden poles – with lines or grooves every 20 cms	100
Sickles for cutting grass x 4	4 x 30 Birr
Plant botany books (7 volumes)	7 x 500 Birr
Measuring tape 50 or 30-meter length	200
Measuring tape 50 or 3-meter length	100
Munsell Soil Color Chart	

3 Stationary

Type of equipment required	Where can it be obtained?	Approximate cost ETB
Flip-charts	Purchase locally	100
Flip-chart pens (different colours)	Purchase locally	100
Notebooks, pens	Purchase locally	50
Large sheets of paper 5 m x 5 m if possible (or tape flip-charts)		100
A4-size paper		0.5



WORKSHEET 2-1

Prepare a woreda Base Map

OBJECTIVE

A woreda Base Map is required as a starting point for developing the land use map and plan. It is the result of **combining woreda boundaries with physical features** in the woreda such as roads, contours, rivers, lakes, mountains, forests, built up areas etc.

ANTICIPATED OUTPUTS

A woreda **Base Map**.

PARTICIPANTS

Woreda land use and and GIS expert(s).

A digital map obtained from the CSA can be used to guide the preparation of the administrative woreda boundary map. The physical features for developing the woreda base map can be obtained by either using topographical maps or satellite images. Such images can be obtained freely (Google Earth, Landsat 8 OLI (Operational Land Imager) and commercially (Ortho photo, Spot imagery and mobile GIS applications such as TRIMBLE GIS to hold and map spatial data).

1. **Using CSA administrative digital maps**
   Digitised maps from CSA can be used as a starting point, with **information from topographic maps overlaid and digitised in GIS**, in order to get the accurate boundary of the woreda and key geographic features.

2. **Using only topographical maps**
   - **Acquire a topographical map** (1:50,000) from the Ethiopia Mapping Agency (EMA), with map index covering the respective woreda area.
   - **Scan the map** of the woreda area to get a soft copy and geo-reference it and/or obtain a soft copy.
   - **Digitise man-made/natural features** such as roads, river, lakes, mountains, forests to produce the village base map.

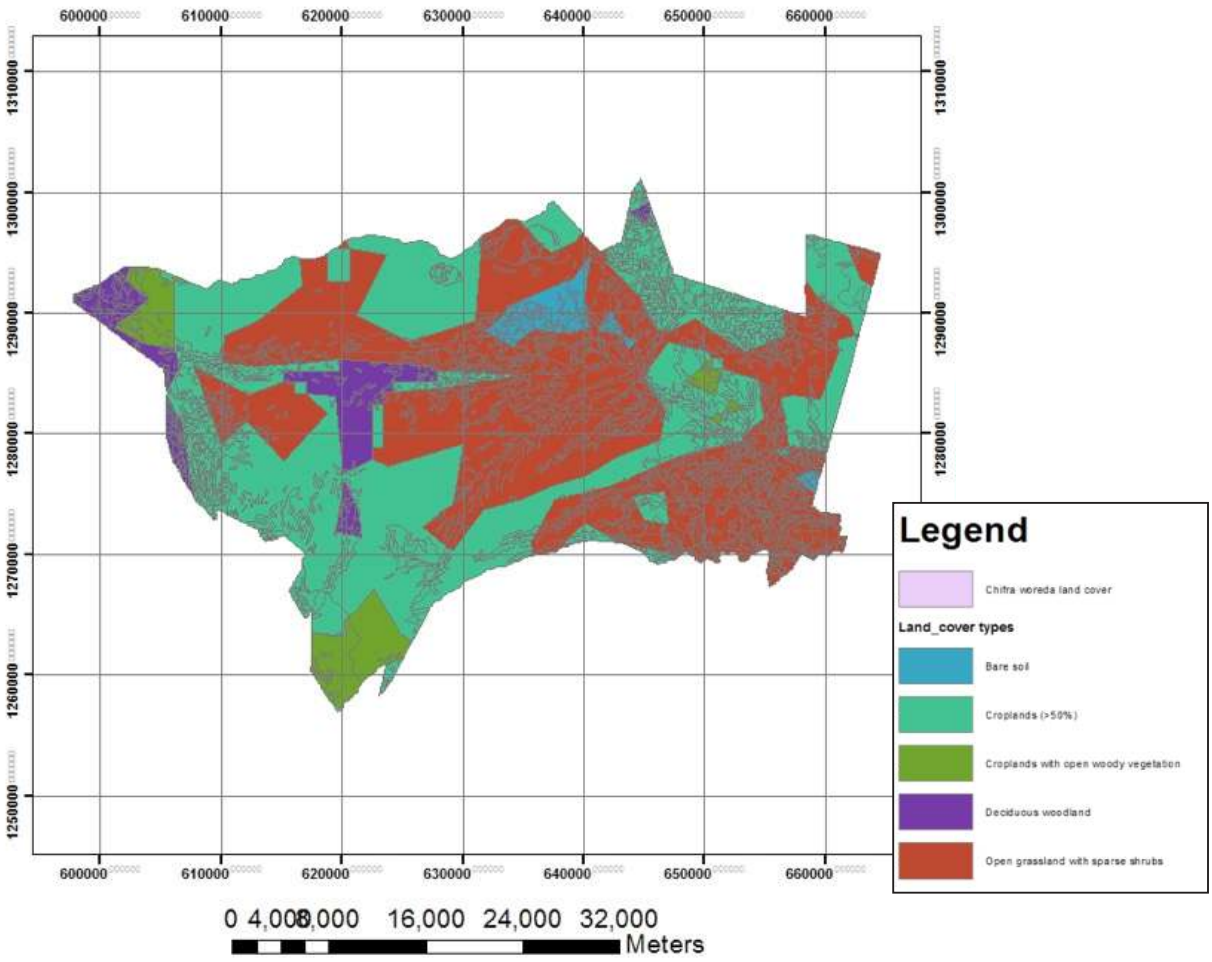


Figure 2-1-1: Example of woreda base map from Chifra woreda with major land covers

3 Using satellite images

Lay the topographical map and the satellite image next to each other on a table and identify the woreda boundary and key woreda geographic features (e.g. roads, rivers, lakes, mountains, settlements etc.) on the topographic map and then make sure that these features are exactly aligned. The geo-references from the satellite image can then be used to produce a digitised base map in GIS.

> **Note:** *This boundaries and key features drawn on this woreda Base Map should align those drawn on the Rangeland Resource map in Exercise/Worksheet 1-10. Though all the details might not be exactly the same – the base map should be compatible with the Rangeland Resource map so that the information on grazing and rangeland resources can be layered on top of the woreda Base Map.*

WORKSHEET 2-2

Stratify woreda into land use planning units

OBJECTIVE

To **produce a map of the sub-units** in the woreda stratified by topography, soil, vegetation and land use, which will then be used as data collection sites.

ANTICIPATED OUTPUTS

A **map of soil landscape-vegetation-land use sub-units.**
It is recommended to finish with no more than 8 sub-units.

PARTICIPANTS

The Coordination and Facilitation Team, the Agricultural and Land Use Team, the Rangelands Resources Team, and the GIS Team.

The first step is to stratify the land:

STEP 2-2 A COLLECT BACKGROUND INFORMATION, MAPS (E.G. SOILS, VEGETATION, CURRENT LAND USE/MANAGEMENT) AND PHOTOGRAPHS[6]**).**

Use this information in the next two steps to **divide the land into key soil-landscape-vegetation-management units** (see *Figure 2-2-1*).

GIS is a useful tool for carrying out the land stratification. The stratification can also be done using a topographical map of the area (scale 1:50,000), aerial photographs, ortho-photos or satellite images. All maps shall be as recent as possible.

Sources of information that will be useful are provided in *Table 2-2-1*. Some information may require verification and triangulation with community-drawn resource maps and/or transect walks.

Remember!
This is only a rough and approximate mapping of the woreda into key soil-landscape-management units. Through the following steps that you will carry out in the land use planning process – much more detail will be collected and used to identify and develop more detailed units.

6 You can also refer to the rangelands map produced by communities in *Step 4/Worksheet 1-9*.

Table 2-2-1 Useful sources of information including maps

Resource	Source
Soil surveys and maps	ATA-EthioSIS Project, local or regional agricultural office or research institute, soil maps produced by different institutions (federal and regional Water Works Design Enterprise – River Basin Studies, Woody Biomass & Strategic Planning Project, FAO Soil maps, master plan studies and others
Administrative boundary maps	CSA (Central Statistical Agency)
Digital Elevation Model (DEM), contour map for slope map production	Ethiopian Mapping Agency
Aerial photos	Ethiopian Mapping Agency
Ortho photos	Ethiopian Mapping Agency, and/or can be produced by Geo-Spatial experts
Topographic maps	Ethiopia Mapping Agency
Vegetation and/or land use/cover maps	Ministry of Agriculture (woody biomass survey and botanical surveys), secondary sources
Species lists	Flora books and related sources such as: - Azene Bekele-Tesemma, A. 2007. Useful trees and shrubs of Ethiopia- identification, propagation and management. - Assegid Assefa and Tesfaye Abebe, 2011. Wild edible trees and shrubs in the semi-arid lowlands of Southern Ethiopia - Jose L. V. et al., 2005. The Red List of Endemic Trees & Shrubs of Ethiopia and Eritrea - Endeshaw Bekele, 2007. Study on Actual Situation of Medicinal Plants in Ethiopia - And other published flora books (Hedberg and Edwards, 1989; Phillips, 1995; Edwards et al., 1995, 1997 and 2000; Hedberg et al., 2003 and 2006; and Mesfin Tadesse, 2004)
Maps and name of invasive species distribution	EIAR (Ethiopia Institute for Agricultural Research)–Alien Plant Species Invasions in Ethiopia
Geological maps	Ethiopian Geological Survey

STEP 2-2 B DIVIDE THE AREA INTO STANDARD SLOPE CLASS UNITS.

Slope class units are areas that are relatively homogeneous with respect to slope angle, and aspect or position and topographic sequence.

Sources of information to use when dividing the woreda into slope class units:

- A **topographical map** showing differences in contour heights can help identify major slope angle, aspect and position. Note – you should only take into account slope differences when these cover a large area and/or have a significant impact on the physio-chemical and morphological nature of the soil and environment. Small topographical differences should NOT be included, otherwise you will end up with too many planning sub-units..
- **DEM (Discrete Element Method)** may also be used to produce a slope map.

You should divide the woreda into between 2 to 4 slope class units only (more would be unmanageable). Only slopes that are known to have a significance in terms of land use should be included.

STEP 2-2 C SUB-DIVIDE THE SLOPE CLASS UNITS INTO SOIL-LANDSCAPE SUB-UNITS

The next step is to **divide the major slope class units into soil-landscape units**. These are areas that are relatively homogeneous with respect to slope angle, aspect or position and soil parent material (material from which the soil was formed) resulting in a relatively homogeneous soil type along a topographic sequence. As a result, they tend to have similar soil types and properties. Where soil types and properties in a landscape unit are similar, they are included in the same soil-landscape unit. Functionally, similar soils have similar potentials to produce a particular type and amount of vegetation under the same climate, and thus to support the same land use.

> *A soil map of the woreda can be extracted from previous soil survey maps at an acceptable scale (for information sources see above)*

You should divide the woreda into between 2 to 4 soil-landscape sub units (more would be unmanageable).

STEP 2-2 D SUB-DIVIDE THE SOIL-LANDSCAPE SUB-UNITS INTO SOIL-LANDSCAPE-VEGETATION (OR LAND USE) SUB-UNITS

Generally, vegetation is correlated with landscape position and soil type, but historic differences in land use can lead to the development of different plant communities on the same soil-landscape unit. Vegetation subdivisions are normally based on the current dominant plant species. They can also be based on the presence of critical species, such as exotic or invasive plants, or by habitat type for a particular animal. Keep in mind that while soil-landscape units are relatively persistent and use independent, soil-landscape-vegetation or land use units can and do change rapidly.

Sources of information to use when dividing the woreda into soil-landscape-vegetation/ land use units:

- Aerial photos or satellite images;
- Rangeland unit map produced by community in *Step 4, Worksheet 1-9*.
- Woreda and kebele land or agricultural maps.
- Vegetation surveys and maps of vegetation and vegetation change carried out by projects or previous government surveys.
- Maps or surveys of invasive species.

You should **divide the sub-unit into between 2 to 4 soil-landscape-vegetation sub-units** (more would be unmanageable and difficult for further analysis). If you find you have too many sub-units then only chose the major ones – for example any sub-units less than 20 hectares could be excluded.

These soil-landscape-vegetation sub-units are the final units used in the biophysical and socio-economic data collection for evaluation and classification exercises of the land in the woreda. Based on the results of the data analysis, the land use plan and management plan will be produced.

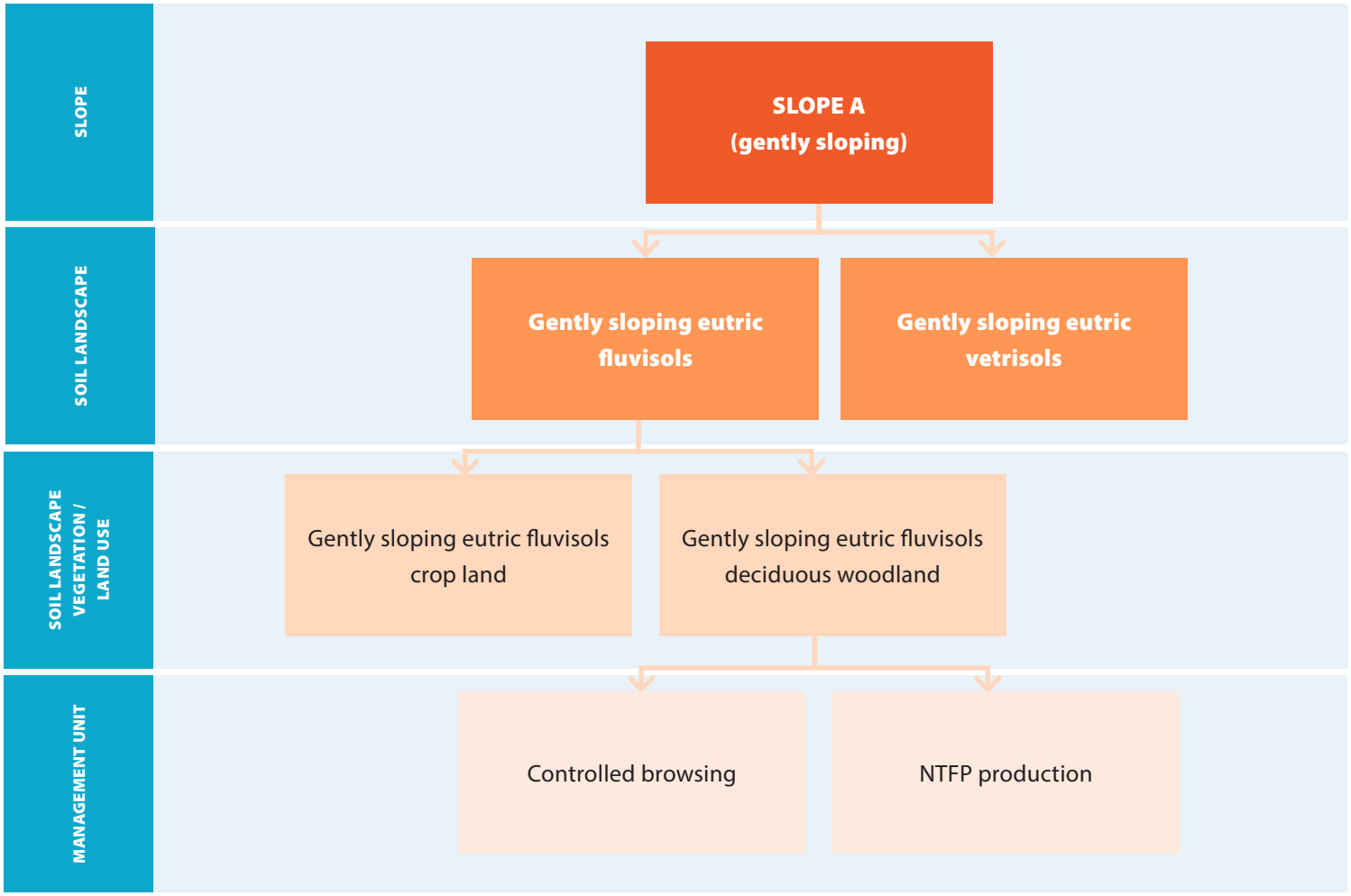


Figure 2-2-1: Dividing the woreda into land use planning units

This final unit is the largest possible area with the same slope class, topography, soil type and vegetation that is expected to respond similarly to the same management/ use practices. Pasture borders, distance from water, prescribed/planned fire, agriculture, commercial investment plans, woody vegetation removal, conservation practices and recreational use can be used to divide up land use planning units.

These soil-landscape-vegetation sub-units determine the different ecological units in the woreda, which determine land use and potential land use as a basis for the JVLUP. How land is currently being used will also be a factor to consider.

Land use types include: perennial crop cultivation, annual crop cultivation, commercial farms and processing, grazing, browsing, wood collection, NTFP (non-timber forest products) collection, nature conservation and wildlife, area enclosure, mining areas, tourism, fisheries, land identified for investment and/or infrastructure.

STEP 2-2 E MAP THE LAND USE PLANNING UNITS

If you have the technology available, **make a GIS map of the soil-landscape-vegetation sub-units** or what can now be called land use planning units. If GIS is not available, then trace the land use planning units onto a topographical map of the woreda.

WORKSHEET 2-3

Developing an information collection plan

OBJECTIVE

To **identify what information needs to be collected** for the development of the WPLUP; where this information can be sourced; what tools/methods will be used to collect this information; and who will be responsible for collecting the information.

ANTICIPATED OUTPUTS

A **plan for collection of information required** for the WPLUP.

PARTICIPANTS

The full WPLUP Team.

GUIDELINES FOR DEVELOPING AN INFORMATION COLLECTION PLAN

1. **Hold a meeting** for all members of the WPLUP Team.
2. **Use the following *checklist*** as guidance for developing the information collection plan.
3. **Each WPLUP Sub-Team should produce a workplan** for their own set of information-collecting activities. For a template for the workplan – see below.

Much information will be collected from communities or other stakeholders.

Information collection should be grouped so that different information collection exercises can be carried out with the same group of stakeholders at the same time in order to save costs and time.
Table 2-1c-1 suggests which participatory exercises can be carried out together with which groups of community members.

Table 2-1c-1 Participatory tools to use for information collection with different community groups

Community Group	Participatory Tools to Carry out with the Group	Worksheets for the Participatory Tools
Mixed group of community members including leaders, farmers, pastoralists, marginalized groups, other land users, men, women, youth, aged etc. It may be necessary to carry out different exercises with men and women if thought appropriate.	1. Land and Resource Use Mapping 2. Hazard Mapping 3. Seasonal Calendar 4. Trend analysis 5. Institution/stakeholder mapping	*Worksheet 2-7* *Worksheet 2-8* *Worksheet 2-9* *Worksheet 2-11* *Worksheet 2-20*
Individual members from the community including leaders, farmers, pastoralists, marginalized groups, other land users, men, women, youth, aged. It may be necessary to carry out different exercises with men and women if thought appropriate.	1. Mobility Mapping 2. Transects 3. Resource benefit analysis 4. Survey or Interview 5. Livestock population census and agronomic data collection	*Worksheet 2-14* *Worksheet 2-10* *Worksheet 2-17* *Worksheet 2-16* *Worksheets 2-18*
Mixed group of pastoralists and other rangeland users including marginalized groups, men, women, youth, aged etc.	1. Rangeland Resource Mapping (needs to be done separately in Step 1) 2. Livestock route mapping 3. Rangeland inventory 4. Land capability assessment (for some of data collection)	*Worksheets 1-8* & *1-9* & *1-10* Worksheet *2-15* Worksheet *2-13* Worksheet *2-6a*, *2-6b*, *2-6c*, *2-6d*

Checklist for information collection plan

Information required	Collected already?	Requires collection	Likely source of information	Tools/methods for information collection	Responsibility to collect information
Current land use including infrastructure	☐	☐	Communities, land office, agricultural office, NGOs	Participatory rangeland & land/resource use mapping (including mapping of rangeland unit already carried out), land cover mapping, transects.	Coordination Sub-Team + Agriculture and Land Use Sub-Team (+Rangeland Resource Sub-Team) + GIS Sub-Team
Land capability including land and environment characteristics	☐	☐	Communities, land office, agricultural office, NGOs, metrological offices, research institutes, projects e.g. MDGs,	Land capability assessment, seasonal calendar for seasonal changes, satellite comparison of vegetation change,	Technical Land and Water Sub-Team + Rangeland Resource Sub-Team
Human population and distribution	☐	☐	Woreda administration office	Human population census	Coordination Sub-Team
Livestock population, movement and distribution	☐	☐	Livestock or agricultural office, mobility mapping, mapping of livestock routes and livestock distribution, CSA	Mobility mapping, livestock route mapping, livestock census, interviews.	Rangeland Resource Sub-Team + GIS Team
Crop types, harvests, diseases	☐	☐	Agricultural office, CSA,	Interviews, mapping.	Agriculture and Land Use Sub-Team
Tenure systems and governance systems	☐	☐	Communities, land office	Land or resource use mapping, institution mapping, interviews with communities and/or local land experts, study on customary laws.	Agriculture and Land Use Sub-Team + Rangeland Resource Sub-Team + Coordination Sub-Team + GIS Sub-Team
Livelihood systems, social systems and changes in them	☐	☐	Communities, woreda administration office, NGOs, research institutes,	Land or resource use mapping, interviews, secondary data in Woreda office including Woreda Risk Profile, focus group discussions, trend analysis, timeline, resource benefit analysis.	Agriculture & Land Use Sub-Team + Rangeland Resource Sub-Team + Coordination Sub-Team + GIS Sub-Team
Rangeland vegetation inventory	☐	☐	Communities, agricultural office, research institutes	Rangeland vegetation inventory with some information collected in land capability, participatory rangeland resource mapping	Rangeland Resource Sub-Team

WORKSHEET 2-4

Using participatory research tools

Participatory tools are exercises and activities that focus on a **high level of involvement of community members** in the information collection process. The tools are usually interactive, physical, and exploratory. *Using participatory tools requires an excellent facilitator* who can work with communities to consolidate their knowledge for an agreed purpose.

In land use planning, participatory tools are useful as **knowledge can be gained from the community (the land users) whilst allowing them to reflect on and develop that knowledge**. It gives communities an opportunity to express their own challenges, priorities, and solutions whilst taking on a greater degree of responsibility for addressing and implementing these. Interactive discussions between participants allow a deeper exploration of the issues and therefore, better understanding. **The use of maps, diagrams and pictures help participants to express themselves in non-literate ways**. Often the discussion that takes place whilst using the tools, is as valuable and revealing as the answers themselves.

Observation of the process can show you how participants and communities interact. It provides a more relaxed forum where people feel comfortable to discuss and share information. *Participatory research tools are relatively low-cost*.

It should be remembered however that **some exercises can be time-consuming and may require repeated visits to communities** to work through different tools and processes. It may be challenging to arrange community meetings that are inclusive and have a fair representation of different groups in the community. Some people find it difficult to interact with groups on such a personal level – and prefer to hide behind a formal questionnaire and clip-board. Information collected may be difficult to understand and/or unclear unless explained fully by the producers – the amount of information collected can also be challenging to analyse and present. Having said this however, overall, the experience of using participatory tools is positive and justified.

Participatory approaches require attitudes that show:

- Respect for community members;
- Appropriate behaviour with reference to custom and culture;
- Interest in what communities know, say, show, and do;
- Participation, facilitation, support;
- Patience, that is not rushing and not interrupting;
- Listening, not lecturing (i.e. 'handing over the stick' to communities);
- Mutual learning;

- Information sharing;
- Empowering community members to express, share and plan; and
- Enhancement and analysis of community knowledge.

Things to do and not to do when using participatory approaches:

- Find the right team – that is people who are comfortable and capable with participatory approaches and tools: include women, youth and disabled on your team.
- Take it slowly – rushing through tools will result in muddled and limited information.
- Be careful how you express questions – try to ask questions beginning with What? Who? When? How? Where?
- Involve a full representation of different land users in the consultation and information-collection processes.
- Build up rapport with the community, build up their trust and make them feel comfortable.
- Show respect to the participants and listen attentively to what they say.
- Try to see and understand the whole situation.
- Avoid making assumptions and value judgements.
- Do not be misled by gossip.
- Avoid generalisations based on small amounts of information.
- Do not raise the expectations of communities beyond what you can commit to.

More information is found in the worksheets on:

- Rangeland/natural resource and land use mapping
- Mapping of mobility or livestock routes
- Seasonal calendars
- Transects
- Trend analysis or timeline
- Resource benefit analysis
- Institution and relationship mapping

Remember!

Throughout the data collection including participatory data collection, it is important to take good notes of accompanying conversations, make clear copies of diagrams and maps, and to write up the exercises and notes as soon as possible after the event.

WORKSHEET 2-5

Why are gender issues important in land use planning?

In the pastoral areas of Ethiopia land use change has occurred, resulting in a fragmentation of the rangelands across the region and encouraged the privatisation of resources as competition over remaining grazing areas and water sources has grown. Many pastoral communities have become more sedentarised. **Such change affects men and women differently.**

As **sedentarisation has increased**, many women have found new opportunities to develop businesses and raise their income. However, this also means that their responsibilities and workloads have increased, which may cause problems for them. Though such activities can provide much needed cash, these increased incomes do little to address the root causes of women's vulnerabilities that affect their lives including marginalisation from decision-making processes and insecure access to resources and assets. This is particularly the case for pastoral women, as pastoralists in general tend to be marginalised and have less secure access to land and resources than other socio-economic groups.

Privatisation and individualisation of resources can have a number of negative impacts on women: where land access have been formalised often women miss out; fences and other barriers mean they have to walk further to collect water and other resources; and the breakdown of communal support systems leave women highly vulnerable.

These changes are contributing to **shifts in decision-making processes and the role and place that women and men have in them**. This is occurring at all levels – from the household to community to government. This has implications for how gender-sensitive development can be supported in pastoral areas.

Many women are achieving greater degrees of voice and participation in decision-making processes. Even at a community level women are increasingly playing a more public role. Women may find alternative and parallel forums more effective than trying to break into male-dominated customary ones. Social and cultural barriers to women's full participation tend to be complex. Poorer, less powerful women may find it particularly difficult to engage. Women's key role in conflict and peacemaking is likely to be ever more relevant as the probability of conflicts over reducing resources increases. However, the nature of many conflicts has changed and thus women are likely to need assistance in addressing the new causes and impacts of these.

Many challenges exist between addressing short-term needs of communities (men and women) and supporting sustainable long-term development and security. This is particularly the case in pastoral areas where short-term solutions to such as food and water insecurity can negatively impact on the long-term health and productivity of rangelands and pastoral systems, upsetting or destroying local rangeland management institutions and processes. The interconnectedness of pastoral systems is often ignored, so a badly planned activity can have highly negative impacts on the system as a whole.

HOW-TO-DO GENDER-SENSITIVE LAND USE PLANNING IN PASTORAL AREAS

1. **Fully understand the changes taking place** in pastoral areas and their driving forces. Identify ways to optimise the positive aspects of these changes and to reduce the negative aspects.

2. **Involve women (and different groups of women – young, old, pastoral, non-pastoral) in all aspects of the data collection** and land use planning process. If women are not comfortable discussing in or taking part in mixed-group meetings, then it will be necessary to organise separate meetings for women. After separate men and women meetings always make sure the information is shared and brought together.

3. **Security of access to assets, resources and land for pastoralists and in particular pastoralist women, need to be advocated and supported** as part of land use planning interventions. Women who lead more mobile lifestyles as part of pastoral systems are likely to have different needs than those who do not, and therefore require special attention.

4. **Change is more sustainable if it is led by local communities** rather than 'outsiders'. By doing so, local communities will feel more in control of the change and able to positively influence it. Women as well as men need to be provided with opportunities to contribute to and participate in making decisions including land use planning decisions that will impact on their lives, and to control the pace of change so that they have time to adapt to it.

5. **Ways to positively support women in decision-making processes need to be identified.** The establishment of new decision-making forums is likely to provide greater opportunities for women's participation than trying to make customary ones more gender-equitable. Understanding what mechanisms women already utilise for influencing decision-making processes, and capitalising from them, is a must for identifying appropriate mechanisms and forums for increasing their influence.

6. **Care needs to be taken that benefits are not created for one particular group in the community at the expense of another.** This includes ensuring that improvements in livestock production for example, support women's concerns for the security of household members – strategies to do this may be different to those supporting privatisation and commercialisation.

7. **Ways to mitigate negative impacts of these processes need to be identified.** This can include re-instilling communal mutually-supporting values that may have been destroyed by more individualistic attitudes. Working in groups and cooperatives can be one way of encouraging this – women may be better placed to do this. There is a need for long-term capacity building and support connected to such group or cooperative development.

WORKSHEET 2-6a

Collect information for a land capability assessment

OBJECTIVE

To carry out **a land capability assessment including detailed collection of data in each sub sub-unit** (soil-landscape-vegetation or land use sub-units) of the woreda.

ANTICIPATED OUTPUTS

Biophysical and socio-economic data collected ready for analysis and use in the land capability classification in *Worksheets 2-6b* and *2-6c.*

PARTICIPANTS

The Coordination and Facilitation Team, the Technical Land Evaluation and Water Team, the Agricultural and Land Use Team, the Rangelands Resources Team.

Once the woreda has been divided into land use planning sub-units (as per the previous activity in *Worksheet 2-2*), **a Land Capability Assessment and Classification** can be carried out for each sub-unit. This **will provide detailed information on land use potential**, which is important for land use planning decisions. However, the exercise is time-consuming and requires significant resources so should only be carried out if these are available. Land capability classification is a tool, and can be replaced by other tools described in this volume if resources are not available.

The capability of land for different activities depends on **three factors**:

- *Degree of hazard or risks of soil damage* or limitation in use;
- *Kind of conservation problems or limitations involved*, such as erosion and runoff, excess water, root-zone limitations, climatic limitations.; and
- *Potentials and continuing limitations* or hazards to produce similar kinds of cultivated crops and pasture plants with similar management practices in the intended planning unit.

Climate (temperature and rainfall) determines whether or not growing conditions needed for specific crops or livestock production are present. Thus it is the first variable to consider. Other environmental variables to consider are: available moisture and/or water for cultivation or livestock production, soil attributes, terrain slope, and surface stoniness.

Land production potential is the result of a mix of crop and livestock suitability with human factors such as settlement, infrastructure, land use patterns, technological advance, agricultural system including pastoral inputs, cropping and grazing systems, and land management practices.

A land capability classification is required for looking at the functionality of land and potential future use of different land types. **Pastoral areas are usually found in drylands where water is a key driving variable in the capability and suitability of land for different uses**. This is different to land in more temperate areas with greater quantities of rainfall where such as soil types and slope are more important – and thus a slightly modified land capability classification in the context of the country and data availability is required for planning in pastoral areas. Additionally, because this Manual is to designed to support a participatory planning approach, this land capability classification supports the participation of local land users in the process, and tools have been developed to reflect this.

The Land Capability Classification should be carried out by a team of technical experts and local community members, as the assigned sub-group of the WPLUP Team (*Worksheet 1-4*).

To carry out a Land Capability Assessment, work through the following steps, and fill out the form *Worksheet 2-6b*. You will then be ready for the step of Classifying the Land Capability – see *Worksheet 2-6d*.

There are **5 STEPs to follow** below. These are:

STEP 2-6a-1 **Decide on where and with whom** the information will be collected for each land use planning sub sub-unit.

STEP 2-6a-2 **Collect information on topography** and landscape features including slope.

STEP 2-6a-3 **Collect information on soil** characteristics.

STEP 2-6a-4 **Collect information on vegetation** including invasive species.

STEP 2-6a-5 **Collect information on other environmental resources** and characteristics – rainfall & water resources, temperature and length of growing period (LGP) etc.

If you complete all these steps you will have adequate information for making a land capability classification.

It is recommended to 'test' the Land Capability Assessment to see how long it takes in different land use types. In rainfed crop farming areas, the Assessment will be much quicker than in rangelands or forests as you do not need to complete a Vegetation Assessment. In rangelands, where the climate and/or weather conditions are harsh to walk through, the whole Land Capability Assessment will probably take around 5 hours for one Data Collection Site.

Accessibility to points is another problem. You should collect data in three data collection points ineach land-use planning sub-unit so this will probably take you three days. The total number of days required to collect all the data depends on the amount of personnel involved in data collection and the extent of the woreda.

STEP 2-6A-1 DECIDE ON WHERE AND WITH WHOM THE INFORMATION WILL BE COLLECTED FROM IN EACH SUB-UNIT

In each land use planning sub-unit identify three Data Collection Points A, B, C to collect information. These should be spread out and picked randomly.

When **choosing the Data Collection Point**, consider the following:

- Make sure the Data Collection Points are *not all next to each other*.
- Select *sites where the topography/slope, soil, and vegetation type are typical of the area* from where you are collecting information.
- Remember that *sites near rivers or streams, will have very different vegetation*, soil properties and other features than those areas that are not near rivers or streams so *these areas should not be considered as representative of the whole area,* can be treated separately if required for special evaluation and the extent is significant, such as for irrigation.
- *Avoid collecting data from sites too close to roads* as the vegetation is unlikely to be representative of the whole area. Ideally, the sites should be at least 200 m from any road.
- *Record the GPS coordinates and altitude* of the Data Collection Point.

Ensure that there are 2-3 community members with you carrying out this data collection as they can help identify such as local names of plant and animal species, their usefulness, trends in rainfall, local names of soils, causes of erosion etc.

At each data collection point you will collect three types of information:

- Information on **topography** and **landscape features** including slope (Step 2-6a-2) & soils (Step 2-6a-3),
- Information on **vegetation** (Step 2-6a-4), and
- Information on **water access** (Step 2-6a-4).

STEP 2-6A-2 COLLECT INFORMATION ON TOPOGRAPHY AND LANDSCAPE FEATURES INCLUDING SLOPE

Slope has a major implication on land use. For example, vertisols and fluvisols tend to be located mostly in fairly level or slightly slopey and low-lying areas. This implies that those areas that have such types of soils have deep and medium to heavy soils that can be used for agriculture, whereas more shallow soils (mostly found in highly sloping mountainous terrain) are better used for grazing as once disturbed by e.g. ploughing, they can be easily eroded. Very level soils may have a drainage problem. On the other hand, steep slopes generally tend to be well drained, but annual crop cultivation is restricted.

Figure 2-6a-1: Slope Measurement using a clinometer (source: Riginos and Herrick 2010)

1 Measuring slope using simple clinometers

You can use a simple clinometer to measure slope – this is how to do it:

- *Point the clinometer* at the slope so that you can see (up or down slope).
- Make sure that the height of your observation (eyes) and the corresponding height (could be a tree, a landmark, a graduated pole or a person working with you) are as equal as possible to read the slope on the forefront ground.
- You can *read the slope gradient in % and degrees* from the scale through the instrument at the horizontal line.
- *Note down the %age* reading in *Worksheet 2-2*.

Remember!

Only collect information on slope if it is relevant to the land use. If the majority of the land is flat, then it will probably not be relevant to collect information on slope – as all data will be the same and no significant topographic variability exists for our land evaluation purposes. However, if there is a large slopey area (which could be used for a different land use), then you will need to use this as one of your Data Collection Points.

2 Measuring slope using poles, string and water-level

Slope can also be measured using a rope and two graduated (in cm) wooden poles and a simple water level using the following procedures.

- *Push the two marked sticks into the ground* 10 meters apart on the slope.
- *Hold one end* of a piece of string at the top of the stick
- *Put the water level at the middle* of the rope
- *Move the other side of the rope up or down* till the air bubble maintains at the center.
- *Read the heights* on the sticks and record in meters.
- Use the following formula to determine the slope:
  Percent slope = (Vertical interval/Horizontal distance) x 100

3 Alternative processes

A simple, fast, and thus less costly development of a slope map of the whole woreda is possible through first **acquiring the DEM of the whole woreda and then manipulating the models using the slope generation and classification using GIS**. Afterwards field verification work will be needed in the field at each data collection points. Guidance is available in "*Quick Tutorial Global Mapper & ArcGIS*" or see: *http://www.globalmapper.com/helpv10/GlobalMapperHelp.pdf*

When back in the office you can work out the Slope Classification, for use in the Land Capability Classification (*Worksheet 2-6d*).

Table 2-6a-1: Classes and percent ranges of slopes

Slope Classes	% Range	Code
Flat to almost flat	0-3	L1
Gently sloping	3-8	L2
Sloping	8-15	L3
Moderately Steep	15-30	L4
Steep	30-50	L5
Very steep	>50	L6

Adapted from MoA/LAUD 2012

BOX 2-6A-2 OTHER SOURCES OF INFORMATION

Further information on topography and landscape features can be obtained from the following sources:

- Topographic map of the woreda
- Google Earth and satellite photographs
- Aerial photographs (if available)
- Participatory land and resource map produced by local communities (see *Worksheet 2-8*).

It is useful to map these topographical and landscape features on a GIS map, so it can be combined with other GIS layers of information. In order to do so, measuring of GPS coordinates will be required. However, if GIS technology is not available, then you can map these features on a topographical paper map.

STEP 2-6A-3 COLLECT INFORMATION ON SOIL CHARACTERISTICS

Hydrology, geology, climate, vegetation and topography affect soil productivity and can determine the kind of land use in that particular area. Data collection and analysis of these important parameters should be included in any soil survey.

Remember!
This step can combined with vegetation collection – Worksheet 2-6c.

Soil maps of landscapes including rangelands rarely include map units named with a lower categorical level soil type (detailed) due to the complexity of most rangeland landscapes (a soil classification is like a plant taxonomy and can be very variable). So **instead of mapping out each individual unit of soil, soils can be mapped as**:

- A *dominant soil only*; or
- A *dominant soil plus a co-dominant soil* and/or one or more associated soils; or
- *Two or three co-dominant soils*; or
- *Two or three co-dominant soils plus one or more associated soils*.

In pastoral areas **"dominant soil only" is recommended**.

Remember!
Dominant soils represent ≥ 50% of the soil cover, codominant soils ≥ 25 and < 50% of the soils cover. Associated soils represent ≥ 5 and < 25% of the soil cover, or are of high relevance in the landscape ecology (IUSS Working Group WRB, 2015).

Soil Reference Groups (RSGs) and their "principal qualifiers," "supplementary qualifiers" and "specifiers" are usually identified based on diagnostic soil horizons, properties and materials. Apart from soil types, other soil features and physio-chemical characteristics important for land management, such as slope, soil surface texture, surface rockiness and salinity are collected, analysed and interpreted. *The soil survey (or a professional soil scientist) can help you decide if the components in a particular map unit are sufficiently similar to be treated uniformly for land use purposes*.

Soil types are distinguished based on RSGs and their "principal qualifiers", "supplementary qualifiers" and "specifiers" from a soil profile. These soil characteristics are usually, but not always, directly related to soil function (i.e. what the soil can be used for).

In *Worksheet 2-2* when you were defining the Land Use Units *you will have already collected some information on the major soil types in the woreda, and used this to divide the woreda into soil-landscape sub-units*. Therefore, the type of soil in each soil-landscape sub unit will roughly be the same. It is useful however to **collect more detailed information on the soils at each Data Collection Point** if time, in order to provide more information on suitable land uses and management.

Follow the steps below and include 2-3 community members on the team so that they can provide local information on soils, functionality of soils etc.

1 Soil depth

The depth of the soil has a major influence on the land capability, classification and growth of pasture and crop groups. Annual crops should not be grown on soils with a depth less than 50 cm. Perennial crops should not be grown on soils less than 80cms. Shallow soils are best used for grazing lands where grass, shrubs and trees protect the soils and prevent erosion. Preferably shallow soils should have a dense and permanent plant cover all year round.

How to measure soil depth

- *Dig a small trench until you hit bedrock*, or look at the profile of a nearby gully or road embankment.
- *Measure the distance* between the surface and the bedrock – this is the soil depth.
- *If you dig down to 1.5 m and have not hit bedrock, write '>150cm' and stop* digging, but in case if you find gully and road banks as deep as 2 m, record it.

When back in the office you can work out the Soil Depth, for use in the Land Capability Classification (*Worksheet 2-6d*).

Table 2-2b-2 Soil Depth Classes

Soil Depth Classes	Cm	Code
Very deep	>151	D1
Deep	100-150	D2
Moderately deep	51-100	D3
Shallow	26-50	D4
Very Shallow	<25	D5

Source: Adapted from MoA/LAUD 2012

2 Soil erosion

How to determine the degree of soil erosion in the area

- At each Data Collection Point *observe the surrounding area* from the point on which you are standing.
- *Make an estimation* of the amount of exposed plant roots, plant cover, surface soil wash, rills, gullies, gravel, stones and rock outcrop you can see – as in the table below you can use your judgement to say whether there is nil, slight, moderate, severe or very serve soil erosion.

When back in the office you can work out the Soil Erosion Class, for use in the Land Capability Classification (*Worksheet 2-6d*).

Table 2-6a-3 Coding system for soil erosion class

Erosion classes	Definition	Code
Nil	No erosion noticeable	E-0
Slight	- Surface wash & small rills - Tree/plant roots slightly exposed - Slight top soil loss - Good plant cover	E-1
Moderate	- Rills cover most or the surface - Some exposure of tree/plant roots - Much top soil is removed on slopes - Poor plant cover	E-2
Severe	- Shallow gullies are frequent - Tree/plant roots are frequently exposed - Most top soils are removed - Poor plant cover	E-3
Very severe	- Most of the land is dissected by gullies - Little top soil left - Tree/plant roots are frequently exposed - Bare soil common - Rock (parent material) exposed	E-4

Source: Adapted from Morgan 2005

3 Soil texture

Soil texture is **an estimate of the relative amounts of sand, silt and clay particles in a soil**. The physical and chemical behaviour of a soil is influenced by soil texture, which will vary due to the differences in the type and mineral composition of the soil, the position of the soil in the landscape, and the physical and chemical weathering processes involved in soil formation. Soil texture affects the movement and availability of air, nutrients and water in a soil and is often used to estimate other soil properties/qualities, particularly soil water properties, if there are no direct measurements already available (*http://soilquality.org.au/factsheets/soil-texture*).

Coarse textured soils, generally rich in sand tend to warm and drain rapidly and have a good aeration, but do not hold water or nutrients well. The **fine textured or heavy soils**, rich in clay and silt are slow to warm but hold a large amount of water and nutrients, they tend to drain poorly and can be more compact, have a great problem with aeration and they are often more difficult to work (heavy soils–hard to very hard, plastic to very plastic and sticky to very sticky). **Medium textured soils** with a fair proportion of sand, silt and clay (L, SL and SIL) combine the best features of the coarse and fine particles and tend to give higher productivity.

Simple method of measuring soil texture

A simple measure of soil texture is the way a soil feels when held in a hand and rubbed between one's fingers – best between the thumb and index fingers.

There are **3 major classes of soil textures** that include the following:

- **Coarse textured soils:** (S) This includes: sand, loamy sand, sandy loam (with less than 18% clay, more than 65% sand).
- **Medium textured soils:** (M). This includes sandy loam, sandy clay loam, silt loam, silt, silty clay loam, clay loam (with more than 35% clay).
- **Fine textured (heavy) soils:** (H). This class includes clay, silty clay, clay loam, silty clay loam (with more than 35% clay).

How to identify soil texture by the 'ball' or hand method

At the Data Collection Point **take a small sample** of soil from below the soil surface. **Try to roll** the soil into the shapes as drawn and described below. **The shape you can form will indicate what kind of soil texture the soil has** (see Figure 2-6a-2). Note down which shape you can make on the form. We can also obtain secondary soil textural class laboratory data from previous soil survey studies.

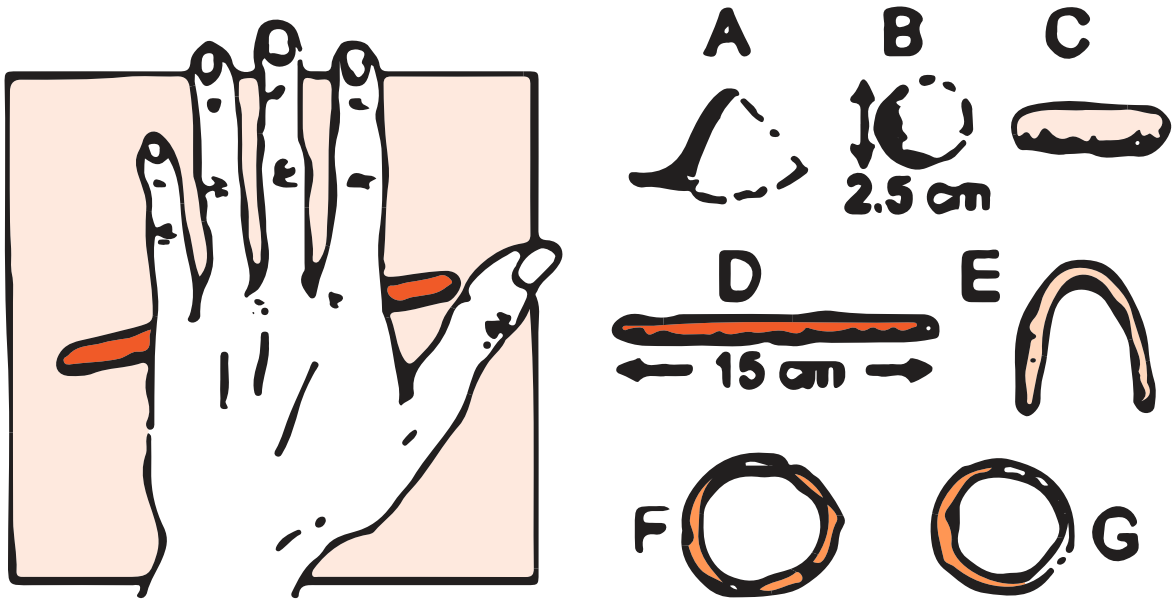


Figure 2-6a-2 Understanding soil texture.Texture classes A-D are sandy to silty soils which generally have good filtration. Texture classes E-G are clayey soils and generally have poor in-filtration. **Source**: *http://www.fao.org/docrep/006/x8234e/x8234e06.htm*

When back in the office you can work out the Soil Texture Class, for use in the Land Capability Classification (*Worksheet 2-6d*).

Table 2-6a-4 Soil textural classes

Textural group	Textural class at field observation	Textural class Laboratory level	Code
Coarse	Sand	Sand	T-1
	Loamy Sand	Loamy Sand	T-2
	Silt Loam	Silt Loam	T-3
Medium	Loam	Loam	T-4
	Clay loam	Clay loam	T-5
Fine	Light clay	Clay, silt clay	T-6
	Heavy clay	Heavy clay	T-7

Source: Adapted from FAO Internet: *http://www.fao.org/docrep/006/x8234e/x8234e06.htm*

4 Soil infiltration or drainage and water logging

Good soil infiltration or drainage allows water and nutrients to be transferred to the roots where it can be used for plant growth. If the soil is not well-drained, and/or it is constantly flooded for a lengthy period of time it results in water-logging. Water-logging can drown plants, preventing oxygen and other nutrients being absorbed. **Water logging is conditioned to a large extent by the texture of the soil.** Fine texture heavy soils generally have high water-logging characteristics. Coarse texture soils may exhibit excessive permeability i.e. very fast drainage and poor water retention.

How to *measure soil infiltration or drainage and water-logging*

- At the Data Collection Point *observe the area* and look for signs of good or bad infiltration and drainage, including oxido-reduction features and colours of the soils. Distributions of mottles (camouflage effect) or streaks of different colours such as gley, rusty, brown, yellow and red in the soil can indicate drainage characteristics. *Water lying on the surface can indicate water-logging* due to there being an impermeable crust, massive soil mass, heavy clay soils.

When back in the office you can work out the Soil Infiltration Class, for use in the Land Capability Classification (*Worksheet 2-6d*).

Table 2-6a-5 Table of surface soil infiltration classes

Infiltration classes	Definition	Code
Good	The soil in the surface layer is porous or very permeable or has a good structure to absorb rapidly. When dry soil is ploughed it breaks into fine clods and grains.	I-0
Moderate	The soil in the surface layer is quite porous or has a moderate to slow permeability; the surface has tendency to compact and seal. When the dry soil is ploughed it breaks in to large clods; ploughing is difficult. Moderate surface cover with plants or grass materials is observed.	I-1
Poor	The soil is not porous. The soil has a strong tendency to seal on wetting or settling to almost impermeable crust on drying difficult to break through. When dry, the soil does not show cracks at the surface.	I-2

Source: Adapted from *http://www.tankonyvtar.hu/hu/tartalom/tamop425/0032_talajtan/ch07s08.html*

Table 2-6a-6 Water logging classes

Water-logging	Definition	Code
No water-logging	Well-drained soil	W-0
Intermittently (sometimes) water-logged	Imperfectly drained areas and/or water logged during heavy rains for less than a week	W-1
Regularly water-logged	Poorly drained areas and commonly flooded during rainy season	W-2
Swampy area	Very poor, drained areas, water table at or near the surface during wet season	W-3

Source: Adapted from MoA/LAUD 2012

5 Surface stoniness or rockiness

The amount of gravel, stone and rocks can be assessed by visual inspection. **Gravel** consists of around 7.5 cm diameter pieces. **Stones** are fragments of 7.5 cm–25 cm diameter. **Boulders** are fragments of larger than 25 cm in size. Rock outcrop is the rocky material or bedrock that is exposed at the surface.

How to *measure the degree of stoniness of the surrounding area*

- *Observe the surrounding area* from the Data Collection Point with a 25 m radius.
- *Make an estimation and proportion* of the amount of gravel, stones and rock outcrop surface occurrence (in percentage) in the total area you can see.

When back in the office you can work out the Surface Stoniness Class, for use in the Land Capability Classification (*Worksheet 2-6d*).

Table 2-6a-7 Stoniness or rockiness classes

Code	Stoniness	Rockiness	Area cover (%)
St-0	No stone or few	No rock or few	<15
St-1	Moderately stony	Moderately rocky	15-30
St-2	Stony	Rocky	31-50
St-3	Very stony	Very rocky	51-90
St-4	Rock outcrop	Rock outcrop	>90

Source: Adapted from MoA/LAUD (2012)

6 Chemical properties of soils

The pH of soils determines whether the soils are naturally acidic or alkaline or as a result of human interventions. Some plants are very sensitive to pH and this fact must be kept in mind in the selection of plants and land uses. The extremes – very acidic or very alkaline – can prevent plant growth.

The presence of too much salt is also of concern – as this will prevent plant growth. If the soil is found to be very salty, remedial action will be required if the land is to be used for cropping or pastures.

How to *determine soil* pH

- It is best to *take a soil sample and send to a laboratory* to determine the pH level of the soil. Soil acidity-alkalinity is expressed in pH. **The ideal pH values vary between 0 to 14**, but soils naturally have pH values between about 3.5 to 10.5.

Table 2-6a-8 Soil pH classes

pH Values	Description
< 4.5	Extremely acidic
4-6-5.9	Very strongly acidic
6.0-6.4	Strong to medium acidic
6.5-7.4	Neutral
7.5-8.1	Slightly to medium alkaline
8.2-9.0	Strongly alkaline
> 9.0	Very strongly alkaline

Source: FAO, 2006

How to *determine the* salinity *of the soil*

- Salinity of soils is *best determined by a laboratory test*. However, *salty soils can be detected by the vegetation or by a thin white layer on the soil surface during the day and dark muddy spots early in the morning* caused by the absorption of condensed water by the salty soil during the cool night.

Table 2-6a-9 Soil salinity classes

Code	Class	Conductivity of saturation extract mm per cm
1	None-saline	< 2
2	Very slightly	2 – 4
3	Slightly saline	5 – 8
4	Moderately saline	9 – 15
5	Strongly saline	> 15

Source: Adapted from FAO undated

STEP 2-6A-4 COLLECT INFORMATION ON VEGETATION

Vegetation found in the woreda may be of many different kinds – it may range from cropping areas, through to grasslands and bushlands, to forests. There may also be different kinds of alien and invasive species ranging from annual herbaceous weeds to woody perennial species. Of particular importance for pastoral livestock production systems is the **presence of palatable species**. In rangelands, *unmanaged grazing and browsing may affect the species composition negatively* and those important palatable species may be replaced by those which are invasive and unpalatable. As a result the whole ecosystem gets disturbed, can cause important economic, environmental and social losses, and the pastoralism way of livelihood and people's food security may get endangered.[7]

It is an important part of the land use planning exercise to **collect information and data on the available plant species including alien and invasive ones** accordingly if a sound land management is to be effective specially in pastoralism. The following Box 2-6A-4 gives examples of the type of information and data that is required.

> **Remember!**
> ***For all types of land cover at the assessment point collect general information on the vegetation.***

At each Data Collection Point observe and note the following[8]:

- *Type of dominant vegetation* e.g. grass, forbs, shrub, invasive species, crop, woodland, bush.
- *Common* grass, forbs, shrub and tree species.
- If cropland, what *type of crop* is it?
- If cropland, *is irrigation being used* or is it rainfed?
- Are there *invasive species* in the area – if so, what species and has anything been done to try to manage them.

In rangelands, grasslands, shrublands or forests more detailed information may be required on the vegetation cover. In order to collect this information *a series of study areas (or quadrants) need to be set up* for each of the three Data Collection Points in each Land Use Planning Sub-unit.

> **Remember!**
> ***For rangelands, grasslands, shrublands or forests only, collect the following more detailed information on basal cover, species and %age distribution, plant height, by following these steps[9].***

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7 To understand more about how to deal with invasive species refer to the *Ethiopia National Strategy on the Management of Prosopis juliflora*, and background technical papers on this and other invasive species.

8 A second and more detailed methodology for a vegetation assessment is given in 2-13.

9 This section has been adapted from the work of FARM Africa and SOS Sahel and their undertaking of participatory rangeland management – see Participatory Rangeland Resource Assessment Methodology (2013).

BOX 2-6A-4 INFORMATION ON VEGETATION REQUIRED FOR DIFFERENT TYPES OF LAND USE

In **croplands**:

- Land area, location and type of crop being grown.
- If two or more crops are being grown, then the approximate %age of each.
- The water source for the crops – rainfed or irrigated (or other).

In **grasslands**, **bush-grasslands** and/or **shrublands**:

- Land area and location of grassland and/or bush grasslands in the woreda.
- Types of plants, species and lifeforms including annual grasses, semi-perennial grasses, perennial grasses, forbs, shrubs and trees.
- Presence and type of any alien/invasive species.
- Distribution and proportion or %age of each main species including the dominant species.
- Distribution and proportion or %age of useful species (palatable or non-palatable).
- Height of the herbaceous layers from ground to the top and/or minimum-maximum tree heights.
- Presence of any bare ground and basal cover.
- Dry matter production in kg/ha.
- Current use of the areas.

In **forests** and **woodlands**:

- Land area, location and type of trees.
- Types and species of trees, and plants.
- Presence and type of any invasive species
- Distribution and proportion or %age of each main species including the dominant species.
- Distribution and proportion or %age of useful species.
- Height of the herbaceous layers from ground to the top and/or minimum-maximum tree heights.
- Ground cover and presence of any bare ground.
- Type of wildlife and population living in the forest (birds, mammals etc.
- Current use of these areas.

On **rocky**, **stoney**, **sandy** land

- Land area and location of barren land including rocky or stony areas (if present).
- Land area and location of sandy/desert areas (if present).
- Current use of these areas.

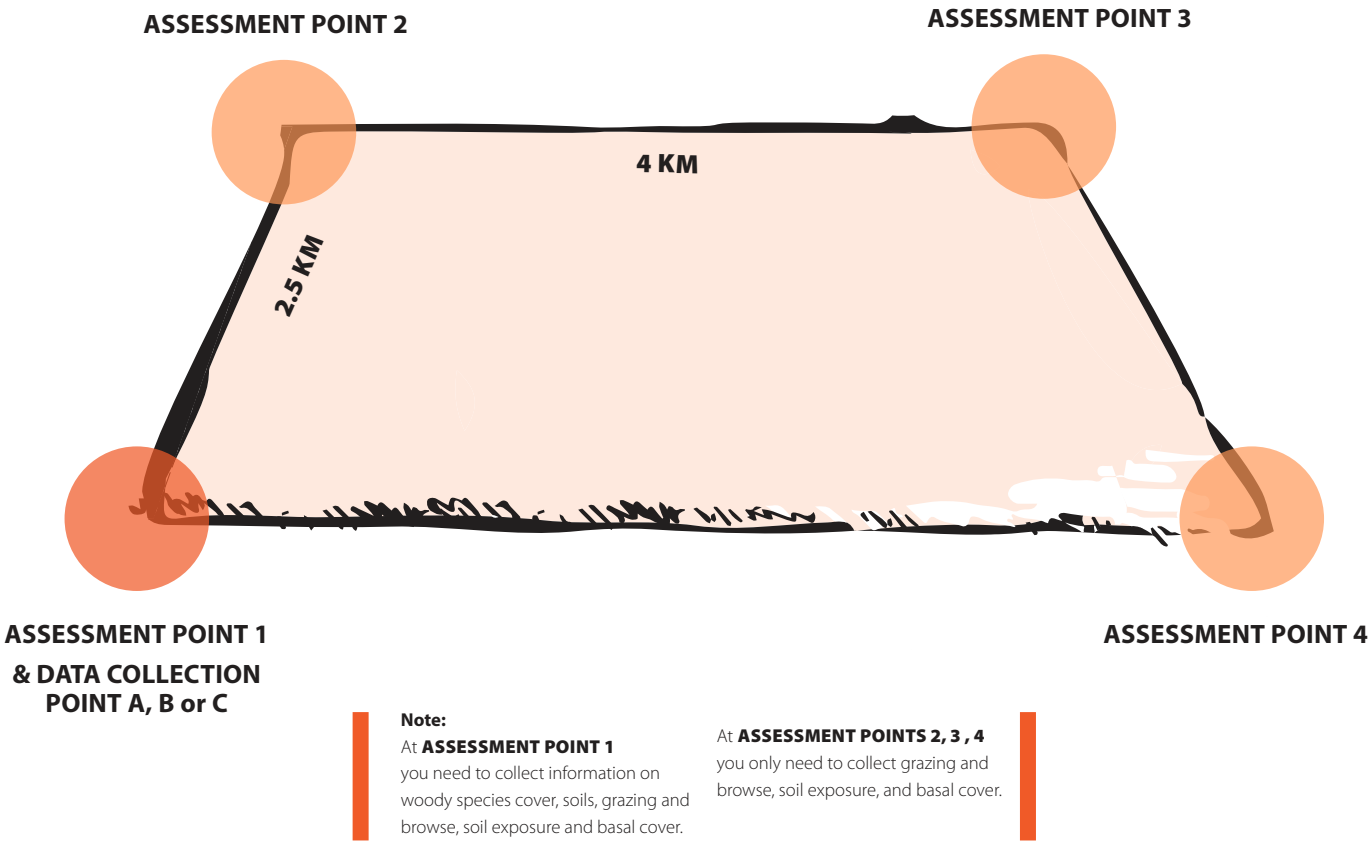


Figure 2-6a.3: A quadrant arrangement for Vegetation Assessment

Steps to set up the quadrants:

- *Note the GPS coordinates of the starting Assessment Point 1* of each Data Collection Site. Carry out the below Vegetation Assessment – at this Point 1 you can also collect the information on soils as above in STEP 2-6A-3.
- Once completed, *face North and walk 2.5 km* in that direction. *This will be the second Assessment Point* of your quadrant. Complete the 2nd Vegetation Assessment here.
- Once completed *face East and walk 4 km* in that direction. This will be the *third Assessment Point* of your quadrant. Complete the 3rd Vegetation Assessment here.
- Once completed *face South and walk 2.5 km* in that direction. This will be the *fourth and final Assessment Point* of your quadrant. Complete the 4th Vegetation Assessment here.

Remember!

It is not the number of plots assessed in a day that is important, but the quality of the information recorded. It is also important to remember that this is a participatory land capability assessment, and so it is necessary to have community members with the data collection team. Discussions with the community may take additional time, but capturing their knowledge and information is central to the process.

How to do a vegetation assessment

Following the above quadrant arrangement (as per Figure 2-6a.3), go to Assessment Point A and collect data on vegetation. Once fully completed you can move to Data Collection Point 2 and 3 within the same sub-land unit, repeating the data collection on vegetation as below.

Follow the **data collection steps** below and fill out Form *2-6c* – the summary of which will be transferred to the Land Capability Form (*2-6b*).

1. **Grazing/browsing intensity (high, medium, low)**

   What are the signs of grazing/browsing intensity within 25 metres radius of where you are standing? What do the communities say? Ask them for three indicators that they look for when measuring grazing/browsing intensity. Write down exactly what they say. Examples are: pathways, tracks/routes, and graze/browse levels. If there are many livestock tracks or routes, then the intensity of grazing tends to be high. If there are moderate tracks or routes then the grazing intensity is medium. If there are few or no tracks then the grazing intensity is likely to be low.

2. **Soil exposure (high, medium, low)**

   Look at the ground within 25 metres radius from the point where you are standing and answer the following questions. How much soil is visible without disturbing the ground? Can you see any soil, or is it covered by grass, vegetation etc? If >50% is visible, the exposure is high. If 10-50%, the exposure is medium. If <10% the exposure is low.

3. *Basal cover of grass species (using a quadrant).*

   From Assessment Point A, walk 5 metres north. Place the quadrant on the ground and count the number of squares with grasses present. The measuring quadrant comprises 100 squares (10 cm x 10cm each).

   Now return to Assessment Point A and repeat the same procedure to the south, east and west. Take the average of the four measurements – and this will be the Point A measurement – to be written down on the form.

4. **Measuring woody vegetation**

   The "T-square" method is one of the most robust distance methods for sampling woody plant communities, particularly in forests, but also in rangelands. It can be used to estimate stand parameters such as density, basal area, bio-volume, and depending on the availability of suitable allometric equations, also biomass. The advantage of this method, over other commonly used distance methods such as the point-centered quarter (PCQ) method, is that it is less prone to bias where plants are not randomly distributed. This methed has been employed for the past decade both by Africa Soil Information System (AfSIS) and Ethiopian Soil Information System (EthioSIS) as a guide to field sampling and measurement procedures in "The Land Degradation Surveillance Framework" (Markus G. Walsh and Tor-G. Vågen, 2006)

Plate 2-6a.1: A 100 square quadrant for measuring basal cover

Under the LDSF (Land Degradation Surveillance Framework) protocol shrubs and trees are sampled separately. It can be downloaded here: *http://landscapeportal.org/uploaded/ldsfFieldGuide_2013_v4_1.pdf*

In rangelands, grasslands, shrublands or forests more detailed information may be required on the woody vegetation cover. In order to collect this information *a series of study areas (or quadrants) need to be set up for each of the three Data Collection Points in each Land Use Planning Sub-unit.*

To complete the T-square measurements for trees and shrubs from the Assessment Point A, *you will need the field recording sheet (Table 2-6a-10)* which later will be an input for *Worksheet 2-6c*, a 15+ meter measuring tape, a diameter tape, a height pole and/or a clinometer, and a calculator. Look around Assessment Point A, then B and then C, and make a woody plants measurement plot design as shown below in the Figure 2-6a-4 as follows:

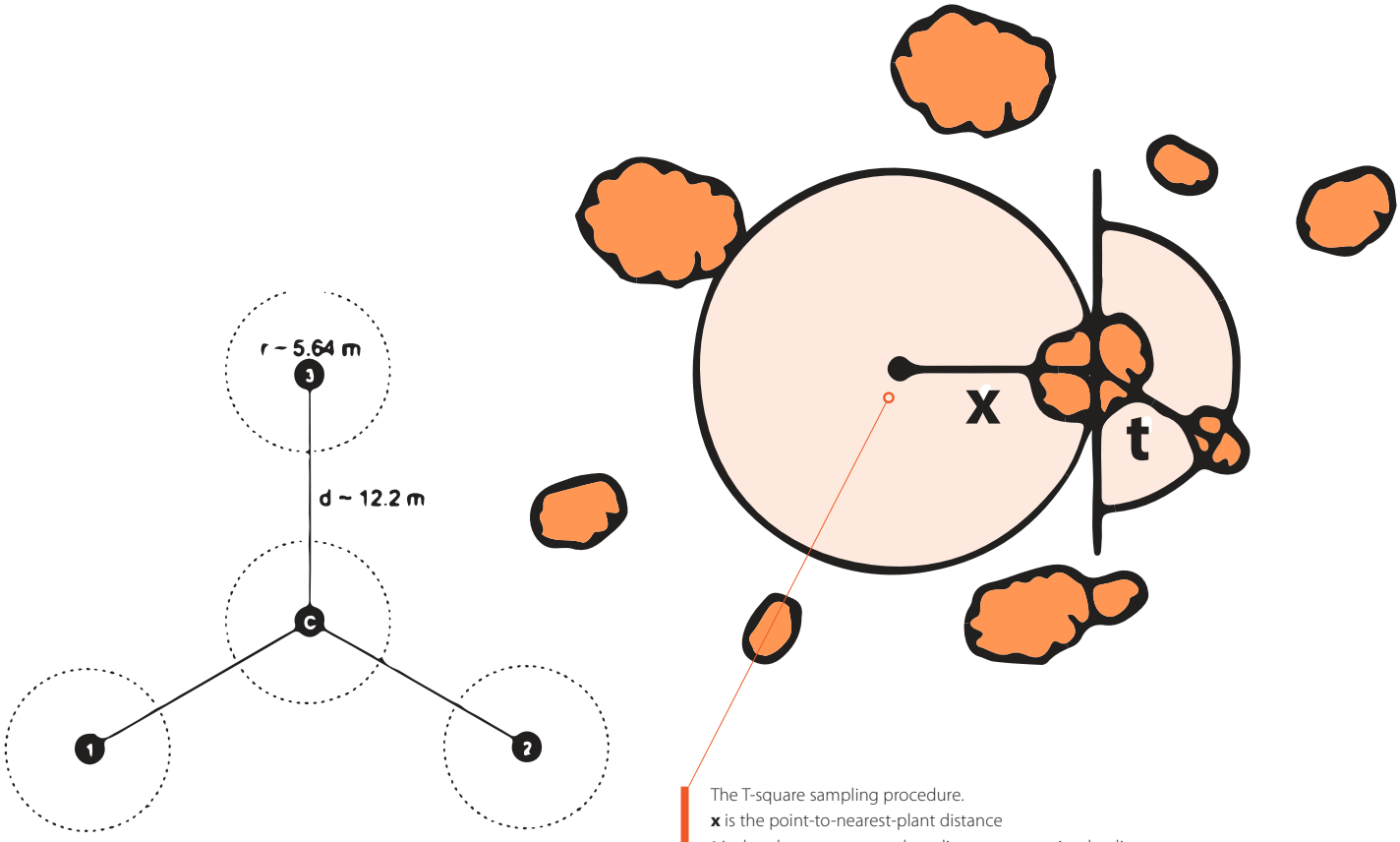
- Standing at the center of each sub-plot, *record the distance from the sub-plot center point to the nearest tree and shrub* (x) (see Figure 2-6a-4). Measure this either to the center of the tree trunk, or to the central portion of the shrub. Record this figure in the appropriate space on the field recording sheet.

- Next *measure the distance to the nearest neighbouring plant* (t). Note, however that the angle of the measurement must be constrained to lie in the hemisphere of a line that lies perpendicular to x. This is the T-square distance. Also record this measurement.
- *For both trees and shrubs measure and record the height* using either the height pole or clinometer methods described further below. Measure only the 2nd plant identified (i.e. the tree and/or shrub identified by the plant-to-nearest-plant measurement).
- *For trees measure the diameter at breast height (DBH) of the 2nd tree.* The DBH should be measured 1.3 meters above ground level. In instances where a tree branches below this level, measure the diameters of all of the branches at 1.3 meters above ground level and sum these. For trees that are tilted determine the 1.3 meters level from the down-slope direction.
- *For shrubs, measure their width, length and height (at center).* Measure distance from subplot to the nearest vegetation. Measure distance to shrubs = <=3m: Height, length, width, number; and trees = > 3m: DBH, height, number
- *Fill the above recordings into the field recording sheet* in the Table 2-6a-10 below. Then the density of shrubs and tree can be converted from 0.1 ha sampling area to a hectare level and to finally to the planning unit.

0.1 ha radial-arm plot layout and sampling locations. The black dots indicate center of the sub-plots where measurements start. Geo-referencing should be completed in the center of the plot. The larger (dashed) circles represent 0.01 ha sub-plots in which vegetation observations should be carried out. r is the subplot radius, d is the center-point distance. Note that the distances are for a flat plot. In instances where slope is >10 degrees. the radii and center-point distances of the subplots should be slope corrected.

Table 2-6a-10 Woody vegetation measurement field recording sheet

Measurement	Shrubs				Trees			
	1	2	3	4	1	2	3	4
Subplot plant density (count)								
Point-to plant distance (m)								
Plant-plant distance (m)								
Height (m)								
Length (mm-shrubs/circumference) (cm, trees)								
Width (m)								



The T-square sampling procedure.
x is the point-to-nearest-plant distance
t is the plant-to-nearest-plant distance constrained to lie in the hemisphere of the dashed line perpendicular to **x**.
Source: Krebs (1989).

Figure 2-6a-4 Woody plants measurement plot design. **-6a-5** Showing woody plants measurement

5 Vegetation description or composition of plant including grass species: vegetation types and proportion of abundance

Look around Assessment Point A, identify the dominant species and calculate the proportion or %age of the surrounding plants (grass, shrubs & trees, and forbs) that are visible and close within 25 metres radius.

List the local name of the plants. If small then cut the plant above the ground. If larger cut a small twig or branch off with the leaves. Once back in the office, identify the plant and give it its botanical name. If you are not able to identify the plant then if possible take the plant to a herbarium/expert.

With grasses list the number of *decreaser* species, *increaser* species and invaders or pioneers (see Box 2-6a-2 and Table 2-6a-11). If shrubs and woody species indicate if they are desirable, undesirable or invasive.

BOX 2-6A-2 CATEGORIES OF GRASSES

Grasses can be categorised according to their palatability and their ability to withstand heavy grazing. There are different types of species:

- Decreasers are palatable grasses – these are desirable grass species which are likely to be reduced by continuous heavy grazing. Examples of decreaser species are: Themeda triandra, Crysopogon spp. and Panicum spp.
- Increasers are moderately palatable grasses – these species are less desirable grasses which will initially replace decreasers that disappear by heavy grazing. Some of the increaser species are: Bothriocloa spp., Eleusine jagri, and Cymbopogon validus spp.
- Invaders or pioneers – these species indicate bad range condition. These are less desirable plant species that replace increasers. These grasses and weedy forbs are unpalatable and have no grazing value.

Adapted from ESGPIP (2009).

Score the distribution of grass species composition (i.e. %age of decreasers, increasers and invaders) see Table 2-6a-11.

Table 2-6a-11 Distribution of grass species composition recording sheet

Description of evaluated site	Scoring
75-100% of the total coverage consists of decreaser species	Excellent
50-75% of the coverage is decreaser species	Good
30-50% of the coverage consists of decreasers, or up to 60% increasers or invaders	Fair
Over 70% of the coverage consists of increasers or invaders	Poor
Below 5% of the coverage consists of decreasers, and over 95% are increasers or invaders.	Very poor

Source: ESGPIP (2009)

Score the distribution of woody plant species composition (i.e. %age of desirable, undesirable and invaders) see Table 2-6a-12.

Table 2-6a-12 Distribution of woody plant species composition recording sheet

Description of evaluated site	Scoring
75-100% of the total coverage consists of desirable species	Excellent
50-75% of the coverage are desirable species	Good
30-50% of the coverage consists of desirable, or up to 60% undesirable or invaders	Fair
Over 70% of the coverage consists of undesirable or invaders	Poor
Below 5% of the coverage consists of desirable, and over 95% are undesirable or invaders.	Very poor

Source: Adapted from ESGPIP (2009)

6 Measure plant height

At the same point, use a *stick or tape-measure* to measure plant height i.e. the herbaceous layer from ground to the top. To *get the mean height*:

- Measure the highest, medium and lowest height categories observed.
- Add together and then divide by three – to get the mean height.

7 Important plant species

Describe important species visible and close within 25 metres radius and record. The species may be important for a number of reasons: livestock feed, medicinal value, commercial products or community use. If you have a local community member with you (e.g. elder, herder), ask him/her about the species – if it grows every year or not, if palatable or non-palatable, if used by the community and what for. If you do not have a community member with you then you can hold a meeting after data collection to discuss this.

List the local name of the plant, then *cut the plant above the ground*. Once back in the office, identify the plant. If identification is not possible then take the plant to a herbarium/expert.

8 Fixed-point landscape photographs

Take a photo of the area. When taking the photo *be sure to include a piece of paper in the photo that indicates the Data Collection Point letter (A, B or C) and Assessment Point number (1, 2, 3 or 4)*. Show the landscape as you would see it if standing and looking out at eye level. This is most useful for monitoring changes in vegetation structure. It is important to *take a landscape photo from the same point and facing the same direction each time* you plan to monitor the site.

- Walk 5 metres south from the fixed point of the Plot. Turn around so you are facing North (use a compass if you have one).

- Get someone to hold the piece of paper with the name and number of the plot and date as well as the direction in which you will take the photo (North) in an upright position *about 5 metres from where you will take the photo* so you can see the paper in the camera lense.
- Hold your camera at standard height and take the photo.

> *Once back in the office you can make a classification of the vegetation in the plot according to the vegetation classes in Table 2-6a-13. This information will be used in the Land Capability Classification (Worksheet 2-6d).*

Table 2-6a-13 Vegetation Classes

Vegetation classes	Code
Good coverage of useful and palatable species and no invasive species or bush encroachment	V-0
Limited coverage of useful and palatable species and no invasive species or bush encroachment	V-1
Limited coverage of useful and palatable species and some presence of invasive species or bush encroachment.	V-2
Limited coverage of useful and palatable species and high presence of invasive species or bush encroachment	V-3
Complete loss of useful and palatable species and all land taken by invasive species or bush encroachment	V-4

Source: Developed based on FARM Africa and SOS Sahel (2013), Walsh and Vågen (2006), Riginos and Herrick (2010).

Now, for the whole 10,000 ha plot also collect the following more general information:

9 Use of the rangeland or forest in the plot

What is the rangeland or forest being used for and in which seasons – this should include wet and dry seasons (major and minor). It should also include primary and secondary use–for example a rangeland may be used primarily for grazing, but also could be used for collection of gums and resins. A forest may be used primarily for beekeeping or timber management, but also used for grazing.

10 Animal health issues

Observe the plot to assess whether there are indicators or signs of disease and parasites or not e.g. ticks or tsetse fly. Ask the community members to explain what diseases occur in the area, and if there are any poisonous plant species. Have livestock died or got sick in the area, and why?

11 Mineral licks

Are there any mineral licks in the plot area? How often are these used and by how many people?

12 Fire evidence

Is there any evidence of fire in the plot – was this accidental fire or was it controlled fire as part of management of the vegetation?

13 Overall quality of the area

What is the overall quality of the vegetation in the plot – high, medium or low/poor. Ask the community members and what indicators they use to assess the quality – note three indicators. Write down exactly what the community members say.

14 Problems and issues with resources

Ask the community members if there are any problems with the use of the land and resources in the area – identify three key problems. Write exactly what they say.

STEP 2-6A-5 COLLECT INFORMATION ON OTHER ENVIRONMENTAL RESOURCES AND CHARACTERISTICS – RAINFALL & WATER, TEMPERATURE AND LGP (LENGTH GROWING PERIOD)

Rainfall and water

Rainfall in pastoral areas of Ethiopia tends to be erratic, unpredictable, low and with high evapo-transpiration patterns. As a result, water is a critical resource for livestock and crop production. Main water resources include: short and long period rains, permanent rivers, seasonal rivers, underground waters, ponds, hand dug wells, drilled wells and dams. *Distribution of these resources is sporadic* among geographical locations. Frequent droughts also contribute to inadequate water availability and accessibility.

It is important to collect as much information about water availability and access in order to make good decisions about land use planning.

Information you require to fill out on the Land Capability Form (*Worksheet 2-6c*):

- Rainfall and distribution over the last five years
- Coefficient of variation of annual rainfall
- When droughts happened in last 20 years
- Groundwater availability (if information available)
- Map of permanent and non-permanent water sources
- Flooding risks
- Water-drought vulnerability class (WD).

How to collect information on water availability

At each Assessment Point (A, B, and C) collect the following information:

- What is the distance to nearest drinking water?
- What is the distance to the nearest permanent livestock water?
- What is the distance to the nearest temporary livestock water?
- Fill in the Land Capability Form accordingly with this information.

How to collect other data on rainfall and rainfall distribution/patterns

Other information on water can be obtained from the following sources:

- Local research or metrological office
- Local agricultural office
- From the community including use of such tools as seasonal calendar and trend analysis (see *Worksheets 2-9* and *2-11*).

Based on this data, calculate:

- The *average rainfall per month within the last ten years*.
- *Droughts in the past twenty years* and their length.

Calculate the *coefficient of variation* (CV) or ask for technical assistance from capable personnel.

CV = *[Standard Deviation of Rainfall / Average Annual Rainfall] x 100*

BOX 2-6A-3 DRYLANDS (INCLUDING PASTORAL AREAS) CAN BE CALLED "NON-EQUILIBRIUM" ENVIRONMENTS

Drylands (including pastoral areas) tend to be non-equilibrium environments with uneven and unpredictable rainfall and vegetation distribution. This has important impacts on the amount of livestock that pastoralists stock – sometimes numbers need to be high, sometimes numbers need to be low. **The coefficient of variation (CV) of annual rainfall and the amount of rainfall are good indicators of the differences between equilibrium and non-equilibrium environments**. Where the CV is greater than 35% and/or receives less than 300-400 mm, the ecosystem tends to be non-equilibrium.

Source: Vetter (2005)

How to collect data on water resources

Collect, document and map information on the following for the woreda:

- Seasonal rivers and ponds (only available during rainy seasons),
- Permanent rivers, ponds, and dams,
- Availability of ground water sources, hand dug and/or drilled wells
- Number and distance to access drinking water for human consumption
- Number and distance to access water sources for livestock (and note watering frequency for different types of livestock)
- Flooding risks in the area e.g. along rivers.

It is useful to map these water sources on a GIS map, so it can be combined with other GIS layers of information. In order to do so, measuring of GPS coordinates will be required. However, if GIS technology is not available, then map on a topographical paper map.

Information can be collected from the following sources:

- Local agricultural development offices,
- Indigenous knowledge of the communities through discussion
- Local or regional research institutes.
- Water resources development offices,
- Regional land use plans and maps (if one is available)
- Irrigation development projects e.g. Millennium Development Goal project
- Maps produced by UN agencies or NGOs.

BOX 2-6A-4 MAXIMUM DISTANCES TO WATER POINTS AND WATER DEMANDS

The recommended maximum distances to access a water source:

- 5 km for humans without stress;
- 5 km for cattle without stress;
- 15 km for small livestock without stress; and
- 30 km for livestock with stress.

Under normal conditions cows in Ethiopia require around 20 litres of water per day.

Source: Mati et al (2005)

Code the water-drought vulnerability of the area

The general lack of permanent and predictable non-variable sources of water in pastoral areas can be a key limiting factor for land use. With the information collected above code different water-drought vulnerability (WD) classes.

Table 2-6a-12 Water-drought vulnerability classes

Water-drought vulnerability classes (WD)	Average annual rainfall	Code
Access to permanent water sources all year round. Time to access water > 30 mins (return) for people and livestock. Flooding can occur.	> 500mm	WD-1
Access to permanent water sources all year round. Time to access water > 2 hours (return). Irrigation possible. Occasional droughts occur.	200-500mm	WD-2
Access to permanent and temporary sources of water. Time to access water between 2-6 hours (return). Irrigation possible. Droughts common.	0-500mm	WD-3
Limited access to permanent sources of water. Time to access temporary water commonly < 6 hours. Droughts common.	0-300mm	WD-4
Very few permanent sources of water. Time to access water commonly < 12 hours. Droughts common	0-300mm	WD-5
No permanent sources of water. Unreliable temporary water source. Time to access temporary water commonly < 24 hours. Drought common.	0-150mm	WD-6

Source: This measurement has been designed and developed as part of the WPLUP process

Temperature

Information required to fill out Land Capability Form (*Worksheet 2-6b*):

- Average temperature for last five years.
- Mean temperature over last five years.

How to *collect information on temperature and patterns*

Information can be obtained from the following:

- Local research or metrological office.
- Local agricultural office.
- Indigenous knowledge of the local communities through a Seasonal Calendar and Trend Analysis (*Worksheet 2-9* and *Worksheet 2-11*).

Length of growing period (LGP)

The length of growing period (LGP) is the length of time in days that enough moisture is available in the soil for plant growth (both for herbaceous vegetation and cropping) and where the mean daily temperature is above 5o C. Generally, it is assumed that there is enough moisture for plant growth when rainfall is greater than half potential evapotranspiration (rainfall greater than 0.5 PET). However, rainfall patterns are variable and unpredictable. Because of differences in amount, distribution and length of rainy days annual and perennial grass species are encouraged.

How to *calculate the LGP*

Information can be obtained from the following sources:

- Local research or metrological office
- Local agricultural office

Table 2-6a-13 LGP classes

LGP in days	Description	Code
<30	Dry arid	G1
31-45	Arid	G2
46-60	Dry semi-arid	G3
61-90	Semi-arid	G4
91-120	Moist semi-arid	G5
>120	Moist	G6

Source: personal communication Amaha Kassahun (PhD)

The *LGP and the LGP class of the sub-unit* should be noted on the Land Capability Form (*Worksheet 2-6b*).

WORKSHEET 2-6b

Land Capability Form

FORM FOR LAND CAPABILITY CLASSIFICATION FOR EACH LAND USE PLANNING SUB SUB-UNIT IN THE WOREDA

Date:
The time of season e.g. at beginning of wet season, at beginning of dry season, or middle or end etc.:

Type of land use planning sub-unit, with GPS coordinates of boundary if available:

Kebeles covered by the land use planning sub-unit?

GPS Coordinates of Data Collection Points			
	Data Collection Point A	**Data Collection Point B**	**Data Collection Point C**
GPS Coordinates			
Current land use (including in different seasons)			
Any settlements close by			

TOPOGRAPHY AND SOILS IN THE SUB-UNIT			
	Data Collection Point A	**Data Collection Point B**	**Data Collection Point C**
GPS coordinates			
Describe topography			
Slope reading			
Slope Class			
Soil Type			
Soil Colour			
Soil depth			
Soil Depth Class			
Soil erosion			
Soil Erosion Class			
Soil texture			
Soil Texture Class			
Infiltration/drainage			
Soil Infiltration Class			
Water-logging			
Water-logging Class			
Estimate of stoniness or rockiness			
Surface Stoniness Class			
pH (acidity/alkalinity)			
Salinity of soil			
Any other notes			

VEGETATION			
	Data Collection Point A	**Data Collection Point B**	**Data Collection Point C**
Type of dominant vegetation			
Common grass, shrub and tree species			
If crop land, what type of crop is grown?			
If crop land, is it irrigated or rainfed?			
Presence of invasive or bush species?			

MORE DETAILED INFORMATION

More detailed information on vegetation collected for rangelands, grasslands, shrublands or forests. **Note:** *this should not be done for croplands.*

	Data Collection Point A	**Data Collection Point B**	**Data Collection Point C**
GPS Coordinates:			
What is the grazing/browse intensity- high, medium or low?			
What is the soil exposure – high, medium or low			
What is basal cover of grass species?			
No. of trees and approximate height			
What are main grass and plant species and %age?			
What is the grass composition score?			
What are main shrub, woody and tree species and %age?			
What is mean plant height?			
List important plant species and their uses			
Vegetation Class:			
Use of rangeland or forest in the whole plot			
Any animal health issues?			
Any mineral licks in the area?			
Any evidence of fire in the plot – if so what kind of fire?			
What is overall quality of the area – high, medium or low?			
What are the main problems of use of land and resources in the area?			

MORE DETAILED INFORMATION (CONTINUES)
Photos of vegetation/landscape at different collection points:
Maps comparing vegetation cover change

WATER AVAILABILITY			
	Data Collection Point A	**Data Collection Point B**	**Data Collection Point C**
Distance to drinking water			
Distance to permanent livestock water			
Distance to temporary livestock water			

RAINFALL IN THE SUB-UNIT

Rainfall and distribution across the land-use sub-unit over the last five years. **See** *worksheets 2-6a-5 and 2-6a*

Tool	**S**	**O**	**N**	**D**	**Ja**	**F**	**Ma**	**Ap**	**May**	**Ju**	**Jl**	**Au**
Rainfall measures average 5 years												
Seasonal calendar average across 5 years												

Note: *You may want to divide the year by more appropriate dry-wet season divisions or other local ways of dividing up the year rather than by months*

Coefficient of variation of annual rainfall (2-6a-5):

Water-drought vulnerability class (2-6a-5):

When did droughts happen in last 20 years and how long did they last?

Groundwater availability

Map of permanent and non-permanent water sources:

Flooding risks:

Note: *Describe flooding risks in the land use sub-unit and include a 'hazard' map if available.*

TEMPERATURE

Tool	S	O	N	D	Ja	F	Ma	Ap	May	Ju	Jl	Au
Average temperature for last 5 years												
Seasonal calendar average temperature for last 5 years												

Mean temperature (based on regression equation):

Describe any evidence of climate change:

LENGTH OF GROWING PERIOD (LGP) IN THE LAND USE SUB-UNIT

LGP Class:

OTHER GENERAL INFORMATION

Any other information:
- Availability of agricultural/livestock extension services and inputs
- Availability of technology/machinery
- Access to markets
- Any wildlife species
- Any animal health issues

CONCLUSION: LAND PRODUCTION POTENTIAL AND CLASSIFICATION – CURRENT AND/OR FUTURE

Note: *Land classification (according to land capability classification tables).*

ANY OTHER INFORMATION

Note: *This should include key conclusions from woreda PLUP Team. Note, these conclusions will be combined with other inputs (including community views and priorities) when writing up the land use plan.*

WORKSHEET 2-6c

Information on vegetation collected from data collection areas

Detailed information collected for rangelands, grasslands, shrublands or forests (NOT croplands). Once calculated transfer the information for each Data Collection Area to the Land Capability Form *2-6b*.

Data Collection Point:	Data Collection Point A				Data Collection Point B				Data Collection Point C			
Assessment Points	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
GPS Coordinates												
What is the grazing/browse intensity – high, medium or low?												
Grazing/browse average for Data Collection Area												
What is the soil exposure – high, medium or low												
Soil exposure average for Data Collection Area												
Basal cover of grass species (using quadrant). No. of squares with grasses:												
Average basal cover for Data Collection Area												
No. of trees and approximate height												
Average no. of trees and approximate height												
Main grass and plant species and %age of area												
Average/mean %age of main plant species in the whole Data Collection Area												
Grass composition score (decreaser-increaser-invader %age)												
Grass composition score for Data Collection Area												
Shrub, woody and tree species and %age of area												
Average/mean %age of main shrub, woody, tree species and %age of Data Collection Area												
Woody species composition score for Data Collection Area												
Mean plant height												

	Data Collection Point A	Data Collection Point B	Data Collection Point C
Average plant height for Data Collection Area			
Important plant species *list all important plant species and their uses, for the whole Data Collection Area*			
Photos of landscape *(can be pasted below)*			

WORKSHEET 2-6d

Land capability classification tables

Information for classifying the land into different land capabilities, which can influence its use, was collected in *Worksheet 2-6a* and documented on the form in *Worksheet 2-6b* and *2-6c*. Now a classification of the land can be carried out.

A conversion table is provided below to identify the land capability classes of the land use planning units, based on data collected. Consider each score on *Worksheet 2-6b* against the below table.

Table 2-6d-1 Land capability classification

Land capability limiting factors											
Slope/SL	1	2	3	4	1-4	1-4	5	6	1-6	1-6	1-6
Soil depth/D	1	1-2	1-2	1-3	1-4	1-4	1-3	1-4	1-5	1-5	1-5
Erosion/E	0	0	0-1	0-2	0-2	0-2	0-3	0-3	0-4	0-4	0-4
Texture/T	3-5	3-6	3-7	2-7	2-7	2-7	2-7	2-7	1-7	1-7	1-7
Water-drought vulnerability /WD	1	2-5	2-5	3-6	4-5	4-5	4-5	5-6	5-6	5-6	2-6
Water logging/W	0	0	0-1	0-2	0-2	0-2	0-2	0-2	0-2	0-3	0-1
Infiltration rate/I	0	0	0-1	0-2	0-2	0-2	0-3	0-3	0-2	0-2	0-1
LGP/G	G6	G6	G6	G5	G1	G1	G6	G1	G6	G1-6	G1-6
Stoniness/ST	0	0-1	0-2	0-2	0-2	0-2	0-3	0-3	0-4	0-4	0-4
Vegetation (palatable or non-p and invasive spp) /V	0-1	0-1	0-1	0-2	0-2	0-2	0-2	0-2	0-3	0-2	4
Capability class	I	II	III	IV	VI	VI	VII	VII	VIII	V	IX
Capability for land use type	Suitable for annual cropping							Not suitable for annual cropping			
	Suitable for livestock – pastoralism									Swampy	Invasive Spp
	Suitable for forest/woodlands & wildlife conservation, tourism									Sensitive ecosystem	Needs special management

Adapted from: MOA/LAUD Local level participatory land use planning manual (2012).

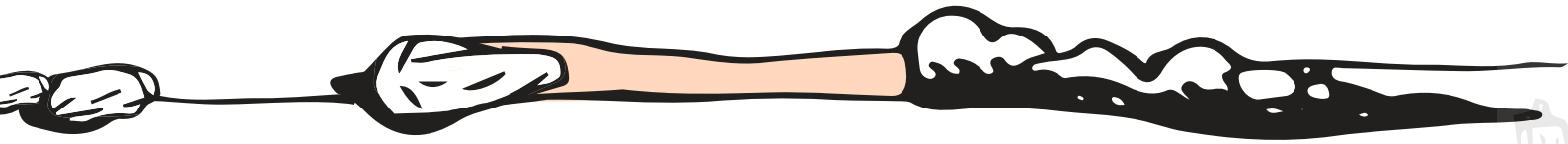


Table 2-6d-2 Land capability classes and conditions

Land Capability Class	Degree of limitation	Capability	Current condition
I	Not significant	For all land uses, with normal land management including grazing and conservation practices.	Flat, well drained and fertile, with access to permanent water and/or little rainfall variability.
II	Little	For all land uses, but conservation practices required in case of annual crops.	Gently sloping and slightly eroded lands with access to permanent water and/or slight-rainfall variability. Good palatable species In grazing areas.
III	Moderate	For all land uses, conservation practices in case of annual crops; good for livestock.	Sloping and moderately eroded lands with access to permanent water and/or can experience rainfall variability. Good palatable species In grazing areas.
IV	Moderately severe	For all land uses, but annual crops on occasional basis and only with intensive conservation practices and permanent water; good for livestock with grassland improvement.	Moderately steep, stony and eroded lands. Patchy, sometimes poor vegetation including presence of unpalatable species Some variability of rainfall.
V	Swampy	Dry season grazing and grass cutting.	Swampy.
VI	Severe	For grazing or pasture or browse and (semi)perennial crops with conservation practices, and forestry and wildlife.	Steep, stony and eroded lands. Presence of unpalatable species. Low and variable rainfall resulting in occasional drought.
VII	Very severe	For forestry requiring enclosures; wildlife or conservation; grass/fodder cut and carry also possible. Controlled grazing access, collection of NTFPs.	Stony and eroded lands. Low and variable rainfall common resulting in regular drought and/or extended dry periods. Lack of palatable species bush encroachment or invasive species present.
VIII	Extremely severe	Very extensive utilisation or infertile drylands. Reserve for wildlife.	Drylands, could be mountainous. Lack of vegetation/ palatable species, presence of bush encroachment or invasive species. Droughts common.
IX	Extremely severe	Agricultural and livestock previously, now lost.	Land heavily invaded by invasive species or bush encroachment.

Table 2-6d-3 Recommended land use options for different current land uses and land class units

Land class unit	Major limiting factors	*Current land use in bold followed by possible land use options to be recommended by the Team in consultation with other stakeholders in Worksheet 2-33 as part of integrated and participatory land use planning process*		
		Cultivated Land	**Grazing Land**	**Forest Land**
I	Nil	Intensive cropping with soil and nutrient conservation measures + maintenance of good vegetation cover + water sources.	- Manage as grazing land - Convert to cultivation if there is a need for this and there are sufficient grazing areas for livestock numbers (future and planned) - Prevent and control establishment of invasive species.	- Manage as 'natural' forest - Develop NTFP and/or timber enterprises - Develop for agro-forestry.
II SL	Slope 2-8 %	Intensive cropping with soil, water & nutrient conservation measures + maintain good vegetation cover + maintenance of water sources.	- Manage as grazing land including improving palatable species - Convert to cultivation if there is and need there are sufficient grazing areas for livestock numbers (future and planned) - Prevent and control establishment of invasive species.	- Manage as 'natural' forest - Develop NTFP and/or timber enterprises - Develop for agro-forestry.
II ST	Stoniness 15-30 %	Removal of stones + Intensive cropping with soil & nutrient conservation measures + maintain good vegetation cover + maintenance of water sources.	- Manage as grazing land including improving palatable species - Convert to cultivation if there is a need and there are sufficient grazing areas for livestock numbers (future and planned) - Prevent and control establishment of invasive species.	- Manage as 'natural' forest - Develop NTFP and/or timber enterprises - Develop for agro-forestry.
II WD	Rainfall low and water variability high	Agriculture with carefully planned water development including irrigation where appropriate. Water conservation measures as required.	Grazing with carefully planned water development.	- Manage as 'natural' forest - Develop NTFP and/or timber enterprises - Develop for agro-forestry with careful water development.

Table 1-6d-4 Recommended land use options for different current land uses and land class units

Land class unit	Major limiting factors	*Current land use in bold followed by possible land use options to be recommended by PLUP Team in consultation with other stakeholders in Worksheet 2-33 as part of integrated and participatory land use planning process*		
		Cultivated Land	**Grazing Land**	**Forest Land**
III SL	Slope 8-15 % Rainfall can be variable	Intensive cropping with soil & nutrient conservation measures + maintain good vegetation cover + water sources and control of run-off water and manage drainage.	- Manage as grazing land incl improving palatable species - Convert to cultivation if there is and need and if there are sufficient grazing areas for livestock numbers (future and planned) - Prevent and control establishment of invasive species - Convert to agro-silvopasture + manage drainage.	- Manage as 'natural' forest - Develop NTFP and/or timber enterprises - Develop for agro-forestry with strip plantation along contours.
III E	Slight past erosion. Rainfall can be variable	Cutoff drain + waterways + if slope 2-8 % apply also the options of class II L. Investment in irrigation.	Same as above.	- Manage as 'natural' forest improving vegetation cover - Develop NTFP and/or timber enterprises - Develop for agro-forestry with strip plantation along contours.
III W	Intermittently water logged	Agriculture with: - Drainage improvement - Bed and furrows system (applied management measures of black clay soils) if slope 2-8 % apply also the options of class III L.	Same as above.	- Manage as 'natural' forest selecting species resistant to water-logging. - Develop NTFP and/or timber enterprises - Develop for agro-forestry.
III WD	Rainfall low and water variability high	Agriculture with carefully planned water development incl. irrigation where appropriate. Water conservation measures	Grazing with carefully planned water development.	- Manage as 'natural' forest - Develop NTFP and/or timber enterprises - Develop for agro-forestry with careful water development.

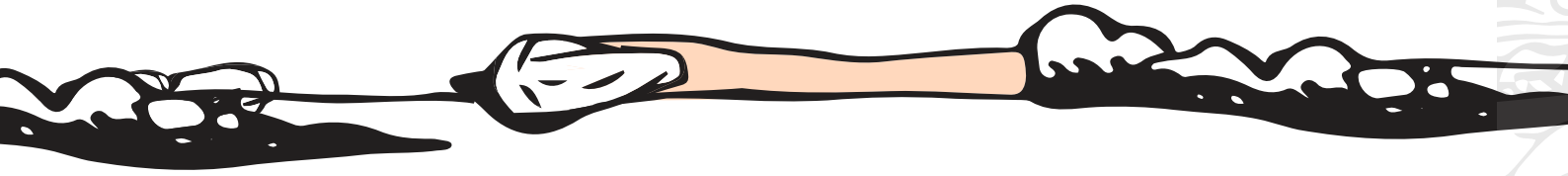


Table 2-6d-5 Recommended land use options for different current land uses and land class units

Land class unit	Major limiting factors	*Current land use in bold followed by possible land use options to be recommended by PLUP Team and other stakeholders in Worksheet 2-33 as part of integrated and participatory land use planning process*		
		Cultivated Land	**Grazing Land**	**Forest Land**
III I	Moderate infiltration. Rainfall can be variable.	Soil and water conservation methods including: - Soil structure improvement - Irrigation investment - Deep ploughing. If slope 2-8 %. Apply also options of class IIL	- Manage as grazing land incl improving palatable species - Convert to cultivation if there is a need and if there are sufficient grazing areas for livestock numbers (future and planned) - Prevent and control establishment of invasive species - Convert to agro-silvopasture + manage drainage	- Manage as 'natural' forest - Develop NTFP and/or timber enterprises - Develop for agro-forestry
III ST	Stoniness 30-50 %. Rainfall can be variable.	Removal of stones + if slope 2-8 % apply also apply options of class II L	Removal of stones and/or same as above.	Same as above.
IV SL	Slope 15-30 %. Rainfall can be variable.	Soil and water conservation activities e.g. - Alley cropping - Soil or stone bunds - Fanya juu - Bench terraces + drainage/ waterways	As above including soil and water conservation activities. Control of any spread of invasive species.	Same as above ensuring ground cover and managed surface water flow

Table 2-6d-6 Recommended land use options for different current land uses and land class units

Land class unit	Major limiting factors	Current land use in bold followed by possible land use options to be recommended by PLUP Team and other stakeholders in Worksheet 2-33 as part of integrated and participatory land use planning process		
		Cultivated Land	**Grazing Land**	**Forest Land**
IV E	Moderate past erosion. Rainfall variability.	Agriculture with soil and water conservation activities including: - Cutoff excessive surface flow + waterways - Soil conservation measures. If slope 208% see also options of class IIL and if slope 8-15% see also the option of class IIIL	- Grassland improvement including palatable species - Convert to cultivation if there is sufficient grazing areas for livestock numbers (future and planned) – soil and water conservation measures required - Prevent and control establishment of invasive species - Convert to agro-silvopasture + manage drainage.	- Manage as 'natural' forest - Develop NTFP and/or timber enterprises - Develop for agro-forestry ensuring soil and water conservation measures.
IV D	Soil depth 50-100 cm. Rainfall variability.	Agriculture with soil and water conservation activities including: - Cut-off excessive surface flow + waterways - Shallow rooting crops + soil conservation measures. - Investment in irrigation. If slope 2-8% see also options of class IIL and if slope 8-15% see also the option of class IIIL.	As above	As above + possibility of plantation development

Table 2-6d-7 Recommended land use options for different current land uses and land class units

Land class unit	Major limiting factors	*Current land use in bold followed by possible land use options to be recommended by PLUP Team and other stakeholders in Worksheet 2-33 as part of integrated and participatory land use planning process*		
		Cultivated Land	**Grazing Land**	**Forest land**
IV W	Regularly water-logged. Rainfall variability.	Agriculture with soil and water conservation activities including: - Selective seasonal cropping - Drainage improvement - Bed & furrows system + waterways. If slope 2-8 % apply also the options of class II L (graded structures).	- Grassland improvement incl. palatable species - Convert to cultivation if there is a need and if there are sufficient grazing areas for livestock numbers (future and planned) – soil and water conservation measures required - Prevent and control establishment of invasive species - Convert to agro-silvopasture + manage drainage.	- Manage as 'natural' forest - Develop NTFP and/or timber enterprises - Develop for agro-forestry ensuring soil and water conservation measures. - Selection of species resistant to water-logging.
IV WD	Rainfall low and water variability high.	Agriculture with carefully planned water development including irrigation where appropriate. Water conservation measures as required.	Grazing with carefully planned water development.	- Manage as 'natural' forest - Develop NTFP and/or timber enterprises - Develop for agro-forestry with careful water development.
IV I	Poor infiltration. Rainfall variability.	Agriculture with soil and water conservation activities including: - Soil structure improvement - Deep ploughing - Investment in irrigation. If slope 2-8 % apply also the options of class II L (graded structure). If slope 8-15 % apply also the options of class III L.	- Grassland improvement incl. palatable species - Convert to cultivation if there is an need and if there is sufficient grazing areas for livestock numbers (future and planned) – soil and water conservation measures required - Convert to agro-silvopasture + manage drainage - Prevent and control establishment of invasive species.	
VI SL	Slope 15-30 %. Rainfall variability.	Agriculture with soil and water conservation activities including: - Soil and stone bunds and drainage channels - Alley cropping - Fanya juu - Bench terraces + drainage/waterways - Gravity irrigation. Convert to grazing or forest land.	- Grassland improvement including palatable species - Convert to agro-silvopasture + manage drainage - Prevent and control establishment of invasive species.	- Manage as 'natural' forest - Use as grazing/browse reserve - Develop NTFP and/or timber enterprises - Develop for agro-forestry ensuring soil and water conservation measures.

Table 2-6d-8 Recommended land use options for different current land uses and land class units

Land class unit	Major limiting factors	*Current land use in bold followed by possible land use options to be recommended by PLUP Team and other stakeholders in Worksheet 2-33 as part of integrated and participatory land use planning process*		
		Cultivated Land	**Grazing Land**	**Forest land**
VI D	Soil depth 25-50 cm. Rainfall variability.	Agriculture with soil and water conservation activities including: - Plant perennial crops. - Convert to grassland or forest land If slope 2-30 % the perennial crops should be on contour bunds.	- Grassland improvement including palatable species - Convert to cultivation if there is a need and if there is sufficient grazing areas for livestock numbers (future and planned) – soil and water conservation measures required - Prevent and control establishment of invasive species - Convert to agro-silvopasture + manage drainage.	- Manage as 'natural' forest selecting species resistant to water-logging. - Develop NTFP and/or timber enterprises - Develop for agro-forestry.
VI E	Severe past erosion. Rainfall variability.	Area enclosure with soil and water conservation activities including: - Use of leguminous plant coverage. - Convert to forest land (plant seedlings) - Gully control cut-off and manage drainage.	- Area enclosures, reseeding as part of grassland improvement including palatable species - Cut and carry of grasses. - Gully control and manage drainage. - Prevent and control establishment of invasive species	- Area enclosures, tree planting. - Tree plantation for catchment protection.
VI ST	Stoniness 50-85 %. Rainfall variability.	Removal of stones + If slope 2-8 % apply options of class II L If slopes 8-15 % establish stone bunds. If slopes 15-30 % stone bunds + bench terraces for annual crops. Convert to grazing or forestlands.	Removal of stones + - Grassland improvement incl palatable species - Convert to cultivation if there is sufficient grazing areas for livestock numbers (future and planned) – soil and water conservation measures required - Prevent and control establishment of invasive species - Convert to agro-silvopasture + manage drainage.	- Manage as 'natural' forest selecting species resistant to water-logging. - Develop NTFP and/or timber enterprises - Develop for agro-forestry. - Development of stone micro-basins and stone hillside terraces
VI WD	High vulnerability to drought	- Limited agriculture with drought resistant crops - Agriculture with strong investment in irrigation from sustainable source - Conversion to grazing or forest land	- Protection and improvement of grazing areas, drought reserves and mobility including in times of drought - Careful development of water points based on sustainable management of resources	- Manage as 'natural' forest selecting species resistant to drought. - Develop NTFP and/or timber enterprises

Land class unit	Major limiting factors	Cultivated Land	Grazing Land	Forest land
VII L	Slope 30-50 %. Rainfall variability.	Agriculture with soil and water conservation activities including: - Soil and stone bunds, terraces and drainage channels - Perennial cropping. Convert to grazing or forest land.	- Area enclosures, control/limited grazing and grassland improvement including palatable species - Cut and carry of grasses. - Convert to silvopasture with good drainage - Prevent and control establishment of invasive species.	- Manage as 'natural' forest - Use as grazing/browse reserve - Develop NTFP and/or timber enterprises - Develop for agro-forestry ensuring soil and water conservation measures. - Tree planting - Plantation for catchment protection.
VII L	Slope > 50 %. Rainfall variability.	Limited agriculture with soil and water conservation activities including: - Soil and stone bunds, terraces and drainage channels - Gully control - Perennial cropping. Convert to grazing, silvopasture or forest land.	- Area enclosures, control/limited grazing and grassland improvement including palatable species - Cut and carry of grasses. - Convert to silvopasture with good drainage - Prevent and control establishment of invasive species - Convert to forest land.	- Manage as 'natural' forest - Use as grazing/browse reserve - Develop NTFP and/or timber enterprises - measures. - Tree planting - Plantation for catchment protection.
VI WD	High vulnerability to drought	- Limited agriculture with drought resistant crops and careful development of water - Agriculture with strong investment in irrigation from sustainable source - Conversion to grazing or forest land.	- Protection and improvement of grazing areas, drought reserves and mobility including in times of drought - Careful development of water points based on sustainable management of resources.	- Manage as 'natural' forest selecting species resistant to drought. - Develop NTFP and/or timber enterprises.
VII V	Heavy infestation of invasive species or bush	- Clear invaded area and rehabilitate as farm land. - Enclose and prevent any further spread of invasive. - Enclose and use biomass for e.g. charcoal making or wood chips.	- Clear invaded area and rehabilitate as grazing land including palatable species - Enclose and prevent any further spread of invasive. - Enclose and use biomass for e.g. charcoal making or wood chips.	- Clear invaded area and rehabilitate as forest land. - Enclose and prevent any further spread of invasive. - Enclose and use biomass for e.g. charcoal making or wood chips.

Table 2-6d-9 Recommended land use options for different current land uses and land class units

Land class unit	Major limiting factors	*Current land use in bold followed by possible land use options to be recommended by PLUP Team and other stakeholders in Worksheet 2-33 as part of integrated and participatory land use planning process*		
		Cultivated Land	**Grazing Land**	**Forest land**
VII D	Soil depth < 25 c.m	- Area enclosure and improvement of ground cover and soil-water conservation measures - Plant seedlings, trees, (catchment protection), convert to forest land - Convert to cut and carry for livestock.	- Area enclosure and improvement of ground cover and soil-water conservation measures - Cut and carry of grasses - Convert to forest land (catchments protection).	- Manage as 'natural' forest - Develop NTFP and/or timber enterprises - Tree planting - Area enclosure and improvement of ground cover and soil-water conservation measures - Encourage wildlife.
VII E	Severe past erosion	- Area enclosure and improvement of ground cover and soil-water conservation measures - Plant seedlings, trees, (catchment protection), convert to forest land - Gully control - Convert to cut and carry for livestock.	- Area enclosure and improvement of ground cover and soil-water conservation measures - Cut and carry of grasses - Convert to forest land (catchments protection).	- Manage as 'natural' forest - Develop NTFP and/or timber enterprises - Tree planting - Area enclosure and improvement of ground cover and soil-water conservation measures - Encourage wildlife.
VII WD	High vulnerability to drought	- Limited agriculture with drought resistant crops - Agriculture with strong investment in irrigation from sustainable source - Conversion to grazing or forest land.	- Protection and improvement of grazing areas, drought reserves and mobility including in times of drought - Careful development of water points based on sustainable management of resources.	- Manage as 'natural' forest selecting species resistant to drought. - Develop NTFP and/or timber enterprises.
VIII D	Soil Depth: < 25 cm	- Area enclosure and improvement of ground cover and soil-water conservation measures - Plant seedlings, trees, (catchment protection), convert to forest land - Convert to cut and carry for livestock.	- Area enclosure and improvement of ground cover and soil-water conservation measures - Cut and carry of grasses - Convert to forest land (catchments protection).	- Manage as 'natural' forest - Develop NTFP and/or timber enterprises - Tree planting - Area enclosure and improvement of ground cover and soil-water conservation measures - Encourage wildlife.
VIII V	Heavy infestation of invasive species or bush	- Clear invaded area and rehabilitate as farm land. - Enclose and prevent any further spread of invasive. - Enclose and use biomass for e.g. charcoal making or wood chips.	- Clear invaded area and rehabilitate as grazing land incl palatable species - Enclose and prevent any further spread of invasive. - Enclose and use biomass for e.g. charcoal making or wood chips.	- Clear invaded area and rehabilitate as forest land. - Enclose and prevent any further spread of invasive. - Enclose and use biomass for e.g. charcoal making or wood chips.

Table 2-6d-3 Recommended land use options for different current land uses and land class units

Land class unit	Major limiting factors	*Current land use in bold followed by possible land use options to be recommended by PLUP Team and other stakeholders in Worksheet 2-33 as part of integrated and participatory land use planning process*		
		Cultivated Land	**Grazing Land**	**Forest land**
VIII E	Very severe past erosion	- Area enclosure and improvement of ground cover and soil-water conservation measures - Plant seedlings, trees, (catchment protection), convert to forest land - Gully control - Convert to cut and carry for livestock.	- Area enclosure and improvement of ground cover and soil-water conservation measures - Cut and carry of grasses - Convert to forest land (catchments protection).	- Area enclosure - Tree planting and encourage regeneration of natural trees - Encourage wildlife.
VIII T	Sand texture	Not applicable.	- Area enclosure and improvement of ground cover and soil-water conservation measures - Wind erosion control.	- Area enclosure - Tree planting and encourage regeneration of natural trees - Encourage wildlife.
VIII S	Stoniness > 85 %	Not applicable.	Area enclosure and improvement of ground cover and soil-water conservation measures	- Area enclosure - Tree planting and encourage regeneration of natural trees - Encourage wildlife
V	Swamp's river beds	Not applicable.	Dry season grazing.	Encourage wildlife.
IX	Complete infestation of invasive species	- Clear land and rehabilitate as agricultural and/or grazing land with ongoing control of re-invasion - Enclose land and prevent any further spread, with possible use of biomass for e.g. charcoal.	- Clear land and rehabilitate as agricultural and/or grazing land with ongoing control of re-invasion - Enclose land and prevent any further spread, with possible use of biomass for e.g. charcoal.	N/A

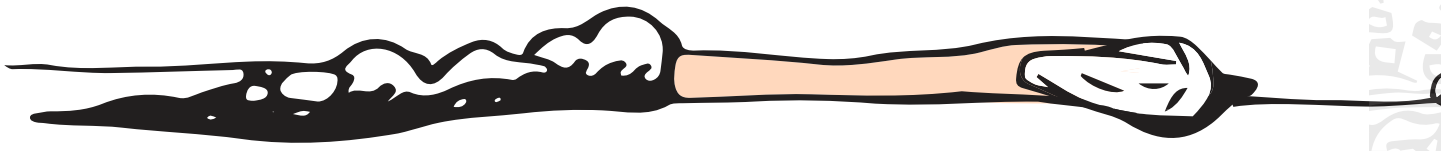


Table 2-6d-11 Descriptive characteristics and possible management practices and land use options of land capability classes

Land capability class	Characteristics	Required management practice	Possible land uses
I	Deep soils; flat to nearly flat; well-drained; little risk of damage while cultivated; along rivers or close to permanent water; low rainfall variability; palatable species and no invasive species.	Use of crop inputs, crop rotation, irrigation, soil-water conservation. Rangeland management including of dry season grazing. Well-planned, careful water development.	All land uses with normal land management practices including cropping, irrigated cropping, grazing, forestry, NTFPs, cut-and-carry.
II	Gentle slope, productive soils; low rainfall variability; water accessible; little land erosion, little invasive species or bush, and presence of palatable spp. Rainfall variability	Use of crop inputs and rotation. Drainage and water flow control e.g. irrigation. Rangeland management and improvement. Well-planned careful water development.	As above
III	Moderately fertile, gentle slope, subject to erosion and soil damage. Rainfall variability.	Use of crop inputs and crop rotation (irrigation costly). Suited to livestock production, need maintenance of plant cover and control of invasives or bush. Grassland improvement. Drought reserves. Well-planned careful water development.	As above
IV	Good soils, flat or gentle slopes, subject to erosion and damage. Poor vegetation cover including non-palatable or invasive species. Rainfall variability.	Grassland improvement including palatable species. Annual crops on occasional basis with intensive conservation practices. Well-planned careful water development.	Limited cropping, grazing, browsing, cut-and-carry, NTFPs, forestry, conservation-wildlife-tourism
V	Wet land or swampy or sandy; level to nearly level; subject to slight erosion. Rainfall variability.	Drainage for agriculture, but better left as dry season grazing	Grazing/pasture – well-managed, forestry, NTFPs; conservation- wildlife-tourism.
VI	Can be steep slopes, or shallow soils; Rainfall variability high.	Physical, biological soil and water conservation; drought resistant species; communal enclosures for regeneration of grassland and palatable species improvement; tree planting. Well-planned careful water development.	Perennial cropping with conservation practices; limited grazing. Forestry, NTFPs.
VII	Can be steep slopes and/or uneven surface, eroded, shallow soils, swampy and drylands; risk of degradation and damage; high risk of drought; invasive species invasion. Drought common.	Well-managed grazing/browse (sheep/goat or camel), careful forest management. Control and management of invasive spp including removal where possible. Wildlife management. Well-planned careful water development.	Drought reserves and cut-carry, maybe use of enclosures. NTFPs; rangeland rehabilitation. Conservation-wildlife-tourism.
VIII	Very steep slope; rocky and stony. Infertile drylands. Drought common.	Well-managed browse (sheep/goat or camel), careful forest management. Wildlife management. Well-planned careful water development.	Bush/woodland/forest–extensive livestock (with access to other grazing and browse as required). Conservation-wildlife-tourism.
IX	High presence of invasive spp or bush.	Management decisions will depend on resources and value of land – will include clearance and rehabilitation to grassland or farming areas, or enclosure and prevention of further spread and/or controlled utilisation of biomass.	Wasteland or if rehabilitated can be used for grazing and/or cropping.

WORKSHEET 2-7

Land and natural resources, use and access mapping[10]

OBJECTIVE

To **document the occurrence and distribution of natural resources and different land use** in the woreda, plus different access and management arrangements.

OUTPUTS

A **detailed hand-drawn map (and short report)** describing the different land uses and natural resources found in the woreda, their distribution, use, management and access, with documented information of this.

PARTICIPANTS

Participants are different types of land and resource users in the woreda including representatives from customary leaders.

The Agriculture and Land Use Sub-Team should lead this activity, but other WPLUP Team members can join if thought appropriate e.g. the Rangeland Resource Sub-Team, the Technical Land and Water Sub-Team, and the GIS Sub-Team (if the map is to be digitised)

In *Worksheet 1-9* the mapping of the larger shared grazing area across woreda boundaries was carried out. Now, the same steps should be used to carry out a more detailed mapping of resources in the woreda itself.

HOW-TO-DO A LAND AND NATURAL RESOURCE USE MAP

1 Agree who should take part in the mapping exercise

Discuss with the community who will represent different stakeholder groups, in order that there is good representation from the community but not too large a group that it is unmanageable. Also *find out whether men and women can carry out the exercise together* or whether separate mapping activities need to be conducted. If men and women regularly meet and discuss issues together in the community, then there is little reason to separate them. Whatever approach is taken, it is vital that both women and men have an equal opportunity to contribute.

10 This section draws from the Irwin, Cullis and Flintan (2015).

2 Agree where and when the mapping exercise should take place

Decide with the community when and where the mapping exercise should take place. It is preferable to carry out the mapping when the temperature is cool – in the early morning or late afternoon. However, **wherever possible the mapping should be completed in one day**, as it is disruptive to the process to break overnight and it is difficult to protect the map from disturbance. Normally, the map will be drawn on the ground. This can be done using chalk on a concrete surface, or with a stick on an area of flat soil. It is important that the area is flat and clear of debris or vegetation; there is plenty of space to walk around and to properly view the drawing; the area is protected from livestock or children who might disturb the map; and it is sheltered (from wind, sun, and rain). It is also helpful if the site has a view over the area or part of the area that is being mapped. Participants are likely to get less distracted if the mapping location is some distance from their homesteads. Visit the site prior to the day of the mapping exercise to ensure that it is suitable.

3 Hold an introductory meeting

Organise an **introductory meeting** for the mapping participants from the community. At this meeting the mapping team should:

- *Introduce the mapping process*, explaining why mapping has an important role within PLUP and how and where it fits in.
- Provide the group with *information about participatory mapping* and the process of undertaking it. Explain how much time and effort and what resources are required;
- *Confirm the most convenient time and place* for the mapping to be undertaken, and clarify transport and refreshment/meal arrangements;
- *Introduce the mapping facilitation team* and begin to build a relationship with the community members;
- *Check the appropriateness of taking photographs and/or filming* the mapping process.

4 Prepare the mapping equipment

The final step in preparing for the mapping is to **ensure that all the right equipment is to hand**. This includes:

- *Tools for clearing* the site, including a brush to sweep off any debris. If the site is unshaded, then it would be of benefit to put up a tarpaulin or plastic sheet to provide shade;
- *A "mapping kit"* of items should be collected that can be used to map on the ground and to supplement what the community themselves can find to use. This can include items such as string, ribbon, chalk, different-coloured soils, coloured card and pens, stones of different sizes, and other items such as sticks, grass, and leaves;
- *Flipchart paper and coloured pens* for copying the map;
- *Notepad and pens*;
- *A camera* for taking photos of the mapping process and of the final map, and/or video equipment.

Plate 2-7-1 Mapping of resources with pastoral communities in Ethiopia. **Source**: PRIME/USAID Kelley Lynch.

5 Print out the resource-mapping checklist

At the end of this section there is a mapping checklist provided. This should be printed out and used in the field to ensure that all items are in place and that all necessary activities are undertaken.

6 Start the mapping

The activity should begin with a **short opening ceremony** that reflects normal customary practices. Time should also be given for clarifying the objectives and the mapping process – it may be the case that a participant has joined the group late, and therefore they need to be updated.

The facilitator will ask the community to begin to create a map of woreda resources. It is good practice to start the mapping exercise with an activity that is relatively easy, so communities quickly understand what to do. *A simple and clear question helps the participants* to take immediate control over the content of the map: for example, "Can you show us (map) the main landscape features in your area?" If the community are having difficulty, the facilitator can assist by suggesting a prominent feature such as a ridge, river, or forest edge, and then encouraging the identification of other, related features. This helps the participants to orientate themselves and to scale down landscape features to the mapping site.

The community participants may need encouragement initially to use twigs, stones, pebbles, leaves, ashes, charcoal, string, or even dried animal dung to represent rangeland resources, supplemented by items provided in the "mapping kit". However, once started, experience shows that they will quickly take control of the mapping and be inventive with the use of materials that are locally available.

Once the key features have been mapped, the facilitator asks the group to map specific information in line with the first objective of the mapping exercise. For example, this may be to show the key natural resources that the community use. In such a case the mapping group might identify and display different grazing and browsing areas, water sources, grass harvesting areas, and permanently cropped fields. The group can provide site-specific and increasingly detailed information relevant for livestock management, e.g. information such as where browsing and plant species are found, where mineral soils or springs and salt licks are located, or areas that they associate with animal disease. Ensure that seasonal use of resources is illustrated. In order to ensure that all rangeland uses and users are represented, the facilitator should ask about different groups, e.g. "Have you shown the resources that women use?"

Experience shows that it is better practice not to start with a boundary around the area. Doing so may limit the development of the map to those resources and features within the boundary, and other resources used by the community outside the boundary may then not be mentioned or included. If, however, the mapping group insists on drawing a boundary first, then the facilitator will have to try to ensure that its presence does not mean that resources outside it are ignored.

7 Make a legend for the map with appropriate symbols and colours

To finish the rangeland resource map, the community should make a legend that clearly describes the different features of the map, using symbols and colours. *The facilitator should ensure that they use the same symbol and colour for all features of the same type* e.g. using twigs for forest patches, and stones for settlement. The map-copier should try to use these same symbols and colours on the paper map.

8 Note all the accompanying discussions

The note-taker will record all the discussions that go on while the map is being created. Most of the information will be generated by the checklist of questions read by the facilitator, but it is also important to record additional issues, debate, and facts of interest that arise during the exercise. The note-taker should also try to record who is speaking and who is mapping. Where there is disagreement, the note-taker should record the different points of view, including which group of users has which set of views. When names of places are given, the map-copier and note-taker should try to record them correctly, but the need for detail should not mean that discussions already in flow are disturbed. It may be necessary to wait until the mapping exercise is completed before such details are noted and any gaps are filled.

9 Adding boundaries, borders, and land use divisions

In Step 4 above, it was advised that *the boundaries of a village, or other unit of focus, should not be drawn too early* on in the mapping process. However, the boundary of the woreda can now be drawn. It may be appropriate to show the boundary as a dotted line, implying that there is movement across it.

10 Mapping key resources and/or resources of specific management importance

A second objective may be to **understand the condition of the resources** and which areas of the woreda might need some specific protection or management.

The land use map should highlight the location and condition of key natural resources (e.g. water, grazing areas, fodder banks, etc.), as well as areas that need specific management actions (e.g. dry season grazing reserves).

A checklist of questions that focus on natural resources, for example, would include the following:

- Are all natural resources used by all users all year round, or are there seasonal patterns? Please explain.
- Who controls access to the different resources?
- What is the condition of the different resources? Are any being over- or under-used?
- Which resources are of greatest importance to your livelihoods and why?
- Where are the resources that you were able to access in the past but are not able to access now? Why are you not able to access them?
- Where are the resources that are most likely to be a cause of conflict?

11 Additional information that can be collected

It can be useful to add some extra information to the land use and resource base map produced above. This information is described in more detail in future Worksheets, and include:

- *Worksheet 2-8* Hazard Mapping
- *Worksheet 2-15* Livestock Routes Mapping

12 Complete the map

The following details should be included on the participatory rangeland resource map (or on the back of the map):

- *Date* that the map was created;
- *Place* that the map was created;
- Names of the *mapping team*;
- Names of the *community members* who prepared the map;
- North should be indicated on the map, but the *orientation* of the map as drawn by the community should not be changed to align with north.

Additional *copies of the natural resource map can be made on A3* (or A4) paper – this can be done either through a scan and reduction or by hand-copying. These smaller maps can then be included in reports. Any duplication should ensure that the original features and details of the map are retained.

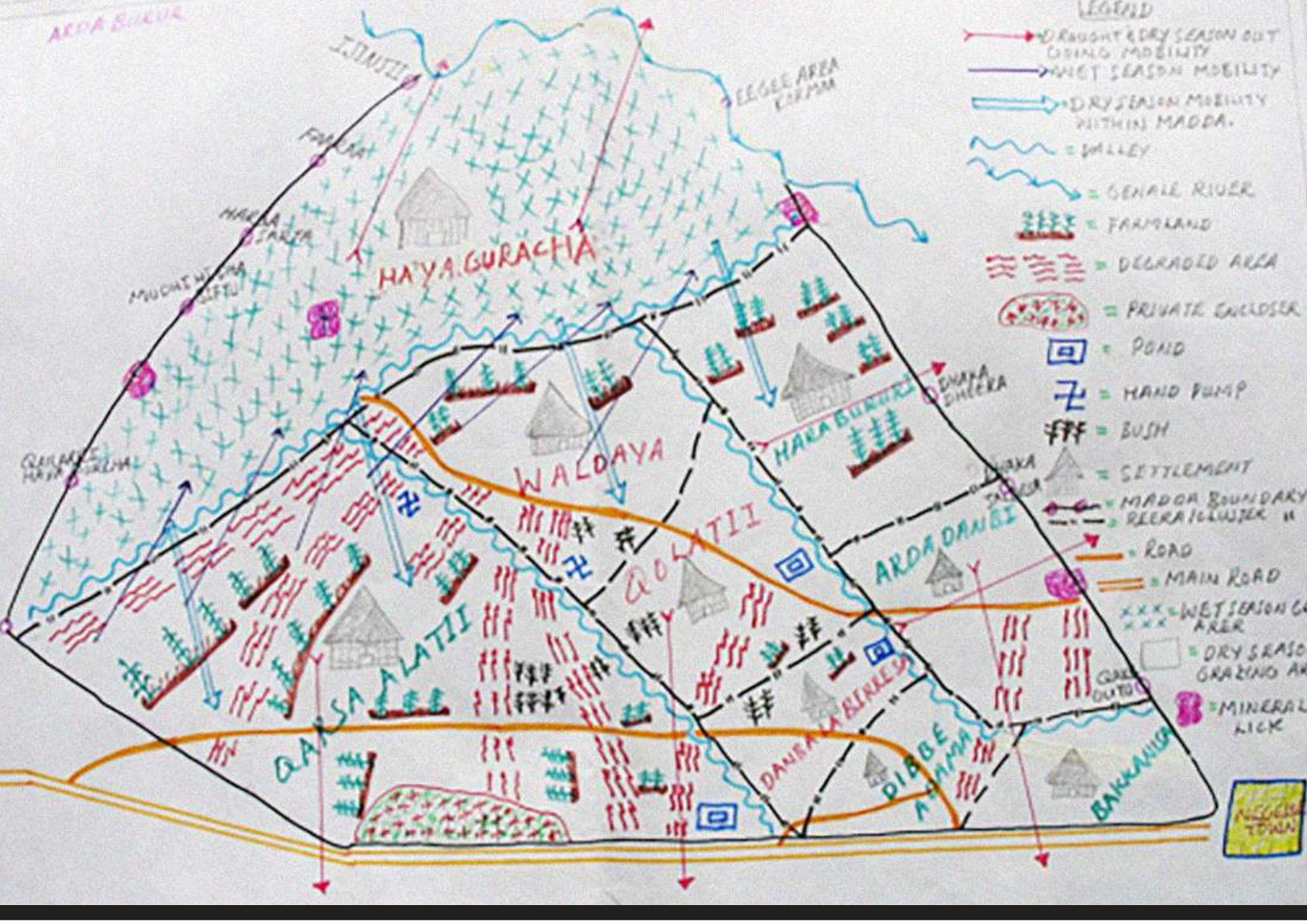


Plate 2-7-2 Example of a resource map copied from a community mapping process

Once the paper map is finalised, it should be checked by the participants who undertook the mapping, or at least a sub-group of participants, before being presented to the larger community (in the next step).

Ensure that all steps in the mapping process have been completed by checking against the below checklist.

13 Organise a feedback meeting

A community feedback meeting *should be organised as soon as possible* after the mapping exercise in order to present the map to the community and other stakeholders. It may be that this meeting results in some additional information and in relatively few major disagreements. If, however, major inaccuracies are found that result in increasingly heated disagreement, it is recommended that the meeting be allowed to continue to completion and that a sub-group meets to reconcile any outstanding issues. It is important that the final rangeland resource map has the broad approval of the community, including both leaders and the majority of the people.

14 Write the report

The mapping report can follow this structure:

Rangeland mapping report	
1	**Title page** with date, author, and contact details
2	Acknowledgements
3	Introduction
4	Field site details Date Name of community Location Main type of livelihood system Names of participants and sex Names of the mapping team and associated roles and responsibilities
5	The primary and secondary objectives of the mapping exercise Where the mapping has more than one objective, it is important that this information is presented, reflecting the points raised by the participants.
6	Copy of the map A copy of the map and a photograph of the original map as drawn by participants
7	**Notes of the discussions** that accompanied the mapping
8	Notes on disputes This section of the report should document any disputes or disagreements that arose from the mapping exercise, and how the disputes were resolved.
9	Notes on levels of participation A short reflective section is useful on the selection process of participants and levels of participation, including particularly engaged or particularly troublesome community members.
10	Conclusions and next steps End the mapping report with any conclusions and proposed next steps, including an associated timeline.

15 Digitize the map

The map can be digitized f*ollowing the same process as in Worksheet 1-10*. This can form another layer in the GIS database, which can be combined with other layers including the mapping of the rangeland (*Worksheet 1-9* and *1-10*) the mapping of mobility (*Worksheet 2-14*) and the mapping of hazards (*Worksheet 2-8*).

CHECKLIST

for natural resource mapping

GETTING STARTED

Introduction

- ☐ All team members understand the objectives of the mapping exercise.
- ☐ A checklist of questions to be answered has been produced by team.
- ☐ A mapping 'kit' of materials for use by the community is available.

The facilitating team

- ☐ The team has at least three members.
- ☐ The team includes both men & women.
- ☐ All the team has been trained in mapping & participation techniques.
- ☐ All the team has read the mapping guidelines.
- ☐ Team roles are identified (mapping facilitator, drawer & note taker).
- ☐ All the team speak the local language (if not, a translator has been provided).
- ☐ At least one team member comes from the local area.

Approaching the community

- ☐ The local government offices are aware & approve of the activities & objectives.
- ☐ Local elders/ leaders are aware & approve of your activities & objectives.
- ☐ You have clearly stated to the community who you would like to participate in the mapping/CAP process. This should reflect your objectives & be socially representative. The group should be at least 6 people.
- ☐ Separate meetings/mappings have been organized for men and women.
- ☐ The arrangements for the exercise are clearly stated for the participants including time needed, payment (or not), refreshments and transport.
- ☐ An appointment for the mapping exercise is made.

MAKING THE MAP

The mapping process

- ☐ The team is introduced to the community.
- ☐ The objectives of the mapping are clearly explained to the community.
- ☐ A discussion is carried out on what should be displayed on the map and at what scale.
- ☐ The mapping is started with a simple question such as: What are the main physical features of the area?
- ☐ The woreda boundary is added after the map was completed (not at start).
- ☐ All resources are mapped including those nearby or far away (depends on your objectives).
- ☐ All places & names are clearly labelled.
- ☐ A legend for symbols is provided.
- ☐ A discussion is carried out during the mapping based on checklist/questions.
- ☐ All participants contribute equally.
- ☐ Participant interest in the exercise is maintained.
- ☐ Time is given for questions from participants.

Note taking

- ☐ Clear & DETAILED notes are available of all discussions including questions and answers.
- ☐ Issues of debate & facts of interest are noted.
- ☐ All notes are typed up & a copy attached to the paper map for future reference.

Copying the map

- ☐ the community has given permission for the map to be copied.
- ☐ A copy of the map has been made on flipchart paper (or larger) as drawn by the community (i.e. no changes in direction of map or details or symbols)
- ☐ A legend for symbols is provided.

Closing the activity

- ☐ the participants are thanked.
- ☐ A discussion takes place about the importance of the map/CAP and its benefits and opportunities.
- ☐ Time is given for questions.
- ☐ Next steps are discussed and agreed.
- ☐ Arrangements are made for next meeting.

FOLLOW UP

With the community

- ☐ the maps drawn by both men and women are shared and discussed.
- ☐ Any necessary amendments to the map/CAP are made.
- ☐ The community is given a complete copy of the map (preferably laminated) and CAP.
- ☐ The community is assisted in implementing their CAP. It is recommended that at least two visits are made at six monthly intervals and any problems addressed if possible.

Report writing

- ☐ A report of the exercise is written up immediately.
- ☐ The following are included in the report:
  - ☐ Field site details (name of group, no. or participants, site or location, gender, livelihoods).
  - ☐ The objectives of exercise.
  - ☐ A clear copy of map/CAP.
  - ☐ Summary of discussions & questions/answers.
  - ☐ Follow up to be provided, when and by whom.
  - ☐ A copy of the report, map (full size hard copy and soft copy) and CAP is sent to head office.
  - ☐ A copy of the report & map is filed in your office.

WORKSHEET 2-8

Hazard mapping[11]

OBJECTIVE

To understand and document what hazards communities and other land users face in the woreda,

OUTPUTS

A map showing hazards faced in the woreda.

PARTICIPANTS

Participants are different types of land users in the woreda including representatives from customary leaders.

The Agriculture and Land Use Sub-Team should lead this activity, but other WPLUP Team members can join if thought appropriate e.g. the Rangeland Resource Sub-Team, the Technical Land and Water Sub-Team, and the GIS Sub-Team (if the map is to be digitised).

Community members face many hazards on a regular basis (perhaps every or every two years) or more occasionally (more than two years but more likely every five or more years). This challenges or limits the use of the land and resources.

Hazards tend to be those events that are not 'normal' in the drylands/livelihoods cycle. Sometimes a hazard might mean that they are forced to use resources in a negative way to overcome the hazard. Therefore, it is good to understand the hazards, and discuss ways that hazards can be overcome in a positive way and/or be better planned for.

Regular hazards that communities face include *droughts* (extended dry periods that are a stress to drylands), though dry periods are a normal part of dryland environmental cycles, droughts even if they occur regularly (e.g. every four years) can be considered a hazard. Other regular hazards can include flooding, fire, disease and conflicts. Other hazards can include *sandstorms*, *cyclones*, or *poisoning of water sources/rivers* or air by a *nearby factory*.

By understanding the hazards that communities face, contingency and hazard planning can be included within land use planning. For example, if it is known that the river flowing through a woreda can occasionally flood, then it would be best to keep the river as pasture or flood-retreat agriculture rather than planting high-value crops.

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11 Contributions to this chapter were made by Sisay Awgachew, CARE Ethiopia.

HOW-TO-DO WOREDA HAZARD MAPPING

1. It is useful to *consider hazards following the mapping* of the resource/land use map carried out in *Worksheet 2-7*. Once the community has mapped out the resource/land use map, you can **ask them about the hazards** that they face in using land and resources in the woreda.

2. In order to do this, **ask the community the following questions**. Note *the word 'hazard' may not be something that the community understands*, so explain what you mean e.g. an event or group of events that can cause a big problem for the community and/or the environment which can happen on a regular or occasional basis – it may be easier for communities to think of past events rather than events that might happen in future:

   - What 'hazards' (bad events) has the community experienced in the last year?
   - What hazards has the community experienced in the last a) five years, b) ten years, c) twenty years? Do these events happen regularly (tell us when) or only occasionally? Are there any other events that occurred longer ago than this that you can tell us about?
   - What was the impact of this event(s)?
   - How did you cope with the event(s) or what did you do when this event(s) happened?
   - Do you have a plan for dealing with the same hazard in future? If so, what is this? How could you better plan for such a hazard in future?

3. **Ask the community to show you on the Land and Resource Use Map** (produced in *Worksheet 2-7*) where the event happened e.g. if it is a drought, flood or conflict, ask the community to show the area that was covered/impacted by the drought or flood.

4. **Digitise the information** as part of a GIS layer, to add to the other GIS layers of information that have been developed.

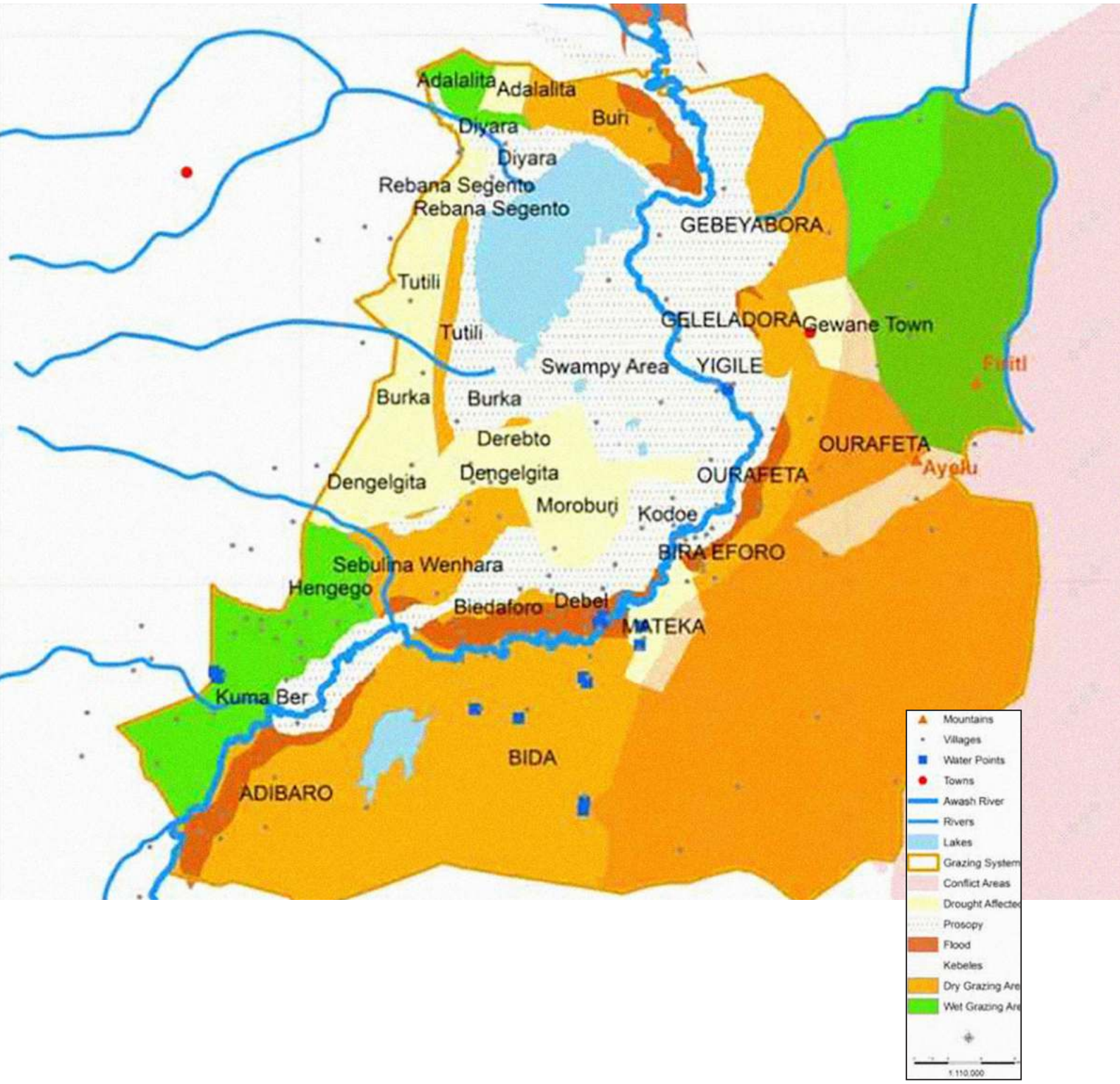


Plate 2-8-1 Example of a Hazard Map

WORKSHEET 2-9

Seasonal calendar

OBJECTIVE

To **document the patterns and trends** of climate, land and resource use, livestock, hazards, agriculture, labour patterns and outputs, prices etc. in the woreda.

OUTPUTS

Schematic drawings of the patterns and trends across seasons and supporting documentation.

PARTICIPANTS

Participants are different types of land and resource users in the woreda including representatives from customary leaders.

The Agriculture and Land Use Sub-Team should lead this activity, but other WPLUP Team members can join if thought appropriate e.g. the Rangeland Resource Sub-Team, the Technical Land and Water Sub-Team, and the GIS Sub-Team (if the map is to be digitised).

BOX 2-9-1 SEASONAL CALENDARS

Seasonal calendars can be **used to show the changes within the year** e.g. rainfall, labour demand, grazing use, water availability, crop production and prices, use of natural resources. **Results are shown in the form of bar diagrams**. It is best to draw this whilst the interview is underway so it can be checked with the respondents.

Remember that *not everyone classifies the year in the same way*: it may be more appropriate to split the year into seasons e.g. small rainy season, big rainy season, dry-time etc. The community members taking part in the exercise should decide upon the means of classification.

It can be useful to carry-out the exercise for a number of different things at once and then compare them (see diagram below). It is often useful to start with rainfall patterns and then focus on other issues afterwards. The activity can be carried out outside on the ground using local materials if thought useful and more understandable/appropriate than drawing on a piece of paper.

HOW-TO-DO A SEASONAL CALENDAR

1. With the group of woreda community members, **decide on how the year is going to be divided** e.g. by months, by seasons, or other.
2. **Agree on the topics of the different trends and patterns** that will be the subject of the Seasonal Calendar exercise(s).
3. On the ground or on a large piece of paper **make a table** with the divisions of the year written across the top headings e.g. January, February, March etc. In the left column write down the topics that are going to be considered in the exercise.
4. Use counters, stones or spots drawn by a pen depending on where the exercise is being carried out, to **score (out of 10) the degree to which the item being discussed occurs in each month (or season)**. The higher the incidence of the item being discussed in one month or season, then the more counters, stones or marks will be shown.
5. **Compare the trends/counters** of the different items together and look for causal and other relationships.
6. **Facilitate a discussion** on the findings and other issues raised with the participants. Some questions might be:
   - How do land uses change over the seasons? Why is this?
   - Are land uses more productive now than in the past? Why is this?
   - How does resource use change over the seasons? Why is this?
   - Has access to resources become easier or more difficult? Why is this?
   - Are there any times of the year when resources run out? Explain this. What do you do when the resources run out? How do you cope with these shortages?
   - What are the differences in land use during the wet and dry season? What happens during times of drought?
7. As with all participatory tools make sure that a good and representative **copy is made** of the exercise.

Table 2-9-1 Example of a Seasonal Calendar

Seasons		Ganna (June-Nov)	Bona (Dec-May)
Rainfall		●●●●● ●●●	●●●●●
Temperature		●●●●	●●●●● ●●●
Wind		●●●●●	●●●●
Frost		●●●●● (Oct-Nov)	
Grazing availability (grass – marga)		●●●	●
Browse availability		●●●●●	●
Water availability		●●●●● ●●●	●●●●● ●●
Income from livestock sale		●●	●●●
Livestock product		●●	●
Milk yield		●●	●
Labour demand for livestock related activities	M	●●●●● ●	●●●●● ●
	F	●●●●	●●●●
Labour demand for non-livestock related activities	M	●●●●	●●●●
	F	●●●●● ●	●●●●● ●
Incidence of disease		●●●●● ●	●

WORKSHEET 2-10

Carry out a transect walk

OBJECTIVE

To **provide a picture and documentation on different land and resource use** and information in a woreda.

ANTICIPATED OUTPUTS

A **schematic drawing/picture** of the transect showing different land and resource use, and access arrangements, with a written report including background information.

PARTICIPANTS

Though transects can be carried out in groups, in this Manual it is recommended that several transect walks are carried out with one or two individuals at a time, in order to triangulate (provide another source) of information on local land and resource use to that which has already been collected from the mixed group in the Land and Resource Mapping Exercise. These individuals should be selected from diverse sections of the woreda society to add variation to the information collected. Transect walks can be done on a flat area e.g. through a village, or it can be done up a hill or mountain to understand the different soil and vegetation layers (see Figure 2-10-1 below).

The Agriculture and Land Use Sub-Team should lead this activity, but other WPLUP Team members can join if thought appropriate e.g. the Rangeland Resource Sub-Team, and the Technical Land and Water Sub-Team.

BOX 2-10-1 WHAT IS A TRANSECT WALK?

A transect walk is simply a walk through a village, community or other area, such as a rangeland during which information is collected and 'mapped'. This can be carried out with a small group from the community or an individual. One could be carried out with men, one with women; though a mixed group can also be a good forum for discussions. Transects demonstrate the importance of going in person (or as a team) to observe and talk about things of local importance.

HOW-TO-DO A TRANSECT WALK

1. **Identify routes** for different teams to conduct Transect Walks, with one or two local key informants accompanying them. This can be an informal stroll through a community along a suggested route; or a more formal straight line through a rangeland.

2. **Identify individuals from different groups** in the woreda communities that represent the community and have knowledge on the local area. Before starting the transect walk explain to the individuals what information you are looking to collect (see below).

3. Try to start the transect walk *from a high geographical point* in the community and walk down through the different levels, land uses, vegetation types etc. Stop at a selected amount of observation points on the transect and **consider the following**:

   - Local name for each land unit
   - Land use
   - Land use change
   - Land cover – dominant species
   - Land cover change
   - Rangeland and other resources
   - Patterns of rainfall and other climatic trends
   - Soil characterisation
   - Herding system
   - Cropping system
   - Soil erosion
   - Hazards
   - Land capability.

> **Remember!**
> *It can be interesting to make two transect walks of the same route – one with a group of male informants, one with a group of female informants and then compare the differences between them.*

As with all participatory tools *make sure that a good and representative copy is made* of the exercise – in this case a diagram of the transect walk, with accompanying information from discussions.

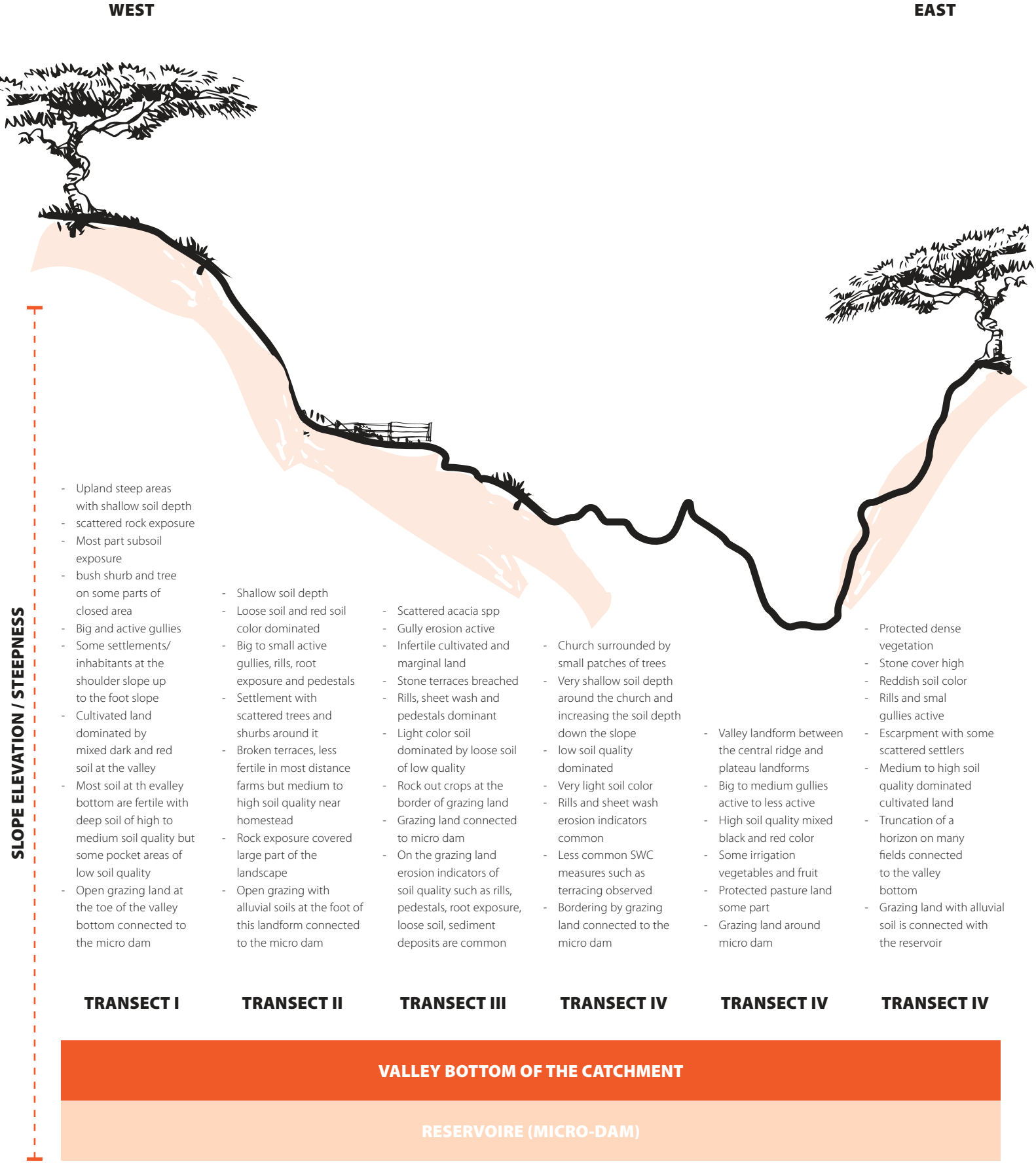


Figure 2-10-1 Example of a transect walk **Source**: Gebreyesus et al (2011)

WORKSHEET 2-11

Carry out a timeline or trend analysis

OBJECTIVE

To **document key events and changes** in the woreda over a period of time, and to consider the reasons, experiences and impacts of these events and changes.

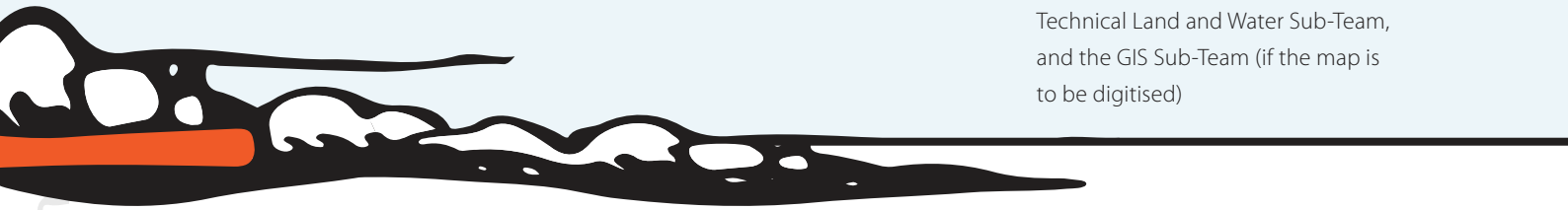
OUTPUTS

A **chronological list** of events and changes in the woreda and documented accompanying discussions.

PARTICIPANTS

Participants are different types of land and resource users in the woreda including representatives from customary leaders.

The Agriculture and Land Use Sub-Team should lead this activity, but other WPLUP Team members can join if thought appropriate e.g. the Rangeland Resource Sub-Team, the Technical Land and Water Sub-Team, and the GIS Sub-Team (if the map is to be digitised)



BOX 2-11-1 A TIMELINE OR TREND ANALYSIS

A timeline or trend analysis is a representation of the changes seen in a community and its resource base. It can also be an analysis of gender-specific changes in who has access to resources and control of them. It is a tool for looking at what is getting better or what is getting worse.

One can use the time line to discuss the situation of land and land use before and after a certain year or event. A listing of key events will provide a historical account of the development seen in a community and its natural environment. Some key events are more easy to remember than others for example changes in government, and environmental events such as fires, floods or droughts. Work in focus groups – these can be divided by men and women. The inclusion of the elderly is essential.

A timeline or trend diagram can include pictures to show the changes that have occurred in the resource base e.g. forest cover, availability of grazing, biodiversity, numbers of wildlife and climate. It can be illustrated as a single line of dates following each other.

HOW-TO-DO A TIMELINE OR TREND ANALYSIS

1. **Ask the group to list key dates and changes** that have occurred within their community and/or in relation to the resource base on which they depend. One can include a focus on different activities carried out 'traditionally' and what activities are carried out now; changes in access to and control of resources; changes in legislation and protection of resources; and changes in the resource base such as grazing, forest cover, wildlife and climate.
2. Encourage the community to **fill in the gaps** between key events so a continuous timeline can be produced.
3. **Discuss** the changes and trends that are seen. Some accompanying questions can include:
   - What changes have occurred in your lifetime in the following categories?
     - Land use
     - Access to land
     - Access to resources
     - Control of resources
     - Decision-making at the individual, household, community/organisational level in relation to land
   - Have these changes been positive or negative and why? What changes in these categories do you hope for?
   - What are the most important land use trends?
   - What the most important environment trends?
   - What are the most important economic trends?
   - What are the most important demographic or other social trends?
   - What other trends are important?
   - What are the linkages between the trends?
   - What is getting better? What is getting worse?
   - What trends impact men and women differently?
   - What trends impact the poor and rich differently?
4. As with all participatory tools make sure that a good and representative **copy is made** of the exercise.

Table 2-11.1 Example of a Trend Analysis

Characteristics	Before 10 years	Present	Significant events (if any) or reasons for change
Quantity of open grassland available for grazing	●●●●● ●	●	Grasslands overtaken by crop cultivation and large scale private farms
Quantity of land under crop production	●●●●	●●●●● ●●●●	Population pressure and increased desire of the people to be engaged in crop cultivation
Time taken to access grazing in wet season	30 minutes	> 10 minutes	No grazing area now and livestock graze around homestead and near rivers
Time taken to access grazing in dry season	30 minutes	> 10 minutes	No grazing area now and livestock graze around homesteads and near rivers
Quantity of browse available for grazing	●●●●● ●●●	●●	
Changes in access rights to grazing	●●●●	●●●●● ●●●●	
Type of livestock kept	**Only local breed**	**Improved livestock breeds**	**Recently introduced**
Average quantity of livestock owned by individual	25	12	
Number of conflicts with wild animals that kill/take livestock	●●●●● ●●	●●●●	In 2007 hyenas were a great problem, but this appears to be less so now
Time needed for accessing water for livestock	30 minutes	30 minutes	
Time needed for accessing mineral springs	2 hours	2 hours	
Changes in income from livestock	●●●●● ●	●●	
Changes in food from livestock	●●●●● ●●●	●	Dramatically decreased mainly due to livestock feed shortages
Changes in time to collect fodder	**> 30 minutes**	**2 hours**	
Changes in amount paid for fodder	-	-	
Genetic improvement activities		●●	
Health improvement			
Vaccination	●●	●●●●● ●	
Spray (dipping)	-	●	
Use of treatment for internal parasites	-	●●●●● ●●●	
Feeding of locally available concentrates	●●	●●●●● ●●●	

WORKSHEET 2-12
How to compare vegetation and land use changes[12]

OBJECTIVE

To **identify past and current trends and patterns of vegetation and land use change** in the woreda, in order to inform land use planning in the future.

ANTICIPATED OUTPUTS

A **series of maps showing trends** and changes in vegetation and land use, with background information.

PARTICIPANTS

Technical Land and Water Team and GIS Sub-Team, with verification from Rangeland Resource Sub-Team with other relevant stakeholders.

BOX 2-12.1 WHY IS COMPARING VEGETATION AND LAND USE CHANGE IMPORTANT

In many areas there has been extensive change in vegetation cover over last thirty to fifty years. This change highlights ongoing trends of land use change and other factors that contribute to vegetation change. For example, in many rangeland areas there has been significant increases of bushy vegetation. In others, tracts of invasive species such as *Prosopis juliflora* are now found; and/or the incidence of bare ground has increased.

Within rangeland ecology *a 'threshold' can be reached* where a type of vegetation changes so much that it crosses a boundary and becomes a different vegetative state from which it is difficult to return. For example, a shift between grasslands and shrub invaded grasslands. The initial shift along the boundary is not reversible on a time scale without substantial investment of range management interventions. Simple management actions such as stocking rate reductions would not be enough to reverse the degradation and more interventionist rangeland management would be required e.g. use of fire and/or large-scale mechanical removal of bush.

12 Contributions to this chapter were made by Masresha Taye, ILRI.

VEGETATION COVER CHANGE

1 How-To-Do a Comparison of Vegetation and Land Use Changes

There are three potential sources of information on trends/patterns of vegetation and land use change:

- From the community through a trend analysis (see *Worksheet 2-11*).
- Using sets of aerial photographs
- Using sets of satellite images.

This Worksheet is concerned with the first and third.
In addition information can be collected from the local agricultural office.

Using Aerial Photographs to Compare Vegetation Changes

- Obtain sets of aerial photographs from the Ethiopia Mapping Authority if available. The EMA does not have aerial photographs for the whole country so you should check first what photographs are available for your woreda. For example, you may be able to obtain aerial photographs (scale 1: 50,000) for years 1967 and 1987. In addition, enhanced Land-sat thematic mapper (ETM+) may be available for year 2002.
- Scan in the aerial photographs by using e.g. resolution of 25µm using VEXCEL Imaging VX4000 Imagining systems from dia-positive transparencies to produce a digital database. The images can then be rectified using ERDAS IMAGINE 8.6 software. Vector maps of roads, road intersections, bridges, and rivers can be overlaid on the imageries for referencing purposes. The resulting images can be projected in the Universal Transverse Mercator (UTM). Thereafter, a mosaic is prepared for portions of the landscape that did not appear on the same photo images of the respective years to have a single image of interest area using the MOSAIC function of ERDAS IMAGINE software. Then land use/land cover of the study area is generated using supervised classification in ERDAS Imagine 8.6.
- The identification and classification of different vegetation/land use cover then needs to be carried out, using some example sites. These example sites should contain an adequate number of pixels and to be spectrally separable to avoid misinterpretation of land cover features for those with similar spectral signature. The sites can be taken as polygons that contain unique land-use or land-cover with known properties – more than five different land use/vegetation types would be difficult to work with.
- Recognised land use/cover patterns from aerial photographs and satellite images can be exported as a polygon into shape files with help of ArcGIS 9.0, opened as Arcview 3.2 software. An overlay of the three files with differentiated colour codes can be made so as to give a visual representation of the land use or land cover changes. This is important to show the extent and spatial distribution patterns of land use or land over patterns.

2 Using Remote Sensing to Compare Vegetation/Land Use Changes

Today, remotely sensed data are very well organized for land use or land cover mapping, vegetation monitoring, assessment of regional potentials and environmental protection. It is the most important tools for gathering information for large areas.

One of the requirements of rangeland use is the need to predict its potential production capacity. Estimation of vegetation productivity is possible using remotely sensed information in instances where ground-truthed and mean values are applied by types, following either of the two approaches. These are either (i) establishment of direct empirical relationships between spectral reflectance and biomass or (ii) the use of spectral reflectance to estimate the amount of absorbed photo synthetically-active radiation. The first approach proved useful for estimating live biomass. However, the second approach is likely to be more successful in predicting biomass across different climatic regimes and biomes.

NORMALIZED DIFFERENCE VEGETATION INDEX (NDVI)

The *Normalized Difference Vegetation Index (NDVI)* is **a standardized index allowing you to generate an image displaying greenness (relative biomass)**. This index takes advantage of the contrast of the characteristics of two bands from a multispectral raster dataset—the chlorophyll pigment absorptions in the red band and the high reflectivity of plant materials in the near-infrared (NIR) band.

An NDVI is often used worldwide to monitor drought, monitor and predict agricultural production, assist in predicting hazardous fire zones, and map desert encroachment. The NDVI is preferred for global vegetation monitoring because it helps compensate for changing illumination conditions, surface slope, aspect, and other extraneous factors (Lillesand 2004).

The differential reflection in the red and infrared (IR) bands enables you to monitor density and intensity of green vegetation growth using the spectral reflectivity of solar radiation. Green leaves commonly show better reflection in the near-infrared wavelength range than in visible wavelength ranges. When leaves are water stressed, diseased, or dead, they become more yellow and reflect significantly less in the near-infrared range. Clouds, water, and snow show better reflection in the visible range than in the near-infrared range, while the difference is almost zero for rock and bare soil. The NDVI process creates a single-band dataset that mainly represents greenery. The negative values represent clouds, water, and snow, and values near zero represent rock and bare soil.

The documented and default NDVI equation is as follows:

NDVI = ((IR–R)/(IR + R))
IR = *pixel values from the infrared band*
R = *pixel values from the red band*

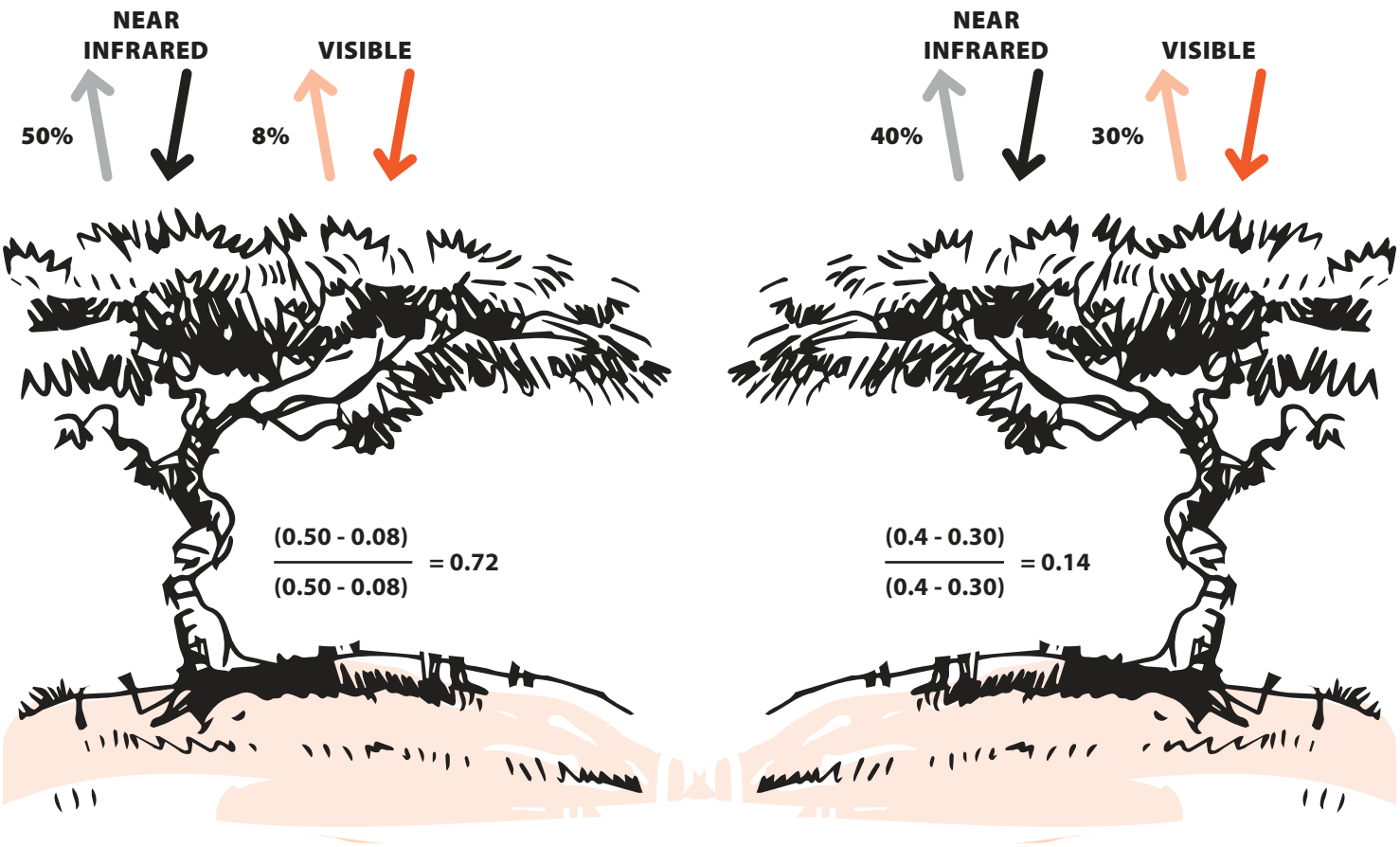


Figure 2-20c-1 Absorption (red and blue) and reflection (infrared and green) of bands (courtesy of NASA)

This index outputs values between -1.0 and 1.0, mostly representing greenness, where any negative values are mainly generated from clouds, water, and snow, and values near zero are mainly generated from rock and bare soil. Very low values (0.1 and below) of NDVI correspond to barren areas of rock, sand, or snow. Moderate values (0.2 to 0.3) represent shrub and grassland, while high values (0.6 to 0.8) indicate temperate and tropical rainforests.

The equation ArcGIS uses to generate the output is as follows:

$$NDVI = ((IR–R)/(IR + R)) * 100 + 100$$

This will result in a value range of 0–200 and fit within an 8-bit structure, which can easily be rendered with a specific color ramp or color map.

If you need the specific pixel values (-1.0 to 1.0), use the Band Arithmetic function and pick the NDVI method. If using the Add Function button on the Image Analysis window to apply an NDVI, you can open the Image Analysis Options dialog box, click the NDVI tab, then check Scientific Output. Also on this tab is the option Use Wavelength, which attempts to identify the correct bands to use if the wavelength information is in the dataset. If not, the band numbers are used.

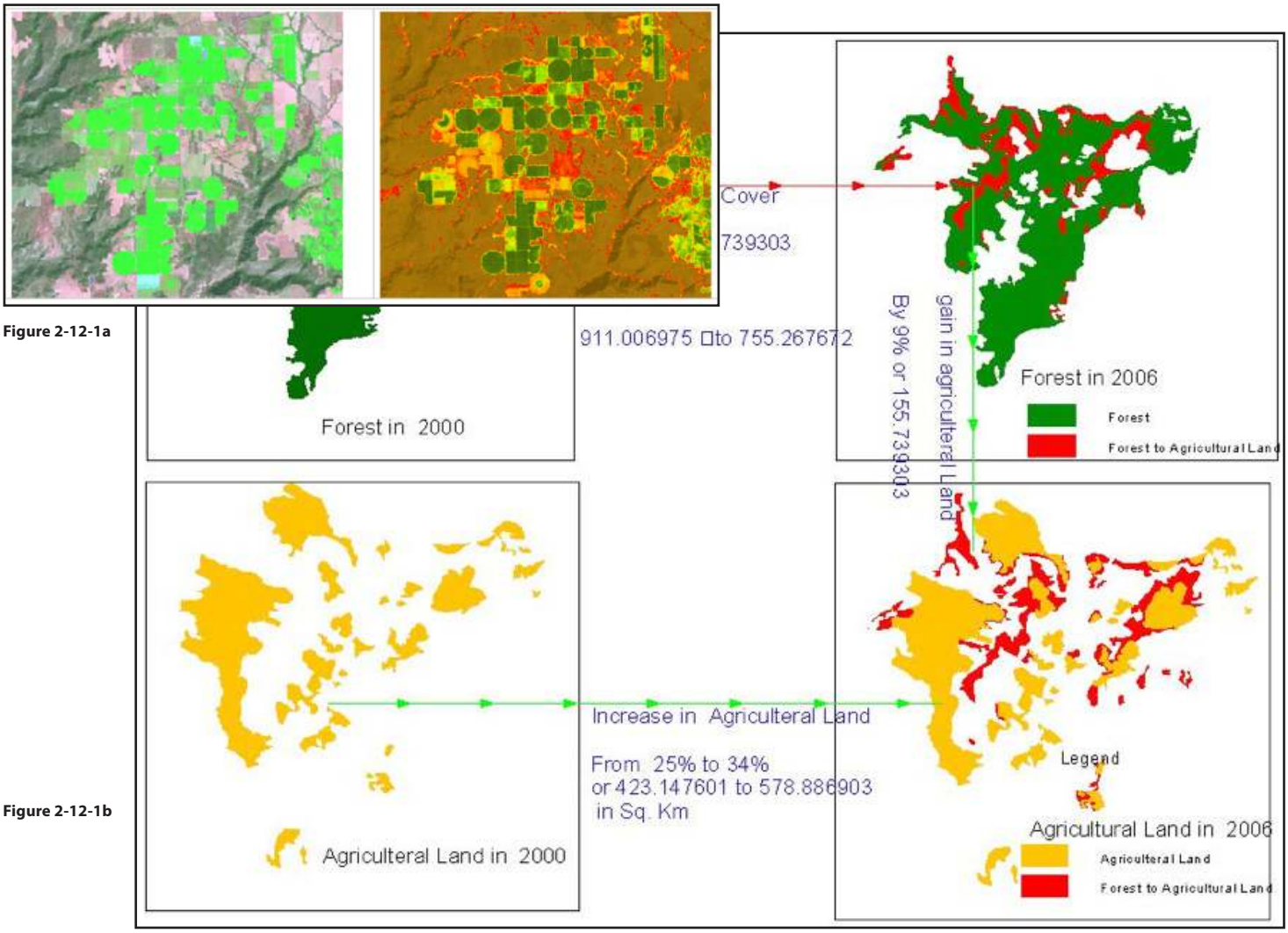


Figure 2-12-1a

Figure 2-12-1b

Figure 2-12-1a Examples of a Landsat 7,4,3 band combination (left) and an NDVI using a color map that highlights the agricultural activity of the area (right).

Figure 2-12-1b Example of use of remote sensing to compare vegetation change **Source**: the Bale Eco-Region Sustainable Management Project, FARM Africa and SOS Sahel

The inputs for this function are the following:

- Input Raster
- Visible Band ID
- Infrared Band ID

Use the Colormap function[13] to visualize with an NDVI color ramp.

On the other hand, proximity to a certain feature can be prepared as proximity layers within a woreda from a raster image available from an internet for free. Other parameters are already available from collected and analysed biophysical and socioeconomic data for land capability classification (*Worksheet 2-6a*). From these parameters those which are important for settlement assessment selected and treated as requirements and limitations, land qualities, land characteristics and later a diagnostic criterion will be prepared for final suitability assessment.

13 The Colormap function is a type of raster data renderer. It transforms the pixel values to display the raster data as either a grayscale or a color (RGB) image based on specific colors in a color map file, or based on a color ramp. You can use a color map to represent analyzed data, such as a classified image, or when displaying a topographic map (or index color-scanned image).

WORKSHEET 2-13a

How to carry out a rangeland vegetation inventory

OBJECTIVE

To **document the different types of vegetation found** in the rangeland area, their palatability, use, and distribution.

ANTICIPATED OUTPUTS

A **map of key vegetation species** (local and species names) and their distribution, with background information.

PARTICIPANTS

Rangeland Resources Sub-Team and Land & Water Technical Sub-Team working with local rangeland users including pastoralists.

HOW-TO-DO A RANGELAND VEGETATION INVENTORY[14]

The process is the similar to that carried out in *Worksheet 2-6b* to collect data on vegetation composition, but done in more detail, and more specifically in the rangeland area. It also uses a slightly different process and steps. If you feel more comfortable with the process in *Worksheet 2-6b* then you could use that methodology with collection of more material and details (as described below).

Identify 15 points at random in the rangeland area – if the rangeland area is small the points can be less, if the area is large these points could be more.

A series of observation and measurements will be made along a transect from the point where you are standing. **Make the transect walk in four directions – North, South, East and West for 20 metres in each direction**.

You need two measuring sticks – these should be 1 m in length, with markings made along it at 20cm intervals (see Figure 2-13-1b). Equally a traditional pastoralist stick (of approximately the same length) could be used and marked.

For each transect:

- **Walk 5m North** in a straight line from the site's centre point.
- **Put down the stick** in front of you.
- Each transect is 25m. You will **lay down the stick and collect data every 5 m** along the transect.
- Use the stick to **collect data on basal cover, plant cover and gaps between plants** and make a mark on the data collection form *Worksheet 2-13a*.

14 This chapter is adapted from Riginos and Herrick 2010

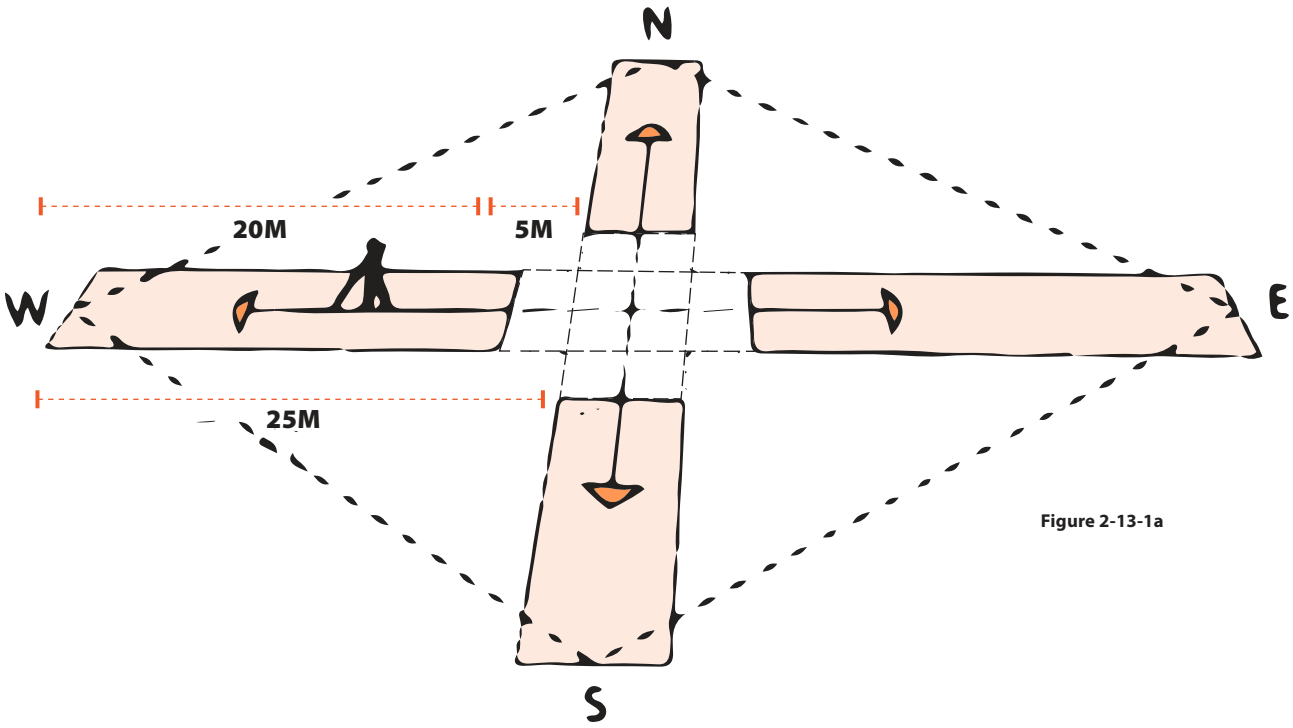


Figure 2-13-1a

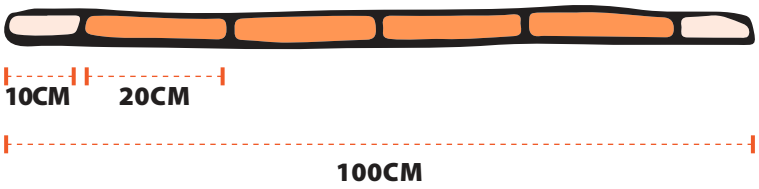


Figure 2-13-1b

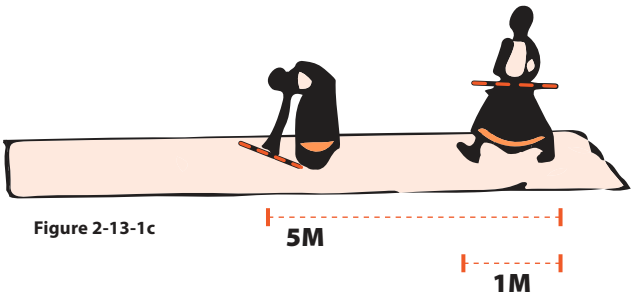


Figure 2-13-1c

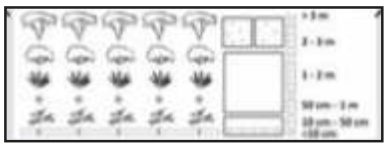


Figure 2-13-1d

Figure 2-13-1a Sampling spots **1b** 1m measuring stick marked at 20cm intervals **1c** Each transect is 25m **1d** Boxes on the datasheet (Worksheet 2-13a)

DATASHEETS

In most cases you will only need the Background Datasheet and the Core Datasheet (*Worksheet 2-13a*). The Core Datasheet is organised around a large cross (+). Each arm of the cross represents one 'transect.' The four transects extend in four directions – North, South, East and West. Each transect is 25 m long. You will lay the stick, collect and record data every 5 m along the transect.

Basic site information

Things to write in the boxes for basic site information:

1. **Record name of the site**
2. **Describe the location** of the site
3. **Describe the centre point** of the site – are there any defining charactersistics that would help you find the site again.
4. **Take GPS readings** if possible.
5. **Record the vegetation or structure** at the site, shrubs and trees etc.

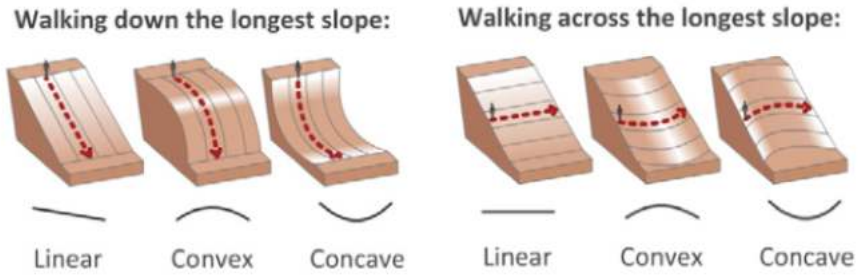
No trees; no shrubs | *Few trees; no shrubs* | *Many trees; no shrubs* | *Dense trees; no shrubs* | *No trees; few shrubs* | *Many trees; many shrubs*

6. **Record the soil depth** – dig until you hit the bedrock, or look at the profile in a nearby gully. If you dig down to 50cm and have not hit bedrock then write ">50cm".
7. Wet a handful of surface soil, rolling it in the palm of your hand for several minutes to **make a ball of mud**. Tick all the descriptions of the soil that best describe it:
   - Is it sticky, slippery or sandy?
   - Is the colour red, grey or brown?
   - Is the colour light, medium or dark?
8. **Repeat this** with a handful of i) sub-surface soil and ii) deep soil.
9. **Determine the percent slope**:
   - Place the stick vertically on the ground. Hold on end of the 5m piece of string at the 50cm mark on the stick.
   - Stand behind the stick on the downhill side of the stick, with your eye level if the 50cm mark on the stick. Look uphill.
   - Find the point on the slope that is level with your eyes. Have a second person walk to this point with the other end of the string. Pull the string tight so that it makes a straight line between the top of the stick and the point on the slope level with your eyes.

- Have the second person mark the end of the string or keep holding it.
- Put the string on the found and measure its length.
- Record the length in meters.
- Calculate percent slope = [1/(2*length)] *100

10 **Circle the shape of the main (longest) downward slope**. Imagine walking down it – what is the shape?

11 **Circle the shape of the cross-slope**.



12 **Fill in the observational indicators** including:

- Erosion features
- Soil surface hardness
- Recent grazing intensity
- Recent browsing intensity
- Distance to water
- Distance to nearest boma/settlement
- Other including is there anything important to note about the site, is it bad or good site for livestock, are there any wildlife species here etc.

Data collection along transects

Collect all the following data along the transects at once including:

- Plant and ground cover
- Gaps >1m between plants (per cent of ground in large gaps)
- Plant height
- Plant density

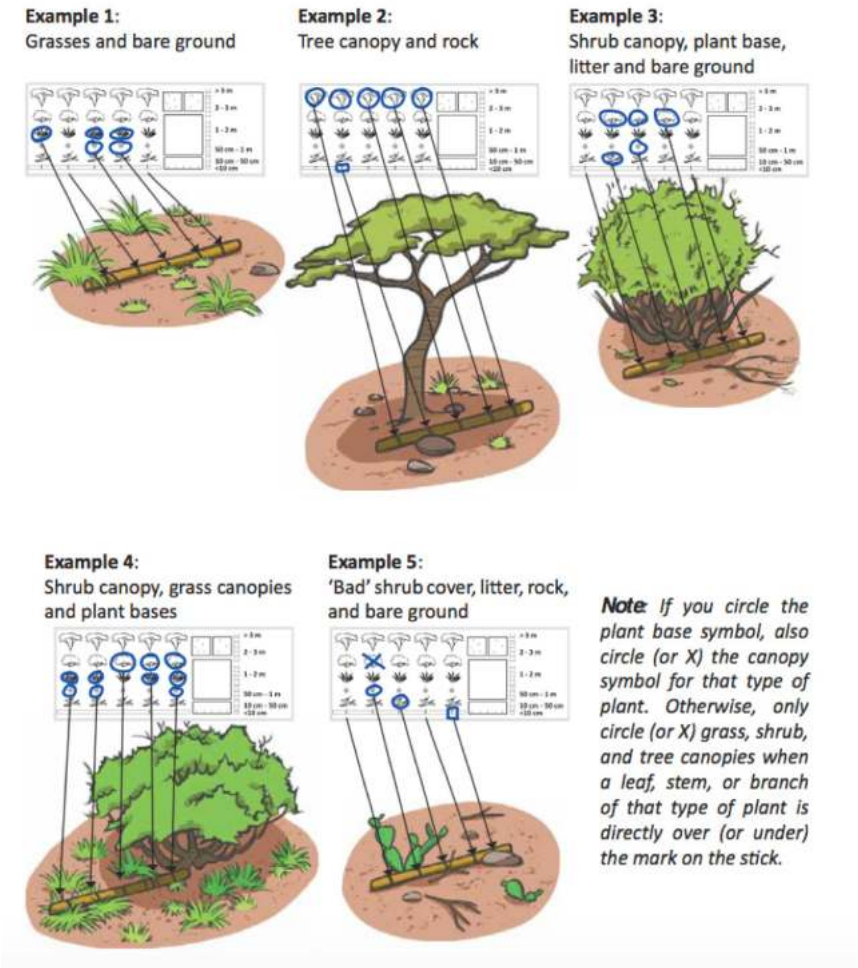


Figure 2-13-2

Plant and ground cover

1. **Walk 5m North** in a straight line from the site's centre point.
2. **Put down the stick** 50 cm in front of your feet.
3. **Record what type of plant or ground cover is present at each mark on the stick**. Only record the plant cover that is either hanging over or is directly under the stick.
4. For each point along the edge of the stick decide what (if anything) is over the soil surface. Draw the appropriate symbol on that point on the stick diagram in the datasheet i.e. 'rock' (any piece of rock or small stone more than 5mm in diameter; if lichen draw a V; if there is nothing do not mark that point in any way.
5. **For each point along the stick decide what (if any) litter or perennial plants cover the ground** at that point. This step focuses on perennial plants (i.e. grow every year). If you wish to collect information on annual plants, then record them as 'key species' using a different symbol.
6. **Mark the appropriate symbols above the stick diagram** on the datasheet (you can circle more than one for each point). You can mark 'good' species of plants by putting a circle round the symbol, and 'bad' species by putting an X. Use these rules as a guide:

- If the point falls on top of litter, circle the stick and leaf symbol. Litter is unattached material such as sticks, leaves, logs and animal dung.
- If the point falls on a perennial plant or grass base, circle the small dot.
- If the point falls under or over a perennial grass or forb, mark the grass symbol.
- If the point falls under a shrub leaf or stem, mark the shrub symbol.
- If the point falls under a tree leaf or stem mark the tree symbol.

7. **Do not mark any symbol if there is no litter or plant cover** at that point.
8. **Continue collecting data every 5 m** until the end of the transect. Repeat these steps for each of the three other transects/directions.

Analysis

1. **Summarise** the data in the '*Plant and Ground Cover (%)*' corner of the datasheet.
2. For **trees, shrubs and grasses**:
   - Count the number of times you have circled the tree symbol. Record this under the 'Good' column. This number represents the percent cover of 'good' trees. If you did not collect separate data for 'good' and 'bad' plant species, skip to step 2c and simply record the total number of times you marked the tree symbol.
   - Count the number of times you have put an X through the tree symbol and record this under the 'Bad' column in the datasheet. This represents the percent cover of 'bad' trees.
   - Add together the number of trees in the 'Good' column and in the 'Bad' column. Record this number in the 'Total' column. This represents the total percent tree cover at this site.
   - Repeat steps 2a – 2c for shrubs and grasses to get good, bad and total percent cover for shrubs and grasses.
3. For **plant bases, litter, rock, and lichen**:
   - Count the number of times you marked each type of ground cover. Record the numbers under the 'Total' column. These numbers represent the percent of the ground that is protected by plant bases, litter, rock, and lichen.
4. To **calculate total number of points with plant cover**, count the number of points on the datasheet where you marked (with a circle or X) any type of plant (trees, shrub, grass or forb, or base). Count each point only once. For example, even if you have circled a grass canopy and a tree canopy, only count this point once. This is the percent total plant cover.
5. To **calculate the percent bare ground**, count the number of points for which you did not make any marks on the datasheet on or above that point on the stick. In other words, count the number of points at which a raindrop falling straight down would hit bare soil. This is the percent bare ground.

Remember!
Collecting cover data for key species, you could add in an extra symbol for a particular plant species such as one favoured by local communities, or an increaser or decreaser (Box 2-6a-2).

Collecting the data

1. **Walk 5 m North** from the site's centre point.
2. **Put down the stick** 50 cm in front of your feet. And repeat as above.
3. As above **collect all types of data at the same time**.
4. **Gaps between plant bases**:
   - Shade, colour in, or mark the basal gap box on the datasheet if the stick touches any kind of plant base in any place along the stick (ignoring the marks on the stick). This indicates that the gap is broken (there is not a gap > 1 m between plant bases).
   - Leave the basal gap box empty if the stick is entirely within a basal gap (the stick is not touching any plant bases). This indicates that the gap is not broken (there is a gap > 1 m between plant bases).
5. **Gaps between plant canopies**:
   - Shade, colour in, or mark the canopy gap box if there is plant leaf or stem over any part of the stick. This indicates that there is not a gap > 1 m between plant canopies.
   - Leave the canopy gap box empty if the stick is entirely within a canopy gap (there is no plant leaf or stem over the stick). This indicates that there is a gap > 1 m between plant canopies.

Remember!
The plant leaf or stem must be between 10 cm and 2 m in height. (Canopies shorter than 10 cm or taller than 2 m are not effective at slowing wind erosion).

6. **Continue collecting gap data every 5 m** until the end of the transect (laying down your stick when you stop at 5, 10, 15, 20, and 25 m from the centre point).
7. **Repeat these steps** for each of the three other transects (East, South, West).

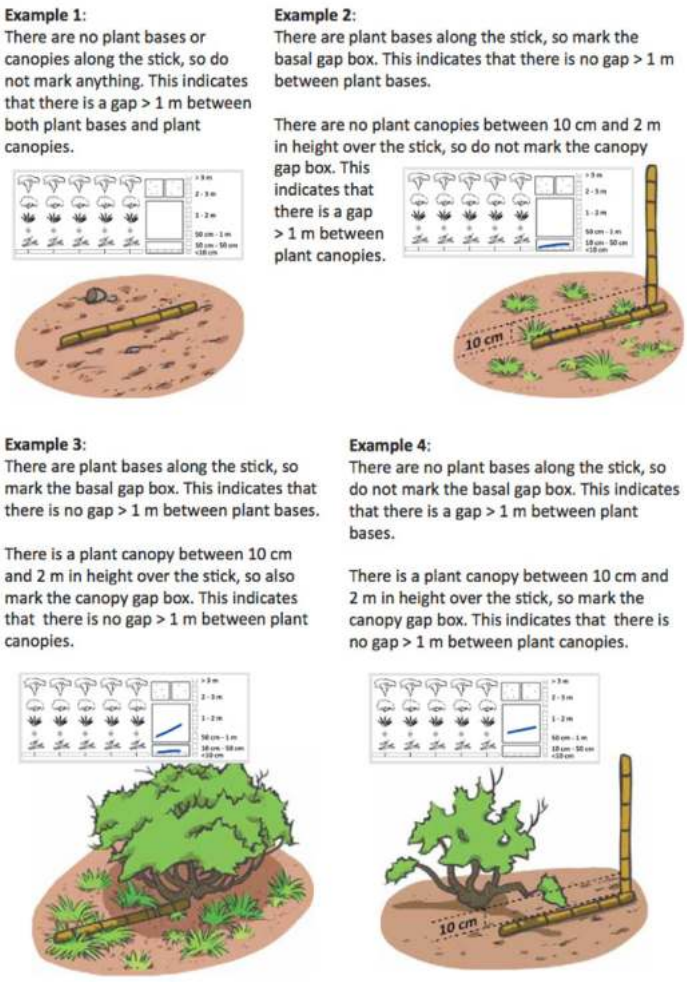


Figure 2-13-3

Analysing the data

1. **Summarise** the data in the 'Gaps' corner of the datasheet.
2. **Count the number of basal gap boxes you did not shade or mark**. (Remember, an empty box means that there was a basal gap; a shaded or marked box means that there was at least one plant base breaking up the gap). Record the number of empty basal gap boxes in the 'Gaps > 1 m Between Plant Bases' box.
3. **Count the number of canopy gap boxes you did not shade or mark**. (Remember, an empty box means that there was a canopy gap; a shaded or marked box means that there was at least one plant canopy breaking up the gap). Record the number in the 'Gaps > 1 m Between-Plant-Canopy' box.
4. **Multiply each number by 5** to get the percent of the landscape that has large (> 1 m) gaps between plant bases and canopies.

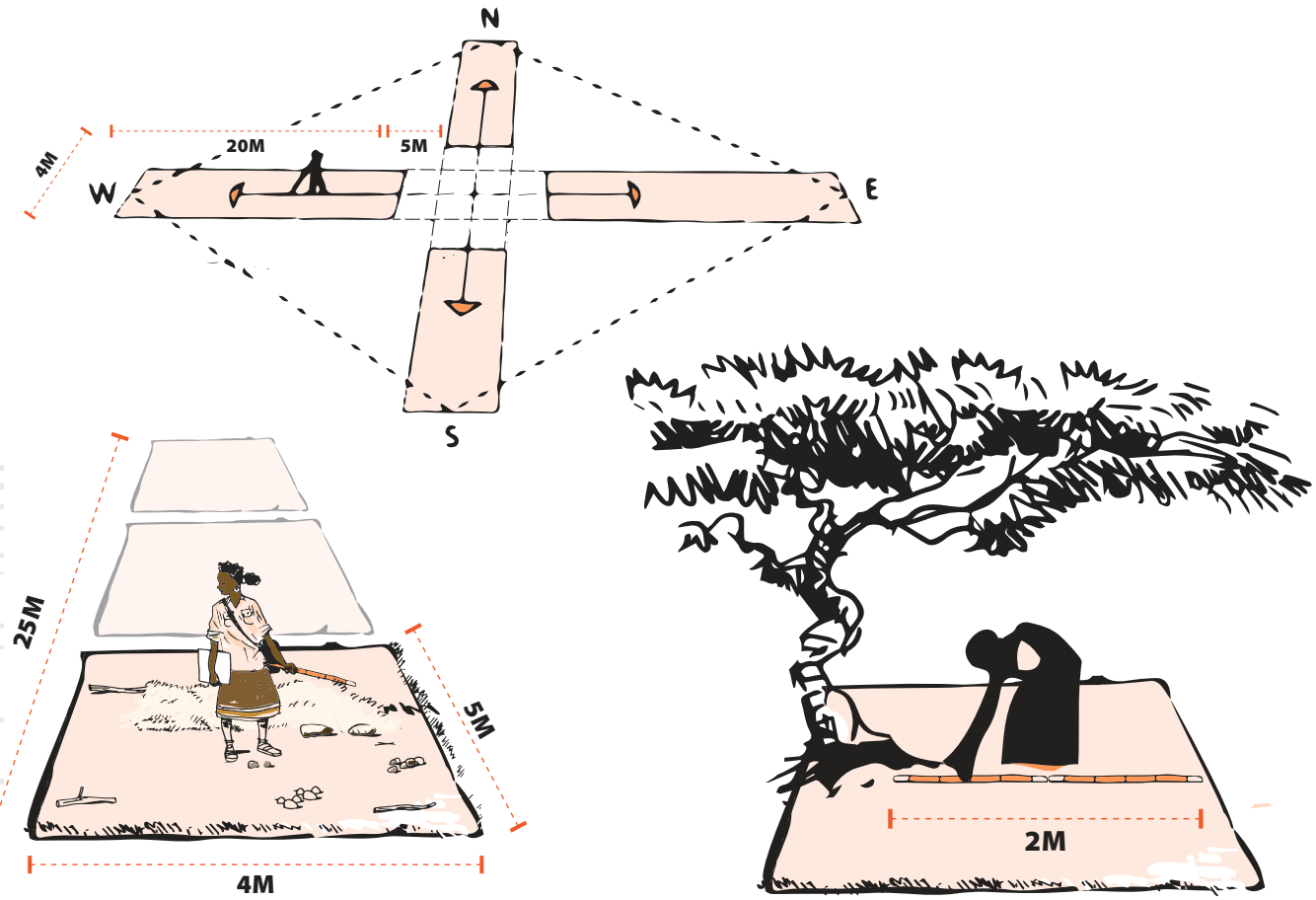


Figure 2-13-4 Collection data on plant density

Plant Density

This method can be used for all species together or for 'key' species of particular interest (good or bad). It can also be used to determine the density of seedlings as well as larger plants. Finally, this method can be used to measure the density of a particular species within several height classes. For example, you could measure the density of seedlings, saplings, and larger plants of an invading or undesirable species. This will give more information about how many large plants of this species you can expect there to be in the future.

Plant density data are collected by counting the number of plants that are rooted within a plot of known size. The plots should be evenly distributed throughout the monitoring site.

Collecting the data - four 20 m-long belt transects (four 80 m^2 plots)

1. **Walk 5 m North** from the site's centre point.
2. **Walk slowly in a straight line, counting the number of plants with the base of the stem (or trunk) rooted within 2 m on either side of the line**. Use the sticks to measure 2 m from the line if you are not sure whether the plant is inside the belt or not.
3. For **plants on the edge of the plot**: count them if more than half of their stem or trunk is within (inside of) 2 m of the line; do not count them if more than half of their stem or trunk is more than 2 m from the line.

4. For each plant that you count, **record a tally mark in the '*Number of Plants*' row** in the '*Plant Density*' corner of the datasheet.
5. **Continue walking and counting** untill you have reached the end of the transect (25 m from the centre point).
6. **Repeat these steps** for each of the three remaining other transects (East, South, West).
7. **Count the number of tally marks you have made for each type of plant** and write this total in the '*Number of Plants*' row of the datasheet.
8. **Record the size and number of plots** in the '*Plot Size*' and '*Number of Plots*' rows.

Analysing the data

1. Calculate the area you sampled: area sampled = plot size x number of plots.
2. Calculate plant density: plant density = total number of plants / area sampled.

Collection of information on local names and uses

If you have a local community member with your ask him/her about the different species – what is its local name, what it is used for, is it palatable/non-palatable, does it grow every year etc. You can also collect some of the plants and identify when them back on the office or send to a herbarium or local expert. If no community members with you, you could hold a meeting with some afterwards.

If there are any non-local and invasive species, make a special note of this. These will need special management to avoid further spread and/or their removal.

You could also rank the plants identified for their usefulness, palatability, and invasive or non-useful characteristics.

Table 2-13-1 Form for documenting local names, uses and occurence

Local name of plant	Latin species name	Use of plant	Considered good or bad	Distribution

WORKSHEET 2-13b

Data collection sheets[15]

Background Datasheet - Version 2

Basic Site Information

(Record only first time site is visited. Used for interpretation.)

Site name: _____

Description of where the site is located:

Description of central point location:

GPS

Datum: _____

Northing: _____

Easting: _____

Vegetation Type:

	None:	Few:	Many:	Dense:
Shrubs	○	○	○	○
Trees	○	○	○	○

Common Species

Grass: _____

Shrub: _____

Tree: _____

Forb/Herb: _____

Soil Surface: 0 - 10 cm

Texture:	Colour:	Colour:
○ Sticky	○ Red	○ Light
○ Slippery	○ Grey	○ Medium
○ Sandy	○ Brown	○ Dark

Sub-Surface: 10 - 30 cm Compared to soil surface:

More:	Less:	Same:		
○	○	○	Sticky	○ Lighter
○	○	○	Slippery	○ Same as
○	○	○	Sandy	○ Darker

Sub-Surface: 30 - 50 cm Compared to 10 - 30 cm:

More:	Less:	Same:		
○	○	○	Sticky	○ Lighter
○	○	○	Slippery	○ Same as
○	○	○	Sandy	○ Darker

Soil Depth: _____ cm

Slope

Length of string: _____ m

% Slope: _____

(% Slope = [1 / (2*length)] * 100)

Shape: (walking down the longest slope)

Shape: (walking across the longest slope)

Observational Indicators

(Record each time data are collected)

Season: _____ Date: _____

- Indicators of Change -

Signs of Erosion:

	None:	Few:	Some:	A lot:
Rills	○	○	○	○
Gullies	○	○	○	○
Litter Dams	○	○	○	○
Pedestals	○	○	○	○
Soil Deposition	○	○	○	○
Water Flow Patterns	○	○	○	○
Sheet Erosion	○	○	○	○
Other: _____	○	○	○	○

Soil Surface Hardness:

Soil surface (0 - 10 cm) in large gaps (gaps > 1 stick) is:

○ Hard ○ Soft ○ No large gaps

Soil surface (0 - 10 cm) in grassy areas is:

○ Much softer than
○ Softer than
○ The same as

the soil surface in large gaps.

- Indicators of Site Use -

Grass (not protected by shrubs/trees) has been grazed:

○ Not at all
○ Lightly
○ Moderately
○ Heavily

Species that have done most of the grazing: _____

Trees/shrubs have been browsed:

○ Not at all
○ Lightly
○ Moderately
○ Heavily

Species that have done most of the browsing: _____

Recent cutting:

○ Grass cutting
○ Tree cutting

Animals visible while at site?

○ No
○ Yes Species: _____

Distance to water:

Temporary	Permanent	
○	○	<200 m
○	○	200 m - 1 km
○	○	1 - 3 km
○	○	>3 km

Distance to boma / settlement:

Used within the past year	Used more than a year ago	
○	○	<200 m
○	○	200 m - 1 km
○	○	1 - 3 km
○	○	>3 km

Other indicators, notes, & observations about the site:

15 Source: Riginos and Herrick, 2010.

Plant and Ground Cover (%)

Plant	Good	Bad	Total
Tree			
Shrub			
Grass			
Plant Base			
Litter			
Rock			
Lichen			

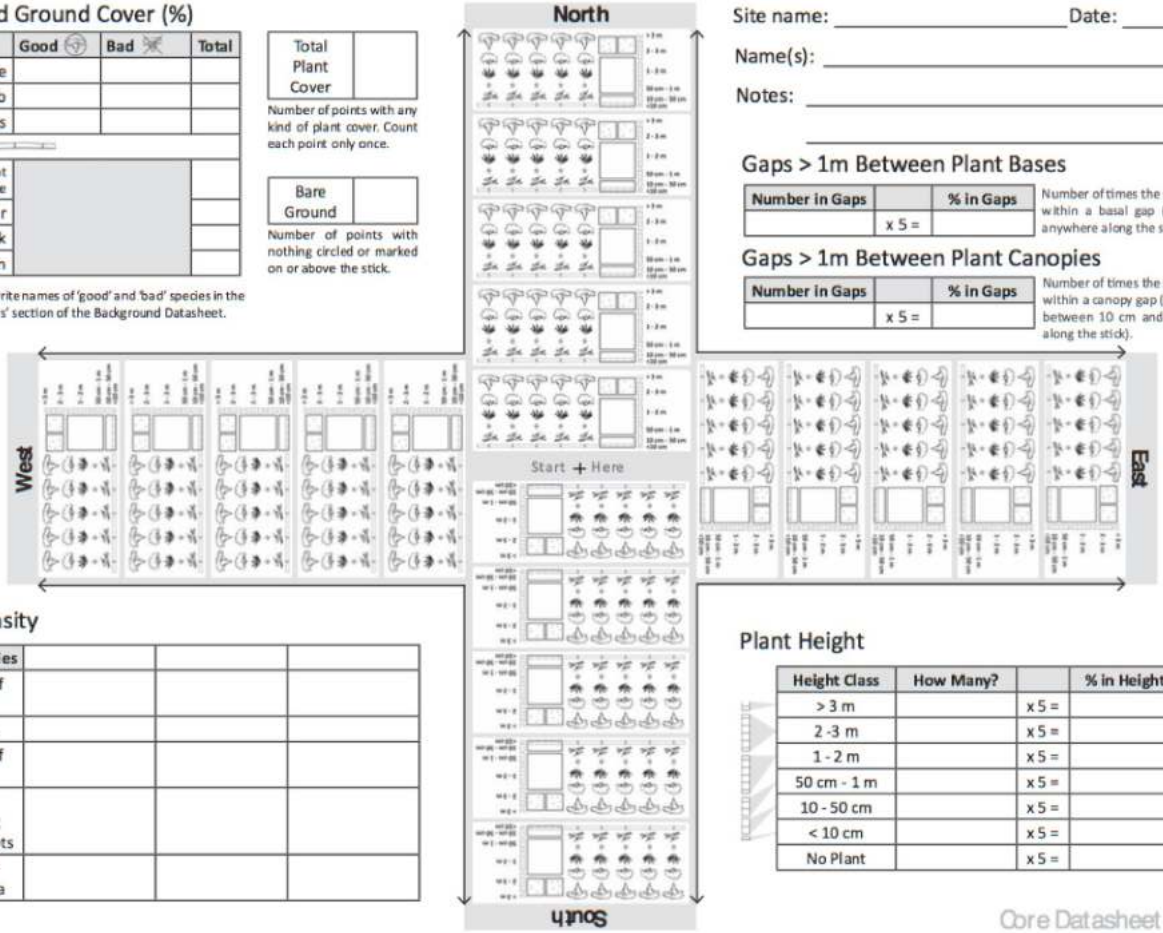
Note: You can write names of 'good' and 'bad' species in the 'Other indicators' section of the Background Datasheet.

Total Plant Cover	

Number of points with any kind of plant cover. Count each point only once.

Bare Ground	

Number of points with nothing circled or marked on or above the stick.



Site name: _____ Date: _____

Name(s): _____

Notes: _____

Gaps > 1m Between Plant Bases

Number in Gaps		% in Gaps
	x 5 =	

Number of times the stick fell entirely within a basal gap (no plant bases anywhere along the stick).

Gaps > 1m Between Plant Canopies

Number in Gaps		% in Gaps
	x 5 =	

Number of times the stick fell entirely within a canopy gap (no plant canopy between 10 cm and 2 m anywhere along the stick).

Plant Density

Type / Species			
Number of Plants			
Plot Size			
Number of Plots			
Area = Plot size x Number plots			
Density = plants/area			

Plant Height

Height Class	How Many?		% in Height Class
> 3 m		x 5 =	
2 -3 m		x 5 =	
1 - 2 m		x 5 =	
50 cm - 1 m		x 5 =	
10 - 50 cm		x 5 =	
< 10 cm		x 5 =	
No Plant		x 5 =	

Core Datasheet - Version 2

Background Datasheet - Version 2

Basic Site Information

(Record only first time site is visited. Used for interpretation.)

Site name: Jackal Kopje

Description of where the site is located:

West of exclosure fence

Description of central point location:

Bare patch by large A. mellifera 50 m west of fence

GPS

Datum: WGS 84 (UTM)

Northing: 0032879

Easting: 0264317

Vegetation Type:

	None:	Few:	Many:	Dense:
Shrubs	○	●	○	○
Trees	○	○	●	○

Common Species

Grass: Cynodon; Eragrostis

Shrub: Rhus; Croton

Tree: A. mellifera; Aetbaica

Forb/Herb: Ocimum; Plectranthus

Soil Surface: 0 - 10 cm

Texture:	Colour:	Colour:
○ Sticky	● Red	○ Light
● Slippery	○ Grey	● Medium
● Sandy	● Brown	○ Dark

Sub-Surface: 10 - 30 cm Compared to soil surface:

More:	Less:	Same:		
○	○	○	Sticky	● Lighter
○	●	○	Slippery	○ Same as
●	○	○	Sandy	○ Darker

Sub-Surface: 30 - 50 cm Compared to 10 - 30 cm:

More:	Less:	Same:		
○	○	○	Sticky	● Lighter
○	●	○	Slippery	○ Same as
●	○	○	Sandy	○ Darker

Soil Depth: >50 cm

Slope

Length of string: 6 m

% Slope: 8.3 %

(% Slope = [1 / (2*length)] * 100)

Shape: (walking down the longest slope)

Shape: (walking across the longest slope)

Observational Indicators

(Record each time data are collected)

Season: Dry

Date: March 3, 2010

- Indicators of Change -

Signs of Erosion:

	None:	Few:	Some:	A lot:
Rills	○	○	●	○
Gullies	●	○	○	○
Litter Dams	○	○	●	○
Pedestals	○	●	○	○
Soil Deposition	○	●	○	○
Water Flow Patterns	○	○	○	●
Sheet Erosion	○	○	○	●
Other: _____	○	○	○	○

Soil Surface Hardness:

Soil surface (0 - 10 cm) in large gaps (gaps > 1 stick) is:

● Hard ○ Soft ○ No large gaps

Soil surface (0 - 10 cm) in grassy areas is:

○ Much softer than
● Softer than
○ The same as

the soil surface in large gaps.

- Indicators of Site Use -

Grass (not protected by shrubs/trees) has been grazed:

○ Not at all
○ Lightly
● Moderately
○ Heavily

Species that have done most of the grazing: unknown wildlife

Trees/shrubs have been browsed:

○ Not at all
○ Lightly
● Moderately
○ Heavily

Species that have done most of the browsing: elephants

Recent cutting:

○ Grass cutting
○ Tree cutting

Animals visible while at site?

● No
○ Yes Species: _____

Distance to water:

Temporary	Permanent	
○	○	<200 m
○	○	200 m - 1 km
○	●	1 - 3 km
○	○	>3 km

Distance to boma / settlement:

Used within the past year	Used more than a year ago	
○	○	<200 m
○	○	200 m - 1 km
●	●	1 - 3 km
○	○	>3 km

Other indicators, notes, & observations about the site:

Bedrock exposed in some places

Plant and Ground Cover (%)

Plant	Good	Bad	Total
Tree			45
Shrub			1
Grass			15
Plant Base			6
Litter			11
Rock			0
Lichen			34

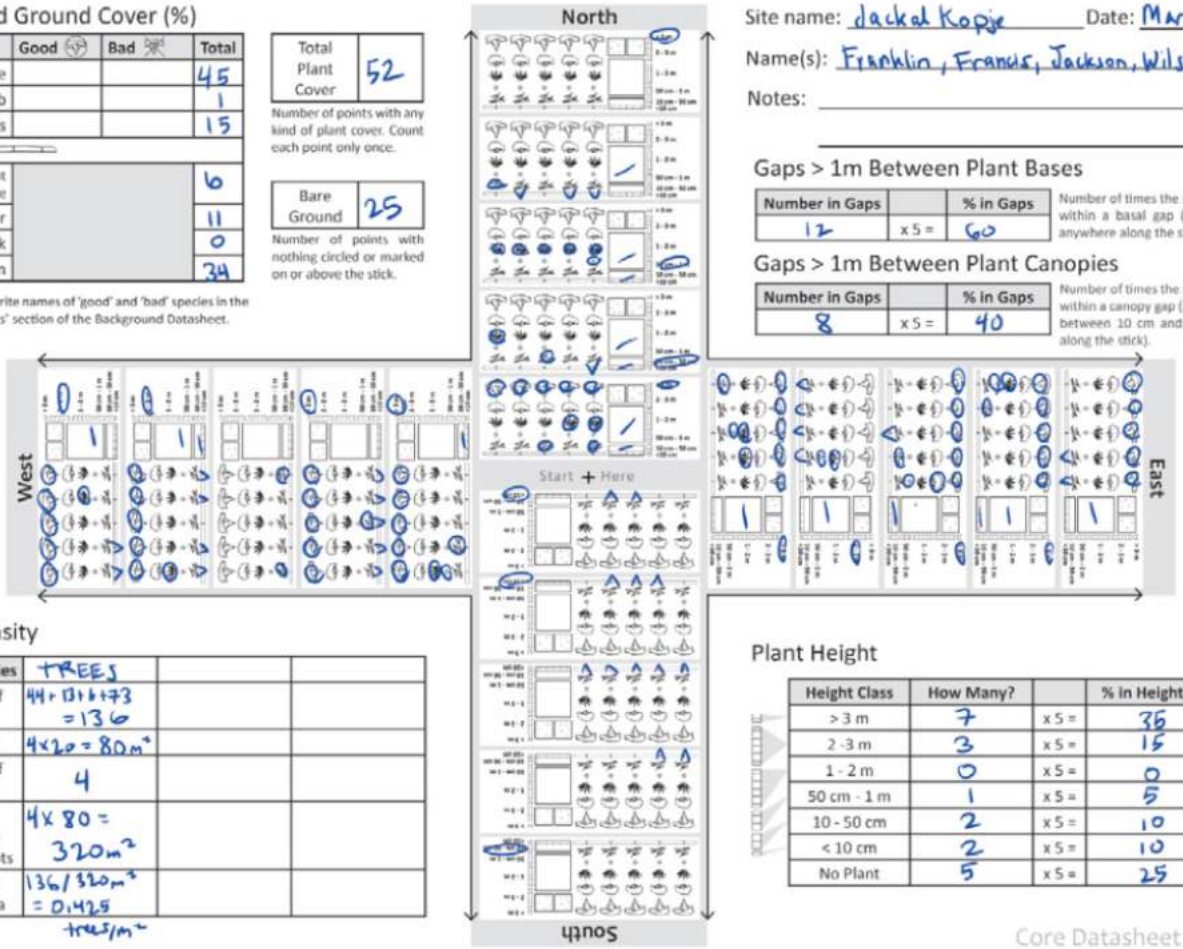
Note: You can write names of 'good' and 'bad' species in the 'Other indicators' section of the Background Datasheet.

Total Plant Cover	52

Number of points with any kind of plant cover. Count each point only once.

Bare Ground	25

Number of points with nothing circled or marked on or above the stick.



Site name: dackal Kopje Date: March 3, 2010

Name(s): Franklin, Francis, Jackson, Wilson

Notes: _____

Gaps > 1m Between Plant Bases

Number in Gaps		% in Gaps
12	x 5 =	60

Number of times the stick fell entirely within a basal gap (no plant bases anywhere along the stick).

Gaps > 1m Between Plant Canopies

Number in Gaps		% in Gaps
8	x 5 =	40

Number of times the stick fell entirely within a canopy gap (no plant canopy between 10 cm and 2 m anywhere along the stick).

Plant Density

Type / Species	TREES		
Number of Plants	44+13+6+73 = 136		
Plot Size	4x20 = 80m²		
Number of Plots	4		
Area = Plot size x Number plots	4x80 = 320m²		
Density = plants/area	136/320m² = 0.425 trees/m²		

Plant Height

Height Class	How Many?		% in Height Class
> 3 m	7	x 5 =	35
2 - 3 m	3	x 5 =	15
1 - 2 m	0	x 5 =	0
50 cm - 1 m	1	x 5 =	5
10 - 50 cm	2	x 5 =	10
< 10 cm	2	x 5 =	10
No Plant	5	x 5 =	25

Core Datasheet - Version 2

WORKSHEET 2-14

Mobility mapping

OBJECTIVE

To understand and **document how the community (and different groups within the community) move** at different times of the year, how often and why.

OUTPUTS

A **diagrammatic map showing where, when and why a person or group of people move** including what resources are taken out of the village/ area, and what resources come in.

PARTICIPANTS

Participants are case study individuals or groups from different types of users in the woreda including representatives from customary leaders.

The Agriculture and Land Use Sub-Team should lead this activity, but other WPLUP Team members can join if thought appropriate e.g. the Rangeland Resource Sub-Team, the Technical Land and Water Sub-Team, and the GIS Sub-Team (if the map is to be digitised).

HOW-TO-DO MOBILITY MAPPING

Ask the individual or focus group to draw their house or village roughly in the middle of a piece of paper.

Then ask them to show where they travel to a) every day, b) every week, c) every month and d) occasionally. Ask them why they travel to these places, how long does it take, how often do they travel there, and with whom. Ask them do they take anything with them (resources, livestock, money etc.) and do they bring anything back.

Draw these movements on the paper with two way arrows which can show which resources, money, people etc. they travel out with, and then which resources, money, people etc. they travel back with (see example of a mobility map below).

A checklist of *questions to ask* include:

- Where do you travel every day? Are there some other places you travel to every week? Are there some other places you travel to every month? Are there some other places you travel to occasionally – how often?
- Why do you travel to these places?

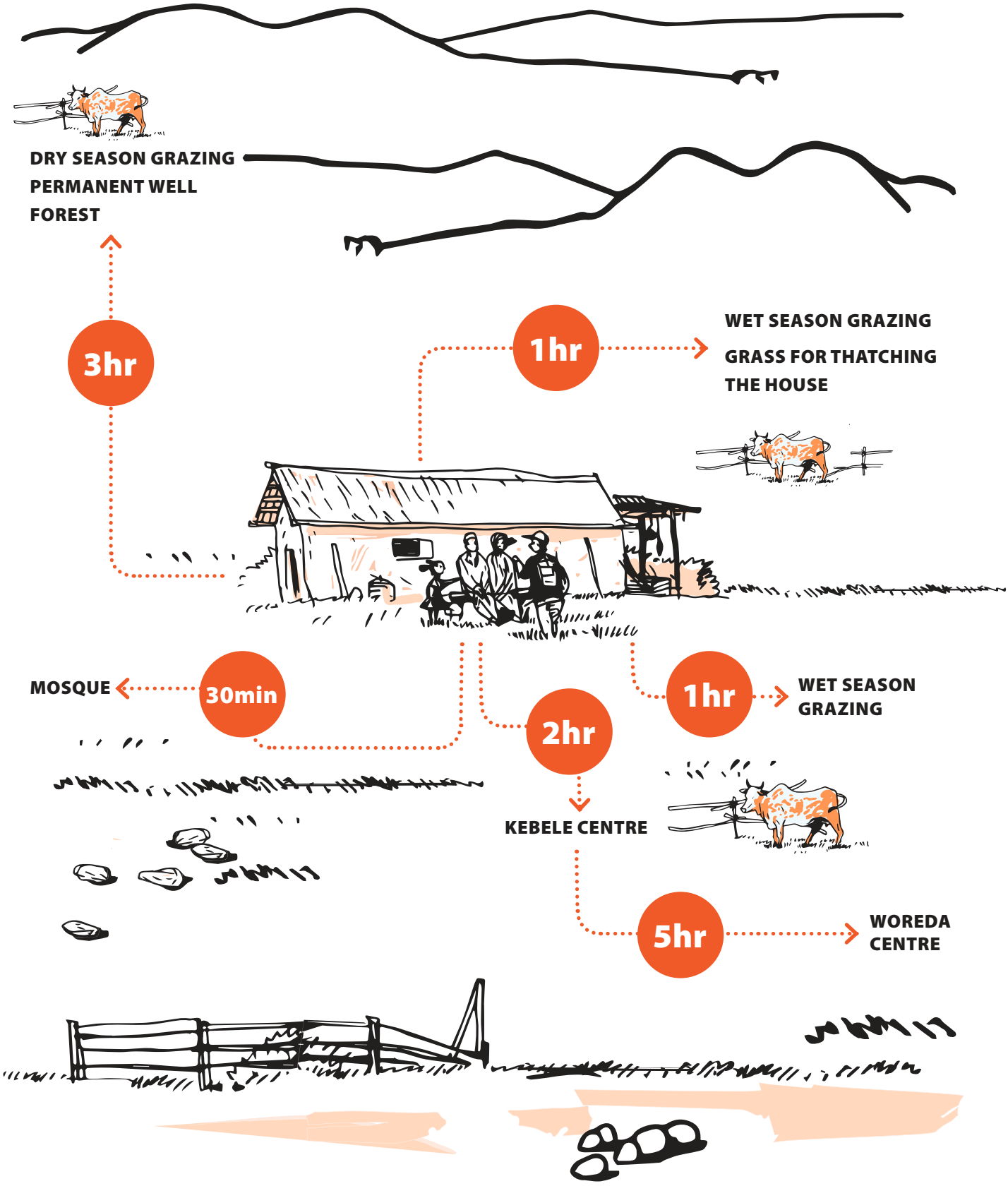


Figure 2-14.1 Map of a household's mobility

BOX 2-14-1 MAPPING MOBILITY

Mobility maps show where, why, and when people move and travel. Mobility information can include:

- Date and frequency of travel;
- Route, distance, and destination;
- Reasons for travel;
- Difference between men, women, boys, and girls;
- Travel routes linked to the flow of resources, including cash.

Mobility maps may be drawn to show the movement of different pastoral groups from different villages, or one group's movements. Individual or household mobility can also be shown.

Additionally, a mobility map can show which areas are most regularly visited and therefore may be under pressure and at risk of over-use. As a result, these may need special management or protection. Alternatively, the map can highlight which areas are not being visited often or at all, and therefore be under-used. It is important to find out the reasons for the mobility patterns and why some areas are visited more often than others. Solutions may then be identified to resolve any problems such as over-use, under-use, and conflicts over resource use.

- How long does it take (time, distance)?
- Who do you travel with? Why?
- Do you take anything with you when you travel to this place? Do you take anything with you when you come back from this place?
- Who from "outside" the community travels into this area and why?

The note-taker should make careful notes of all these movements and related discussions.

WORKSHEET 2-15

Mapping of Livestock Routes

OBJECTIVE

To **understand and document how livestock move** at different times of the year, how often and why; what services (if any) are provided along the livestock routes and their status; and whether any routes are being blocked.

OUTPUTS

A **map of livestock routes** and services in the woreda (and beyond woreda boundaries), with supporting written information.

PARTICIPANTS

Participants are different types of livestock keepers (including pastoralists) in the woreda and representatives from customary leaders.

The Rangeland Resource Sub-Team should lead this activity, but other WPLUP Team members can join if thought appropriate e.g. the Agriculture and Land Use Sub-Team, the Technical Land and Water Sub-Team, and the GIS Sub-Team (if the map is to be digitised).

HOW-TO-DO A MAP OF LIVESTOCK ROUTES

Livestock routes can be added to the natural resource map drawn in *Worksheet 2-7*. However, by doing so the maps can become over-messy and cluttered, so it is usually good practice to make a separate map on a clean piece of paper.

Often it can be difficult for livestock keepers from the community to draw the livestock routes directly on to a piece of paper, so as with previous participatory mapping exercises it is good to make a map first on the ground and then transfer the information on to paper. To commence the process, you should first ask the participants to draw some key landmarks on the ground, and then to draw the routes that they use to move livestock (including the reasons for moving livestock), and to show the key livestock resources such as grazing areas, watering points etc. Note – this mapping of livestock routes should be for the whole woreda, whereas the mapping that took place in *Worksheet 1-9* was only for the rangeland-grazing unit.

BOX 2-15-2 MAPPING LIVESTOCK ROUTES

An important aspect to consider in land use planning in rangelands is **how to incorporate and protect livestock routes** so that livestock and their herders can move through the area including through such as agricultural areas, without problems of and/or cause conflicts with other land users. Thus it is necessary to understand the patterns of mobility and the use of livestock routes both within and outside the area.

Mobility routes can be mapped for different livestock species, and maps can show seasonal usage and the provision of any holding or grazing areas, water points, dipping tanks, etc. along them.

Changes in livestock movement can be an indicator of drought – when unusual movements and/or increasing conflicts over livestock movement can occur.

Alternatively, and in order to provide more details on the livestock routes (including GPS readings) you can **draw the routes on to topographic maps (1: 50,000) or a satellite image**. Communities can participate in this process with some assistance. You could also show the different services such as veterinary posts, dipping tanks, water points, resting places along the routes – and make a note if they are functioning or not. All information can then be digitised as a GIS layer to be used with other GIS layers of information collected in the land use planning process.

Check list of **questions for the mapping exercise**:

- Where do you take your different groups of livestock (check whether all livestock goes together or if different groups of livestock go to different places)?
  This can include grazing areas, markets, water points, mineral areas etc.
- How often do you take your livestock here?
- Why do you take your livestock to these places?
- How long does it take (time, distance)?
- Who do you travel with? Why?
- Do you need permission to move with your livestock? If so, who gives you permission?
- Are there any services along these livestock routes e.g. water points, resting places, veterinary posts? Do you need permission to use these services? If so, who gives the permission? Do you need to pay for the services?
- Do you change your livestock routes and destinations in times of drought? How does this change?

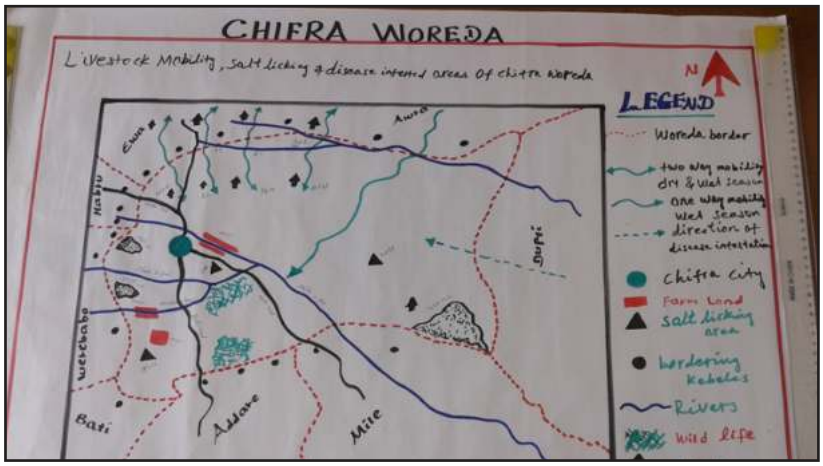


Figure 2.15-1a

Figure 2.15-1b

Figure 2.15-1c

Plate 2-15-1a Hand-drawn map of livestock movements **1b** Digitised map of livestock routes **1c** Government and community representatives mapping livestock routes on topographic maps prior to digitization [Credit: Fiona Flintan/ILRI]

- Do you ever face problems in moving your livestock? What problems are these? Do you ever face conflicts with other land users? How are these resolved?
- Does livestock ever come into the area from outside the community? Where does it come from, and why? Who gives permission for the livestock to come here?

The note-taker should make careful notes of all these movements and related discussions.

Livestock routes can also be mapped out on topographic maps and then digitized.

WORKSHEET 2-16a

Interviews

INTERVIEWS OBJECTIVE

To **obtain information from key informants** that will contribute to the development of a land use plan.

ANTICIPATED OUTPUTS

A **set of clear, concise responses** from those interviewed as input to land use planning.

PARTICIPANTS

Participants are key informants who are believed to hold particular information that would be useful for the planning process and/or are individuals who represent important stakeholders in the process but have not yet contributed to the information collection.

The Agriculture and Land Use Sub-Team should lead this activity, but other WPLUP Team members can join if thought appropriate e.g. the Rangeland Resource Sub-Team, the Technical Land and Water Sub-Team, and the GIS Sub-Team (if the map is to be digitised).

Interviews can provide the means of in-depth exploration and discussion with individuals. It is often useful to interview men and women separately to avoid domination of the interview by one or another. A fair representation of individuals should be interviewed: taking into account the divisions found in communities e.g. sex, age, wealth, jobs.

Interviews can be structured or semi-structured. **Structured interviews** have a list of questions, like a survey. **Semi-structured interviews** are more useful if in-depth exploration of a subject is required. The key questions need to be identified before the interview takes place. However, when asking the questions there should be flexibility and space for the respondents to take the interview off in a direction that they wish. This will allow the collection and exploration of issues that perhaps had not been pre-identified. At a suitable point it may be necessary to redirect the interview back to the key questions.

Questions should be clear and objective.
Ambiguous and leading questions must be avoided.

Remember!
It helps to start questions with:
Who? Why? What? When? Where? How?

Lead up to sensitive or important questions – when the respondent should be feeling more relaxed. Individual interviews should not take more than 1 hour. Group interviews should not take more than 2 hours.

> **Remember!**
> *Team make-up is important and it is useful to have one person asking questions; one taking notes; and one observing and checking. When interviewing women, there should be at least one woman on the team, though preferably all should be women. When focusing on land use issues, it is useful to have an inter-disciplinary team including a land use expert.*

Ensure that the setting for the interview is comfortable and at a time suitable for the respondents. Be relaxed; culturally sensitive; aware of one's own behaviour; and avoid acting the 'expert'. Try not to intimidate, but make people feel comfortable, open and relaxed!

Special issues to think about when interviewing women:

- Need for women on interviewing team
- There may be resistance from husband/men
- Finding a suitable time and place for the interview
- Women may be more easily distracted e.g. by their children
- Women are more easily intimidated – they may be shy and not aware of the value of their knowledge and contribution
- Strong women may dominate an interview
- Older, rural-based women can be illiterate or their understanding of a given situation is less: need for diagrammatic techniques and patience

INTERVIEWS

- **Plan your team**: identify everyone's roles
- **Identify your key questions**: but remember these may change or develop as the interview progresses. You should allow room for flexibility. Remember: it is helpful to start questions with Who…? What…? Why…? When…? How…?
- **Carry out the interviews**, bearing in mind the above points.
- **Take notes** during or immediately after the interview (a *tape-recorder* can be useful).
- **Analyse the notes** after the interview and identify any gaps or contradictory and conflicting information: if necessary carry out a second interview.

WORKSHEET 2-16b

Surveys

SURVEYS OBJECTIVE

To **obtain information from a large number of informants** through a structured set of questions that can be compared and analysed, and trends identified.

ANTICIPATED OUTPUTS

A **dataset of a relatively large number of responses** indicating the current situation, past trends etc.

PARTICIPANTS

A %age of the population relevant to the questions being asked.

The Agriculture and Land Use Sub-Team, the Rangeland Resource Sub-Team, the Technical Land and Water Sub-Team, and the GIS Sub-Team.

Surveys are useful tools to obtain important information from households, leaders of institutions and public post holders. The views from these stakeholders and participants of the survey can further be stratified based on the respondents age, sex and other socio-cultural attributes that relate to land use planning.

Surveys need to be guided by a key set of questions, and then the survey questions to ask the respondents will provide more details within these sets. The survey questions should flow well from one to another and do not jump around too much. **Keep the questions simple and structured** so that the respondent will give a clear answer – this answer could be single or multiple. If multiple the questionnaire will need to be structured to accommodate this. **Questions should not be leading** and use the starting word(s): *Who? What? How? How many? When? Which? Why?*

The information collected will be quantitative rather than the more qualitative data that is collected through semi-structured interviews.**The survey can be conducted through the use of paper questionnaires or electronically** using a system such as CAPI.

When the survey is ready to be carried out, **households should be selected randomly** using kebele lists of households. *Ensure that some female-headed households are included as well as male-headed households.* Inform those selected for interview ahead of the allotted day and time. Interviews can either be carried out by going house-to-house or they can be carried out by calling the selected community members to a central place e.g. the kebele centre. The same issues about how to carry out good interviews (as above) also apply here.

The responses collected from the survey will be triangulated with information from interviews and focus group discussions.

WORKSHEET 2-17

Resource benefit analysis

OBJECTIVE

To **identify who uses, benefits from, and makes decisions** about which land and/or natural resources.

ANTICIPATED OUTPUTS

Case study examples of how households use different land and resources, who benefits and who makes decisions about them.

PARTICIPANTS

Participants are case study individuals from different types of users in the woreda including representatives from customary leaders.

HOW-TO-DO A RESOURCE BENEFIT ANALYSIS

1. **Decide on the topic** that you want to discuss with the community members or household. Do you want to ask about land use/access or a set of resources; or do you want to ask about a particular resource e.g. a tree or plant? If you want to ask about a resource, what do you want to know about it?
2. **Make a table listing the different land uses or resources** used by a household. If looking at different land uses then this could include grazing, agriculture, forests, land for grass collection etc. If looking at different resources this could include such as a palm or other type of tree, a particular type of grass, or different types of livestock (cattle, camel, goats). You can either look at the different sets of resources that a household uses, or you can look at one particular resource in detail. For example, if it is a cow – you can split this up into meat, milk, hide, other.
3. **Ask key questions** concerning the use of the land, the sets of resource or the individual resource: Who in the family uses the land or the resource? Who decides how it is used? Who collects or gathers it? When is it collected or gathered? Where is it collected or gathered from? Who decides how it is used? Who decides to sell it? Who decides how to spend the money?
4. **Fill out the table** by asking these questions for each type of land or resource (or part of resource).

BOX 2-17-1 RESOURCE BENEFIT ANALYSIS

At a household level the use, access, decisions about and benefits from different resources can be explored through a resource benefits analysis chart. It opens up opportunities to **analyse the different relationships that men and women have with natural and other resources and the related processes of control and decision-making**.

Researchers should be mindful of the gender divisions of access, roles, responsibilities and rights negotiated at different levels as they influence use, access and control. *The different knowledge and values that men and women have for different resources can also be explored.*

Below find an example of a resource benefit analysis for a cow:

Table: 2-17-1 Example of a Resource Benefit Analysis

Product or part of the cow	Who collects or accesses it?	Who controls access?	Who uses it?	Who controls its use?	Who controls money if sold?	How is it inherited?
Live animal	Man	Man	Man and woman	Man	Man	Man to son
Meat	Man and woman	Man	Man and woman	Woman	Woman	N/A
Milk	Woman	Man	All family	Woman	Woman	N/A
Cheese	Woman	Woman	All family	Woman	Woman	N/A
Hide	Man	Man	Woman	Woman	Woman	N/A
Intestines	Woman	Man	Woman	Woman	Woman	N/A

WORKSHEET 2-18

Livestock data collection including census

OBJECTIVE

To **collect data on livestock** in the woreda in order to inform land use planning in the future.

ANTICIPATED OUTPUTS

Data on livestock numbers, and types and **trends of livestock sales and deaths**.

PARTICIPANTS

Rangeland Resource Sub-Team and the Agriculture and Land Use Sub-Team.

Livestock data that can be assessed for land use planning:

- Livestock types and numbers of livestock/TLU.
- Livestock production systems.
- Types of feed and feed resources.
- Constraints and opportunities in livestock resources.
- Area coverage of grazing lands.
- Numbers of livestock per household/TLU per household.
- Feed requirement gap depending on TLU.

Remember!

Figures on how many livestock and the different types may already be available in the woreda livestock office or CSA – if these are not available then a livestock population census can be carried out.

BOX 2-18-1 TROPICAL LIVESTOCK UNITS

Animals are often counted as tropical livestock units (TLU).

Camels = 1 TLU	**Cattle = 0.7 TLU**
Sheep/goats = 0.1 TLU	**Horse = 0.8 TLU**
Mule = 0.7 TLU	**Ass = 0.5 TLU**
Pig = 0.2 TLU	**Chicken = 0.01 TLU**

1 TLU = one animal with a body weight of 250kg.

BOX 2-18-2 WHY DO YOU NEED TO KNOW LIVESTOCK NUMBERS?

Knowing the livestock numbers is helpful **for better understanding if the carrying capacity of a given piece of land is being exceeded** or not. However identifying the carrying capacity in a dryland environment is very complex as the grass and fodder is distributed unequally, and goes up and down according to rainfall. In a temperate environment it is reasonable easy to predict when rainfall will fall, so resources are more predictable and can be more easily tracked and used. If livestock numbers exceed the carrying capacity of the land then either more resources are needed to be found or numbers reduced.

However in arid areas with high rainfall variability, it is very difficult to predict rainfall and tracking and use of resources is more difficult. Therefore it *may be better for numbers of livestock to be kept below what could be accommodated* for so that is there is drought for example, there will be less loss. However, some would argue that this means not making the most of the resources available as in a good year there will be forage (grass) left over. As such **the concept of carrying capacity is best used in areas where vegetation and rainfall is NOT variable** and resources/vegetation is more constant. Further the concept of carrying capacity is really only suitable for cattle and not sheep or goats.

Though the concept of "carrying capacity" and set figures for the amount of livestock that can be accommodated in a piece of land are not so relevant to semi-arid and arid areas in particular and drylands in general, it is still useful to know livestock numbers. To accommodate for the rise and fall of livestock and its reliance on variable vegetation/rainfall over different years, **livestock populations should be measured in both 'good' and 'bad' years**.

These issues are discussed in more detail in *Worksheet 2-30 Livestock Population Numbers, Stocking Strategies and Carrying Capacity*

HOW-TO-DO A LIVESTOCK POPULATION CENSUS

- **Identify the approximate numbers of livestock herders** (mixed crop-livestock and pastoralists) in the woreda, and their distribution across Kebeles.
- Identify an appropriate proportion of the total livestock herder population, and randomly **identify respondents** to ensure good representation of respondents.
- **Fill out the following Livestock Population Census** form with each respondent. An average can then be calculated. Additional questions can be asked about trends in livestock-keeping.
- Add-up and **analyse the data**.

LIVESTOCK POPULATION CENSUS				
Location:		Kebele registered		
Ethnic group:		Number of people in households		
Given name		Men over 50 years		Women over 50 years
Family name		Men between 20-50 years		Women between 20-50 years
Origin		Men between 12-20 years		Women between 12-20 years
Phone		Boys under 12 years		Girls under 12 years
Type	**No. owned**	**How many did you sell last year?**	**How many did you buy last year?**	**How many died during the last year?**
Bull/oxen				
Local cow				
Crossbred cow				
Local calve/heifer				
Sheep male>1year				
Sheep female>1 year				
Lambs < 1 year				
Goat male >1 year				
Goat female > 1 year				
Kids > 1 year				
Donkeys				
Horse				
Mule				
Young camel > 1 year				
Camel < 1 year				
Poultry				
Beehives				

What challenges do you face in finding grass or browse for your livestock? Tick the following:					
Not enough grass	Not enough browse	Invasive species	Bush encroachment	Enclosures	Blocked livestock routes

How far do your livestock travel every day in dry (and wet) season?			
Cows	Sheep	Goats	Camels

INTERVIEWER: **DATE:**

Keep these numbers for later analysis including within *Worksheet 2-30*.

WORKSHEET 2-19

Agronomic data collection – Background information sheet

OBJECTIVE

To **collect data on crops grown** in the woreda in order to inform land use planning in the future.

ANTICIPATED OUTPUTS

Data on crops and types, and **trends of crop disease, pests, harvest yields etc.**

Figures on crops grown, harvest/ yields, pest and diseases may already be available in the woreda agricultural office or CSA.

PARTICIPANTS

Agriculture and Land Use Sub-Team.

Crop production data that can be assessed for land use planning:

- **Biophysical data** (climate, temperature, rainfall, LGP – see Land Capability Assessment *Worksheet 2-6b*).
- **Major crops** cultivated (including whether irrigated or not, or whether annual/ perennial).
- **Production and productivity** (including area of coverage of crop type, crop variety used – local/hybrid, use of fertiliser or pesticide or herbicide).
- Current **agronomic practices** (including land preparation and tillage practices, planting time, planting method, weed control, harvesting, storage).
- **Soil fertility management** practices (multiple cropping, mono-cropping, inter-cropping, crop rotation, use of fertilisers or crop residue or manure).
- **Cropping pattern** – the yearly sequence and spatial arrangement of crops and fallow on a given area.
- **Water use** and moisture conservation practices – use of irrigation, water harvesting practices.
- **Agricultural support services** – agricultural extension, research, input supply, marketing, processing.
- **Problems and constraints** e.g. major crop diseases, weeds, drought, hazards such as flooding and frost.
- **Production challenges** such as storage, markets, etc.

Crops can be classified as the following:

- **Cereals** – wheat, barley, sorghum, teff, maize, millet etc.
- **Pulses** – faba bean, field pea, haricot bean, soyabean etc.
- **Oil crops** – mustard, linseed, sesame seed, sunflower etc.
- **Fruit crops** – banana, orange, pineapple, coconut etc.
- **Vegetables** – potato, tomato, cassava, onion etc.
- **Special purpose** – green manure (e.g. put nitrogen back into the soil), feed crops.
- **Fibres** – sisal, cotton, etc.
- **Stimulant crops**
- **Commercial crops**
- **Irrigated crops**

Remember!
"Agronomy" is the 'art and science' of field crop production and management. It will include things such as crops, plant breeding, soil science, crop protection (weed control, disease and pest control).

FACTORS AFFECTING CROP PRODUCTION

1. **Environmental** factors
   - Climate (temperature and rainfall).
   - Growing period.
   - Water–food, drainage, moisture.
   - Frost (in highland areas only).
   - Soil including texture, chemical properties (e.g. pH), fertility of soil, depth as well as root growth or system of crop.
2. **Chemical** environments
   - Pollution from soil, water or air.
3. **Biological** environment
   - Weeds, diseases, insect pests.
4. **Socio-economic** factors
   - Consumption preference i.e. what people like to eat.
   - Living standards (e.g. will influence what inputs such as fertiliser, are available).
   - Transportation.
   - Income level.
   - Market access.
   - Storage.

5. **Crop** factors
6. **Seed quality** (viability, purity, healthiness, size, uniformity/sameness).
7. **Genetic** factor (quality, yield potential, environmental adaptation, tolerance to environment); and nutritional value including protein and/or gluten content.

AGRO-CLIMATIC ZONES

Knowing what your agro-climatic zone is, will give you a good overall starting-point for planning land uses. **Both altitude and rainfall influence agro-climatic zones**.

Once you know your *altitude* and *mean annual rainfall* (e.g. with information from the local meteorological office) you can see which zone you are. For example, if the local rainfall is < 900mm and the altitude is 800 m then you must be in the *Dry Kolla zone*.

The rainfall categories, cut across altitude levels, give three agro-climatic zones (*rainfall category + altitude layer)*. In the example above these could be:

- Dry Kolla
- Moist Kolla
- Wet Kolla

Table 2-19-1 Calculating agro-climatic zone in Ethiopia

Altitude layers	Rainfall categories
- **Alpine wurch** – higher than 3,700 m above sea level - **Wurch** – 3200-3700 m - **Dega** – 2300-3200 m - **Weyna Dega** – 1500-2300 m - **Kolla** – 500-1500 m - **Bereha** – below 500 m	- **Dry** – less than 900 mm of rainfall/year - **Moist** – 900-1400 mm of rainfall/year - **Wet** – more than 1400 mm of rainfall/year

WORKSHEET 2-20

Stakeholder, institutions and relationship mapping

OBJECTIVE

To **understand which different groups, parties and individuals have an interest in land and different land uses**, what their roles are, and what is the relationship between them.

ANTICIPATED OUTPUTS

A **diagram** showing the different stakeholders and groups, and relationships between them, with background information.

PARTICIPANTS

A focus group including representatives from different members of the community, led by the Agriculture and Land Use Sub-Team.

HOW-TO-DO INSTITUTION, STAKEHOLDER AND RELATIONSHIP MAPPING

Prepare pieces of card cut into different sized circles (3 or 4 sizes). It can be useful to use two colours: one for organisations and institutions within the community and another for 'external' organisations and institutions.

Ask the group to determine the criteria for the importance of an organisation and to rank the groups according to these criteria. Write the name of the organisations or put a symbol on the appropriately sized circle. Do not ask them to list all the organisations in a community, but only those that are the most relevant or important, to them in relation to land use and land use decision-making processes. The size of circle should correspond to the importance of an organisation to the group.

Arrange the circles on the paper so they are placed in relation to their closeness to the community. Lines can then be drawn between the circles to show the different types of relations between the organisations. These can include:

- **Thick solid** line for a strong relationship.
- **Thin dotted** line for a weak relationship.
- A **broken** line (with a gap in the middle) for a broken relationship.
- A **zig-zag** line for a conflict.

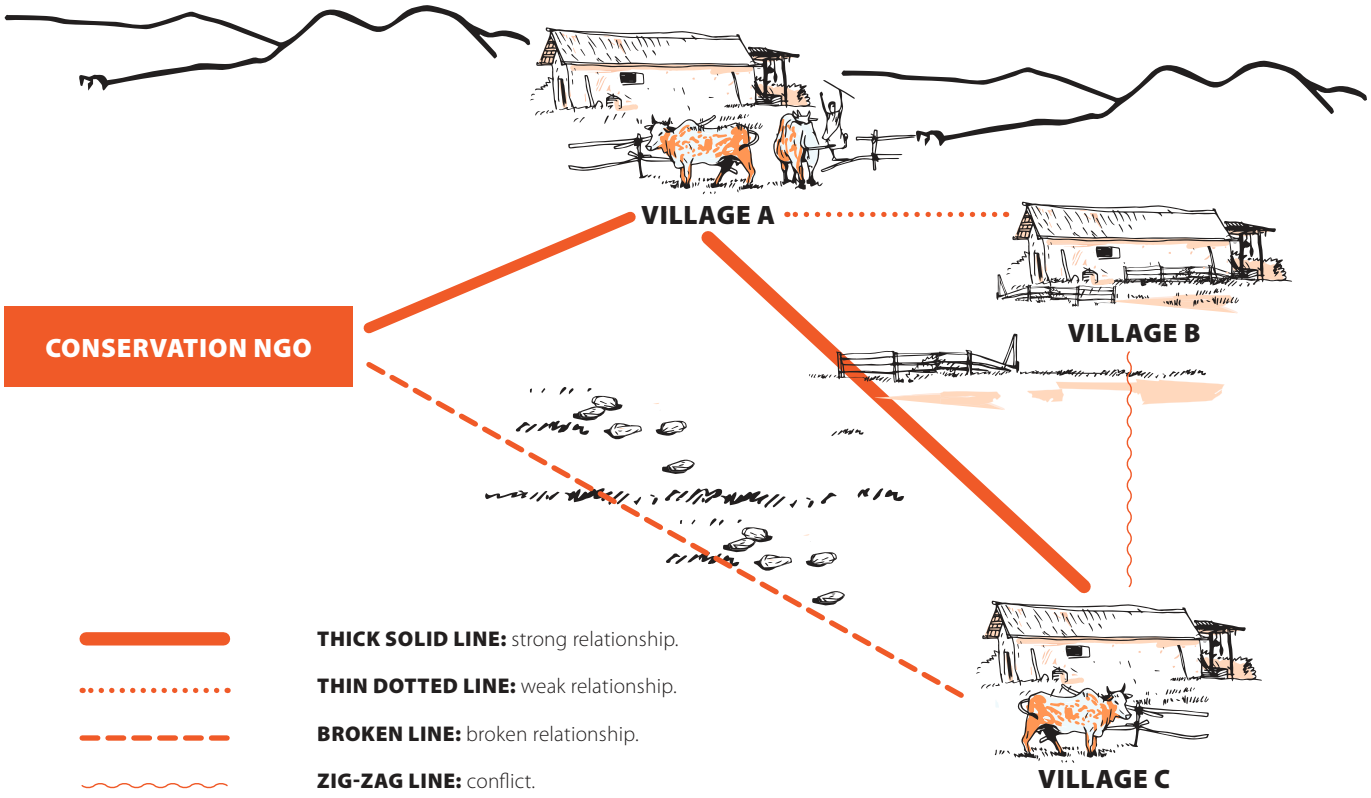


Figure 2-20.1 An example of Relationship Mapping

BOX 2-20-1 INSTITUTION, STAKEHOLDER AND RELATIONSHIP MAPPING

In order to **understand what stakeholders are involved in land use making decisions at the community level**, a stakeholder and relationship mapping can be carried out. This tool helps a facilitator to understand the roles of local organisations and the perceptions that people have about them. It shows which institutions are the most important, which have the respect and confidence of women and men, and who participates in and is represented by which ones. It also helps to identify what outside groups work with which community groups, NGOs or government and which groups can effectively engage in sustainable development and pastoral activities.

WORKSHEET 2-21

Review of national and regional policies, strategies, legislation and other documents

OBJECTIVE

To **ensure that the WPLUP accommodates and reflects national and regional policies**, strategies, legislation and other documents.

ANTICIPATED OUTPUTS

A **summary of key points from national and regional policies**, strategies, legislation and other documents that are relevant for woreda PLUP in pastoral areas.

PARTICIPANTS

The Coordination and Facilitation Sub-Team will lead this activity. It may be necessary to consult and/or interview key informants.

National and regional policies, strategies, legislation, and other documents support the development and implementation of WPLUPs. It is important to recognise these, and their relevance for the WPLUP process.

In addition, **WPLUP can help fulfil the commitments of both national and regional governments** in their national or regional plans and strategies for better, more integrated development planning processes, which is decentralised and participatory.

A review of these documents is a useful activity for setting the WPLUP process in a wider political, socio-economic context. Some useful documents include the following.

Table 2-21-1 Policy, strategies legislation and other documents relevant for land use planning

Policy, strategies, legislation, or other documents	Summary
Regional development and land use plans and maps	Available from some regional governments these indicate the land use and development priorities in the region
Investment plans and maps	Available from the Land Investment Agency, these plans and maps will give an indication as to which land in the woreda and in neighbouring woreda is meant to be for commercial investment.
FAO/LUPRD 1984	1979-1983 Country level land use plan scale 1:1,000,000 and area level studies 1983-1986 in selected areas of country at different scales.
Agricultural development and use plans	Integrated river basin development programs, irrigation based agriculture and forage development, commune development plans and zone-level land use plans should all be considered here.
Federal Ministry of Water, Irrigation and Electricity Water Sector Development Program	Development of major programs based on River Basin studies.
Federal Land Administration and Use Proclamation No. 456/2005	Mandates the establishment of a focused systematic study of problems on land administration and land use for recommending solutions, based on guiding land use plans.
Regional land policies and legislation	Federal and regional land administration and use proclamations.
Growth and Transformation Plan	Five year long national plan to improve Ethiopian economy through a projected increase in GDP
Climate Resilience Green Economy (CRGE) strategy	A strategy that focuses on agriculture, power, deforestation, transportation sectors to achieve a middle-income status by 2025
Road building plans	Roads Authority
Woreda risk profiles	Many woredas have developed woreda risk profiles – these can be an important source of information and guidance.
Strategic Road Map for National and Regional Rural Land Administration and Use System	Ministry of Agriculture (MoA)
Integrated Land Use and Policy Roadmap	MoA
National Biodiversity Strategy and Action Plan	Institute of Biodiversity Conservation (IBC)
FDRE Rural & Agricultural Development Policy & Strategy	MoA
Realising REDD+ National strategy and policy options	MoA
FAO, 2012. National Strategy and Action Plan for the Implementation of the Great Green Wall Initiative in Ethiopia	MoA
Environmental Policy of Ethiopia	
Ethiopian Water Sector Policy	MoWIE
Ethiopia's Agricultural Sector Policy and Investment Framework (PIF)	MoA
Ethiopian Water Resources Management Policy	MoWIE
The National Population Policy of Ethiopia	The Office of the Prime Minister (OPM), the Office of Population (OP)

WORKSHEET 2-22

Prepare the current woreda land use map

OBJECTIVE

To **produce a woreda land use map** illustrating the current land use.

ANTICIPATED OUTPUTS

A **map** of current land use.

PARTICIPANTS

Coordination & Facilitation sub-Team; woreda land use experts; and the GIS Mapping Team.

A current land use map is **a combination of the village base map, with land uses and resources identified in the previous Steps, and observation and details from groundwork using GPS**.

Current land uses as defined through the PRA etc. must be measured and digitised.

1. **Organise a meeting** for the full woreda PLUP Team meets to agree on what information is currently available and what might still need to be collected and/or verified in the field to produce the woreda land use map. This meeting should include all sub-Teams including the GIS Mapping Team.
2. The GIS Mapping Team will **geo-reference the woreda base map produced previously with actual features in the village**. It may be necessary to visit different features in the woreda and take GPS readings. Features must be labelled and coloured, and a key provided.
3. Areas (acreage), length and percentage of various land uses and resources such as agriculture, grazing land, social facilities, forestry, water bodies and residential are **mapped and calculated by using computer-based GIS software** and recorded.
4. A first **draft of the village existing land use map is printed** and presented to the WPLUP Team for sharing, comments and finalised.

Table 2-22-1 Table of example coordinates of features for the map

Name of woreda:				
No.	Land Use	Explanation	W (coordinate)	E (coordinate)
1	Residential/farms	End of residential area and beginning of farming area	9236725	0456789
2	Dispensary (social services)	Dispensary in Kwaga village – about 2 acres	9239654	045601
3	Water source (well)	Water well surrounded by sorghum farms	9239985	0456292
4	Rangeland/farms	End of farming area and beginning of rangeland	9236900	0456900
Etc.	Etc.	Etc.	Etc.	Etc.

Note: coordinates should be in a range for polygons, such as farms, resident areas, and a single coordinate for point features, such as water points.

Remember!

With improvement in technology, it is now possible to acquire GPS (mobile computers) e.g. Trimble GPS; which record point coordinates automatically; and at the same time drawing land use polygons requiring only entry to legend to produce and download land use maps.

WORKSHEET 2-23

Identifying problems through use of a problem tree

OBJECTIVE

To understand and **get to the root of the problems** that communities and other stakeholders face in relation to land and land use, in order that these root problems can be recognised and addressed in the land use planning process.

ANTICIPATED OUTPUTS

A **diagram and background information** on the problems that communities and other stakeholders face.

PARTICIPANTS

The Coordination and Facilitation Sub-Team will lead this activity, with assistance from the Rangeland Resources Sub-Team and the Agriculture and Land Use Sub-Team. The participants should be a mixed group of stakeholders from the woreda including one representative from each kebele, pastoral groups, women, youth and other stakeholders.

This Activity can be done with the following Activity of Ranking Problems (*Worksheet 2-24* and will be built upon in the Solution Tree *Worksheet 2-25*).

HOW-TO-DO A PROBLEM TREE AND ANALYSIS

Draw a tree with large branches and roots. The trunk represents the problem and the roots represent the causes. *You may need several of these trees* if you are going to look at several different problems. If the group of participants is large you can divide up the group into around 8-12 participants, who can each take a problem to analyse.

Ask the participants what are the key problems that they face in using land and resources in the woreda. You will already have a good idea of what these are from the information collected during the Land Capability Assessment and the Socio-Economic Data Collection – you can prompt the community with problems that were identified in these.

Take one key problem and write this on a card and place it on the trunk of the tree.

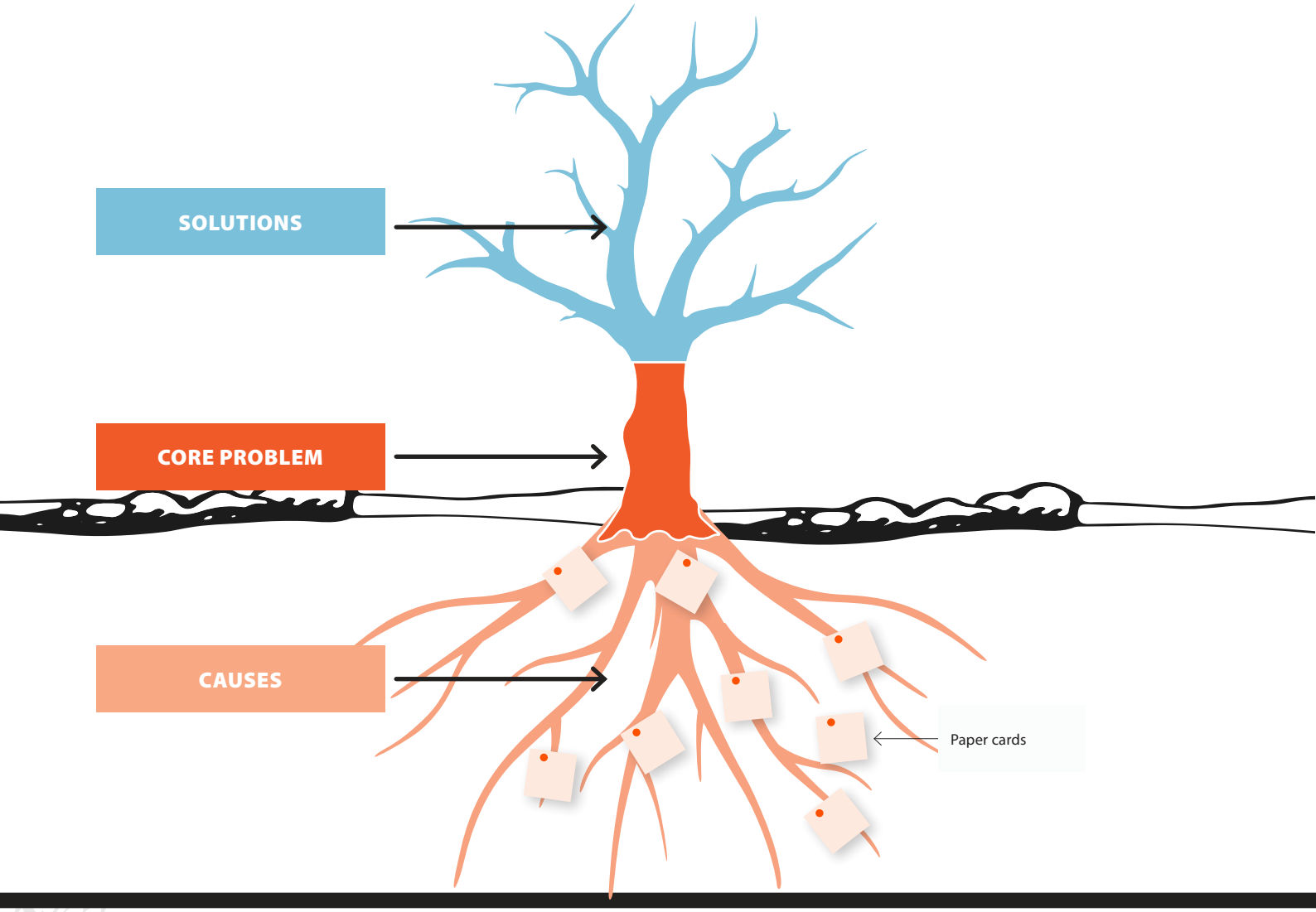


Figure 2-23-1 Diagram of Problem Tree: root section (causes)

Then **ask the participants what are the causes of this problem**. As causes are identified start to note these on pieces of card. Help the participants to place these cards so that major causes come first, and then these are broken down into more detailed causes, leading to a series of smaller or 'root' causes. When physically trying to address problems, it is good practice to tackle these root causes first because by doing so there is more chance that the causes above, and consequently the problem, will be resolved. If one tries to tackle the surface causes without tacking the root causes, the impact may be small and the problem may continue to re-occur.

Paste the pieces of paper on the roots of the tree showing a 'chain' of causes: with the root causes at the very bottom. A useful way of achieving this is to keep asking "But why?" after each explanation.

From the root causes we should be able to establish points of intervention and solutions that can be incorporated in the land use plan, prioritizing problems (and possible solutions) accordingly.

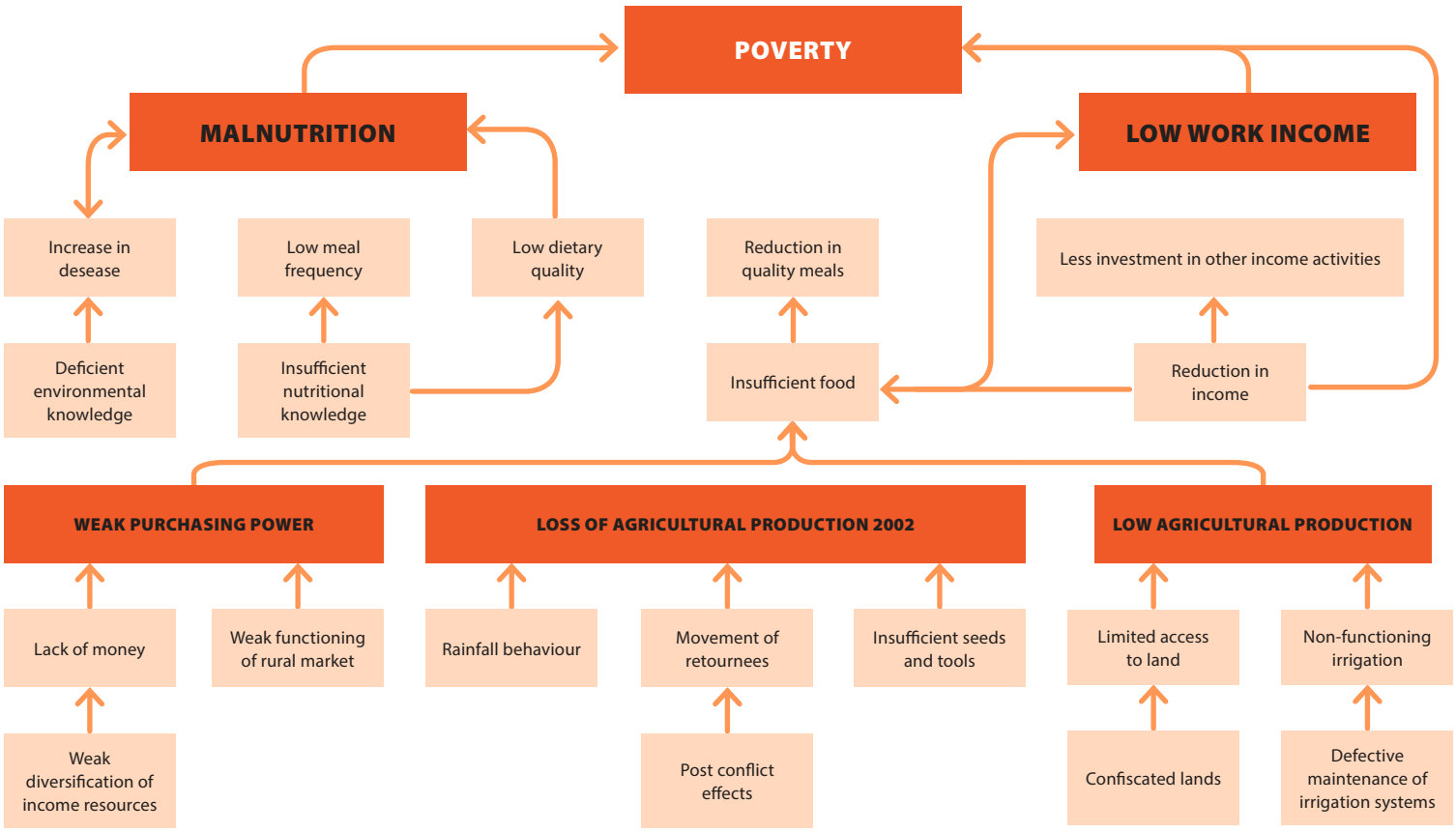


Figure. 2.23.2 Source FAO *http://www.fao.org/docrep/008/y5815e/y5815e0b.htm*

BOX 2-23-1 A PROBLEM TREE

Using a Problem Tree **can help identify concerns and their causes, whilst also prioritising problems**. It helps to break-down problems to root causes. Using this participatory tool gives greater opportunity for participants to voice their opinions, so that at least their problems are discussed and perhaps, also acted upon.

As with all participatory tools, make sure that a good representation of the exercise is made.

After the Problem Tree has been completed the same **participants can now rank the Problems** as described in *Worksheet 2-14*.

For some examples see above.

WORKSHEET 2-24

How to carry out a ranking (prioritisation) of problems

OBJECTIVE

To **prioritise land use problems** in a participatory way, as a basis for making decisions in the woreda land use plan.

ANTICIPATED OUTPUTS

A **list of problems prioritised/ranked** by community members.

PARTICIPANTS

The Coordination and Facilitation Sub-Team will lead this activity, with assistance from the Rangeland Resources Sub-Team and the Agriculture and Land Use Sub-Team. The participants should be the same mixed group of stakeholders that participated in the Problem Tree exercise (*Worksheet 2-23*) (i.e. a mixed group from the woreda including one representative from each kebele, pastoral groups, women, youth and other stakeholders).

It is best if this Activity follows on from the previous Activity - the Problem Tree – *Worksheet 2-23.*

HOW-TO-DO RANKING (PRIORITISATION) OF PROBLEMS

1. Ask participants to **divide into groups (4-5 people)**. Ask one to lead the activity asking questions and writing the responses.
2. Key problems will have been identified in the previous activity – The Problem Tree (*Worksheet 2-23*) – **use these key problems in this Ranking Exercise**.
3. For the different problems, **identify the main negative impacts** of these problems. Produce between 8-15 impacts.
4. Each group should then **draw a matrix on flipchart paper** with the key problems across the top (on the first row as heading) and the impacts down the side in the first column (for an example see below – Table 2-23-1).
5. Informants should then be asked to **score against the different boxes in each row i.e. giving value to the different problems and their impacts**. They should score out of 10 – with the higher number being given to a more direct relationship between the two. For example, if the problem of 'loss of dry season grazing areas' has a high impact on 'poor animal health' then a score of 8-10 should be given. Or if 'lack of livestock water' has only a small and indirect impact on human health through less livestock products e.g. meat or milk being available, then the score should be between 1-3.

Plate 2-24.1 Using participatory rural appraisal tools engaged communities in the development of the WPLUP in Chifra

6. The **columns are then totaled up** to provide overall scores.
7. It may be necessary to **weight certain impacts if it is felt that some impacts are far more important than others**: for example, impact on 'poor health of humans' may be weighted more heavily than 'displacement of livestock to other woreda'.
8. **Copy the final table** onto paper.
9. You can also consider the different decision-making processes that occurred during the exercise.

As with all participatory tools, *make sure that a good and representative copy is made* of the exercise.

See an example of a problem ranking in Table 2-23-1.

Table 2-23-1 An Example of a Ranking of Land Use Problems

IMPACTS OF THESE PROBLEMS	LAND USE PROBLEMS										
	Loss of dry season grazing	Loss of wet season grazing	Blocked migration routes	Loss of forests	Increased invasive species	Soil erosion in fields	Reduced crop harvests	Rangeland degradation	Lack of livestock water	Lack of drinking water	Unplanned settlements
Poor health of animals	9	5	7	2	10	2	4	5	5	0	3
Death of animals	10	3	4	3	5	2	4	5	5	0	3
Poor health of humans	1	1	1	2	3	2	5	1	1	7	0
Death of humans	1	1	1	2	1	2	3	1	1	3	1
Loss of household food	2	2	2	3	1	2	8	3	2	0	1
Loss of income	3	3	5	3	3	3	3	3	3	1	1
Conflicts between farmers & herders	7	6	8	4	6	4	4	5	5	0	7
Movement of livestock to other woreda – displacement	9	7	8	4	8	1	1	6	7	0	5
Total scores	**42**	**28**	**36**	**23**	**37**	**18**	**32**	**29**	**29**	**11**	**21**

BOX 2-24-1 MATRIX RANKING

Matrix ranking and scoring is a tool that helps priortise problems and/or preferences of different community members. It allows for easy comparison of different people's priorities.

Many people's priority problems are those related to the day-to-day struggle to meet basic needs. Some problems and issues are related specifically to land use, such as access to and control of key resources. Matrix ranking provides space for communities to establish criteria for problems or preferences in the use of resources that can be used to rank them.

The exercise in itself offers a good forum for discussion and exploration of the issues.

WORKSHEET 2-25

How to identify solutions through a solution tree

OBJECTIVE

To understand and **identify potential solutions for problems** that communities and other stakeholders face in relation to land and land use, in order that these solutions can be targeted in the land use planning process.

ANTICIPATED OUTPUTS

A **diagram and background information** on potential solutions to the problems that communities and other stakeholders face.

PARTICIPANTS

The Coordination and Facilitation Sub-Team will lead this activity, with assistance from the Rangeland Resources Sub-Team, and the Agriculture and Land Use Sub-Team. The participants should be a mixed group of stakeholders from the woreda including one representative from each kebele, pastoral groups, women, youth and other stakeholders.

This Activity can be done following the identification of problems (*Worksheet 2-23*) and ranking (*Worksheet 2-14*) of Problems. You can use the same problem tree(s) that were used in the Problem Tree exercise – but here you will be working upwards (on the leaves) to solutions to problems.

HOW-TO-DO A SOLUTION TREE AND ANALYSIS

Return to the Problem Tree(s) drawing in exercise (*Worksheet 2-23*. Now you can identify solutions to these problems working upwards (instead of downwards). However, you may also have decided on some new problems that will require a new tree to be drawn. If the group of participants is large you can divide up the group into around 8-12 participants each who can each take a problem/solution to work on.

Ask the participants to **identify solutions to the problems that have already been identified** – one set of solutions for each problem. As solutions are identified start to note these on pieces of card. Help the participants to place these cards so that major solutions come first, and these are broken down into more detailed solutions that interventions can more easily target. You may find that the same solution(s) can help resolve several problems at the same time.

Paste the pieces of paper on the branches of the 'tree' showing a line of solutions: with the most detailed solutions at the very top of the branches. A useful way of achieving this is to keep asking "But how?" after each explanation.

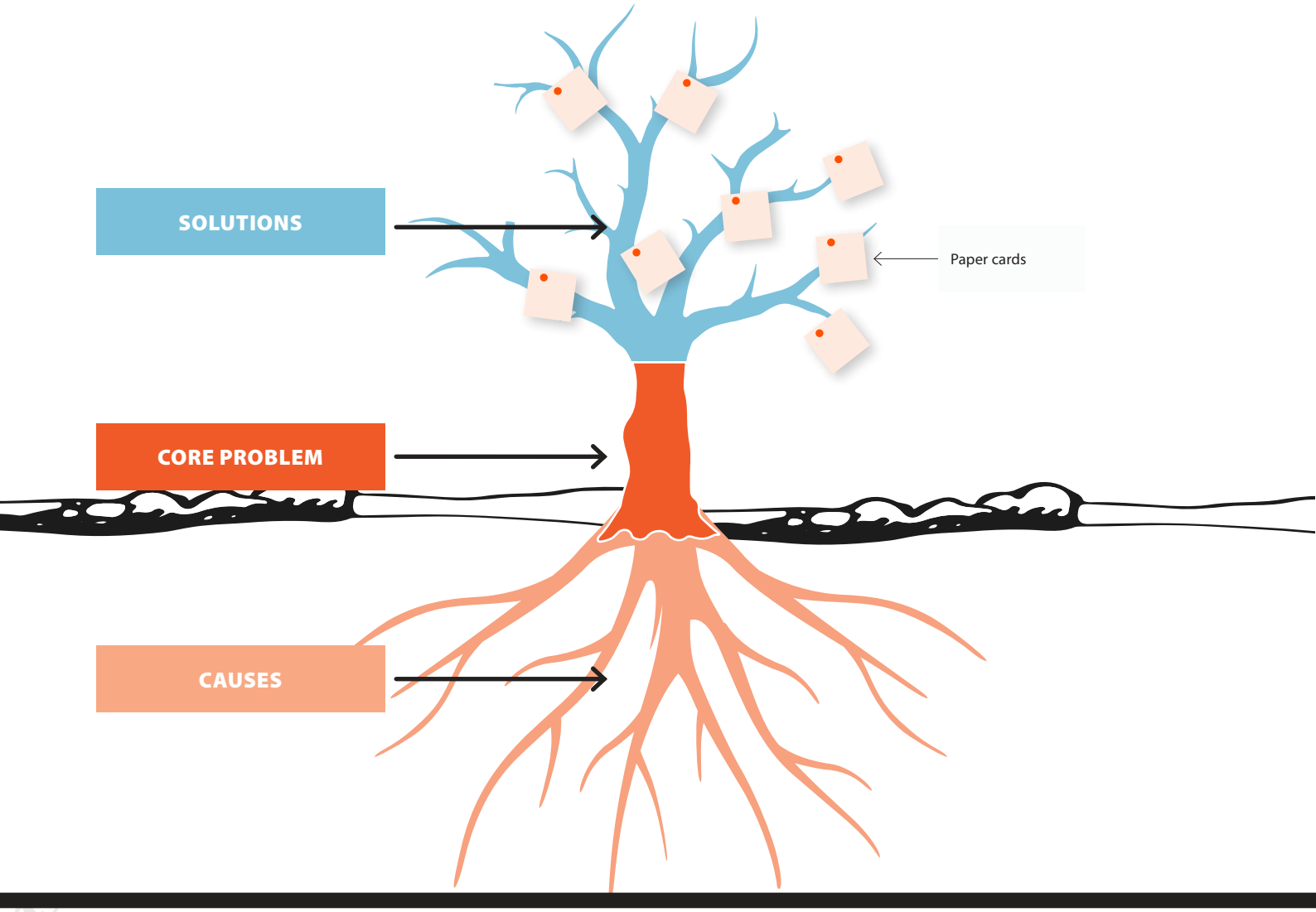


Figure 2-25-1 Diagram of Problem Tree: upper section (solutions)

BOX 2-25-1 A SOLUTION TREE

Using a Solution Tree can help **identify potential solutions** to the problems and their causes that communities and other stakeholders face in land use planning, whilst also prioritising these. Using this participatory tool gives greater opportunity for participants to voice their opinions, so that at least their solutions are discussed and then also acted upon.

From the solutions you should be able to **establish points of intervention in the land use plan**, prioritising these accordingly.

As with all participatory tools, *make sure that a good representation of the exercise is made.*

After the Solution Tree has been completed the same participants can now carry out a SWOT Analysis of the different solutions (*Worksheet 2-28*) and Scenario Planning (*Worksheet 2-27*) and then rank the solutions as described in *Worksheet 2-26*.

For an example see above.

WORKSHEET 2-26

How to carry out a ranking (prioritisation) of solutions

OBJECTIVE

To **prioritise solutions for land use problems** in a participatory way, as a basis for making decisions in the woreda Land Use Plan.

ANTICIPATED OUTPUTS

A list of **solutions to different problems prioritised and ranked** by community member.

PARTICIPANTS

The Coordination and Facilitation Sub-Team will lead this activity, with assistance from the Rangeland Resources Sub-Team and the Agriculture and Land Use Sub-Team.

The participants should be the same mixed group of stakeholders that participated in the Solution Tree exercise (*Worksheet 2-25*) (i.e. a mixed group from the woreda including one representative from each kebele, pastoral groups, women, youth and other stakeholders).

It is best if this Activity follows on from the previous Activity – the Solution Tree – *Worksheet 2-25*.

HOW-TO-DO RANKING (PRIORITISATION) OF SOLUTIONS

1. Ask participants to **divide into groups (4-5 people)**. Ask one to lead the activity asking questions and writing the responses. Key solutions will have been identified in the previous activity – The Solution Tree (*Worksheet 2-25*) – use these key solutions in this Ranking Exercise.
2. For the different solutions, **identify the main positive impacts** of these solutions. Produce *between 8-15 impacts*.
3. Each group should then **draw a matrix on flipchart paper** with the key solutions across the top and the impacts down the side (for an example see below – Table 2-26-1).
4. Informants should then be asked to **score against the different boxes in each row i.e. giving value to the different solutions and their impacts**. They should score out of 10 – with the higher number being given to the more direct relationship between the two. For example, if the solution of mapping and protecting livestock routes has a high impact on 'reducing animal deaths' then a score of 8-10 should be given. Or, if a 'zoning of land uses' has only a small and indirect impact on human health through more agriculture being available, then the score should be between 1-3.

BOX 2-26-1 MATRIX RANKING

Matrix ranking and scoring is a tool that helps us **learn about the most important solutions to problems and/or preferences of different community members**. It allows for easy comparison of different people's priorities.

Some solutions will target and resolve several problems at a time – so they should be consolidated accordingly. Matrix ranking provides space for communities to establish different impacts of solutions or preferences in the use of land and resources that can be used to rank them.

The exercise in itself offers a good forum for discussion and exploration of the issues.

5. The **columns are then totalled up** to provide overall scores.
6. It may be necessary to **weight certain impacts** if it is felt that some impacts are far more important than others: for example, impact on 'poor health of humans' may be weighted more heavily than 'displacement of livestock to other woreda'.
7. **Copy the final table** onto paper.
8. You can also consider the different decision-making processes that occurred during the exercise.

As with all participatory tools make sure that a good and representative copy is made of the exercise.

For an example, see below – Table 2-26-1.

Table 2-26-1 Ranking (prioritisation) of solutions

LAND USE SOLUTIONS	Zone different priority land uses	Stop new allocations of farming in dry season grazing	Move individual farms out of dry season grazing areas & resettle	Stop new allocations of farming in wet season grazing	Map, protect, mark livestock routes	Remove individual enclosures & replace with communal ones	Remove invasive species from priority areas and rehabilitate for grazing and crop land	Enclose low priority areas of invasive species preventing livestock	Invest in soil and water conservation measures	Rehabilitate degraded rangelands	Build carefully planned water points
IMPACTS OF THESE SOLUTIONS											
Improve health of animals	2	8	8	8	8	8	8	8	2	8	7
Reduce deaths of animals	2	8	8	8	9	9	8	6	2	8	8
Improve health of humans	2	2	2	2	3	3	3	3	3	3	5
Reduce deaths of humans	2	2	2	2	3	3	3	3	3	3	5
Improve household food security	4	6	5	5	6	6	6	4	6	6	5
Improve household income	4	7	5	5	7	7	6	4	6	6	5
Reduce conflicts between farmers and herders	8	7	7	7	9	8	6	4	4	4	5
Reduce movement to other woredas	8	8	7	8	7	6	6	4	3	3	5
Improve environment in long-term	6	6	6	6	7	7	9	8	8	7	6
Supports participatory planning processes	10	3	3	3	5	5	3	3	3	3	5
TOTAL SCORES	**48**	**57**	**53**	**54**	**64**	**62**	**58**	**47**	**40**	**51**	**56**

WORKSHEET 2-27

Scenario planning for considering different land use visions

OBJECTIVE

To **identify major changes that may occur** in the future, and different ways to cope with the changes in order to reach different scenarios or visions of the future.

ANTICIPATED OUTPUTS

A **set of different scenarios** realised through different actions taken in land use planning.

PARTICIPANTS

The Coordination and Facilitation Sub-Team will lead this activity, with assistance from the Rangeland Resources Sub-Team and the Agriculture and Land Use Sub-Team. The participants could be a mixed group of stakeholders (as in previous exercises) or one particular group e.g. pastoralists and/or agriculturalists.

HOW-TO-DO SCENARIO PLANNING

1 Identify the drivers of change

The starting point for thinking about the future lies in the past. First, a**sk the group to look back and discuss the major changes in their lives** over the past 20-30 years. Then ask them to identify what is causing these changes – these are the drivers of change. For example, pastoralists may see worsening drought as a major change in their environment. Some causes of this change could be increased settlement, destruction of ecosystem balance (through loss of access to key resources), and unnecessary acceptance of relief food.

The changes identified by the group are likely to be of **three kinds**:

- *Those that fall within their control*, such as social values or agricultural practices.
- *Those that fall within the authority of the state, but over which they could exercise influence*, such as service delivery, conflict management, land tenure or governance.
- *Those over which they have little control,* such as climate change or population growth, or international dynamics such as terrorism and trade.

Disaggregating them in this way can help to shape the action planning that ends the process. This process is adapted from SOS Sahel (2009).

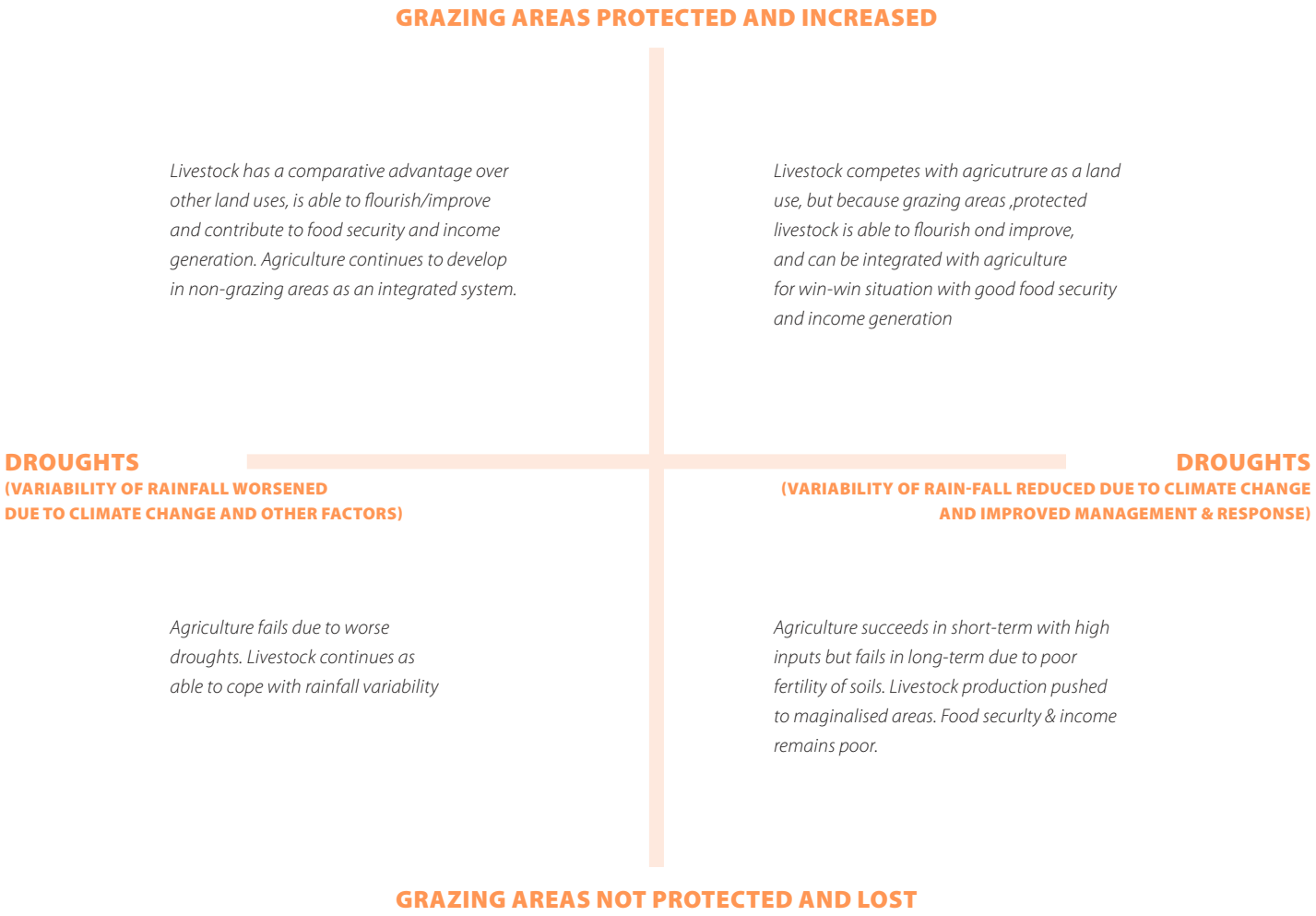


Figure. 2-27-1 Different scenarios for land use in pastoral areas

2 Develop the scenarios

This is the critical stage in the process, when **drivers are paired together across two broad areas of uncertainty (or axes)**, thus generating four different scenarios. The choice of drivers to pair is important: those selected may be of critical interest to the community in question or to the theme of the meeting, or they may be those which have high levels of uncertainty (such that their influence on the future will be harder to predict). It might be better to work in small groups for this exercise – and to consider different sets of scenarios.

See example Figure 2-27-1 of scenarios based on i) Grazing areas protected or not protected; and ii) Droughts increased or decreased due to changes in variability of rainfall and other factors.

3 Create a vision?

One option at this stage of the process is to **develop a 'preferred future'** or vision. This could be for example:

- Land use planned so that both livestock and agriculture-based livelihoods can flourish and grow, including resettlement of farms out of key dry season grazing areas.
- Investments made at local level in livestock production including extension services, building capacity of pastoralists to cope with drought, and rangeland rehabilitation (e.g. clearance of invasive species).
- Mobility of livestock to access and use resources (dry and wet season grazing and water) is facilitated through designated, protected livestock routes.
- Agricultural plots provided to those who are have dropped out of pastoralism.

4 Deciding the next steps

The discussions followed during the exercise will have helped participants to consider different options or visions for the future, and how these options or visions might be realised. This is important input to the land use planning process including how to deal with uncertainty of for example, climate change i.e. it might be best to go for a scenario that encourages diversification (e.g. both livestock and agriculture) in order to keep options open.

Steps to achieve the 'preferred future' or vision can be further discussed in detail in relation to how land use planning can contribute to these, and then incorporated into the land use plan.

WORKSHEET 2-28

How to carry out a SWOT analysis to identify solutions to different land use problems

OBJECTIVE

To **identify and consider the strengths, weaknesses, opportunities and threats (SWOT)** of different potential solutions to land use planning problems.

ANTICIPATED OUTPUTS

Prioritisation of different land uses.

PARTICIPANTS

The Coordination and Facilitation Sub-Team will lead this activity, with assistance from the Rangeland Resources Sub-Team and the Agriculture and Land Use Sub-Team. The participants should be the same mixed group of stakeholders that participated in the Problem Analysis Exercises (*Worksheets 2-23*, *2-24*) and the Solution Analysis Exercises (*Worksheet 2-25*, *2-26*, *2-27*) (i.e. a mixed group from the woreda including one representative from each kebele, pastoral groups, women, youth and other stakeholders).

HOW-TO-DO A SWOT ANALYSIS OF SOLUTIONS TO DIFFERENT LAND USE PROBLEMS

1. With participants, **list the different potential solutions** to land use planning as listed through *Exercise/Worksheet 2-26* and *2-27*, for example:
   - Zone different priority land uses
   - Stop new allocations of farming in dry season grazing
   - Move individual farms out of dry season grazing areas and resettle
   - Stop new allocations of farming in wet season grazing
   - Map, protect, mark livestock routes
   - Remove individual enclosures & replace with communal ones
   - Remove invasive species from priority areas and rehabilitate for grazing and crop lands
   - Invest in soil and water conservation measures
   - Rehabilitate degraded rangelands
   - Build carefully planned water points.
2. **Insert these in the vertical axis** of a Table (for example see below Figure 2-28-1). List across the top of the Table – Strengths, Weaknesses, Opportunities and Threats.
3. **Ask the participants to fill in the Table** considering the Strengths, Weaknesses, Opportunities and Threats of each potential Solution. Please see Table 2-18a below.

Table 2-28-1 Example of SWOT analysis

SOLUTIONS	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
Zone different land uses	Provides direction for planning and investment.	Can be time-consuming to develop in good way.	Assistance from regional governments, and NGOs.	When land is allocated for one land use, it can limit other or multiple land uses – this should be avoided.
Move farms from dry season grazing areas and resettle	Will provide more land for livestock.	Can be difficult to achieve if farmers do not agree.	Better agricultural land available to give to farmers.	Greedy farmers who want more land.
Stop new farms in dry season grazing areas	Will keep land for livestock.	Prevents land being used for agriculture.	Livestock suitable production system for land. Supported by national Livestock Master Plan.	Farmers who want more land and commercial investment.
Stop new farms in wet season grazing areas	Will keep land for livestock.	Prevents land being used for agriculture.	Though this land can be used for agriculture, by keeping for grazing it means more marginal areas not suitable for agriculture can be used for livestock.	Farmers who want more land.
Map, protect, mark livestock routes	Will keep livestock routes open to facilitate livestock movement to markets etc	Can be time-consuming.	Assistance from national, regional government and NGOs.	Famers and infrastructure that continue to block routes.
Remove individual enclosures & replace with communal ones	Opens up rangelands and spreads benefits amongst group rather than few individuals. Drought reserve.	May cause conflict as individuals may not want to dismantle enclosures.	Commitment from customary leaders to take forward.	Settlers coming into area and enclosing land.
Remove invasive species and rehabilitate	Will clear land for other land uses including pasture/crops.	Expensive and time-consuming.	National strategy on Prosopis Management support such interventions.	Resprouting of invasive species due to seed bank – needs constant removal.
Invest in soil/water conservation measures	Will conserve soil/water for more grazing and agriculture.	Time-consuming and needs local labour.	Programs such as PSNP (productive safety-net program) can be used to provide labour.	Lack of tenure security means poor incentive to invest in soil/water conservation
Rehabilitate degraded rangelands	Improved grazing land.	Time-consuming and requires local labour.	Programs such as PSNP can be used to provide labour. Support from NGOs carrying out PRM (participatory rangeland management).	Lack of tenure security means poor incentives for investing in rangeland rehabilitation.
Build carefully planned water points	More water for livestock and agriculture.	Badly planned water points can create more bad impacts than good.	Resources available in PCDP and other government programmes for building water points.	Rush to put in water points as a solution disturbs rangelands and leads to degradation.

WORKSHEET 2-29

Conflict resolution in relation to land use planning[16]

OBJECTIVE

Provision of different **tools for use in conflict resolution** that may result from land use and land use planning.

ANTICIPATED OUTPUTS

Conflict-free land use in the woreda.

PARTICIPANTS

Participants will be those involved in different conflicts. The Coordination and Facilitation Sub-Team can lead this activity, with assistance from the Rangeland Resources Sub-Team and the Agriculture and Land Use Sub-Team (depending on the type of conflict and who is involved).

HOW-TO-DO CONFLICT RESOLUTION

The following different tools can be used in different situations depending on the type of conflict, how long it has been going on, the people involved, what it is about, and what the causes are.

The first step in any conflict is to get a good understanding of the issues (including causes) and who the interested parties/stakeholders are.

Why do you need to analyse conflict?

- To understand the background and history of the situation as well as current events;
- To identify all the relevant groups involved, not just the main or obvious ones;
- To understand the perspectives of all these groups and to know more about how they relate to each other;
- To identify factors and trends that underpin conflicts: power; attitudes; behaviours; systems and structures; levels of involvement; root causes and triggers; needs, interests and positions.
- To learn from failures as well as successes.

Conflict analysis is not a one-time exercise: it must be an on-going process, as the situation is developing, so that you can adapt your actions to changing factors, dynamics and circumstances.

16 This chapter draws tools from Fisher et al (2000).

BOX 2-29-1 WHAT IS CONFLICT ANALYSIS?

Conflict analysis is a practical process of **examining and understanding conflict from a variety of perspectives**. This understanding will then form the basis on which strategies can be developed and actions can be planned. Analysis can be done with the help of a number of simple, practical and adaptable tools and techniques.

TOOLS FOR UNDERSTANDING CONFLICTS

These tools and techniques are not rigid processes; you are encouraged to adapt them, as necessary, to the particular circumstances being analysed. Don't feel that you have to follow these suggested steps if they don't seem to work in your context. It is important that you are as creative as possible in the approach you take.

1 ABC triangle

Violence is more than behaviour: it also involves context and attitudes.

Conflicts tend to have three major components: the context or the situation, the behaviour of those involved, and their attitudes. These are represented graphically as the corners of a triangle (see Figure 2-29-1a).

These three factors influence each other. The behaviour of any one group influences the attitudes of another. That attitude has an effect on the context. This context will in turn affect each group's behaviour and attitudes, and so on. If the conflict situation is to improve, it is likely that one or more of these will have to change. An action aimed at reducing violent behaviour, crucial though it is, needs to be complemented by actions directed at both context and attitudes, if real or positive peace is to be achieved.

Steps:

- Make a separate **ABC triangle** for each of the major parties in the conflict.
- On each triangle, list the key issues related to attitude, behaviour and context from the viewpoint of that party – if the parties are participating in the analysis, then each can make a triangle from their own perspective.
- Indicate for each party what you think are their most important needs and/or fears in the middle of their own triangle.
- Compare the triangles, noticing similarities and differences between the perceptions of the parties.
- Identify a starting point for intervention in the situation.

2 Conflict Tree based on Problem Tree *Worksheet 2-24*

A Conflict Tree exercise works the same as the *Problem Tree* exercise (*Worksheet 2-23*). **Instead of a problem being the focus of the middle of the trunk, the conflict can be the focus** e.g. "Conflict between herders and agriculturalists". Then the same process is followed as per Worksheet *2-23* and *2-25* to find the causes and solutions of the conflict.

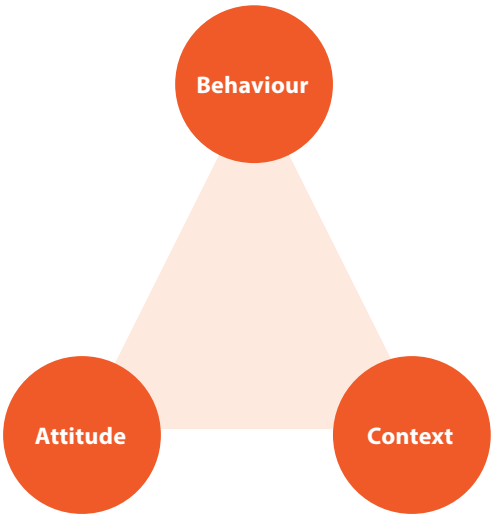


Figure 2-29-1a

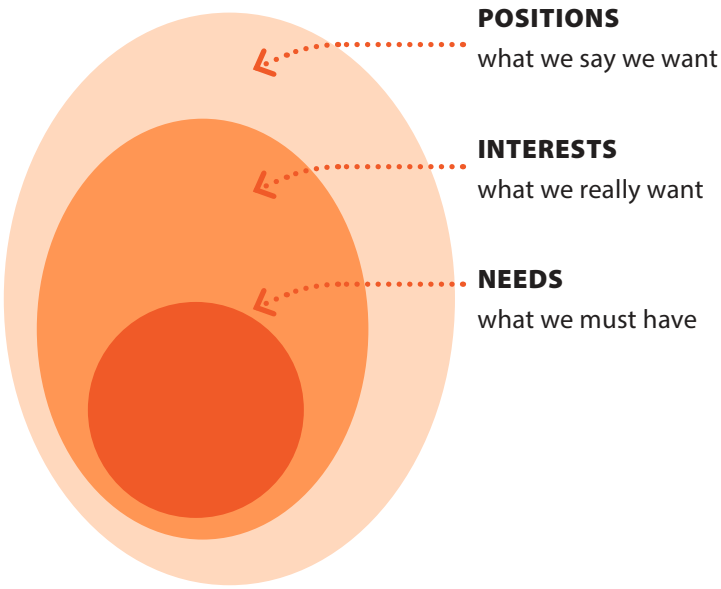


Figure 2-29-1b

Figure 2-29-1a ABC Triangle – showing Attitudes, Behaviour, and Context – All important parts of understanding conflicts. **1b** The Onion Diagram showing Positions, Interests and Needs

3 The Onion

It is important to analyse what different parties are saying or thinking about a conflict. This can be achieved by using the graphic tool of **The Onion** above. This represents the different layers of the onion, which can be 'peeled off' to show/identify the different layers of:

- Positions;
- Interests;
- Needs.

The **Position** is normally what we see, but underneath this top layer we see the stakeholder/person's **Interest** in a situation, which is based on a stakeholder/person's **Needs**. Where we can find common areas of interest and need, this can be a good starting point for negotiations between conflicting parties.

It is important to be aware about the distinction between positions and interests:

- Positions are what people say they want in a conflict.
- Interests refer to what people really want, and what motivates them.
- Needs are what people must have.

The outer layer of the onion represents the *positions* we allow everyone to see and hear (*what we say we want*). Underlying these are our *interests* (*what we want*), which represent what we wish to achieve in a conflict situation. At the core of the onion are our *needs* (*what we must have*). These must be fulfilled in order for the conflicting parties to be truly satisfied with the outcome. While interests can often be negotiated, needs are non-negotiable. Although it may be difficult to set other dynamics aside, it is critical that conflicting parties understand their own and each other's core needs, so that constructive and satisfying outcomes can be achieved.

When analysing interests, we should bear in mind that:

- All parties have interests and needs that are important and valid to them.
- A solution to the problem should meet the maximum number of interests of the maximum number of parties possible.
- There is always more than one acceptable solution to a problem.
- Any conflict involves compatible interests, as well as conflicting ones

When to use The Onion?

The Onion model can be used as part of an analysis to understand the dynamics of a conflict situation, but also in preparation for facilitating dialogue between groups in a conflict, or as part of a negotiation or mediation process itself – even during the post-conflict reconstruction process.

It can be helpful for those engaged in dialogue in order that they understand the situation in order to facilitated a successful negotiation. It is also useful before entering into a negotiation, to better understand the other party's interests, positions and needs, and also to clarify our own ones, keeping them in mind throughout the process. The idea is to carry out the onion analysis for each of the parties involved, including our own.

The Onion model can also bring insight into prolonged conflicts; even raising new hopes for them, as these kinds of conflicts are often seen to result from hiding or distorting actual needs, making the conflict intractable. By further peeling off the layers of conflict, these needs can be identified.

4 Timeline or Trend Diagram

A timeline is a very simple tool. It is a **graphic that shows events plotted against time**. It lists dates (years, months or days, depending on the scale) and depicts events in a chronological order. One can use timelines to show the history of a conflict. In a conflict, groups of people often have completely different experiences and perceptions: they see and understand the conflict in quite distinct ways. They often have different histories. People on opposing sides of the conflict may note or emphasise different events, describe them differently and attach contrasting emotions to them.

The aim in using timelines in this way is not to try to arrive at a 'correct' or 'objective' history, but to understand the perceptions of the people involved. For this reason, the different events mentioned by different groups are an important element in understanding the conflict. The timeline is also a way for people to learn about each other's perceptions and each other's history of the situation. And in discussing their different perceptions of the conflict, and the events that each group commemorates, they will develop a richer understanding of their shared situation.

For information on How-To-Do a Timeline or Trend Analysis, see *Worksheet 2-11*. Use this activity for understanding the conflict, by focusing specifically on understanding the history leading to the conflict.

5 Stakeholder and Relationship Mapping

Mapping is **a technique used to represent a conflict graphically, placing the parties in relation to the problem and in relation to each other**. When people with different viewpoints map their situation together, they learn about each other's experiences and perceptions. Its purpose is:

- To understand the situation better;
- To see more clearly the relationships between parties;
- To clarify where the power lies;
- To check the balance of one's own activity or contacts;
- To see where allies or potential allies are;
- To identify openings for intervention of action;
- To evaluate what has already been done.

For information on How-To-Do a Stakeholder and Relationship Mapping, see *Worksheet 2-20*. Use this activity to understand the different people and groups involved in the conflict and the relationships between them.

STEPS IN CONFLICT MANAGEMENT

Conflict management and transforming a conflict into something positive is very challenging, and can take a long time. In a long and violent conflict, you are likely to need assistance from an expert – this could be a traditional leader or an expert in conflict resolution and peacemaking.

1. **Compile all important information** related to the conflict from all stakeholders (see the tools above). Verify these facts where possible.
2. **Select a time and a place for the meeting** that is agreeable to all parties and organise the meeting.
3. **Ask each party to explain their position** clearly (what they want and why). They should be allowed to do this without interruptions (except for clarifying questions)

4. **Identify where there are areas of agreement** or similar interests. Identify the areas of disagreement or conflicting interests.
5. **Agree on a common overall goal** for negotiation.
6. **Compile a list of possible options** to meet this goal.
7. **Evaluate each option** against mutually-agreed criteria (e.g. threat to resource, livelihood needs).
8. **Facilitate an agreement** on the options that maximise mutual satisfaction among the parties.
9. **Determine a process, timeframes and responsibilities** for actions required to implement the agreement.
10. **Write up any decisions** reached and get the parties to sign this.

BOX 2-29-2 TRADITIONAL METHODS OF CONFLICT RESOLUTION

In the rural areas of Ethiopia many people depend on traditional methods for resolving conflicts.

Features of traditional approaches to conflict resolution:

- The tend to operate from the *'bottom up'* rather than the 'top down.'
- They are *initiated by local elders, family members or religious leaders.*
- No ground rules on time limit to speak (*free, unlimited expression* is allowed).
- Conflicting parties are expected to express feelings and get some relief.
- *Process depends upon moral persuasion by elders*. Elders ensure that no side is embarrassed (face-saving device).
- This is a 'win-win' system of conflict resolution.
- *Each side receives a share of blame* and the responsibility.
- *The mediator is an integral member of the community* – a highly respected individual known for wisdom and neutrality.
- *The mediator tries to be fair* and impartial and ensure effective implementation of whatever is decided.

Shortcomings of traditional mechanisms:

- *Women may not be allowed* to sit in the council of elders.
- *Elders now expect some material gain* and may prolong the process in order to get more benefits (e.g. drinks) from disputing parties.
- *Educated people tend to dismiss traditional methods* as being backward.
- **Modernisation is affecting traditional methods**.

WORKSHEET 2-30

Background note on livestock population numbers, carrying capacity and stocking strategies–understanding the difference between an 'opportunistic' stocking strategy and a 'conservative' stocking strategy

DRYLANDS AS "NON-EQUILIBRIUM" ENVIRONMENTS

Drylands or arid lands are often said to be **"non-equilibrium" because the environment, particularly rainfall, is unpredictable**. **As a result vegetation growth is highly variable**, and is distributed across the land unevenly. In areas of higher and more predictable rainfall – we can say the environment is "equilibrium" – the vegetation is more evenly distributed and does not change so much because of environmental conditions such as rainfall (Vetter 2005).

The *coefficient of variation (CV)* of annual rainfall and the amount of rainfall are good indicators of the differences between equilibrium and non-equilibrium environments. Where the CV is greater than 35% and/or receives less than 300-400 mm, the ecosystem tends to be non-equilibrium.

Forage growth and distribution in semi-arid rangelands are driven by precipitation and tend to be highly variable: intra annually, inter annually, and spatially. The degree of temporal variation depends upon the average annual rainfall, with variation increasing as annual rainfall levels decrease. A consequence, spatio-temporal variation in forage quality and quantity is high and a single, average carrying capacity does not adequately describe this complexity.

In non-equilibrium environments including many pastoral areas drylands, the concept of carrying capacity is difficult to identify – and will change depending on the vegetation available.

STOCKING STRATEGIES

In order to make the most of the variable environment and the resulting variable vegetation, **pastoralists tend to stock their livestock opportunistically tracking the temporally variable forage supply**. As forage production is closely correlated with annual rainfall in semi-arid and arid systems, tracking leads to higher stocking rates in years of high rainfall and reduced stocking rates in years of low or no rainfall. The aim of this strategy is to take advantage of higher forage production in wet years while avoiding excessive mortality and production losses by reducing stocking rates (through slaughter or sales) in dry years.

This means when a drought or extended dry period occurs pastoralists will need to sell some of their livestock (often getting low prices due to many livestock being sold). Alternatively livestock can be redistributed to other grazing areas or pastoralists, or the livestock will die. Usually, in a good year, the land/resources including grass are likely to bounce back and re-grow. However, if a degradation 'threshold' is reached i.e. the degradation is so bad that the land/grass cannot recover, rehabilitation of the land will be more difficult.

This **stocking strategy of having high numbers to make most of the good year growth of grass and fodder** (even though livestock may die in a bad year) is called: a "**tracking stocking strategy**" or "**opportunistic stocking strategy**" (Scoones, 1994; Sandford and Scoones 2006; Campbell et al 2006).

BOX 2-30-1 TRACKING STRATEGIES

Tracking strategies would tend to be more appropriate where rainfall variability is relatively predictable as they allow pastoralists to plan ahead for stock sales and purchases.

Whereas, **high variability and low predictability favors conservative stocking** policies because tracking is more difficult. Costs of purchasing and the loss from sales could be high and destocking is likely to be undertaken too late.

An alternative stocking strategy is a "**conservative stocking strategy**," which maintains a relatively constant stocking rate, which is set on the bases that the carrying capacity will not be exceeded in 'normal' dry years. The aim of this stocking strategy is to avoid livestock losses and vegetation degradation caused by overstocking in dry years. However, in unusually and excessive dry years, livestock losses and overgrazing can still occur, especially when livestock numbers have been maintained using the temporary provision of supplementary feed. With this strategy it is likely that during a good year there will not be enough livestock to eat all the vegetation.

In semi-arid areas where rainfall is variable but reasonably predictable, the best practice and most efficient stocking strategy therefore is a tight "*tracking stocking strategy*" where livestock numbers are increased and reduced according to the available grass and fodder (going up in good years, and down in bad years). **In very variable and often more arid areas** where it is more difficult to predict rainfall, the best practice and most efficient stocking strategy is likely to be a "*conservative stocking strategy*" because tracking is more difficult. Costs of purchasing and the loss from sales could be high and destocking is likely to be undertaken too late. Pastoralists tend to delay destocking if the severity and duration of a dry period cannot be predicted, as keeping livestock through a short drought is likely to be less costly than destocking and re-stocking. If the drought lasts more than 1 year and herders decide to destock, livestock fetch low prices, partly because of their poor condition and partly because market prices at such times of high supply tend to be low.

CARRYING CAPACITY

As a general guideline domestic livestock requires a daily dry-matter intake of some 2.5% of their live weight, for maintenance. As discussed previously, livestock is normally measured in terms of TLU (tropical livestock units). So for a 250 kg TLU, 6.25kg/day of dry-matter is required which amounts to around 2.28 tonnes/year. For a 175kg cow (i.e 0.7 TLU), as per the below table, around 4.22kg/day or 1.5 tonnes/year is required (Kearl 1982).

Table 2-30-2 Tropical livestock units

Camels = 1 TLU	Cattle = 0.7 TLU
Sheep/goats = 0.1 TLU	Horse = 0.8 TLU
Mule = 0.7 TLU	Ass = 0.5 TLU
Pig = 0.2 TLU	Chicken = 0.01 TLU

Note: Animals are often counted as tropical livestock units (TLU)–1 x TLU = one animal with a body weight of 250kg.

Annual biomass production to maintain 1 x TLU is 2.55 tonnes dry-matter. In predominantly pastoral areas, in order to sustain long-term production under harsh climatic condition, it may only be appropriate to use 50% of the available herbage biomass. Therefore, to maintain 1 x TLU, around 4.56 tonnes dry-matter or dryland herbage biomass should be produced, or 3 tonnes for a cow.

BOX 2-30-2 TERMS

Biomass or **dry-matter** refers to the weight of plant material within a given area. Often expressed as kg/ha. It can be collected for an individual species, or as a total weight of vegetation. Biomass can be useful in carrying the carrying capacity of an area, however in rangelands where vegetation is distributed variably in time and space it can be difficult to calculate the biomass.

Carrying capacity is the maximum number of individual animals that can survive the greatest period of stress each year on a given land area.

Stocking rate is the number of animals expressed either in animal units or animal unit months, on a specific area at a specific time and/or the time period of grazing. Stocking rates can vary from year to year, and even across years through different dry and wet seasons. Average long-term stocking rates should closely reflect carrying capacity to ensure the optimal and sustainable grazing of range resources. Stocking rate tends to be expressed as TLU/ha or alternatively, and better for pastoral areas – as ha/TLU i.e. the amount of hectares required to support 1 x TLU.

Calculating the carrying capacity is complicated and is best down by rangeland experts. This is even more complicated in rangelands where the grazing areas are not all the same and resources are distributed unevenly. Table 2-30-4 gives estimated carrying capacities of Ethiopian pastoral areas and this can be used to roughly calculate how many animals can be grazed on a particular area. Remember you will need to convert TLUs to animals i.e. a cow is 0.7 of a TLU.

To work out how many hectares with 800mm rainfall one cow needs (i.e. 0.7 of a TLU) follow this calculation:

2.00 divided by 70 x 100 = 2.85 ha/cow

Table 2-30-4 Estimated carrying capacity of Ethiopian pastoral areas

Average annual rainfall (mm)	Carrying Capacity (ha/TLU)
800	2.0
700	3.0
600	4.5
500	6.5
400	9.5
300	14.0
200	22.0

LIVESTOCK AND WATER

All species perform best under a daily watering regime. Even camels will drink each day where water is readily available. However, in order to make the best use of available herbage, stock may have to be located far from water points, particularly during the dry season. Stock get a certain amount of water from forage – however, when this is dry, or of low availability, then they require more regular watering.

The amount of water consumed by livestock is determined by different factors:

1. **Species** – water economy in cattle is lower than in camels (and sheep, goats and equines are between the two) i.e. canels can use water more effectively. Lactating animals require additional water.
2. **Climate** – water requirement rises with ambient temperatures.
3. **Herbage** (grass, leaves etc.) – moist feed (e.g. lush grass) contains 70-80% water, which significantly reduces the additional water requirements of livestock. Conversely diets containing dry feed (hay or mature grasses or concentrate) increase drinking water requirements.

4. **Stock mobility** – the greater the distance covered by livestock in search of feed, and travelling to and from water, the greater the water intake.
5. **Water interval** – stock watered frequently will consume more water, expressed as volume per day.

In a recent study of livestock watering in the southern rangelands preliminary results indicate that during the dry season cattle and donkeys are watered every third day, sheep and goats every 3-5 days and camels every 7-15 days.

For livestock in the northeast rangelands where water is more readily available in the dry season, the cattle, sheep and goats are watered every second day, and camels every third or fourth day. However, when no green herbage is available, stock will need to be kept close to water points and be watered daily.

Stock watered frequently will consume more water than those watered at less frequent intervals, expressed as volume per day.

It is not only location and quantity that matters, it is also the quality of the water e.g. level of salinity and/or presence of minerals at toxic or harmful levels.

WORKSHEET 2-31

Mainstreaming disaster risk management within land use plans

OBJECTIVE

The objective is to **mainstream disaster risk management** in land use planning.

ANTICIPATED OUTPUTS

A **WPLUP that considers disaster risk management** within its development and design.

PARTICIPANTS

Participants are key informants who are believed to hold particular information that would be useful for the planning process and/or are individuals who represent important stakeholders in the land use planning process but have not yet contributed to the information collection process.

The Agriculture and Land Use Sub-Team should lead this activity, but other WPLUP Team members can join if thought appropriate e.g. the Rangeland Resource Sub-Team and the Technical Land and Water Sub-Team.

Potential disasters such as *drought* and *flood* are common occurrences in pastoral areas. Therefore, **it is important to consider this when developing the land use plan and ensure that risks are managed**. *Worksheet 2-8* considered what hazards the community faces in the woreda, and here it is important to consider what can be done to mitigate those risks.

For example, if drought is a regular occurrence, then the woreda may want to consider establishing drought reserves. If flood is a problem e.g. along a river, then the woreda may want to consider actions in the woreda land use plan to ensure that settlements are not close to the rivers and/or vegetation along the rivers is maintained to lessen the impact of the flood.

Figure 2-31-1. Mainstreaming disaster risk management in LUP (adapted from FAO *http://www.fao.org/docrep/008/y5744e/y5744e04.htm*).

WORKSHEET 2-32

Participatory settlement and resettlement assessment in WPLUP

OBJECTIVE

To carry out a **land suitability assessment for human settlement** in the woreda.

ANTICIPATED OUTPUTS

A settlement or re-settlement **action plan**.

PARTICIPANTS

The Coordination and Facilitation Team, the Agricultural and Land Use Team, the Rangelands Resources Team, and participants from urban development offices.

APPROACHES

Once the woreda has been evaluated for its capability in terms of agriculture, pastoralism, and other land uses, the status and future needs of settlements will need to be assessed (see below). If houses are very sparsely and widely distributed across the kebele and woreda, it will be difficult to efficiently and effectively provide services. As such, there may be a need for encouraging households to consolidate or move households into one particular area, and/or at the very least closer together. A decision may also be made by community members that it would be better to keep prime grazing and agricultural areas completely free of permanent settlements so that it is easier to prevent local degradation (e.g. around houses).

In Borana for example, local pastoral communities themselves decided that the trend of community members setting up a homestead randomly in wet and dry season grazing areas was not sustainable and was leading to the fragmentation of these areas, and threatening their productivity. As a result, and with general agreement of all community members, the community leaders instigated a move of settlements and huts within the grazing areas to areas around them, leaving the grazing areas free for livestock. This kind of zoning and planning of land uses should be encouraged.

In other cases, resettlement of populations may also be required – this could be in the event of new roads or other large constructions, where there is no choice but to build these on areas where people are already living. Though such a situation should be avoided as much as possible, due to the disruption often caused, in some cases it is unavoidable. When this is the case, all should be done to ensure that the process of resettlement is completed in a manner that minimises disruption to those involved. The new site should at the very least be of the same standard and specifications as the old one, though it would improve the situation if it was better.

The FDRE has developed different policies, strategies and programmes for settlement, rural development and housing. FDRE has outlined land settlement as part of the solution in its rural development policy and strategies and area-compatible development packages should be prepared in drought-prone regions. It is stated that a settlement programme is to be conducted without haste and should be improved on the basis of feedback from practical experience and implementation problems encountered.

Rural Development Centers

Rural Development Centres (RDCs) are small rural centers with inhabitants between 500-1999 and expected to grow in the short-term to regular towns of inhabitants more than 2000. More than 17,000 RDCs have been established in the last decade. To strengthen this a Rural Housing Development Strategy was put into action in 2015. Some documents have been prepared to help implement this Strategy such as:

- Five years (2008-2012) and (2008-2017) ten years Rural Housing Development and Administration programme and sub-program,
- Housing Development Administration Extension Programme document,
- Rural Houses Model, Standards, Organization and Modalities Document,
- Rural Houses Design.

Rural Housing Development Implementation Strategy

1. Developing house designs compatible with local cultures, resources and capacity,
   - Compatible with local climate,
   - Compatible with local culture,
   - Easily implementable, and
   - Low cost designs.

2. Provision of land for settlement and RDCs should be developed with an appropriate plan, including the following
   - A sketch plans17 for RDCs should be prepared which later can be upgraded to a basic plan 18showing the different land uses that will accommodate settlements in the future,
   - Socio-economic studies,
   - Making sure that the RDCs do not compete with prime agricultural lands, there is suitable soil for construction (not stony, no landslides), and are close to water sources. These centers should also accommodate the local pastoral and agro-pastoral communities and be close to markets,

3. Awareness creation amongst pastoralists and agro-pastoralists should be supported.

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17 Small town category is prepared at a scale of 1:2000, have a population of not more than 20,000 and is a plan for rural villages with urban character.

18 Medium town category is prepared at a scale of 1:5000, have a population of less than 50,000 but greater than 20,000 and is a plan for guiding development but with detailed implementation elements.

Settlement in Pastoral Areas: Approaches and Programs

A consultative and participatory process and model for identifying suitable land for settlement has been developed by Walter M. et al., (2015), and the following steps are based on this.

GENERAL PRINCIPLES

Land evaluation for resettlement concerns people who have moved from a familiar environment. If new conditions are very different, their situation is correspondingly more difficult. They may lack experience of how their new land should be used or of the vagaries of local climate and soils. Therefore, the following principles should guide the process.

1. **Voluntary**: Settlement and resettlement should be voluntary and not non-voluntary.
2. **Quality**: Where resettlement is concerned the new site should at least be of the same quality and specifications as the old one, and preferably it should be better.
3. **Environmentally friendly**: New settlements should be established in areas with a high risk of impact on environmental values, or unacceptable environmental hazards;
4. **Respect cultural values and norms**: New settlements should take into account the cultural values of local communities and their social networks, interactions, needs and preferences.
5. **Mitigating and compensatory**: Settlement and resettlement development should ensure that mitigating and compensatory action is undertaken, during the appropriate phase of the planning process, for unavoidable but justifiable environmental, social and economic impact resulting from that development.
6. **Water source oriented**: New settlements should take into account potentially suitable sites with particular reference to low-cost irrigation and as close as possible to water sources.

Government Principles as stated in Rural Housing Development Strategy Ethiopia

The following are key principles of the Rural Housing Development Strategy:

- Rural housing should be implemented within the settlers' capacity, standard and initiative.
- Participation and promotion of local institutions should be supported.
- Environmental concerns should be taken into account.
- Settlement pattern should promote marketing.
- Actions should be participatory and voluntary.
- Settlement should be integrated with other rural development strategies.
- Local employment should be promoted.

ACTION POINTS

1 Assess and analyse data on potential settlements

Information on current settlements will have been collected in the data collection phase of the WPLUP process. Some further data including details may now be required to fill in any gaps.

The information should now be reviewed and any concerns or challenges with the current settlement pattern raised. Questions to ask include:

- Are the current settlement patterns supporting the future provision of public services for local communities? If not, can mobile services be provided? Or is there a need to encourage more consolidated settlement patterns?
- Are the current settlement patterns supporting current land uses including pastoralism and agriculture, or are there some challenges with this?
- Can current settlements grow in response to local population growth and the demands of this population, or are new or different settlements required taking into account environmental, social, economic and cultural impacts of these?
- What new infrastructure is anticipated in the woreda or in neighbouring areas (such as economic development corridors, economic or industrial zones, large-scale commercial investment as factories or farms), and what is the likely impact of these on new or future settlement patterns?
- Are current settlement patterns risk-averse or are they open to environmental or other risks e.g. flooding? If current settlements are at risk where are areas that would offer a less risky living space?
- What new areas in the woreda are suitable for settlement, taking into account the land capability assessment, future needs of land for agriculture (specially irrigation potential), grazing and other land uses, and potential impacts of new settlement on the environment, and local society, economy and culture? Once these sites have been identified there is likely to be a need for further and deeper investigation into their suitability. Other criteria to consider include soil quality in terms of suitability for buildings, land quality, hazards, proximity to infrastructure, linkages to social amenities and markets, proximity to water, and lands with unique resources (These requirements are summarized in a matrix table in a way suited for comparison, (see Table 2-32-1 below).
- Where risks have been identified in new settlement sites what mitigating or compensatory actions can be taken to reduce these?
- As a first step, and taking into account the above questions the WPLUP team will need to agree on whether current settlement patterns are appropriate, where there are potential new sites for settlement, and what if any actions need to be taken to mitigate or compensate for any risks to these new sites.

Table 2-32-1 Land requirements and qualities for dwellings (without basement)

Site suitability criteria	Suitability ranking	Reference				
Site Quality	**Site Characteristics**	**S1**	**S2**	**S3**	**N**	
Soil Quality						
	Soil Texture	S	C	Si, SiC	Peat or Muck	Walter M. et al., 2015
	Slope (%)	0-10	10-20	20-30	>30	Najat Q. and Aram M., 2016
	Shrink-swell (%)	<3 (Low)	3-6 (Moderate)	>3 (High)	Shrink-swell	Najat Q. and Aram M., 2016
	Soil drainage	ED, SWED, WD, MWD	SWPD	PD, PD	VPD	Najat Q. and Aram M., 2016
Land Quality						
	Stoniness (%)	<25	25-50	>50	Large stones	Najat Q. and Aram M., 2016
	Depth to bedrock (cm)	>100	50-100	<50	Depth to bedrock	Najat Q. and Aram M., 2016
	Depth to water table (cm)	Below a depth of 75	Below a depth of 50	Above a depth of 50	Wetness	Najat Q. and Aram M., 2016
Hazard						
	Flooding	None		rare	Flooded	Najat Q. and Aram M., 2016
Vegetation						
	NDVI (See *Worksheet 2-12*)	<0.25	0.25-0.49	0.5-0.75	>0.75	Walter M. et al., 2015
Proximity to socio-economic services						
	Proximity to informal settlements (km)	<5	5-10	11-15	>15	Walter M. et al., 2015
	Proximity strategic infrastructure projects (SIP) (km)	<15 km	15–30	30–45	>45	Walter M. et al., 2015
	Proximity to economic development corridors (EDCs) (km)	<15 km	15–30	30–45	>45	Walter M. et al., 2015
	Proximity to roads (km)	<3km	3-6	7-10	>10	Walter M. et al., 2015
	Proximity to cities and towns and health and education centers (km)	<7	7-14	14-21	>21	Walter M. et al., 2015
Proximity to Water Resources						
	Proximity to permanent water sources	<5	5-7	8-10	>10	Walter M. et al., 2015

S: Sandy; C; Clay; Si: Silt; SiC: Silty Clay; **ED**: Excessively drained; SWED: Somewhat Excessively drained; WD: Well drained; MWD: Moderately well drained; SWPD: Somewhat poorly drained; PD: Poorlly drained; VPD: Very poorly drained **Source**: Based on Guide for Interpreting Engineering Uses of Soils (Soil Survey Staff, 1971). **S1**: highly suitable; S2: moderately suitable; S3: marginally suitable; N: non-suitable

- Land confirmed through the local process as being of high or medium risk will require assessment and commitment to the appropriate mitigating or compensatory actions as outlined in Action points 2 to 4 (below) prior to the inclusion of the land in the woreda land use plan. Development of such land should only be permitted where it is demonstrated to be consistent with the requirements of Action points 2 to 4.

2 Avoid impacts and hazards on land assessed and confirmed by Action point 1 as being:

High Risk

Planning principle: Settlement should not be located in areas of high risk of environmental or social impact, or hazard. Development should be directed to unconstrained land(s) within the release area. In the occasional and justifiable circumstance where part of a proposal will be located on land identified as high risk because of the presence of biodiversity values, natural hazard impacts or other physical or social limitations, the development must be planned to minimise these impacts and provide appropriate offsets. These may include protecting and enhancing the long-term viability of priority vegetation and/or rehabilitating degraded priority areas. Justification of this approach should be based on social and economic grounds.

This approach is to be undertaken in consultation with the relevant government agency for its compliance with government settlement and resettlement policies and strategies. The appropriate mitigating and compensatory actions will apply at the relevant stage in the planning process, see Action points 3 and 4 (below).

Medium Risk

Planning principle: settlement should avoid areas of medium risk of environmental and social impact or hazard wherever possible. The majority of the development should be directed to the least constrained land within the release area. In the justifiable circumstance where this cannot be achieved appropriate mitigating and compensatory actions will be required to be incorporated at the relevant stage in the planning process, see Action points 3 and 4.

Low Risk

Settlement may proceed in these areas as appropriate. Environmental variables to consider are presented Table 2-32-1 and 2-32-2.

3 Mitigating actions

Where development of high and medium risk land is unavoidable and justified, appropriate mitigating actions will be applied at the appropriate stage in the planning and development process.

Development of land with biodiversity values direct and indirect impacts.

Local area impacts

Mitigating actions at a relevant stage should be identified together with the land users in the planning process. Land with possible development limitations due to soil, terrain, landform, environmental hazard, or proximity to places of heritage value or possible conflicting land uses need to be carefully considered.

4 Compensatory actions

Where development of high or medium risk land is unavoidable (such as development of land with high direct and indirect biodiversity values) and if these impacts cannot be mitigated through Action point 3, appropriate compensatory actions will be need to be applied at the relevant stage in the planning process. The technical team should identify the actions and the stage that they should be applied.

Table 2-32-2 Mitigating actions for environmental features

Risk	Mitigating action
Development on land affected by inundation	Local growth management strategy - Locate development options of a flooding management plan. Development assessment - Land filling below the 1%-year flood level should be consistent with an adopted a flooding management strategy.
Development on steep land	Development on steep land local growth management strategy - Avoid development on slopes greater than 30%. Development assessment - Apply erosion and sediment control practices in conjunction with site specific geo-technical assessment.
Development in wet landscape and riparian areas	- Allow for provision of adequate riparian buffer areas - Require provisions for riparian corridor protection and water quality/quantity protection.
Development of land at unacceptable risk to public health due to its location with respect to mosquito habitat	Local environmental plans/development assessment - An assessment should be carried out by qualified health officers as to the risk by pests such as mosquitoes as a result of settlement being established near or inside potentially supporting pest habitats. - A management plan should be prepared to mitigate any risk. - A high risk should be considered a constraint to development.
Development in proximity to existing rural uses which may result in conflicts	Local growth management strategy, and Local environmental plans and development assessment - Where land proposed for settlement adjoins land that is currently used for agriculture, organising a conflict assessment should be undertaken and measures implemented to avoid situations of land use conflict, consistent with the principles of the relevant regional farmland protection strategies or laws.
Development in proximity to a place or objects which are considered taboo or cultural heritage values to the community	Local growth management strategy - Undertake consultation with relevant sections of the community and/or religion leaders to identify issues to be addressed Local environmental plans/development assessment - Undertake an assessment of the likelihood of the community's objects, places or values in the locality and identify any potential adverse impacts arising from relevant settlement proposals. Propose settlement site strategies to safeguard heritage values being identified in consultation with the local community

Table 2-32-3 Land with potential biodiversity value

Risk	Mitigating action
Lost opportunity for future improved connectivity of vegetation and habitats	Local growth management strategy - Locate development footprints outside modelled corridors. In circumstances where this cannot be achieved, identify the location of an alternate corridor. Local environmental plans/development assessment - Establish an ongoing revegetation and enhancement program to achieve identified targets. - Establish a monitoring and compliance program to ensure implementation of the revegetation and enhancement targets. - Secure re-vegetated and enhanced areas by formal agreement or zoning. - Apply fire safety standards in bushfire prone areas . - Area closure strategies for a range of natural habitats where relevant. - Restrict use of invasive plants in gardens within dispersal range of natural habitats where relevant.

Table 2-32-4 Compensatory actions with environmental features: land of existing high biodiversity value

Risk	Compensatory action and stage
Development of land with biodiversity values – direct and indirect impacts: Site impacts - vegetation and habitat loss - species loss Local area impacts - reduced connectivity of vegetation and habitats - increased edge effects on local remnants from incompatible land uses - changed management regimes for local vegetation remnants (particularly fire management) - increased predation ranges from domestic animals - increased ignition sources for fires - increased distribution centres for environmental weeds (alien and invasive species - increased rates of soil erosion and local pollution	Local growth management strategy - Identify broad areas where compensation activity is to be undertaken Local environmental plans/development assessment. Offset any vegetation clearing by: - Land re-vegetation or vegetation enhancement consistent with the principles of offset. - Make sure that the country and its communities obtain fair and equitable share from the benefits arising out of the use of genetic resources so as to promote the conservation and sustainable utilization of the country's biodiversity resources based on the Biodiversity Proclamation of Ethiopia (Proclamation No. 482/2006) and National Biodiversity Strategy and Action Plan (IBC, 2005). - Establish an ongoing management program for revegetated and enhanced areas to achieve identified targets. - Establish a monitoring and compliance regime to ensure implementation of management targets. - Secure re-vegetated and enhanced areas by formal agreement, covenant or environment protection zoning. - Adopt fire management strategies. - Adopt invasive and alien weed species management strategies e.g. monitor and take remedial action such as removing these plants on a regular basis for first year after construction]. - Adopt fire management strategies. - Adopt soil erosion and pollution control and management strategies.

Table 2-32-5 Compensatory actions for environmental features: land with potential biodiversity value (modelled corridor on currently non-vegetated land)

Risk	Compensatory action
Lost opportunity for future improved connectivity of vegetation and habitats	Local growth management strategy - Identify alternate corridor location. Local environmental plans/development assessment - Establish an ongoing re-vegetation and enhancement program to achieve identified targets. - Establish a monitoring and compliance regime to ensure implementation of the revegetation and enhancement targets. - Secure re-vegetated and enhanced areas by formal agreement, covenant or environment protection zoning.

WORKSHEET 2-33

How to decide on different land uses [19]

19 Adapted from Riginios and Herrick, 2010.

OBJECTIVE

To **make decisions on different land uses** for inclusion in the woreda PLUP, based on information collected and analysis of problems and solutions.

ANTICIPATED OUTPUTS

Prioritisation of different land uses.

PARTICIPANTS

The Coordination and Facilitation Sub-Team will lead this activity, with assistance from the Rangeland Resources Sub-Team and the Agriculture and Land Use Sub-Team. The participants should be the same mixed group of stakeholders that participated in the Problem Analysis Exercises (*Worksheet 2-25*, *2-26*, *2-27*, *2-28*) and the Solution Analysis Exercises (*Worksheet 2-22*, *2-23*) (i.e. a mixed group from the woreda including one representative from each kebele, pastoral groups, women, youth and other stakeholders).

HOW-TO-DO A RANKING OF LAND USE ALTERNATIVES

1. **Organise a meeting** with community members and other stakeholders in order to decide on different land uses. A summary of the information collected through the different investigation methods, focus group discussions, etc. should be shared.

2. **Define your general objectives**. Ask the participants: What do you want the land in the woreda to look like in ten or twenty years from now in the woreda? What goods and services do you want it to be able to provide? Imagine this as a description of what you would like the land to be like in the future. Keep this description broad e.g.

   - Manage land degradation and erosion,
   - Maximise forage production for livestock.

   A future landscape description might include features like:

   - Abundant grass of a variety of species that can support livestock,
   - Little or no bare soil,
   - Trees and shrubs of a variety of ages and sizes,
   - Abundant wildlife of a variety of species,
   - Soil that absorbs rainwater,
   - Healthy plants and good cycling of minerals back into the soil.

Make sure your objectives are possible and realistic (see Box 33-1: Different Sites have Different Potentials), as well as being clear and understandable to all stakeholders.

Define your specific objectives. How do you want your management to affect the land in the next 1, 5, 10, and 20 years? Try to be as specific as possible. For example, if your objective is to increase forage production for livestock, your specific objectives will depend on whether you are managing for cattle, sheep, goats, camels, or a combination of these animals.

Identify and record any management actions you are already taking towards your management objectives. What outcomes do you expect or want from these management actions? For example, if you are doing bush clearing, what positive outcomes do you expect from the bush clearing?

BOX 2-33-1 DIFFERENT SITES HAVE DIFFERENT POTENTIALS

'Site potential' refers to what is possible at a site, if it is well-managed. Different sites have different potentials, can depend on the soil, available resources and climate. For example, sites with deep soils usually have higher potential for plant cover than sites with shallow, rocky soils.

3 **Rank land use alternatives.** To discover relative preferences of land users about land use alternatives, carry out a ranking of different land use alternatives (LUA) for each woreda Land Use Planning Unit (see map produced in *Worksheet 2-2*).

Provide different land use alternatives, and their criteria, for example:

- LUA 1 = Managed for dry season grazing for cattle.
- LUA 2 = Managed for dry season grazing for cattle and gums/resins collection.
- LUA 3 = Mixed smallholder farming and livestock.
- LUA 4 = Fodder production.
- LUA 5 = Lease to commercial investor for irrigated agriculture.

Ask the participants what their preference of proposed LUAs would be for the piece of land, expressed in priority numbers ranging from 1 (most preferable among the land use alternatives) to 5 (least preferable). Ask for the reasons for this preference.[20]

Count how many times each LUA is ranked 1st, 2nd, 3rd, 4th, etc (i.e. in the first row of the below table, LUA1 is ranked 1st zero times (0/8), 2nd five times (5/8), 3rd twice (2/8), 4th once (i.e. 1/8) etc.

20 It is usually the case that though local land users separate lands based on soil-landscape attributes, their land-related decisions are based on different land use determinants. Land tenure and income generation potential are common determinants for local land users.

Table 2-33-1 Preference ranking of different land uses – example

LUA	User 1	User 2	User 3	User 4	User 5	User 6	User 7	User 8	Total counted	Overall Calculated Rank	Actual Rank
LUA1	2	3	4	2	2	3	2	2	2(5/8)+3(2/8)+4(1/8)	2.5	2nd
LUA2	1	1	1	1	1	1	1	1	1(8/8)	1	1st
LUA3	3	4	3	3	3	2	4	3	2(1/8)+3(5/8)+4(2/8)	3.125	3rd
LUA4	4	2	2	4	4	4	3	4	2(2/8)+3(1/8)+4(5/8)	3.375	4th
LUA5	5	5	5	5	5	5	5	5	5(8/8)	5	5th

As seen from table 2-33-1 in the last column ranks can be calculated from participants' preferences. In this method LUA2 gets the first preference.

To calculate participants' preference as a %age of each LUA, divide the number of times each LUA was ranked 1st, 2nd, 3rd, 4th, etc. by the total participants multiplied by 100 i.e. as per first line above LUA1 was ranked second five times out of 8 (5/8 = 0.625 x 100 = 62.5%); and LUA1 was ranked third two times out of 8 (2/8 = 0.25 x 100 = 25%) etc.

Table 2-33.2 Participants' preference expressed in % of each LUA–example

LUA	Preference 1	Preference 2	Preference 3	Preference 4	Preference 5	Total %
LUA1		62.5	25.0	12.5		100
LUA2	100					100
LUA3		12.5	62.5	25.0		100
LUA4		25.0	12.5	62.5		100
LUA5					100	100
TOTAL	**100**	**100**	**100**	**100**	**100**	

As such, in this example LUA2 scores the highest %age preference of all land uses (as above).

Now note the reasons for participants' preferences.

Table 2-33.3 Reasons for local land user's preference–example

	Preferences of local land users	Reasons	
LUA1	2	5/8	Use of area for dry season grazing means that the pastoral production system over the whole rangelands is protected. New market opportunities for livestock.
LUA2	1	8/8	Multiple use and diversified use, so good risk strategy. Use of area for dry season grazing means that the pastoral production system over whole rangelands is protected – this is well-practiced livelihood system that they feel comfortable with and know is manageable in a dryland environment. Maintains access to river/water. Gums-resins high value trade not yet fully exploited.
LUA3	3	5/8	Diversified and integrated production system, but risky in this dryland environment. Also risk of degrading soils etc. Some privatisation of land, but majority communal land holdings as are better for rangelands.
LUA4	4	5/8	Of value to a smaller number of community members – those growing fodder and those able to afford to buy. Requires inputs and investment including soil conservation measures.
LUA5	5	8/8	Only small minority of land users benefit. Lose control of land. Blocks access to water as well as dry season grazing putting livestock production system in whole rangeland at risk.

WORKSHEET 2-34

Checklist for meeting on how to write-up WPLUP

OBJECTIVE

To **check all information** that has been collected for writing the WPLUP, the decisions made, and to define roles and responsibilities for writing up the WPLUP.

ANTICIPATED OUTPUTS

Checklist completed, ready for write-up of WPLUP.

PARTICIPANTS

Facilitation and Coordination Sub-Team and other WPLUP Team members are required.

Checklist	Yes	No	Action required (if any)
Are your objectives for the WPLUP still clear?	☐	☐	
Have all stakeholders in the woreda had an opportunity to participate in the WPLUP process so far?	☐	☐	
Have all WPLUP Team members completed their roles and responsibilities?	☐	☐	
Are you still within budget and have enough funds to complete the Plan?	☐	☐	
Are you still able to complete the Plan by the agreed deadline?	☐	☐	
Do you have a map of Rangelands and Rangeland Resources, completed in GIS?	☐	☐	
Do you have a woreda Base map?	☐	☐	
Did you divide up the woreda into different LUP Sub-Units?	☐	☐	
Do you have a Woreda Map of different LUP Sub-Units?	☐	☐	
Did you carry out a Land Capability Assessment, and make a Land Classification for each Sub-Unit including the following?			
Information on vegetation in woreda + map	☐	☐	
Information on topography and landscape features	☐	☐	
Information on soil characteristics	☐	☐	
Information on other environmental aspects including rainfall & water, temperature and length of growing period	☐	☐	
information on socio-economic characteristics	☐	☐	

Did you collect and analyse the following socio-economic information?		
Woreda Land Use and Resource Mapping	☐	☐
Mobility Mapping	☐	☐
Hazard Mapping	☐	☐
Livestock Route Mapping	☐	☐
Transects	☐	☐
Seasonal Calenders	☐	☐
Timeline/Trend Analysis	☐	☐
Vegetation Change Mapping	☐	☐
Rangeland Inventory	☐	☐
Surveys/Interviews	☐	☐
Resource Benefit Analysis	☐	☐
Livestock Numbers	☐	☐
Stakeholder/Relationship Mapping	☐	☐
National and Regional Policies and Legislation	☐	☐
Did you consider the following Mainstream Issues?		
Gender	☐	☐
Climate Change and DRM	☐	☐
Conflict resolution	☐	☐
Did you complete the following Problem Identification activities:		
Problem Tree	☐	☐
Ranking of Problems	☐	☐
Did you complete the following Solution Identification activities:		
Solution Tree	☐	☐
Ranking of Solutions	☐	☐
Scenario Planning	☐	☐
SWOT Analysis	☐	☐
Have you carried out a ranking of Land Use Alternatives with a group of mixed stakeholders?	☐	☐
Do you have all the above information at hand for the WPLUP Team to commence writing?	☐	☐

WORKSHEET 2-35

Background note on joint woreda land use planning and participatory rangeland management[21]

In order to support pastoral production systems and to protect resources such as grazing and water that are often shared across kebele or woreda, *Joint Woreda Land Use Planning* and *Participatory Rangeland Management (PRM)* are recommended.

JOINT WOREDA LAND USE PLANNING

As described elsewhere in this volume (*Worksheet 3-4*), **joint woreda land use planning is the process that facilitates several woreda who share resources** such as grazing and water to plan together, in order to protect those shared resources and the structures and institutions that enable the sharing to take place. Joint woreda land use planning follows the same process described in this Manual but includes the extra steps of developing a joint woreda land use map, and a joint woreda land use plan or agreement between the relevant woredas. This agreement ensures that the shared resources are protected and without change, unless all woredas that are part of the agreement agree to the change.

With a shared grazing now protected across woreda boundaries it means that the area available for livestock in the woreda is larger and contiguous, with less likelihood of pastoralists running into conflict with other land users. It also means that the variety of resources including vegetation found in variable dryland environments are protected as one contiguous (joined-up and continuous) productive landscape unit. Livestock routes including those that cross woreda boundaries should also be protected in the joint woreda land use plan and/or agreement.

PARTICIPATORY RANGELAND MANAGEMENT (PRM)

Once a grazing area (including a shared grazing area across woreda boundaries) and other resources have been defined and agreed upon through the woreda land use planning process, it is necessary to **strengthen or establish a group to manage these resources through the development and implementation of a rangeland management plan (RMP). In order to achieve this, it is recommended that the following process of Participatory Rangeland Management (PRM) is followed.** Further details on the PRM approach can be found in the Manual for PRM currently being developed by the Ministry of Agriculture.

PRM is made up of three key stages – Understanding, Planning and Implementation, and eight steps. The process commences with the identification or confirming of the appropriate unit for rangeland management (such as a traditional grazing area). Rangeland resources are identified and a governing community association or institution is strengthened or set-up. A Rangeland Management Plan (RMP) is developed based on an in-depth rangeland inventory (see *Worksheet 2-13*) and community action planning.

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21 This section is drawn and developed from Flintan and Cullis (2010).

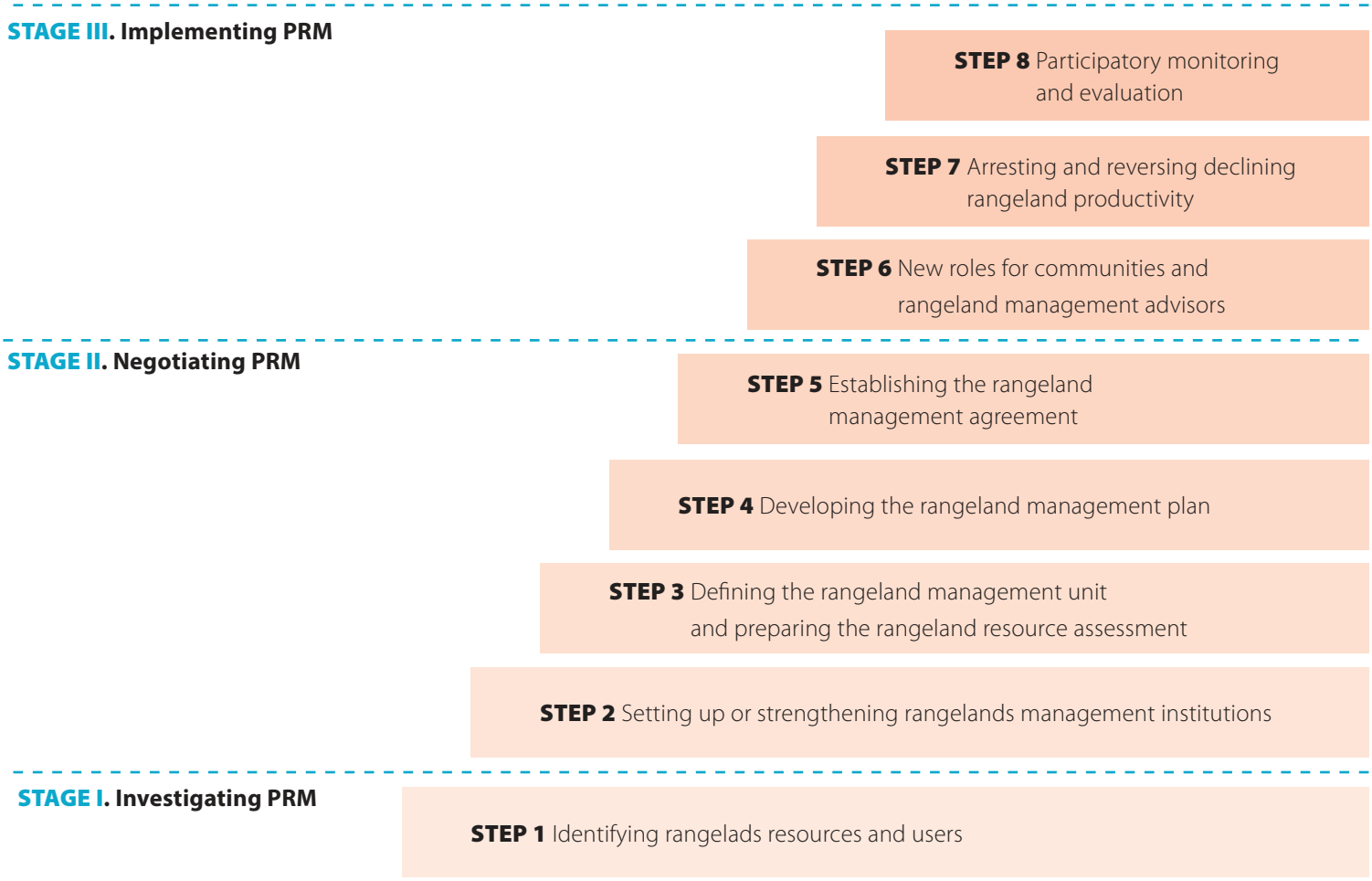


Figure 2-35-1 Stages and steps of PRM as designed by Flintan and Cullis (2010)

Access to resources is improved through the registration of the grazing area in a Registry of grazing areas held by the Ministry of Agriculture and on the agreement of a Rangeland Management Plan.

STAGES AND STEPS OF PARTICPATORY RANGELAND MANAGEMENT

Summary of the Participatory Rangeland Management (PRM) Process

The PRM can be broken into 3 distinct stages (see Figure 2-35-1):

1 STAGE I Investigating PRM

The first stage and **STEP 1** in the PRM process is the **gathering of information** about the different resources found in the rangelands, their uses (including at different times of the year), and the stakeholders and users (including their institutions and groups that have a role in rangeland resource management). This can be achieved through the use of different tools including a resource mapping and stakeholder analysis (see previous worksheets). Information collected in the development of the WLUP or JWLUP will be an important contribution here including the Rangeland Resource Map produced, but some further details and information are likely to be required.

2 STAGE 2 Negotiating PRM

Once a good understanding of rangeland resources, users and current management systems and institutions has been gathered, the next step is to **identify the most appropriate community-led group or institution** to manage these – the *rangeland management institution(s)* (**STEP 2**). These groups or institutions may be ones that already exist, and with some adaptation can fulfil the necessary roles and responsibilities required of them. However, it may be the case that no such groups or institutions exist or they exist in a weakened state, so that the development of a new group or institution is the best solution.

In many pastoral areas, customary institutions still play a central role in the management of rangeland resources and their access. Where these are strong and where pastoralists are the only ones using the grazing area, it may be enough to confirm and strengthen the customary institution as the management body for the grazing area. However, in some pastoral areas the customary institutions are not strong, and/or there are a number of other livelihood groups that use the grazing area – for example farmers or even business people may own livestock and thus need to have representation in the rangeland management institution.

In addition a management group will need to be established i.e. a group responsible for the day-to-day management of the grazing area – for example a Rangeland Management Committee. This group should be members of the customary institution or 'group' who have technical skills and knowledge about the rangelands and will be responsible for the development of the Rangeland Management Plan, with the support of other community members and technical experts.

STEP 3: Once the most appropriate community rangeland management institution (customary, committee or other) has been identified, the *rangeland management unit* for which this institution(s) will be responsible for, needs to be fully understood and **any sub-boundaries within the whole unit identified and clarified**. Within the WLUP or JWLUP process the boundaries of the overall grazing area will have been identified, but there may be boundaries of sub-units that need to be clarified such as wet and dry season grazing areas, water points, wetlands, areas used for beekeeping or collection of non-timber forest products. There will also be areas that are more degraded than others and/or covered by bush or invasive species that require particular management interventions and/or access arrangements.

Once the negotiations have been concluded and consensus has been reached on a) the rangeland management institution, and b) the rangeland management unit and sub-units, the *Rangeland Management Plan* can be drawn up – **STEP 4**. This management plan should specify a) the rangeland management institution and its roles and responsibilities, b) the rangeland management unit including detailed information on resources and their condition, and c) clear rangeland management processes that will be followed including monitoring and evaluation, and adaptive management.

BOX 2-35-1 WHAT IS MEANT BY RANGELAND 'HEALTH'?

The rangeland's 'health' is the degree to which the soil, vegetation, water, and air, as well as the ecological processes and services provided by the rangeland ecosystem, are balanced and sustained. There are three main features to consider:

- **Soil and site stability**–the capacity of an area to limit loss of soil resources (including nutrients and organic matter) by wind and water.
- **Hydrologic function**–the capacity of an area to capture, store, and safely release water from rainfall and run-off.
- **Biological capacity**–the capacity of the biological community to support ecological processes within the normal range of variability expected for the site. The biological community includes plants and animals as well as microorganisms.

As such, it is recommended that a *participatory rangeland resource assessment* is carried out including a rangeland inventory, water analysis including groundwater potential, and an overall assessment of rangeland health.

In addition a livestock population census and study (see *Worksheet 2-18*) will be carried out to identify how many livestock are using the grazing area or rangeland, or different parts of it, at different times of the year and what different types of livestock this includes. It may also be important to know who owns which livestock, who is responsible for them, and what trends of sale and off-take exist.

The combination of the rangeland resource assessment and the livestock population census and study will help to work out the carrying capacity of the land and what livestock management interventions might be required. The results of these two analyses and other relevant information should be shared at a consultation meeting with the members of the customary institutions, Rangeland Council, Rangeland Management Committee or other.

The meeting should begin with a *presentation of the findings* of the rangeland resource assessment. The meeting should then *establish some objectives* for the rangeland management unit (and sub-units) based on what is considered as being the absolute and actual potentials of the sites. The meeting should then decide on the rangeland *management approaches and activities* that need to take place to achieve the objectives. Monitoring and evaluation of results of the implementation of the plan should also be included. Key principles, such as the importance of sustainability, should be discussed. The RMP should then be drafted based on this information by a small drafting team.

Once the rangeland management institution has a draft of the RMP, there is a need to arrange for the institution to hold consultations with the appropriate local/district government office(s) about the plan. It may be necessary to consult more than one government office as responsibilities for issues such as water, business/ cooperative development, and livestock are often split across them. 'Outside' facilitation by the practitioner will help ensure that these meetings are productive and supportive of their intended outcomes.

The result of step four will be a RMP that has been kept relatively simple and brief. Procedures should be included to ensure that it is reviewed on a regular basis. It should set an overall long-term vision (25 years), as well as short-term objectives that can be monitored.

BOX 2-35-2 STRUCTURE OF THE RANGELAND MANAGEMENT PLAN

The rangeland management plan might follow this structure, though local adaptations can be made:

- Introduction.
- Description of the rangeland management unit, including a resource map and the information collected through the rangeland resource assessment (summary of results and recommendations). This should show clearly the different 'resource type sub-units', their potential and condition. It may be thought useful to consider the different sub-units separately, and split the management plan in order to focus on each in turn.
- Objectives of the rangeland management plan.
- Rangeland management institutions and responsibilities including:
  - Rangeland resources and use;
  - Rangeland users and rights of access;
  - Management responsibilities.
  - Rangeland management actions including:
  - Rangeland improvement;
  - Rangeland development;
  - Rangeland utilization and herd management.
- Monitoring and evaluation.
- Methods for revision of the plan as part of adaptive management.

The most important principle is that the community should develop the rangeland management plan. It must be based on their decisions on how to manage the resources. Practitioners assisting them must resist the urge to impose rules and regulations, and revert to a top-down approach. Skills and knowledge will be built through practical experience and the operation of the RMP.. The management plan must receive the approval of all the communities living within the rangeland management unit. Without this approval it is unlikely that actions will be taken seriously, or even allowed.

STEP 6: The final step of the negotiation stage of PRM is to **get approval** from the local/district livestock office of the Rangeland Management Plan and an agreement on this. Once agreement is reached then the grazing area can be registered.

3 STAGE 3 Implementing PRM

The final stage of the PRM process is the implementation of the RMP, and adherence to the rangeland management agreement by the rangeland users. This is the responsibility of the rangeland management institution. It is supported by the appropriate government office, which provides necessary technical advice and legal backing.

STEP 6 is establishing new roles and responsibilities for community members and rangeland practitioners. Effective participatory rangeland management will require that new partnerships be established between the appropriate local government office and the community rangeland management institution–with each side working towards mutual goals. Practitioners will need to help PRM partners to adapt to their important new roles, as well as learn their own new roles.

STEP 7 is arresting and reversing declining rangeland productivity. For maximum effectiveness PRM partners will need to implement new rangeland management practices. Communities will not be able to manage the many new challenges facing rangelands without assistance: They will need support, skills and technical know-how from practitioners and other professional rangeland/natural resource managers in order to deal with the pressures on the rangeland environment and to identify innovative solutions.

In some areas rangelands have been degraded so much that simply reducing grazing pressure will not be enough to allow the land to recover. In these cases communities and practitioners might consider doing some ecological restoration, or rehabilitation, to promote land recovery. It is likely that communities and practitioners will have some knowledge and skills for undertaking rehabilitation, but these can be improved upon and lessons learnt from other rangeland areas and experiences. All these techniques will need to be tested and adapted by communities to their specific rangeland conditions.

The ideal approach for practitioners is to use participatory and experimental techniques for developing new community dryland practices, but to base these upon indigenous knowledge and customary practices. Participatory Technology Development (PTD) is a method that can be used to develop and try out appropriate rangeland-based trials. For example, where the management plan's aim is to rehabilitate a rangeland area and encourage the growth of specific high value grass species, the community members, supported by the rangeland manager, might set up a number of area-based experiments in order to determine the best species to introduce and how to manage them.

STEP 8: *Participatory monitoring and evaluation*

The effectiveness of its monitoring and evaluation system will ultimately determine the success of the PRM process. Communities need to develop their own M&E systems as part of taking up, or strengthening, their rangeland management roles. There are two key steps within the PRM process where M&E must be integrated: in the negotiating stage when developing the RMP, and here in the implementation stage where M&E should be used to facilitate adaptive management and/or help determine best management practices.

M&E for the Rangeland Management Plan

The first task is to define the appropriate indicators to measure change – based upon the objectives and activities of the management plan and the data collected in the rangeland resource assessment. If the objectives of the RMP are clearly defined, and incorporate useful scientific knowledge (collected through the participatory rangeland resource assessment, step 3), then developing monitoring tools is relatively simple. The key is to ensure that the communities articulate what changes they want to see in order to improve their rangeland, for example an increase/reduction in a particular species, or certain practices used or controlled.

The collection and use of data within M&E systems can present a key challenge to rangeland management groups, particularly to non-literate groups. Non-literate methods of data collection and analysis can be developed based upon local methods/tools already used. Table 2 provides six basic indicators of changes in rangeland condition that can be used for M&E purposes. These can be measured using four basic methods: amount of plant cover, tree/shrub density, gaps between plants and plant height. This list of indicators is not exhaustive and should be adapted to the local situation by the practitioner and the community. Qualitative indicators can also be identified (indicators that are simply observed, not measured). More details of this are presented in the manual: Monitoring Rangeland Health by Riginos et al.

Table 2-35-1 Examples of indicators that can used for monitoring rangeland health

Indicator	Description	Method
Amount of bare soil	More bare soil (soil that is not protected by dead plant material or rocks) means more erosion and less forage for livestock and wildlife.	Cover
Perennial grass cover	Most managers want more of the ground to be covered by perennial grasses as this means more forage for livestock and less erosion.	Cover
Tree and shrub cover	Most managers want more cover of 'good' trees and shrubs (which provide forage to browsing livestock, such as goats and camels) and less cover of 'bad' trees and shrubs (problem species such as Acacia drepolobium, Prosopis or Opuntia)	Cover
Tree and shrub density	Tree and shrub density, together with tree and shrub cover, tells managers whether they are getting more 'good' or 'bad' trees in the rangeland. Increasing seedling densities is a good early-warning indicator that tree cover is going to increase in the future.	Tree/shrub density
Gaps in ground cover	When plants are close together, water and wind cannot pick up enough speed to carry the soil away. Instead, water soaks into the ground and wind has little effect. Plant bases slow the flow of water, while plant canopies slow wind erosion.	Gaps between plants
Plant height	Different species of wildlife and livestock prefer different heights of trees and grasses. Plant height, together with the space between plants, can be used to measure changes in vegetation structure.	Plant height

M&E for adaptive management

Practitioners need to ensure that mechanisms are put in place to systematically review the results of the M&E processes within the management plan. A review allows results to be reflected upon and new actions developed, based on the results, as part of adaptive rangeland management. Regular woreda (district) level PRM working group meetings should be held to bring key government and community PRM actors together to discuss issues arising, and resolve problems. In other areas these have emerged as a useful review mechanism for M&E information, and have ensured that the information is collectively analyzed and acted upon.

It is important that the M&E system reflects the objectives and contents of the RMP. This will include the monitoring of the overall condition of the rangeland management unit and the different 'resource type sub-units.' It is recommended that monitoring be carried out in the same sample sites used for collecting data in the rangeland resource assessment, utilizing the baseline data (see Step 3). Monitoring should also take place in areas of particular interest or where a particular management technique is being implemented.

WORKSHEET 2-36

Prepare woreda land use plan

OBJECTIVE

Prepare a woreda **Participatory Land Use Plan**

OUTPUT

A written-up woreda **Participatory Land Use Plan**

PARTICIPANTS

Coordination and facilitation sub-team with the input of all other sub-teams.

Now that all the information is gathered including the ranking of problems and potential solutions **the team will need to start writing the plan**. A suggested Index for the Plan is provided in *Worksheet 2-37*.

The **key areas** that should be included in the Plan are:

- Description of the woreda.
- Methodologies used for data collection.
- Summary of all data collected (physical and socio-economic) including maps and tables. The details for the data can be included as Annexes. For a good example see the WPLUP for Chifra woreda that was produced as a pilot to test the use of this Manual.
- Problem ranking and solution identification.
- Analysis of the information and recommendations.
- Appraisal of the sustainability factors of land use options.
- Logframe analysis, workplan and budget.

Technical data in the Plan should include at least the following (based on data as collected in the WPLUP process):

- A map of current land uses using the woreda base map as a starting point.
- Land capability classification and map (*Worksheet 2-6d*)
- A map of the rangeland area (if applicable) (*Worksheet 2-7*)
- Rangeland vegetation inventory (including local names) (*Worksheet 2-13*)
- Land cover map and comparison of land cover changes over years (*Worksheet 2-12*)
- A map of water distribution and supply (based on resource mapping and other information collected *Worksheet 2-6a*)
- Map of soil types/physical properties (based on biophysical data *Worksheet 2-2*)
- Socio-economic analysis (based on information collected in Step 3 and 5) and map of socio-economic infrastructures.

- A map of current land uses (*Worksheet 2-22*)
- A map of future land uses/development (if changed) from current ones described in no. 1 above.

ANALYSIS OF THE DATA AND INFORMATION

Ideas for improved land use options will have emerged through the planning process as stakeholders suggested changes, and information became progressively available. Review of these options by the WPLUP Team should be a continuous process. The preliminary identification and screening of options could be a simple problem in a limited area. However, usually there are various problems to deal with and a large number of options to be considered. Ideas will have come from community and different stakeholders as part of the solution identification process.

Options should be screened for consistency with all the stakeholder objectives, for acceptability and for broad feasibility according to the resources needed for their implementation. One option to include in all planning exercises is "to do nothing." The result of such non-activity can then serve as a benchmark against which the result of various "active" options can be measured.

The task of analysing the data, making sense of it, and building on this to make recommendations and a plan is challenging. Some tools that could be useful include a cause and effect 'fishbone' analysis; and the identification of land potentials and management requirements.

1 Cause and effect 'fishbone' analysis

Similar to a problem tree but considers problems and outcomes in more detail, the cause and effect 'fishbone' analysis is good guidance for identifying areas of intervention for the WPLUP.

When utilizing a team approach to problem solving, there are often many opinions as to the problem's root cause. One way to capture these different ideas and stimulate the team's brainstorming on root causes is the cause and effect diagram, commonly called a fishbone. The fishbone will help to visually display the many potential causes for a specific problem or effect. It is particularly useful in a group setting and for situations in which little quantitative data is available for analysis.

The fishbone has another benefit as well. Because people by nature often like to get right to determining what to do about a problem, this can help bring out a more thorough exploration of the issues behind the problem – which will lead to a more robust solution.

To construct a fishbone, **start with stating the problem in the form of a question**, such as "Why is rangeland degradation rate so high?" Framing it as a "why" question will help in brainstorming, as each root cause idea should answer the question. The team should agree on the statement of the problem and then **place this question in a box at the "head" of the fishbone**.

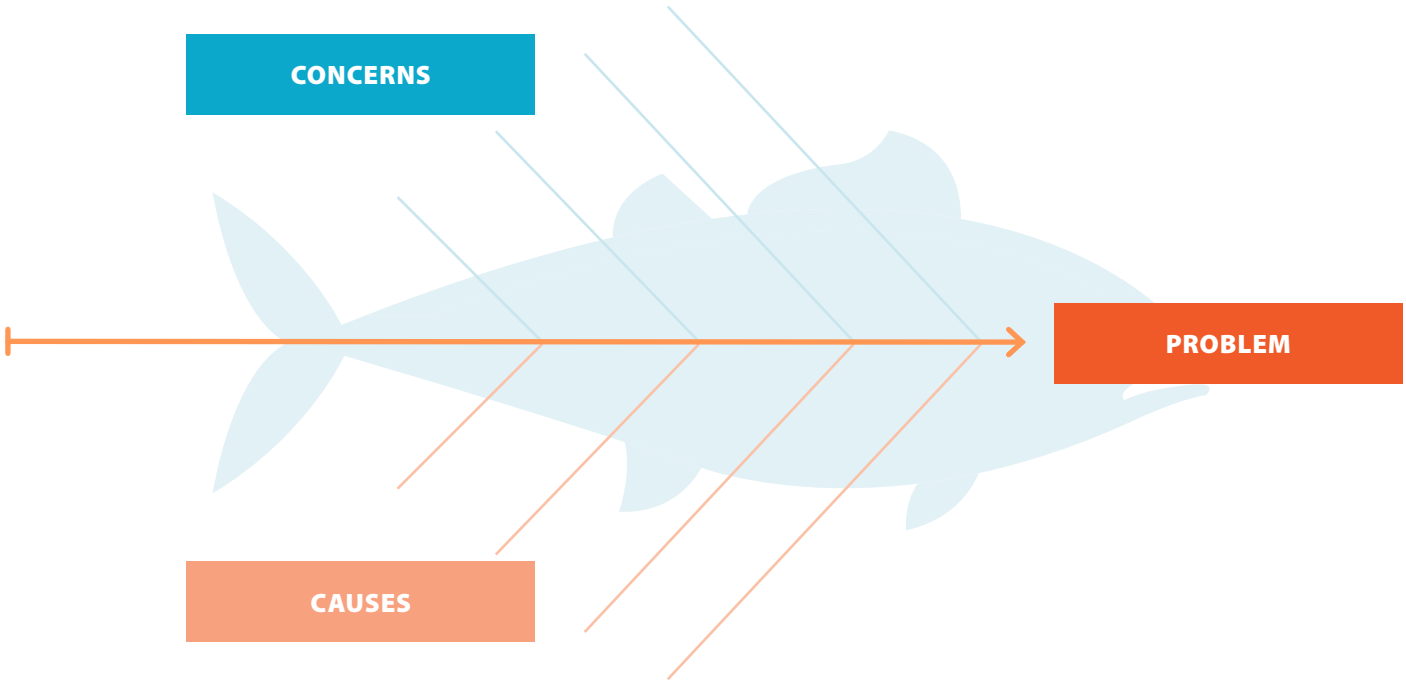


Figure 2-36-1 Fishbone for analysis

The rest of the fishbone then consists of one line drawn across the page, attached to the *problem statement*, and several lines, or "bones," coming out vertically from the main line. These **branches are labeled with different categories**. The categories you use are up to you to decide.

Once you have the fishbone completed, you are well on your way to understanding the root causes of your problem. It would be advisable to have your team prioritize in some manner the key causes identified on the fishbone. If necessary, you may also want to validate these prioritized few causes with a larger audience. (Source: *https://www.isixsigma.com/tools-templates/cause-effect/cause-and-effect-aka-fishbone-diagram/*).

2 Identification of land potentials and management requirements

The land capability classification and more detailed data on such as rangeland vegetation, challenges, problems and options will have provided information on the key priority issues requiring improved management and land use. Potentials and management requirements for each land use planning sub-unit should then be identified. Some external expertise here may be required as input to this.

An example of the one completed by Chifra woreda in their WPLUP process is provided below – Table 2-36-1.

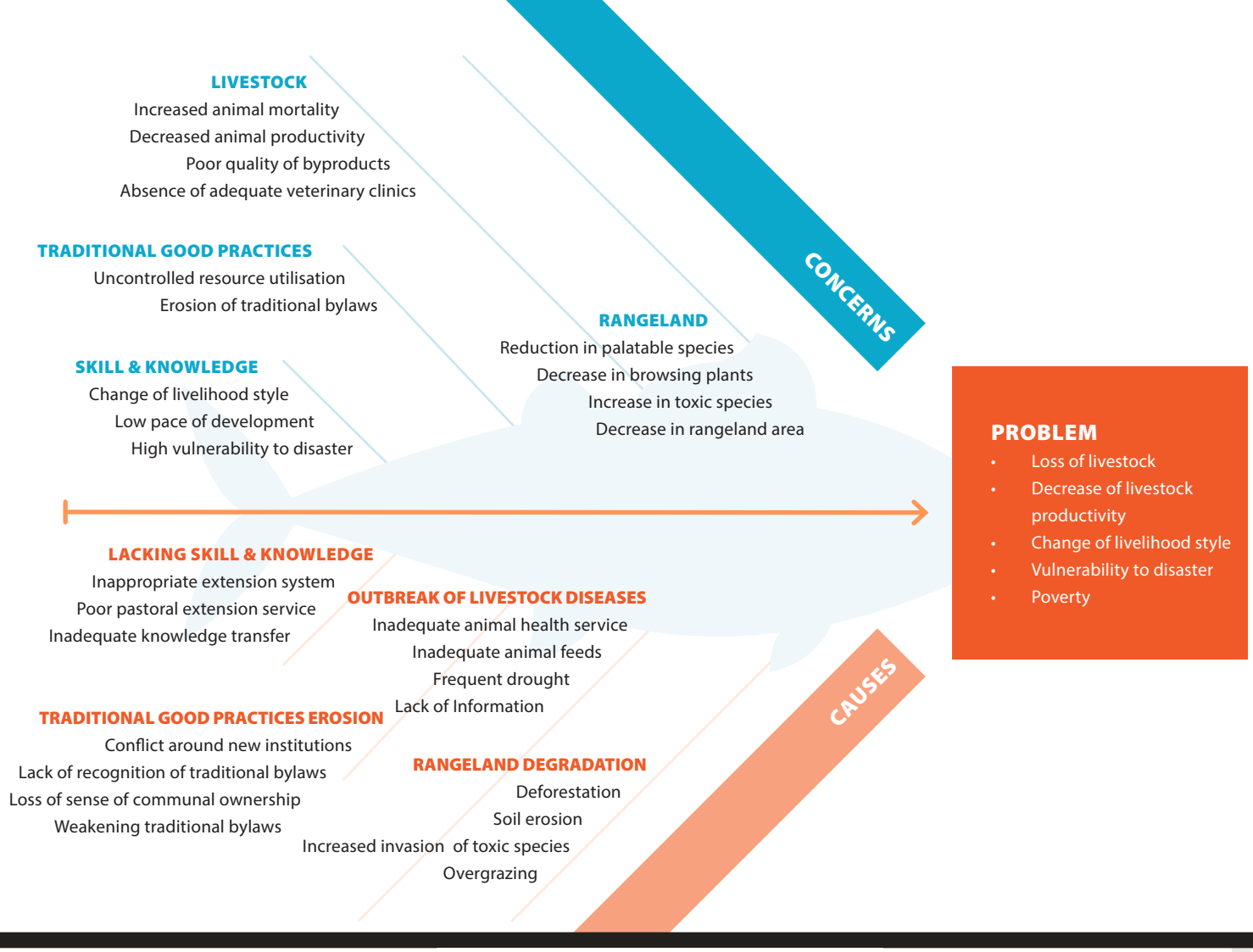


Figure 2-36.2 Cause and effect 'fishbone' analysis

Appraising the sustainability factors of land use options

Land use options should be appraised according to financial and economic viability; social acceptability and potential impacts on the environment. The sustainability of each option and constraints for implementation should also be vetted.

Economic viability – including gross margins, benefit:cost ratio; net present value; and internal rate of return; plus qualitative information from the PRA.

Social impact – constant dialogue with different stakeholders should ensure that proposed land uses are socially acceptable to these groups. At this critical stage in the planning process, intensive consultations should be held with these groups to discuss the implications of possible land use changes. Such changes may have implications for issues such as rights of access, or impose responsibilities for management and conservation. This includes people who might be effected by the change but be outside the woreda.

Environmental impact – sustainable land management is dependent on maintaining the productive potential of natural resources. In addition to protecting the resources on which a specified production system depends. The operation of the production system may have effects on other attributes of the environment, either at the site of production or elsewhere. The method chosen depends on the availability of data,

BOX 2-36-1 QUESTIONS TO ASK BEFORE DECIDING UPON OPTIONS FOR LAND USE DEVELOPMENT OR CHANGE

The following questions should be asked for each option mentioned for a proposed land use development or change:

- Roughly how much will the proposed land use change **cost**? Will the costs be distributed equally across the woreda and if so, how will this be managed? Will the economic benefit gained outweigh any financial or other investment? Is the proposed land use change economically viable? Where will funds be found to support this land use change? Will there be an economic cost to communities in the short-term – if yes, how will this cost be offset? What is the overall financial gain of this proposed land use change or development to the woreda? Will this be gain be distributed equally across the woreda and if so, how will this be managed? What new equipment is required and can this equipment be obtained locally or will it need to be imported at extra cost? If new equipment is required who will maintain this and what will be the cost of this maintenance?
- Is the proposed land use change **acceptable to communities** and other stakeholders? What will be the result of this change on livelihoods in the short and long-term? How will this change effect the culture of the communities – and is any change accepted by community members? Will this change affect movement of livestock and have the impacts of this on land use, land use conflicts, and management of drought been taken into account? Will this land use change impact on the coping strategies of communities to deal with drought? Will this land use change impact on different social groups differently – men, women, children, elderly? And are all these changes positive? Will this proposed land change effect people and livestock outside the woreda and if yes, is this acceptable to them? If no, how will any negative impacts be mitigated? Do community members have the skills and capacity to manage this land use change? If not, how will their skills and capacity be built? Will this land use change mean more settlements are required and if yes, where will these settlements be placed?
- What will be the **impact** of this land use on the environment? Will this change in land use effect other parts of the rangelands adversely and if yes, how will these negative impacts be mitigated? Will this land use change result in pollution and if so, how will this be managed? What are the new water demands of this land use change? And how will an increased need for water be fulfilled? Will the impact of this proposed change impact land users up/down-stream – and if so how will this be managed? Will this land use change adversely impact wildlife and plants and if yes, how will these negative impacts be mitigated? Will this land use change result in more erosion and soil degradation and if yes, how will this be managed? Have all potential hazards of this land use change been considered including fire, flood, drought and how will these be managed?

the knowledge of cause-effect relationships of the factors concerned, the availability of models and the requirement of quantitative results. Often a combination of the above methods is appropriate. Changes in land use may have off-site impacts, such as reduced downstream flows, concentration of livestock on limited grazing areas, or interruption of wildlife migration corridors.

Negotiation and deciding on land-use options

Discussions should be carried out with stakeholders about the different options and negotiating on these. Negotiation can only be effective if all stakeholders accept the forum as legitimate. A workshop can be held to discuss with stakeholders and reach consensus, and ultimately a decision. If no decision can be reached, another meeting will need to be arranged to allow time for the representatives to discuss relevant issues with their groups, and if required, to improve the quality and quantity of the information on which the decision will finally be based. Before deciding on which option is best – consider the questions in Box 2-36-1.

Table 2-36-1 Land Use Planning Units, potential and requirements

An example from Chifra woreda of land use planning units and management potentials and recommendations

Capability Class		Area (ha)	Potentials and Management Requirements
RLU- I	RM unit I	73,621	This Land Unit can produce a wide variety of pastures to increase its carrying capacity at higher levels with water harvesting / flood spreading structures, with less risk of damage to the land, than any of the other rangeland units. Several techniques for increasing the productivity of the rangeland can be implemented including deferring grazing, shrubs planting, reseeding, scarification, etc.
RLU- II	RM unit II	31,250	This Land Unit can produce a wide variety of pastures to increase its carrying capacity at higher levels, but soil erosion and gully formation should be controlled with soil conservation and water harvesting structures. Several techniques for increasing the productivity of the rangeland can be implemented including resting, shrubs planting, reseeding, soil scarification.
RLU- III	RM unit III	1,580	This Land Unit can produce a wide variety of pastures to increase its carrying capacity at higher levels with introduction of soil and water conservation measures as well as gully reclamation works. Techniques for increasing the productivity of this land unit includes resting for less than 3 years, under grazing and grass sawing, shrubs planting,
RLU- VI	RM unit IV	14,459	This Land Unit is marginal for continuous grazing. Gully reclamation works and water spreading techniques are required for increasing the productivity of this land unit. Resting for 3 to 5 years, under grazing and shrubs planting are among the requirements.
RLU- V	RM unit V	1,830	This Land Unit is considered the limit for grazing and browsing. It is restricted by severe hazards or limitations such as salinity and grazing and browsing can only occur one or two years out of ten years resting (area closure for rejuvenation) and selective planting shrubs, controlled livestock soil. As well a natural reserve area for wildlife habitation.
RLU VI	RM unit VI	2,983	This Land unit is considered as runoff- contributing area where the limited rainfall which is being lost as food will be captured in foot slope lands and used for rangeland improvement and animal watering. Water harvesting techniques, included pond, contour bund, micro basin, loss stone bunds and infiltration galleries are recommended.
ICL	Potential irrigated crop land	19,001	Some land is suitable for irrigated crop production. But current land area under irrigation is very small and unmanageable.
CR	Community ranch	7,169	This land unit after re-vegetation of pastures and browsing bushes can be developed for a community ranch. Water pumped from Mille River

WORKSHEET 2-37

Suggested contents of WPLUP

Here is a suggest Table of Contents for the WPLUP report – as written in *Worksheet 2-36*.

1. Cover page
   - Title
   - Name of the organisation preparing the report
   - Date of preparation

2. Introduction
   - Background
   - Objective of the WPLUP
     - General objective
     - Specific objectives

3. Methodology
   - Description of the woreda
   - Methodologies used – preparatory phase, fieldwork, tools used, validation workshop.
   - Stakeholders analysis
     - Major stakeholders
     - WPLUP Team members
   - Data collection and analysis
     - Biophysical data collection and analysis
     - Socio-economic data collection and analysis
     - Livestock and rangeland assessment
     - Land capability classification
     - Problem and solutions

4. Results and Discussion
   - Findings on biophysical resource assessment (using PRA and conventional approach)
     - Bio-physical resource assessment result
     - Maps (resource map, base map, soil map, slope map, land use/land cover map etc.…)
   - Findings on socio-economic survey (using PRA and conventional approach)
     - Socio-economic resource assessment result
     - Maps (social service and infrastructure maps etc. …)
   - Findings on livestock and rangelands assessment
     - Rangelands assessment result (community and conventional)
   - Land capability classification based on physical land resource evaluation
     - Land capability evaluation result
     - Land capability map
   - Socio-economic evaluation based on land capability classification
     - Alternative zoning evaluation and maps at each planning unit
   - Over all evaluation and proposed land use with justifications including ranking
     - Land use alternatives or options set (screened)
     - Recommended proposed best land use option with proposed land use map
     - Final Proposed optimal land use and management options (with different maps)
       - Sustainable land management measures at each proposed land use (with maps, planning zones)
     - Action plan (and budget)
     - Approval process
     - Implementation arrangement and regulatory framework modalities
     - Participatory monitoring and evaluation

5. Summary of recommendations and conclusion

WORKSHEET 2-38

Prepare a woreda land use map showing any proposed land use change or plans

OBJECTIVE

To **produce a woreda land use map** that reflects any proposed land development or change as part of the woreda PLUP.

ANTICIPATED OUTPUTS

A **map showing proposed future land use** and development including land capability classes and other important information.

PARTICIPANTS

Woreda land use experts and the GIS Mapping Team.

The starting point for the map is the current woreda land use map produced in *Worksheet 2-22*. This map can be adapted/changed to show any proposed changes to land use in the woreda.

1. **Organise a meeting** for the full woreda PLUP Team to agree on what changes need to be made to the current land use map for the woreda.
2. If new/changed land uses are suggested that then the GIS Mapping Team will need to **geo-reference** these **new areas** and show them on the map.
3. Areas (acreage), length and percentage of any **new/proposed land uses and resources** such as agriculture, grazing land, social facilities, forestry, water bodies and residential areas **are mapped** and calculated by using computer-based GIS software and recorded.
4. A **first draft of the village future/proposed land use** or development map is printed and presented to the WPLUP Team for sharing, comments and finalised. The map will be included in the presentation made to stakeholders with the finalised woreda participatory land use plan.

WORKSHEET 2-39

Hold a meeting with key stakeholders to present the WPLUP and get feedback

OBJECTIVE

The objective is for the **WPLUP to be presented** to all relevant stakeholders in order for them to provide feedback so the plan can be finalised.

ANTICIPATED OUTPUTS

The outputs of this meeting will be a **list of issues or points that need addressing** to finalise the plan.

PARTICIPANTS

Participants will include representatives from the different stakeholder groups, which you identified in the previous meetings, plus any others that may have since been identified, together with the whole WPLUP Team.

GUIDELINES FOR THE MEETING

1. **Identify a suitable venue**, day and time for the meeting.
2. **Send out invitations** to the participants of the meeting at least one week before the meeting date. In this letter explain what the meeting is about, and why their contribution is important.
3. During the **meeting** you need to include the following:
   - A discussion on why it is important to have a WPLUP.
   - A summary of the steps that were taken to produce the WPLUP.
   - The presentation of the Plan and Map.
   - A discussion (preferably in small groups) on what may be some of the key issues to take into consideration in the improvement of the draft WPLUP.

A **summary of the main points** discussed in the meeting, any decisions made for changes in the Plan, and next steps should be documented. If there are substantial changes to be made then further consultations and approval meetings may be required. If there are only small changes to be made then the Team can finalise.

WORKSHEET 3-1

Implementation of the plan

OBJECTIVE

To set up enabling structures for implementation of the Plan.

OUTPUTS

Established structures for the implementation of the Plan and known roles and responsibilities.

PARTICIPANTS

The Woreda Administration office.

The WPLUP is a guiding document that will require implementation at both woreda and kebele levels. At woreda level the Plan will act as a coordinating mechanism for cross-kebele planning on land use and related activities. Depending on the content of the Plan this could be through zoning areas for rangeland rehabilitation, more intensive agriculture or for such as clearing of invasive species. The woreda will guide and provide resources to the kebele to implement activities in areas under their jurisdiction – this will involve working with the communities there.

The implementation of the Plan will need both incentives and in some cases enforcing mechanisms. In most cases incentives should be enough to ensure participation of local communities in implementing the Plan – and these should have been explained to kebele and communities from the beginning in the first meetings to gain support for the Plan – *Worksheet 1-1*, *Worksheet 1-2*, *Worksheet 1-3*. It is important that all the population of the woreda is at least aware of the Plan from the start of the planning process and, as many members of the different kebele and communities are represented and involved in the collection of data (e.g in the Rangelands sub-Team) and/or in public or Team meetings contributing to decisions about the content of the Plan. If kebele and communities have a strong feeling of contribution or "ownership" over the Plan from the beginning, then they are more likely to implement it.

INCENTIVES

Incentives will be important to encourage woreda residents–kebele and communities–to implement the Plan, together with woreda administration sector experts. Some examples of incentives are provided in Table 3-1.1

Table 3-1-1 Incentives for implementing the plan

Direct incentives	Indirect incentives	Immaterial rewards
- Compensation (land, money) - Payment, salaries for services. - Subsidies. - Credit, revolving funds. - Tools, seeds, machinery, livestock. - Skills, knowledge, capacities. - Infrastructure, roads, boreholes, irrigation. - Clearance of land, removal of invasive species, rehabilitation of rangeland etc.	- Improved food security. - Higher livestock productivity. - Income. - Improved rangeland productivity. - Access to services.	- Peace. - Improved quality of life. - Feeling of participation and ownership of decision-making processes.

ENFORCEMENT MECHANISMS

There may also be the need to develop some enforcement mechanisms e.g. to protect land and land uses, such as on use of protected forests or to prohibit the spread of invasive species, or such as on use of fertilisers/pesticides in agriculture or development of settlements in certain areas.

Where laws, rules and regulations including bylaws need to be developed they should be done together with and building on local and customary laws, so that they fit with how the land is currently being used and managed. All bylaws should be agreed by communities, well-documented, shared with all woreda inhabitants through awareness-raising meetings. Committees or groups to oversee the implementation of new rules and regulations may need to be established.

Existing local land protection laws need to be identified; additional laws, rules, codes may be proposed. Customary and religious laws will also be important in the implementation. Local bylaws may need to be developed.

IMPLEMENTATION STRUCTURES, AND ROLES AND RESPONSIBILITIES

The woreda PLUP will need to be implemented through and with the kebele and community management structures. The WPLUP acts as a guiding document and for its implementation to succeed, the kebele and local communities must feel ownership of the Plan and be prepared to invest in it.

New structures are likely to be needed at the local levels. Woreda and kebele focal persons will need to take responsibility for the implementation of the Plan. A woreda and kebele level WPLUP implementation working group may need to be established including relevant government representatives from the different woreda and kebele sectoral offices.

Local committees for different activities may need to be established in the kebele made up of local communities and other stakeholders.

Local level roles and responsibilities

Communities in the kebele including pastoralists will be responsible for implementing day-to-day decisions, under the guidance of the kebele and woreda leaders. Responsibilities include (amongst others):

- To actively and voluntarily participate in meetings, training, capacity development activities, and workshops to be organized by the kebele and woreda for implementation of the Plan.
- To implement and maintain the activities of the Plan with the assistance of the kebele and woreda.
- To raise awareness on the importance of participating in the implementation of the Plan amongst the wider kebele and woreda population.
- To contribute resources including cash, time, labour to activities and/or infrastructure that will benefit the community.
- To respect and look after any communal infrastructure that has been built during the implementation of the Plan.

Kebele level responsibilities

The kebele are responsible for (amongst others):

- To participate in and mobilse communities to take part in meetings, training, capacity development activities, and workshops to be organized by the kebele and woreda for implementation of the Plan.
- To implement and maintain the activities of the Plan with the assistance of the kebele and woreda, and working with neighbouring kebele as and when necessary.
- To provide oversight at local level for any contracts or contractors that might have been employed to build infrastructure or other.
- To raise awareness on the importance of participating in the implementation of the Plan amongst the wider kebele population.
- To mobilse communities to contribute resources including cash, time, labour to activities and/or infrastructure that will benefit the community.
- To ensure that any communal infrastructure that has been built during the implementation of the Plan is maintained and functioning.
- Working with local communities and woreda to develop rules and regulations that are important for implementing the Plan.
- Resolving conflicts between different land users over land use at the local level.
- Acting as a channel of information between woreda and local communities.

Woreda level responsibilities

The woreda are responsible for (amongst others):

- For overall implementation of the WPLUP in partnership with kebele and local communities;
- To provide necessary technical assistance and capacity building to kebele and local communities to implement the Plan.
- To coordinate kebele to work together for activities that cross kebele borders, as and when necessary.
- To raise awareness of the importance of participating in the implementation of the Plan amongst the woreda population.
- To facilitate meetings between kebele, communities and other stakeholders to come to more detailed agreement about implementation of certain processes and activities contained in the Plan.
- To access budget/funds to implement the Plan from higher levels of government, NGOs or others.
- To ensure that any contractors employed to build infrastructure or other are employed through a transparent process, and carry out their contract to the highest standard and in a timely manner.
- To liaise with and report to zonal and/or regional government on the progress of implementation of the Plan.
- To update the Plan every 10 years.

Zonal level responsibilities

The zonal government has the following responsibilities (amongst others):

- Guide the woreda in the implementation of the Plan.
- Coordinate cross-woreda activities and/or discussions between woreda about joint woreda land use planning if and when required (see *Worksheet 3-4*).
- Provide training and capacity building to woreda experts in the implementation of the Plan as and when necessary.
- Store a copy of the Plan for use by other stakeholders wanting to support activities in the woreda such as NGOs, and advise such actors on how they can support the implementation of the different woreda plans as part of their own development support programmes.
- To assist the woreda to access budget/funds to implement the Plan from higher levels of government, NGOs or others.
- Ensuring that woreda update their WPLUPs every 10 years.

Regional level responsibilities

The regional government has the following responsibilities (amongst others):

- Providing guidance to the woreda in the implementation of the Plan.
- Providing technical support to the woreda in the development and implementation of the Plan by building up number and capacity of relevant technical experts in the woreda offices.
- To coordinate any cross-zonal/woreda activities and/or discussions on issues of relevance at the regional level.
- Store a copy of the Plan for use by other stakeholders wanting to support activities in the woreda such as NGOs, and advise such actors on how they can support the implementation of the different woreda plans as part of their own development support programmes.
- Assist the woreda to access budget/funds to implement the Plan from higher levels of government, NGOs or others by including requests for budget in annual regional budgets and allocating necessary resources to operationalise the Plan.
- Developing enabling policy and legislation at regional level that supports woreda participatory land use planning and its implementation.
- Providing oversight, supervision and monitoring of the Plan implementation.
- To report to federal government on the progress of the woreda planning process.
- Ensuring that woreda update their WPLUPs every 10 years.

Federal level responsibilities

The federal government, namely the Land Administration and Use Directorate of the Ministry of Agriculture has the following responsibilities (amongst others):

- Providing guidance to the regional (and to a lesser extent the woreda) in the implementation of the Plan.
- Providing technical support to the region (and to a lesser extent the woreda) in the development and implementation of the Plan by building up the number and capacity of relevant technical experts in regional offices.
- To coordinate any cross-regional activities and/or discussions on issues of relevance at the national level.
- Store a copy of the Plan for use by other stakeholders wanting to support activities in the woreda such as NGOs, and advise such actors on how they can support the implementation of the different woreda plans as part of their own development support programmes in collaboration with the regional government.
- To prioritise the spending of national budgets on woreda PLUP processes and their implementation.

- Developing enabling policy and legislation at national level that supports woreda participatory land use planning and its implementation.
- Providing oversight, supervision and monitoring of the WPLUP process and their implementation.

DEVELOPING A PILOT PROGRAM

The main output of a participatory land use planning exercise is more than a document with maps. The interactive planning process enables the stakeholders to reflect on important issues and come up with a number of agreed activities. The process of discussion and negotiation, and of empowerment, can be more important than the resulting documents.

The completion of the planning process includes:

- Plan for achieving the successful agreed objective(s) and related activities by a task force in collaboration with other institutions concerned.
- Finalising and keeping updated maps and report.
- Action plan (short – medium term)
  - What, where, by whom, when
  - Showing objectives, outputs, activities, costs and benefits.
- Developing monitoring and evaluation (M&E) framework, proposals and budgets to access funds for the Plan. These will be discussed further in the following Worksheets.

It may be considered that implementing the Plan all at once is beyond the capacity of the woreda at this present time, and so a pilot programme is developed. An example of a pilot programme is proved in *Worksheet 3-3*.

Updating the Plan

The Plan is expected to be implemented over 10 years. At the end of this period the Plan should be updated following the same process as defined in this Manual.

WORKSHEET 3-2

How to develop a participatory M&E system for the WPLUP[22]

OBJECTIVE

To **develop an appropriate M&E system** for the WPLUP.

OUTPUTS

A **M&E plan**.

PARTICIPANTS

The Coordination and Facilitation sub-Team with the input of others.

1 Define your monitoring objectives

The general objectives of the land use plan have been defined in Stage 1, Step 1. Here you need to decide on your monitoring objectives.

Questions to ask yourself and the WPLUP Team:

- What do we want to monitor?
- What do we want to learn from the monitoring?
- Are there management or restoration activities we want to monitor?
- Are there areas we are concerned about – such as areas where the risk of degradation is high – and that we especially want to monitor?
- Do we want to monitor changes over the whole landscape or changes in specific areas that are likely to change within a few years? Or both?

Revisit your monitoring objectives after you have worked through Steps 3, 4, and 5, below (Decide What to Monitor, Decide Where to Monitor, and Decide When and How Often to Monitor). Make sure you can achieve your monitoring objectives, given how much time you and the community can spend on monitoring. Also, be sure that your monitoring objectives will help you meet your management objectives.

An example of the Monitoring and Evaluation (M&E) Plan developed for Chifra woreda during the piloting of WPLUP is provided in Table 3-2-4.

22 Adapted from Riginios and Herrick, 2010.

BOX 3-2-1 SOME EXAMPLES OF MONITORING OBJECTIVES

- Monitor land degradation increases or decreases.
- Compare areas where you are trying different management approaches – such as bush clearing, fire, various grazing regimes, or reseeding – with each other or with areas that are not being actively managed.
- Monitor changes in specific, target areas that you think might change more quickly than the rest of the woreda.
- Monitor changes in the most common or most important habitats in the woreda.
- Monitor changes over the woreda as a whole.

2 Decide what to monitor

For each management objective, ask the management and the WPLUP Team:

- What observable changes in the land will indicate that the management objectives are met?
- Are there 'early-warning' indicators that meet the management objectives?
- Choose the indicators you want to monitor.
- Decide which measurements you want to make, based on your indicators.
- Decide whether there are any specific plant species you want to monitor for changes in cover and/or density.

Table 3-2-1 Suggested Indicators for Three Common Management Objectives.

Management objective	Amount of bare soil	Perennial grass cover	Tree/shrub cover	Gaps between plants	Plant height	Tree/shrub density	Other
Minimise land degradation (erosion)	High	High	Medium	High	Low	Medium	
Maximise forage production for livestock	High	High	High	Low	High	Medium	
Maintain habitat structure for wildlife	High	High	High	High	High	High	
Other							

Not all indicators are important for every management objective. This table provides suggestions about the relative importance of these indicators for each management objective. You can also fill in additional management objectives and indicators in the blank spaces. The indicators are described more fully in Box 3-2-3: Basic Indicators.

Table 3-2-3 Basic indicators for measuring land use changes

Basic indicators		
Amount of bare soil	More bare soil (soil that is not protected by dead plant material or rocks) means more erosion and less forage for livestock and wildlife	Cover
Perennial grass cover	Most managers want more of the ground to be covered by perennial grasses, as this means more forage for livestock and less erosion	Cover
Tree and shrub cover	Most managers want more cover of 'good' trees and shrubs (which provide forage to browsing livestock, such as goats and camels) and less cover of 'bad' trees and shrubs (problem species such as Acacia reficiens, Prosopis or Opuntia	Cover
Gaps in cover	When plants are close together, water and wind cannot pick up enough speed to carry the soil away. Instead, water soaks into the ground and wind has little effect. Plant bases slow the flow of water, while plant canopies slow wind erosion.	Gaps between plants
Plant height	Different species of wildlife and livestock prefer different heights of trees and grasses. Plant height, together with space between plants, can be used to measure changes in vegetation structure.	Plant height

This list of indicators is not exhaustive. The WPLUP Team may come up with more indicators and more things you want to monitor. Qualitative indicators can also be included.

3 Decide where to monitor

Consider the different land type and land use areas in the Plan. Revisit your monitoring objectives. Do you want to monitor specific areas or the whole woreda?

If you want to monitor specific areas, use the comparison or targeted approaches (below) to help decide where to locate your monitoring sites.

If you want to monitor the whole woreda:

- **Decide whether there are areas you do not want to monitor**. These could include soil or vegetation types that are not common or not very important in your woreda; or any areas that do not represent the landscape in general.
- Use the representative areas or random approaches (below) to help **decide where to locate your monitoring sites**:
  - **Comparison:** If your monitoring objective is to compare two (or more) areas that are being managed differently, locate your monitoring sites within these areas. Make sure you only compare monitoring sites that have the same soil and similar slope, and current vegetation type.

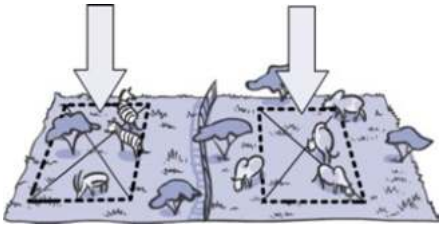


Figure 3-2-1 Comparison method

- **Targeted:** If your monitoring objective is to catch early signs of degradation or recovery in sensitive areas (areas that have high risk of rapid degradation or high opportunity for rapid recovery), locate your monitoring sites in these targeted areas.

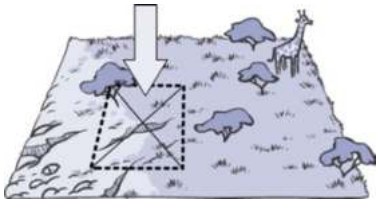


Figure 3-2-2 Targeting M&E

- Representative Areas: If your monitoring objective is to monitor changes across the entire landscape, you can identify and locate monitoring sites in areas that represent the larger landscape. For example, a representative area might be close enough to water to be used frequently by wildlife and livestock, but not so close that it is heavily impacted and more degraded than most of the woreda.

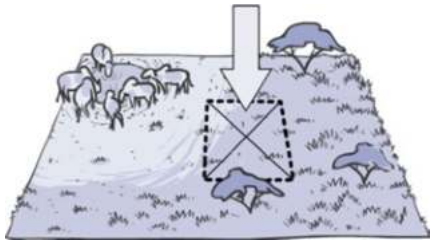


Figure 3-2-3 Representative M&E

- Random: If your monitoring objective is to monitor changes throughout the woreda and you are not confident that you can select representative areas, you can locate monitoring sites randomly in the woreda. Randomly selected sites can also be used to increase the quality of the monitoring data within comparison, targeted or representative areas.

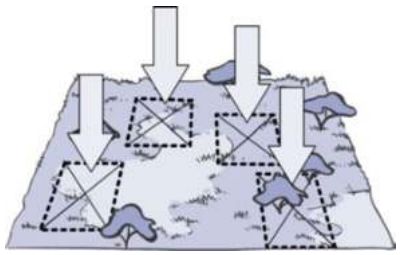


Figure 3-2-4 Random M&E

- Replicate the monitoring sites. A general guideline is to collect data from at least three sites within each area you are trying to compare (for the comparison approach), within each target site (targeted approach) or within each soil and/or vegetation type (for the representative areas and random approaches). The more sites you can collect data from, and the farther they are spaced apart, the better.

4 Decide when and how often to monitor

If you are monitoring once a year, try to collect your data during the same season each year. The end of the rainy season is the best time of year for identifying plant species and observing signs of erosion. The dry season is the best time to observe changes in the amount of space between perennial plants. Collecting data during the same season is more important than collecting it on exactly the same date each year. However, if you usually collect data during the rainy season and the rains fail, you should still collect the data so that you are monitoring at least once every year. Many of the changes focusing on here require long-term monitoring – changes will not be seen within one year. Different monitoring strategies for short and long-term monitoring are required.

5 Document a specific monitoring plan

By documenting a specific monitoring plan, you provide a record that other stakeholders can use to help understand the data. A description of the monitoring plan is important for interpreting the results of monitoring, for helping others understand what, how, and why it has been decided to monitor, and for data collectors to remind themselves of specific protocols each time they collect data.

The monitoring plan should include:

- Monitoring and management objectives,
- Monitoring methods that will be used, and any modifications to the methods,
- Indicators that will be calculated from the methods,
- Other indicators that will be observed,
- Where data will be collected (including if possible a map, GPS coordinates, and/or a written description of the locations and how to find them),
- When and how often data will be collected,
- Who will collect the data.

6 Carry out the monitoring (collect the data)

The tools to be used for collection of data can be drawn from Step 6 (above) – Collect and Analyse Data and the different tools for this – *Worksheet 2-3* and the different tool worksheets.

7 Interpret the results

To interpret the results of your monitoring, compare the changes in your indicators between years of data collection and between different monitoring sites.

- For each indicator, decide what the changes will mean. What changes will tell you that you are meeting your management objectives? This could include both the direction of change (positive or negative) and the amount of change (for example, 25% decrease in bare ground).

- If you are using the comparison approach to 'where to monitor':
  - For each indicator, calculate the average across the replicate sites where you monitored within each management type.
  - Compare the changes that have occurred under the different management types. Remember, you should only compare areas with the same soil type, and similar slope and vegetation.
- If you are using the targeted approach:
  - For each indicator, calculate the average across the replicate sites where you monitored within each target sensitive area.
  - Consider separately the changes that have occurred in each target sensitive area.
- If you are using the representative areas or random approaches:
  - For each indicator, calculate the average for all of your monitoring sites within each type of soil and/or vegetation in the landscape. (If you have only monitored in one type of soil and/or vegetation, then calculate the average for all of your monitoring sites).
  - For each soil and/or vegetation type, compare the average for each indicator with the average you got in the first year of monitoring.
- Consider and discuss the changes you have observed and whether these results suggest that you are meeting your management objectives or not.

8 Learning from and acting on results

The final, important step of the monitoring process is to learn from and act on the results of the monitoring. The results and interpretation of the results should be presented to the wider community or group of stakeholders, and any changes in management should be agreed upon.

- Make sure that everybody involved in the monitoring process reviews and agrees on the interpretation of the results.
- Present the monitoring results to all of the key stakeholders involved in the management of the area. A facilitator can help by putting together maps and simple charts that are easy to understand.
- Discuss and agree upon whether management of the area needs to be changed in order to better meet your management objectives. If management needs to be changed, agree on how it should be changed.
- Incorporate any changes in management into your management plans and actions.

In Table 3-2-4 is provided an example of the M&E Plan used for the Pilot Programme (see *Worksheet 3-3*) to implement the WPLUP for Chifra woreda as developed in the piloting of the WPLUP process.

Table 3-2-4 Participatory Monitoring & Evaluation Plan for the Chifra WPLUP Pilot Program

Type	Indicator	Target	Means of Verification	Data Collection Frequency	Responsible Personnel	Who will use it?
Goal	**Creating productive & profitable pastoralism and agro-patoralism**		**Final Evaluation**		**Evaluation Team**	
SO 1: Improving Rangeland management	Area of rangeland rehabilitated	1,800	Baseline data, Mid-term and final evaluation	Beginning, mid & end of project	PPIT	EPLUA, Woreda, Administration,
Use of livestock product increased	Milk productivity in targeted villages	8 villages	Progress reports, M&E system	Quarterly & annual reports	PPIT	EPLUA, Woreda, Administration,
Increased vegetation cover	Area rehabilitated	1800	Progress reports, M&E system	Quarterly & annual reports	PPIT	EPLUA, Woreda, Administration,
Household cash income increased	Targeted household income	1600	Baseline survey, Progress reports, M&E system	Quarterly & annual reports	PPIT	EPLUA, Woreda, Administration,
Relief aid dependency decreased	Targeted household income	1600		Annual reports	PPIT	EPLUA, Woreda, Administration,
SO 2: Decreasing livestock disease incidences	Animal disease occurrence decreased	8 villages	Baseline data, mid-term and final evaluation	Beginning, mid & end of project	PPIT	EPLUA, Woreda, Administration,
By 2019, livestock mortality decreased by 20%	Random sampled villages	8 villages	Baseline data Progress reports, M&E system	Quarterly & annual reports	PPIT	EPLUA, Woreda, Administration,
By 2019, livestock products increased by 20%	Random sampled villages	8 villages	Baseline data Progress reports, M&E system	Quarterly & annual reports	PPIT	EPLUA, Woreda, Administration,
By 2019, quality of livestock byproducts improved by 20%	Random sampled villages	8 villages	Baseline data Progress reports, M&E system	Quarterly & annual reports	PPIT	EPLUA, Woreda, Administration,
SO 3: Strengthening traditional rangeland management system	Rangeland units	4	Baseline data, Mid-term and final evaluation	Beginning, mid & end of project	PPIT	EPLUA, Woreda, Administration,
3.1. Strengthening traditional rangeland management practices	Bylaws endorsed	4 x rangeland units	Progress reports, M&E system	Quarterly & annual reports	PPIT	EPLUA, Woreda, Administration,
3.2. Strengthening traditional wildlife protection practices	Bylaws endorsed		Progress reports, M&E system	Quarterly & annual reports	PPIT	EPLUA, Woreda, Administration,
SO 4: Adoption of appropriate technology	# of pastoral & agro pastoral adopted	2400	Baseline data, Mid-term and final evaluation	Beginning, mid & end of project	PPIT	EPLUA, Woreda, Administration,
4.1. New improved rangeland technologies adopted	# of pastoralist adopted	1200	Progress reports, M&E system	Quarterly & annual reports	PPIT	EPLUA, Woreda, Administration,
4.2. Dry land technologies adopted	# of pastoralist adopted	600	Progress reports, M&E system	Quarterly & annual reports	PPIT	EPLUA, Woreda, Administration,
Small-scale Irrigation technology adoption	Improved Irrigation system adopted	4 SSI schemes	Progress reports, M&E system	Quarterly & annual reports	PPIT	EPLUA, Woreda, Administration,
4.3 Livestock management improved	# of pastoralist adopted	600	Progress reports, M&E system	Quarterly & annual reports	PPIT	EPLUA, Woreda, Administration,

WORKSHEET 3-3

Developing a pilot programme and workplan

OBJECTIVE

To **develop a pilot programme** as a first step in implementing the WPLUP.

OUTPUTS

A **proposal for a pilot program**, workplan and budget

PARTICIPANTS

The Woreda Administration office (with input of other stakeholders).

To implement the WPLUP at once will take significant resources including finance, manpower and knowledge. Therefore it is recommended that a pilot programme is first developed which can test the implementation of the WPLUP in a certain area and/or for certain activities. The below pilot programme is the programme developed in Chifra woreda during the piloting and development of the WPLUP process. This is only meant to serve as an example and as guidance for your own pilot programme relevant for your own woreda and local circumstances, needs and priorities.

EXAMPLE OF CHIFRA WPLUP PILOT PROGRAMME

The Chifra WPLUP Pilot Programme was developed as a first step in implementing the Chifra WPLUP. It is a holistic pilot programme designed to align rangeland restoration and risk mitigation with pastoral and agro-pastoral economic development using a collaborative, multi-juridical coalition-of-partners approach.

Objective of Chifra's WPLUP Pilot Programme

The main objective of the pilot program is to commence the implementation of Chifra's WPLUP. To this end, the pilot project shall:

- Put some of the priority activities proposed in the Chifra WPLUP to trial.
- Develop a model and mechanism for implementation of the land use plan.
- Develop the capacities of frontline development workers to implement and manage the intervention and activities of the WPLUP.
- Support action-learning- research as one of the major objectives of pilot program. The action-learning-research envisaged to devise innovative experimental ideas by identifying appropriate approaches and technologies to enhance skills, and build capacities of pastoral communities and other stakeholders.

Scope of the Pilot Programme

The pilot projects will be implemented in four rangeland units in Chifra woreda. The pilot programme focus initially on a small number of target villages or number of sites in each rangeland unit to be manageable. In general, two to three objectives will be implemented in each rangeland unit. Activities selected for the pilot programme are listed in Table 3-3-1.

A participatory logframe analysis is provided in Table 3-3-2. The purpose of this practice was to summarize as well as to indicate the logical relationship between objectives and intended inputs, planned activities, and expected results as well as what potential problems could affect the success of the Programme and how the progress and ultimate success of the Programme will be measured and verified.

Environmental Management Plan

It is important to consider the implications of the Plan and any pilot activities on the environment in order to prevent and/or reduce any negative impacts on the environment. The environmental management plan (EMP) produced during the process of developing the Chifra WPLUP Pilot Programme is given in Table 3-3-3.

Workplan/Implementation Schedule

Once the activities have been decided upon, there is the need to develop a workplan or implementation schedule. The Implementation Schedule for the Chifra WPLUP Pilot Programme is provided below in Table 3-3-4. This was developed by the woreda WPLUP Team working with pastoralist representatives so it fitted with their own community action planning. Once the workplan or implementation schedule has been developed, discussions will need to be undertaken with kebele and local communities as to how activities can be incorporated into kebele plans and those of local communities.

Budget

A detailed budget was then developed for activities in the Pilot Programme. The budget prepared for the Chifra WPLUP Pilot Programme is provided below in Table 3-3-5. Note – this is only provided an example and as guidance – you will need to produce your own budget for the set of activities decided upon in the implementation of your own WPLUP.

Remember!
The following tables are given as examples and guidance and will need to be revised according to the local circumstances, needs and budget.

Table 3-3-1 Pilot Activities – EXAMPLE ONLY, TO BE REVISED TO LOCAL CONTEXT

Activity	Unit	Quantity
SO 1: Improved Rangeland Management in rangelands units identified in WPLUP		
Grass & tree nursery establishment (1ha)	No	1
Grass seed & fodder seed collection	Kg	30
Grass seed multiplication	Variety	10
Fodder & tree Seedling production	No	750,000
Rangeland demarcation for area closure and Improved management	Ha	500
Area closure	Ha	1,200
Pitting	No	750,000
Planting	No	750,000
Invasive plant uprooting	Ha	600
Grass & fodder planting	Ha	600
Pastoralist training on Participatory Rangeland management (process of planning, rangeland rehabilitation, by laws...)	No	438
Pastoralist training on ecotourism	No	80
Road construction	Km	18
Road maintenance	Km	12
Terrace construction along escarpment	Km	600
Check-dam construction	m3	150

Activity	Unit	Quantity
SO 2 Decreasing animal disease incidences		
Construction of veterinary Clinic	No	1
Revolving fund for veterinary medicine purchase	No	4
Livestock value chain study & establishment	No	1
Farmers training on improved Livestock management	No	1,000
Pastoralist livestock enterprise (agro enterprise) group formation	No	6
Pastoralist training on livestock value chain	No	300
SO 3 Strengthening Traditional Rangeland management System through Participatory Rangeland Management		
Survey & study of traditional bylaws	No	4
Rangeland management group formation	No	60
Bylaws development and legally recognized	No	4
Empowerment of pastoralists on written bylaws	No	3,000
Conducting conflict resolution meetings	N0	30
SO 4 Promotion & adoption of appropriate technology		
Small-scale irrigation schemes design in areas identified for irrigation potential in WPLUP	No	4
Small-scale irrigation development	Ha	75
Irrigation canal maintenance	Km	12
Farmers' training on irrigation water management	No	600
Supply of improved seed	Qt	30
Eco tourism promotion	Village	4

Table 3-3-2 Logframe–EXAMPLE ONLY, TO BE REVISED TO LOCAL CONTEXT

Type	Description	Indicator	Means of Verification	Assumptions
Goal	Creating productive & profitable pastoralist & agro pastoralist	BY 2026, 60% of the pastoralist & agro pastoralist increased their household income by 30%	Baseline data, final evaluation, case studies	Drought, budget
Outcome	Livestock value chain	By 2026 four livestock value chain are operational	Baseline data, mid-term & final evaluation, case studies	Drought, budget
	Incense & gum value chain	By 2026 four incense and gum value chain are operational		
	Eco tourism promoted	By 2016 targeted people benefit from eco-tourism		
Strategic Objective 1	**Improving rangeland management**	**By 2026 60% of the rangeland are is rehabilitated**	**Annual progress reports, monitoring reports, sample survey studies**	**Rainfall shortage, budget, manpower**
Outputs	Increased livestock production and productivity	By 2026 livestock byproducts increased by 20%	Sample survey, progress reports, case studies	Rainfall shortage, budget, manpower
	Increased vegetation cover	By 2026 vegetation cover increased by 60%		
	1.3 Decreased drought vulnerability	By 2026 relief aid support decreased by 80%		
Activities	1.1.1.Grass multiplication, seedling production			
	1.1.2 Capacity building			
	1.1.3 Construction of soil & water harvesting structures			
	1.1.4 Introduction of improved fodder species			
	1.1.5 Distribution of farm tools			
	1.1.6 Rangeland improvement techniques			
Strategic Objective 2	**Decreasing livestock disease incidences**	**By 2026 animal disease occurrence decreased by 80%**	**Annual progress reports, monitoring reports, sample survey studies**	**Budget, manpower, equipment**
Outputs	2.1. Decreased livestock mortality	By 2026 livestock mortality decreased by 80%	Sample survey, progress reports, case studies	Budget, manpower, equipment
	2.2. Increased livestock production and productivity	By 2026 livestock products increased by 20%		
	2.3. Improved quality of livestock products	By 2026 quality of livestock byproducts improved by 95%		
Activities	2.1.1Establishment of feed bank			
	2.1.2 Capacity building			
	2.1.3 Establishment of veterinary clinics			
	2.1.4 Supply of veterinary medicines			
	2.1.5 Animal disease scouting and establishing information net work			

Type	Description	Indicator	Means of Verification	Assumptions
Strategic Objective 3	**Strengthening traditional rangeland management system**	**By 2026 traditional rangeland management system strengthened in the five traditional rangeland units**	**Annual progress reports, monitoring reports, sample survey studies, community witness**	**Budget, community initiatives, political will, government commitment**
Outputs	3.1. Strengthening traditional rangeland management practices	By 2026 bylaws are documented and practiced in five rangeland regimes	Sample survey, progress reports, case studies	Government commitment and political will, budget, manpower, equipment
	3.2. Strengthening traditional wildlife protection practices	By 2026 traditional bylaws are endorsed and accepted to local government		
	3.3. Study and documentation of traditional by laws	By 2026, traditional rangeland management courts are operational		
Activities	3.1.1 Survey, identify and study of traditional norms			
	3.1.2 Documentation of traditional bylaws			
	3.1.3. Certifying communal property right			
	3.1.4 Resolving conflicts between communal bylaws and legislations			
Strategic Objective 4	**Adoption of appropriate technology**	**By 2026, 50% of the pastoralist & agro pastoralist will adopt new technologies**	**Annual progress reports, monitoring reports, sample survey studies,**	**Budget, community initiatives, manpower**
Outputs	4.1. New improved technologies adopted	By 2026, livestock management improved by 50%	Baseline data sample survey, progress reports, case studies	Budget, community initiatives, manpower
	4.2. Dry land technologies adopted			
	Small-scale irrigation technology adoption			
	4.3 Livestock management improved			
Activities	4.1.1. Promotion of appropriate technologies			
	4.1.2. Strengthening capacity of pastoral & agro-pastoral extension service			
	4.1.3. Establishment linkage with academic and research institutes			
	4.1.4 Conducting training of trainers programme			
	4.1.5 Capacity building			

Table 3-3-3 Environment Management Plan for Chifra WPLUP Pilot Programme–EXAMPLE ONLY, TO BE REVISED TO LOCAL CONTEXT

Problem	Mitigation Measures
Water problems	
Salt buildup on irrigated land	Provide drainage and line canals in highly permeable areas to prevent leaks
	Encourage agro pastoralist to value water resources by establishing a system of water user fees tied to consumption
	Design system to allowing leaching with excess water
	Adjust crop patterns (fallow times, crop selections, etc.) to prevent further salt buildup.
	Plant salt-tolerant catch crops such as onion
Crops not growing over entire irrigated field	Maintain irrigation canals
	Clear weeds
	Line canals against leaks
	Encourage farmers to value water resources by establishing a system of water user fees tied to consumption
Weeds & invasive plant seeds disseminated with irrigation water	Frequent weeding and uprooting invasive plants before flowering stages
Canal erosion	Proper design and stone/ grassed waterway
Health problems	
Increased incidence of water related diseases	Periodically flush slow or stagnant waterways with water from ponded to remove snails (which cause schistosomiasis). Note that this is effective only for a few hundred meters from where the water is released
	Clear clogged irrigation canals
	Control mosquitoes, snails and blackfly along canals, diversion weirs by periodically fluctuating water levels, making shorelines steeper
	Train women in health issues
Social problems	
Water use conflict	Design and manage system to improve access by "tail-enders" (users whose fields are farthest from the water source)
	Establish bylaws and enforce socially accepted -based water fee
	Improve system management, including maintenance of main canal.
Ecosystem problems	
Damage to downstream ecosystems from reduced water quantity and quality	Use irrigation schedule operations to mitigate changes in flow regimes of rivers and prevent weeds and diseases

Problem	Mitigation Measures
Rangeland Improvement	
Damage to downstream community and environment (land degradation, land slide, gully formation and flooding) as a result of failure of the	Proper design of structures
Removal of native plant/tree species	Protect and encourage regeneration of endemic species
Introduced plant/tree species invasion of native species	Ensure non-native species are compatible with native species
Insufficient capacity to manage catchment ponds	Establish a water users committee, where appropriate, and/or kebele bylaws and provide training to water users
Insufficient capacity to manage new plantations or pastures	Establish a local committee, where appropriate, and/or kebele bylaws and provide appropriate controls
Area closure and plantation on degraded rangelands	
Conflict	Establish bylaws and awareness building
Gully rehabilitation	
Growth of invasive plants	Approve appropriate measures at planning stage (by senior staff); and Ccnduct frequent site supervision by Pilot program team and taking control actions as needed
Establish nursery (Seedling production)	
Loss of biodiversity of local species if exotic seedlings are grown	Limit seedling production of exotic varieties – use local species.

Table 3-3-4 Implementation Schedule of Chifra WPLUP Pilot Programme–EXAMPLE ONLY, TO BE REVISED TO LOCAL CONTEXT

No	Description	2017				2018				2019			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	**Office & Staff Arrangement**												
1.1	Recruitment of staff and assigning												
1.2	Baseline survey												
1.3	Purchase of vehicle & Office equipment												
2	**Objective 1: Improved Rangeland Management**												
2.1	Grass & tree nursery Eetablishment (1ha)												
2.2	Grass seed multiplication												
2.3	Fodder & tree seedling Production												
2.4	Rangeland demarcation for area closure and Improved management												
2.5	Area closure												
2.6	Pitting												
2.7	Planting												
2.8	Invasive plant uprooting												
2.9	Grass seedling												
2.10	Rangeland management group formation												
2.11	Legally recognized bylaws development												
2.12	Pastoralist Training on Participatory Rangeland Management (planting, soil & water conservation, by laws...)												
2.13	Nursery materials, tools &equipment												
2.14	Farm tools (rangeland improvement)												
2.15	Eco-tourism promotion												
2.16	Pastoralist Training on Ecotourism												
2.17	Road construction												
2.18	Road maintenance												
2.19	Terrace construction												
2.20	Terrace maintenance												
2.21	Check-dam construction & maintenance												

No	Description	2017				2018				2019			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
3	**SO 2 Decreasing Animal health incidences**												
3.1	Construction of veterinary clinic												
3.2	Revolving fund for veterinary medicine purchase												
3.3	Livestock value chain study & establishment												
3.4	Farmers training on improved livestock management												
3.5	Farmers training on value chain												
3.6	Pastoralist livestock enterprise group formation and follow up												
4	**SO 3 Strengthening traditional rangeland management System**												
4.1	Survey & study of traditional bylaws												
4.2	Certification of communal property rights												
4.3	Conducting conflict resolution meetings												
5	**SO4 Adoption of appropriate technology**												
5.1	Small-scale irrigation schemes design												
5.2	Small-scale irrigation development												
5.3	Irrigation canal maintenance												
5.4	Farmers' training on irrigation water management												
5.5	Supply of improved seed												
6	**Monitoring and Evaluation**												
6.1	Participatory monitoring												
6.2	Mid-term evaluation–external												
6.3	Mid-term evaluation – donor, government staff and communities												
6.4	Final evaluation – external												
6.5	Final evaluation – donor, government staff and communities												

Table 3-3-5 Budget produced for the Chifra WPLUP Pilot Programme–EXAMPLE ONLY, TO BE REVISED TO LOCAL CONTEXT

Description			2017		2018		2019		Total Cost
A. Personnel	**Time %**	**Staff #**	**Monthly**	**Total**	**Monthly**	**Total**	**Monthly**	**Total**	
Project coordinator	1	1	15,000	180,000	15,750	189,000	16,538	198,450	567,450
Range ecologist	1	1	10,000	120,000	10,500	126,000	11,025	132,300	378,300
M&E officer	1	1	10,000	120,000	10,500	126,000	11,025	132,300	378,300
Clerk accountant	1	1	6,000	72,000	6,300	75,600	6,615	79,380	226,980
Salary				492,000		441,000		542,430	1,475,430
Medical, insurance, pension/provident fund, etc. (27% of Salaries)				132,840		119,070		146,456	398,366
Hardship allowance (40%)				196,800		176,400		216,972	590,172
Sub Total Salary & Benefit				**821,640**		**736,470**		**905,858**	**2,463,968**
B. Office Expenses	**Unit**	**#**	**Cost/U**	**Total Cost**	**Cost/U**	**Total Cost**	**Cost/U**	**Total Cost**	
Occupancy (water, electricity etc.)	Month	12	2,000	24,000	2,200	26,400	2,420	29,040	79,440
Supplies, stationery etc.	Month	12	4,000	48,000	4,400	52,800	4,840	58,080	158,880
Supplies, e-mail, telephone, fax etc.	Month	12	5,000	60,000	5,500	66,000	6,050	72,600	198,600
Maintenance, office equipment				0		10,000		10,000	20,000
Sub Total Office Expenses				**132,000**		**155,200**		**169,720**	**456,920**
C. Woreda EPLUA Capacity Building	**Unit**	**Quantity**	**Cost/U**	**Total Cost**					
Desktop computer	No	3	15,000	45,000					45,000
Laptop computer	No	5	20,000	100,000					100,000
Printer	No	3	5,000	15,000					15,000
Photocopier and scanner	No	1	40,000	40,000					40,000
GPS	No	8	5,000	40,000					40,000
Simple field survey instruments (line level, measuring tape…)	No	multiple	Lamp sum	4,500	Lamp sum	3,500	Lamp sum	3,500	11,500
Office & Field Equipment Sub Total				**244,500**		**3,500**		**3,500**	**251,500**

Description			2017		2018		2019		Total Cost
D. Vehicle Expenses	**Unit**	**Quantity**	**Cost/U**						
Motorcycles	No	4	120,000	480,000					480,000
Vehicle	No	2	650,000	1,300,000					1,300,000
Fuel & lubricants	Year	Lump sum		640,000		652,800		665,856	1,958,656
Spare parts and maintenance	year	Lump sum		445,000		467,250		490,613	1,402,863
Insurance	Year	6		48,000		40,000		40,000	128,000
Sub Total Vehicle Expenses				2,913,000		1,160,050		1,196,469	5,269,519
E. Staff Travel & Experience sharing Visits	**Unit**	**Quantity**	**Cost/U**						
Per diem and hotel accommodation	No	15	Lamp sum	225,000	Lamp sum	225,000	Lamp sum	225,000	675,000
Staff allowance & incentive	No	15	Lamp sum	450,000	Lamp sum	450,000	Lamp sum	450,000	1,350,000
Sub Total Staff Travel				675,000		675,000		675,000	2,025,000
F. Staff Training	**Staff #**	**Days #**	**Daily Rate**	**Total Cost**					
Stakeholder staff training on rangeland management, NRM and GIS oerdiem and accommodation	21	15	1,000	315,000		81,000		40,500	436,500
Trainers honorarium fee & training materials	1	15	Lump sum	120,000		77,000		38,500	235,500
Stakeholder staff training on livestock Value Chain	15	10	1,000	150,000		36,000		18,000	204,000
Trainers honorarium fee & training materials		10	Lump sum	80,000		40,000		20,000	140,000
Stakeholder staff training on animal disease control	15	15	1,000	225,000		45,000		22,500	292,500
Trainers honorarium fee & training materials		15	Lump sum	80,000		40,000		20,000	140,000
Stakeholder staff training on Irrigation principles	21	15	1,000	315,000		60,000		30,000	405,000
Trainers honorarium fee & training materials		15	Lump sum	120,000		40,000		20,000	180,000
Baseline survey		30	Lamp sum	300,000					300,000
Sub Total Staff Training & Baseline survey				1,705,000		419,000		209,500	2,333,500

Description			2017		2018		2019		Total Cost
Project Activities Implementation									
SO 1 Participatory Rangeland Management	**Unit**	**Quantity**	**Cost/U**	**Total Cost**	**Cost/U**	**Total Cost**	**Cost/U**	**Total Cost**	
Grass & tree nursery establishment (1ha)	No	1	Lump sum	100,000					100,000
Grass seed & fodder seed collection	Kg	30	Lump sum	3,000		3,000		3,000	9,000
Grass seed multiplication	Variety	10	Lump sum	200,000					200,000
Fodder & tree seedling production	No	750,000	3	750,000		750,000		750,000	2,250,000
Rangeland demarcation for area closure and improved management	Ha	1,200	1,000	400,000	1,000	400,000	1,000	400,000	1,200,000
Area closure	Ha	1,200	2,000	800,000	2,000	800,000	2,000	800,000	2,400,000
Pitting	No	750,000	3.50	875,000	3.50	875,000	3.50	875,000	2,625,000
Planting	No	750,000	2.00	500,000	2.00	500,000	2.00	500,000	1,500,000
Invasive plant uprooting	ha	600	1,000	200,000	1,000	200,000	1,000	200,000	600,000
Grass & fodder Planting	ha	600	1,000	200,000	1,000	200,000	1,000	200,000	600,000
Pastoralist training on Participatory Rangeland management	No	1,200	1,000	400,000	1,000	400,000	1,000	400,000	1,200,000
Nursery materials, tools & equipment	No	200	2,000	400,000	Lump sum	110,000	lump sum	120,800	630,800
Farm tools (rangeland improvement)	No		Lump sum	100,000	Lump sum				100,000
Pastoralist training on Ecotourism	No	80	1,000	1,200,000	600	36,000			1,236,000
Road Construction	Km	18	75,000	450,000	75,000	450,000	75,000	450,000	1,350,000
Road maintenance	Km	12	0	0	12,500	75,000	12,500	75,000	150,000
Terrace construction	Km	600	6,250	1,250,000	6,250	1,250,000		1,250,000	3,750,000
Check-dam construction	m3	150	50	2,500		2,500		2,500	7,500
Sub Total Rangeland Improvement				**7,830,500**		**6,051,500**		**6,026,300**	**19,908,300**

Description			2017		2018		2019		Total Cost
SO 2 Decreasing animal health incidences	**Unit**	**Quantity**	**Cost/U**	**Total Cost**	**Cost/U**	**Total Cost**	**Cost/U**	**Total Cost**	
Construction of veterinary Clinic	No	1	Lump sum			1,000,000			1,000,000
Revolving fund for veterinary medicine purchase	No	2	Lump sum	800,000					800,000
Livestock value chain study & establishment	No	1	Lump sum	300,000					300,000
Farmers training on improved livestock management	No	1,000	1,000	507,500	1,000	507,500	1,000	507,500	1,522,500
Pastoralist livestock enterprise group formation	No	6	10,000	20,000	10,000	20,000	10,000	20,000	60,000
Pastoralist training on livestock value chain	No	300	1,000	100,000	1,000	100,000	1,000	100,000	300,000
Sub Total SO 2				1,727,500		627,500		627,500	2,982,500
SO 3 Strengthening Traditional Rangeland management System	**Unit**	**Quantity**	**Cost/U**	**Total Cost**	**Cost/U**	**Total Cost**	**Cost/U**	**Total Cost**	
Survey & study of traditional bylaws	No	4	Lump sum	300,000					300,000
Rangeland management group formation	No	60	Lump sum	180,000	Lump sum	180,000	Lump sum	180,000	540,000
Bylaws development and legally recognized	No	60	Lump sum	30,000	Lump sum	30,000	Lump sum	30,000	90,000
Empowerment of pastoralist on written bylaws	No	3,000	5,000	500,000	5,000	500,000	5,000	500,000	1,500,000
Conducting conflict resolution meetings	N0	30	Lump sum	50,000	Lump sum	50,000	Lump sum	50,000	150,000
Sub Total Animal Health				1,060,000		760,000		760,000	2,580,000
SO 4 Promotion & Adoption of Appropriate Technology	**Unit**	**Quantity**	**Cost/U**	**Total Cost**	**Cost/U**	**Total Cost**	**Cost/U**	**Total Cost**	
Small-scale irrigation schemes design	No	4	Lump sum	200,000	0	0	0	0	200,000
Small-scale Irrigation development	Ha	75	30,000	450,000	31,500	945,000	33,075	992,250	2,387,250
Irrigation canal maintenance	Km	12		0	2,000	12,000	2,000	12,000	24,000
Farmers' training on irrigation water management	No	600	1,500	180,000		360,000		360,000	900,000
Supply of Improved seed	Qt	30	2,500	25,000		25,000		25,000	75,000
Eco-tourism prromotion	Village	4	50,000	200,000	20,000	60,000			260,000
Sub Total				1,055,000		1,402,000		1,389,250	3,846,250

Description			2017		2018		2019	Total Cost
I. Monitoring and Evaluation	**Staff #**	**# of days**	**Daily rate**					**0**
Participatory monitoring & learning	20	5	200	20,000		20,000	20,000	60,000
Stakeholders mid-term evaluation–	10	15	200			30,000		30,000
Mid-term evaluation–external	2	20	6,000			240,000		240,000
Stakeholders final evaluation	10	15					30,000	30,000
Final evaluation–Eeternal	2	20	6,000				240,000	240,000
Sub Total Monitoring and Evaluation				20,000		290,000	290,000	600,000
J. Audit and Accounting Fees								
Audit fees		Lump sum		30,000		30,000	30,000	90,000
Total Audit and Accounting Fees				30,000		30,000	30,000	90,000
Total Project Cost (Birr)				18,214,140		12,310,220	12,283,097	42,807,457

WORKSHEET 3-4

Joint woreda participatory land use planning

OBJECTIVE

To **develop and facilitate a joint woreda participatory land use plan (JWLUP) and joint woreda resource agreement (JWRA)** for shared resource(s)

OUTPUTS

A JWLUP and a JWRA.

PARTICIPANTS

The WPLUP Coordination and Facilitation Team, the woreda Administrations from the different woreda that share resources, and woreda Sub-Teams.

Joint woreda land use planning is the process that facilitates several woreda who share resources such as grazing and water to plan together, in order to protect those shared resources and establish structures and institutions that enable the sharing to take place. In the early stages of this WPLUP process described in this manual it should have been identified and agreed that in order to protect resources, such as a grazing area shared by two or more woreda, a joint WPLUP and **joint woreda resource agreement** (JWRA) would be established as well as, and in addition to, the individual woreda PLUP.

This decision should have been made at the beginning of the WPLUP process to allow for neighbouring woreda to plan together to ensure that the shared grazing area is kept intact and contiguous across the woreda boundaries. Discussions about how best resources can be shared across woreda boundaries should have been carried out from then, and ideally WPLUPs should have been established by the woreda in parallel. However, even if the decision was not made at the beginning to do such joint planning, then it is still possible at this stage to do so.

STEPS IN THE JOINT WOREDA LAND USE PLANNING PROCESS:

1. **Confirm which resources are shared** by communities in the different woreda and across the woreda boundaries. For this a more detailed mapping of rangeland resources will be required (*Worksheet 1-9*). involving representatives from all woreda. This can be carried out on the ground next to each other so the woreda representatives can see and discuss about the shared resources and ensure that they join up.

2. **A joint WPLUP Team and committee should be set up**. The Team would be made up of members of each WPLUP Team from the different woreda. The joint WPLUP committee should be made up of key stakeholders including leaders and local government of the woredas involved.

3. Once the mapping of rangeland resources including shared resources has been undertaken, **a meeting should be held by the joint WPLUP Team with the JPLUP Committee and other stakeholders to agree on what resources are shared**, and that they should be included in the Woreda Resource-sharing Agreement (WRA). The boundaries of these shared resources such as grazing should now be roughly agreed upon.

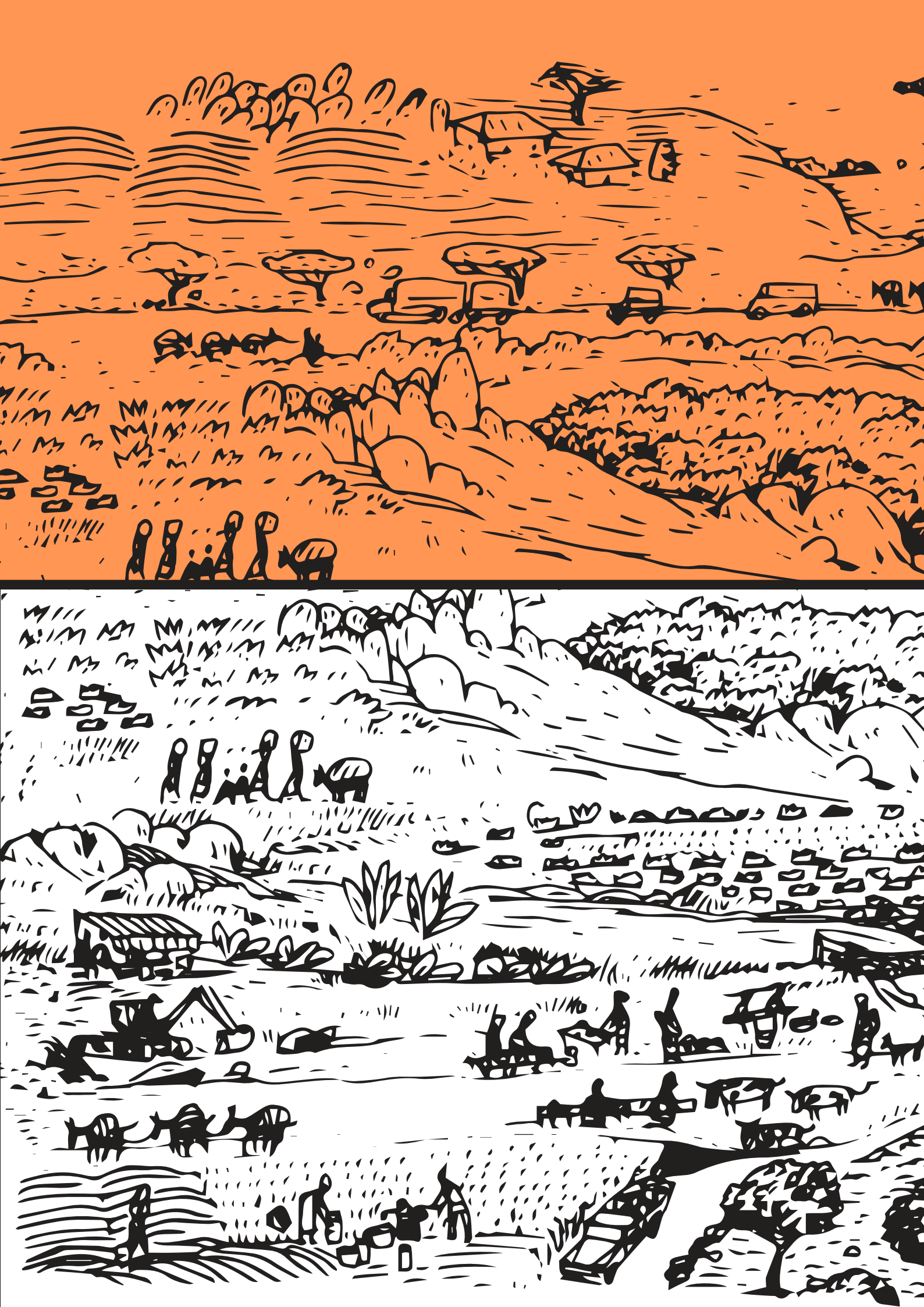
4. Once agreement has been reached, **each woreda will undertake its own WPLUP** as described in this volume, ensuring that any shared resources are mapped and protected as part of this. Regular meetings between the JWPLUP and JWPLUP Committee should be carried out to ensure that woreda are keeping to their commitments and the joint planning is on track.

5. **Whilst the WPLUP Team develops the plan for the individual WPLUP, so too should the JWPLUP Team and Committee develop the JWLUP** including particular attention given to the shared resources. This JWPLUP should be agreed by all stakeholders in the woreda involved. A joint WPLUP map will need to be produced detailing the boundaries of the shared resource, potentially with markers or signboards. There may be a need at this point to have further consultations and agreements between the different woreda about the boundaries of the shared resource so agreement is reached.

6. **A WRA will then need to be established highlighting who can use the shared resources, how they are going to be managed and by whom, who is responsible for them, what contributions will be made to their improvement and how**, etc. If the shared resource is part of customary management systems then it is likely that a management body already exists. However if not, then a joint management body will need to be established such as a cooperative, association or council. A key feature of the WRA will be that none of the woreda that are part of the WRA can change the land use of the shared grazing area or other, without the agreement of ALL woreda that have signed the WRA.

7. **A management plan will then need to be established** for the shared resource by the management body in consultation with all users. For a shared grazing area this would take the form of a Rangeland Management Plan (see *Worksheet 2-35*).

8. **The joint WPLUP Committee will need to continue to work with the management body and the individual WPLUP leaders to ensure that the JWPLUP is implemented**, and that decisions made by individual woredas do not conflict with the resource-sharing agreements.



RANGELANDS INITIATIVE GLOBAL

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CGIAR RESEARCH PROGRAM ON Policies, Institutions, and Markets Led by IFPRI

CGIAR RESEARCH PROGRAM ON Livestock

IFAD Investing in rural people

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

german cooperation DEUTSCHE ZUSAMMENARBEIT

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Schweizerische Eidgenossenschaft
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Swiss Agency for Development and Cooperation SDC

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