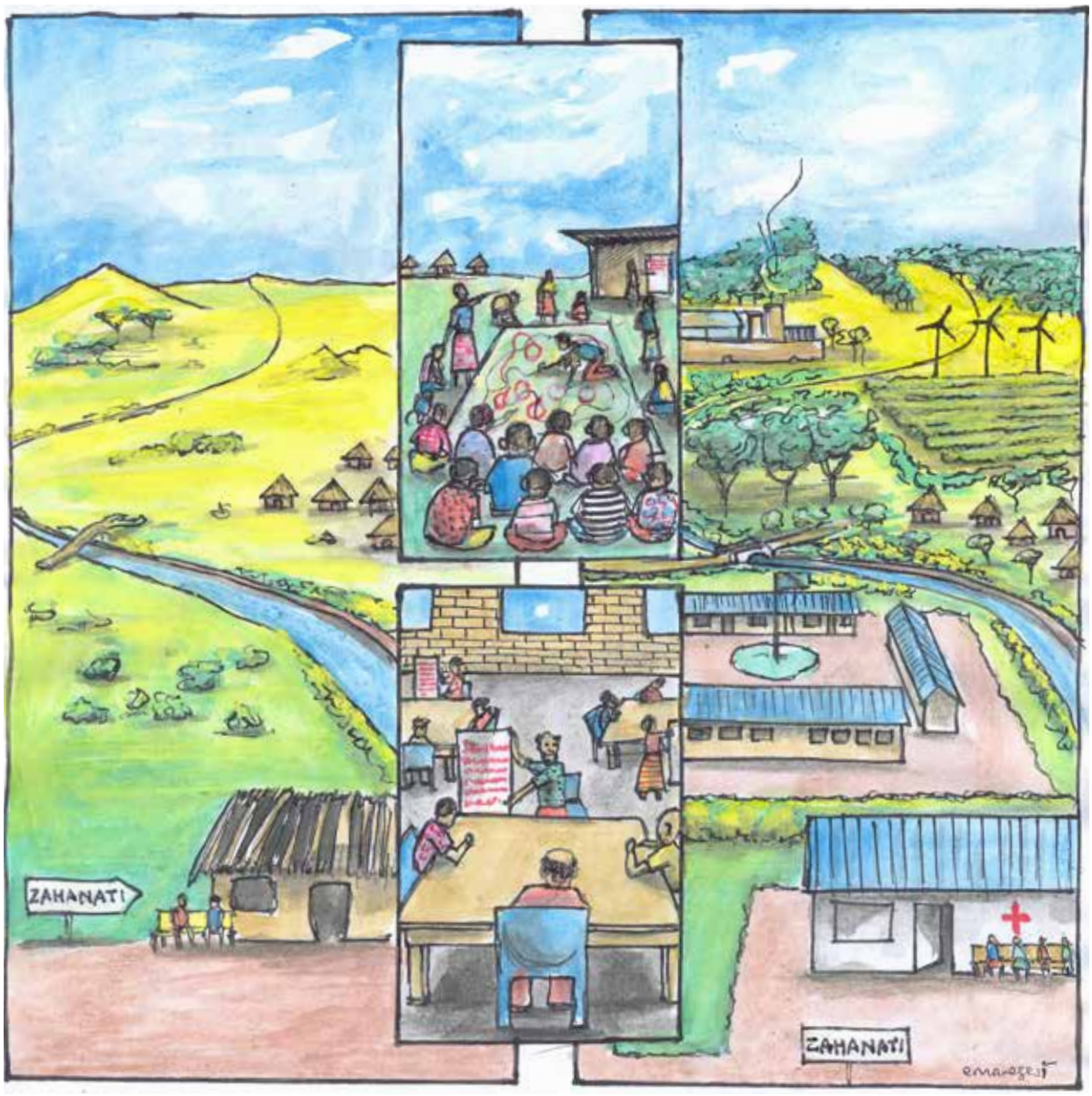


# Tools and Spatial Technologies for Village Land Use Planning

## A Practitioner's Manual for Active Community Engagement

**The United Republic of Tanzania,**
**Ministry of Land, Housing and**
**Human Settlement Development**

**National Land Use Planning**
**Commission**

# Tools and Spatial Technologies for Village Land Use Planning

A Practitioner's Manual for Active Community Engagement

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The manual development has been supported by:

Ministry for Foreign Affairs of Finland

The United Republic of Tanzania, Ministry of Natural Resources and Tourism

# Acknowledgements

The Practitioners' Manual for Village Land Use Planning using tools and spatial technologies for community engagement has been prepared using the Guidelines for Participatory Village Land Use Planning, Administration and Management in Tanzania. The Manual focuses on the first four steps of the VLUP by giving detailed instructions of each step on how Village Land Use Planning process can be carried out through the application of satellite images and active stakeholder participation.

The National Land Use Planning Commission therefore wishes to acknowledge all stakeholders involved in the development of this Manual. The development process involved different stakeholders from Sector Ministries, Government Institutions, Civil Society Organizations as well as Private Sectors. Development of tools and documentation of practices in this manual was facilitated by the Ministry for Foreign Affairs of Finland, and the Ministry of Natural Resources and Tourism of Tanzania through the Private Forestry Programme and the SUSLAND project of the University of Turku funded by the Academy of Finland.

Specifically, the NLUPC extends its gratitude to Andrew Ferdinands of the Private Forestry Programme, Salla Eilola and Niina Käyhkö of the University of Turku Finland, and Kelvin Mveyange and Yusuf Ssessanga of RLabs Iringa for their initial work and contributions in the development of this Manual. Special appreciation is also extended to the NLUPC Task Force led by Albina Burra, Director of Land Use Coordination and Policy for their valuable contributions and coordination of the process in the course of developing this Manual.

The NLUPC also wishes to thank Nora Fagerholm of the University of Turku for her professional insights on the use of participatory spatial technologies and the Coady International Institute and their partners, especially Gord Cunningham and Lisa Fuchs, for their insights on the use of asset-based community development (ABCD) tools. The NLUPC further acknowledges the PLUM teams of Njombe Town and District Councils and District Councils of Makete, Mufindi, Ludewa and Kilolo for their participation and valuable feedback during the review meetings and field-testing of tools presented in this Manual.

Finally, all stakeholders involved in rural development processes are urged to use this manual and other Guidelines issued by the National Land Use Planning Commission to actively involve communities in preparation, implementation and management of land use plans in Tanzania.

Fidelis K. Mutakyamilwa
Chairman - National Land Use Planning Commission
November 2018

# Foreword by the Director General

Village land use planning, administration and management is an important tool for natural resource management and sustainable rural development in Tanzania. The use and management of land resources has been addressed in a participatory and integrated approach under the Land Use Planning Act, Cap. 116, the Village Land Act, Cap. 114, the Environmental Management Act, Cap. 191 and other key Sectoral legislation with a base on land administration and management.

The National Land Use Planning Commission has a primary obligation to implement the Land Use Planning Act, Cap. 116 which by it's nature is a participatory legislation. The Commission has gained a years of experience on implementation of the Act.

PLUM Guidelines experienced implementation challenges necessitate revision of the approaches practices that were applied over years to address the challenges the NLUPC in collaboration with stakeholders developed the Manual for VillagePremised by the PLUM Guidelines, village land use planning is undertaken by using different tools for data collection and mapping including GPS and satellite images. This Practitioner's manual provides guidance on participatory village land use planning by using different and selected community engagement tools, practices and up-to-date spatial technologies for mapping. This Practitioner's manual for active community engagement has been developed by National Land Use Planning Commission (NLUPC) in collaboration with the Private Forestry Programme (PFP) supported by the Ministry for Foreign Affairs of Finland, the Ministry of Natural Resources and Tourism of Tanzania and the University of Turku (UTU).

The Practitioners' Manual has been prepared to further aspirations of the Guidelines for Participatory Village Land Use Planning, Administration and Management in Tanzania. It suggests and provides detailed instructions for 17 practices and tools and four tasks for facilitators with GIS skills. However, these practices and tasks are optional and when necessary can be modified to fit the village context and available resources. The manual has been designed to be user-friendly to practitioners to carry out Village Land Use Planning activities with communities at grassroots' level.

Tools and practices presented in this manual enables collection and analysis of location-based information by villagers even from areas that are inaccessible to create more detailed, accurate and standardized Village Land Use Planning maps. These accurate and jointly established maps enhance sustainable land management and mitigate land conflicts. Furthermore, the mapping and group working tools in this manual support villagers to actively discuss and learn about their village land, its resources, socio-economic situation and address villagers' commitment in implementing VLUPs for improved and sustainable production.

This manual should not be considered to supersede the PLUM Guidelines but rather to be used to provide guiding principles that have to be applied according to the local agro-ecological, socio-economic and cultural context through cost-effective tools and practices. The manual may need to be revised from time to time in order to incorporate future technological advancements and the evolving needs of rural communities.

Dr. Stephen Justice Nindi
Director General - National Land Use Planning Commission
November 2018

# Contents

# List of Acronyms and Abbreviations

| | |
|---|---|
| ASTER | Advanced Spaceborne Thermal Emission and Reflection Radiometer |
| CAP | Community action plan |
| CCRO | Certificate of customary right of occupancy |
| CSV | Comma-separated values |
| DEM | Digital elevation model |
| DPI | Dots per inch |
| ECW | Enhanced compression wavelet |
| ESRI | Environmental Systems Research Institute |
| FAO | Food and Agriculture Organization |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| HIV | Human Immunodeficiency Virus |
| ICT | Information and communication technologies |
| ILC | International Land Coalition |
| JPEG | Joint Photographic Expert Group |
| KML | Keyhole markup language |
| MAST | Mobile application to secure tenure |
| MKUKUTA | Mkakati wa Kukuza Uchumi na Kupunguza Umaskini Tanzania |
| MLHHSD | Ministry of Lands, Housing and Human Settlements Development |
| NGO | Non-governmental organisation |
| NLUPC | National Land Use Planning Commission |
| OLI | Operational land-imager |
| OSM | Open-Street Map |
| PDF | Portable document format |
| PFP | Private Forestry Programme |
| PLUM | Participatory land use management |
| PNG | Portable network graphics |
| PRA | Participatory rural appraisal |
| QGIS | Quantum GIS |
| RLabs | Reconstructed Living Labs |
| SRTM | Shuttle Radar Topography Mission |
| SUSLAND | Sustainability, Scale Relations and Structure-Function-Benefit Chains in the Landscape Systems of the Tanzanian Southern Highlands Project |
| TZS | Tanzanian shilling |
| UPS | Universal polar stereographic |
| UTM | Universal Transversal Mercator |
| UTU | University of Turku, Finland |
| VC | Village council |
| VEO | Village executive officer |
| VLUMC | Village land use management committee |
| VLUP | Village land use plan |
| WGS | World Geodetic System |

# Glossary of Key Terms

**Existing village land use map** = a map of the existing land uses of a village.

**Geo-referencing** = the process of assigning real-world coordinates to each pixel of a raster image or to a physical map.

**Proposed land use map** = a map of the proposed land use of a village which is presented to the village assembly for its approval.

**Satellite image map** = a processed satellite image with real colors and key features of a map such as a north arrow, a grid with coordinates, and a scale bar.

**Sketch map** = a hand-drawn map created by villagers on a transparent plastic sheet on top of a satellite image map which demarcates boundaries of land uses for both existing and proposed land use maps.

**Village land use plan map** = a proposed land use map which has been approved by a village assembly and is attached to VLUP.

# List of figures and tables

# 1. Introduction

## 1.1. Spatial and participatory tools to support land use planning in Tanzania

Village land use (VLU) planning in Tanzania has its basis in the Land Use Planning Act No. 6 of 2007 and the Village Land Act of 1999, both of which give village councils (VCs) the powers to plan, manage and administer the lands within their village. Sectoral legislation such as the Environmental Management Act of 2004 directs and obliges every village community to practice the sustainable management of the resources within its village. The process of village land use planning is guided by "Guidelines for Participatory Village Land Use Planning, Administration and Management", 3rd edition ("The PLUM Guidelines (3rd edition)"), a document which describes the six steps to be followed in the VLUP process: 1) preparations at the district level, 2) participatory rural appraisal (PRA) for land use management, 3) mapping of existing village land uses, 4) participatory VLU planning, 5) detailed village land use management planning, and 6) implementation of village land administration. This practitioners' manual focuses on the first four steps of the VLU planning process. It is an annex to "The PLUM Guidelines (3rd edition)" and provides detailed instructions on how practitioners can carry out activities in the first four steps of the VLUP process.

The manual proposes and provides detailed instructions on 17 practices and tools and four tasks, all of which are tailored to facilitate VLUP activities (Table 1). These tools and practices are optional and, when necessary, can be modified to suit the village context and resources available. Figure 1 shows the workflow of the various activities in the VLUP process based on "The PLUM Guidelines (3rd edition)" and the proposed practices, tools and use of spatial data at each step of the process. The figure suggests the order in which the tools and practices can be used in the VLUP process.

Decisions regarding land use allocation and management can be made only with information on the locations of existing resources, land uses, and people's preferences and needs. In addition, reaching well-informed, mutually agreed, and locally owned decisions about VLU planning requires wide stakeholder representation and the effective participation of villagers. Informed decisions and good-quality village land use plans (VLUPs), thus, necessitates that village-level spatial information is available. In the majority of villages in Tanzania, however, this information is inadequate and disorganised. Moreover, the collection of such information often relies on laborious fieldwork which is challenging to conduct with the resources available. Today, however, free spatial data and technologies and mobile technology offer new opportunities to enhance the cost-efficiency of and stakeholder participation in the VLUP process. In addition to the use of spatial technologies, "The PLUM Guidelines (3rd edition)" emphasises empowering local communities, especially women and other disadvantaged groups, to participate in decision-making.

**Table 1.** The practices and tools as well as tasks for the facilitators with GIS skills instructed in this manual. The tools are optional and you can choose the ones which best fit to your resources and needs. The summary table includes the VLUP step number(s) in which each tool is suggested to be used, the objectives and benefits of the tools and timing, preparations and materials needed.

| Practice or tool (Step in PLUM Guidelines (3rd edition)) | Outcomes | Benefits of the practice or tool | Time used | Preparations and material needed | Page in the manual |
|---|---|---|---|---|---|
| Reconnaissance visit (Step 1) | • Familiarization of village<br>• Schedule set for VLUP process | • Prior understanding of village land use challenges and opportunities for commencing the planning<br>• Trust building<br>• Opportunity given for villagers to influence VLUP process design and their expectations | Meeting for 1 to 2 hours, walking up to 6 hours; should be done some days or weeks before the step 2 starts in a village | Village satellite image map, notebooks, pens and camera (not necessary). | 29 |
| Participatory stakeholder analysis (Step 1) | • Various stakeholders of VLUP process identified and prioritized | • All VLUP stakeholders are identified and included in the planning if necessary<br>• People who have power in the village decision-making and those who have not are considered | 30 mins to 2 hours | Flipchart paper, marker pens and masking tape or blackboard and chalk. | 32 |
| Village boundary verification (Step 1) | • Village boundary verified and any boundary issues identified and resolution started | • Boundary problems and inconsistencies in the official boundary are resolved before efforts on VLUP planning are started | 1 to 5 hours; preferably done at early stages of VLUP process. The verification will take up longer time if a boundary conflict is discovered. | Whiteboard marker pens and something to erase the markings off the plastic sheet, clear wide tape, scissors, village satellite image map and 4-5 meters of transparent plastic sheet, notebooks, pens, report template and camera. | 36 |
| Knowledge gap tool (Step 2) | • Awareness raising topics identified and targeted to the audience | • Special attention given to the needs and knowledge gaps of the participants<br>• Motivates people to learn while they realize they already know something that it is worth sharing | 30 min to 1 hour depending on the topics and time available | Optionally flipchart paper and marker pens. | 42 |
| Group work, dialogue and learning cafe tools (general participatory tools) | • Diverse opinions captured<br>• Participants are actively participating | • Encourages participants to express their opinions and knowledge<br>• Motivates and keeps the participants active<br>• Gives more people opportunity to speak | 30 mins to 2 hours | Note taking material and alternatively chairs and tables or other things to sit and write on. | 46 |
| Village history timeline tool (Step 2) | • A timeline of events and conditions in the village from past to present | • Increases understanding of the past achievements and conditions in the village thus encouraging local agency in development<br>• Indicates the future developments in the village and helps to plan actions towards future goals | 2 hours | Flipchart paper, masking tape and marker pens or blackboard and chalk. | 54 |
| River of life tool (Step 2) | • A timeline in a form of a river with events and conditions in the village from past to present | • Increases understanding of the past achievements and conditions in the village thus encouraging local agency in development<br>• Indicates the direction the village might be taking so as to plan actions for the future<br>• Is more inspiring presentation of the history than timeline thus invoking stories and imagination | 2 to 3 hours | Flipchart paper, masking tape and marker pens or blackboard and chalk. | 57 |
| Trip to the future tool (Step 2) | • A list of desired future developments in the village | • Encourages villagers to think broadly and outside the box what developments they want to have in the village<br>• Creates shared goals for future developments<br>• Better understanding of what it takes to achieve what they want | 2 to 3 hours | Flipchart paper, masking tape and marker pens or blackboard and chalk. | 59 |

| Practice or tool (Step in PLUM Guidelines (3rd edition)) | Outcomes | Benefits of the practice or tool | Time used | Preparations and material needed | Page in the manual |
|---|---|---|---|---|---|
| Problem tree analysis (Step 2) | • Problems and their causes and effects in different sectors of village life are identified | • Problems are broken down into smaller and definable parts which can be prioritized and focused on<br>• Better understanding of inter-linked and sometimes contradictory causes of problems | 2 to 3 hours | Flipchart paper, masking tape and marker pens or blackboard and chalk. | 62 |
| Community leaky bucket tool (Step 2) | • Information on components and state of village economy<br>• Potential income sources and saving opportunities identified in the village | • Assists in understanding local economy and how different activities contribute or undermine it<br>• Helps participants to see how economy works and how it can be influenced | 1 to 2 hours | Flipchart paper, masking tape and marker pens or blackboard and chalk. | 66 |
| Mapping areas of environmental risks on a satellite image map (Step 3) | • Potential environmental risk areas are mapped in order to guide land allocation to minimize and avoid loss of lives and material damage | • Utilizes local experiential knowledge to identify hazardous areas in spatially explicit way<br>• Combines local and expert knowledge with terrain information to refine the predictions of environmental risk area | 1.5 to 2.5 hours; advised to be done before the existing land use mapping and some days before the proposed land use mapping in order to have time to calculate future area needs (projections) | Whiteboard marker pens and something to erase the markings off the plastic sheet, clear wide tape, scissors, village satellite image map and 4-5 meters of transparent plastic sheet, flipchart paper, masking tape, marker pens, notebooks, pens, report template and camera. | 70 |
| Mapping existing land uses on a satellite image map (Step 3) | • Sketch map of the village land uses on satellite image map | • Village land uses and village boundaries are mapped in more detail with villagers onto a georeferenced map<br>• Areas which cannot be accessed on foot or car can be mapped and GPS tracking time is reduced<br>• Participants use satellite image to discuss land use areas and gain shared understanding of the locations under discussion | 3.5 to 6 hours; advised to be done some days before the proposed land use mapping is conducted in order to have time to calculate future area needs (projections) | Whiteboard marker pens and something to erase the markings off the plastic sheet, clear wide tape, scissors, village satellite image map and 4-5 meters of transparent plastic sheet, flipchart paper, masking tape, marker pens, notebooks, pens, report template and camera. | 74 |
| Tips for Community action plan development (Step 2 or 4) | • Community action plan which integrates previous information collected and topics discussed with participants | • Supports active discussion and idea generation during the CAP development<br>• Shows clearly the link between the CAP and the information collected during previous exercises in VLUP process | Time required for CAP development and some additional time required depending on the group working tool used | Flipchart paper, masking tape and marker pens or blackboard and chalk, documentation of outcomes from the previous exercises. | 88 |
| Mapping proposed land uses on a satellite image map (Step 4) | • Sketch map of the proposed village land uses on satellite image map | • Same benefits as in mapping existing land uses on satellite image map<br>• Land allocations can be discussed with detail and by considering land use rights of more people<br>• Area delineations are visible on the image for all to see increasing transparency of decisions | 2 to 4 hours | Whiteboard marker pens and something to erase the markings off the plastic sheet, clear wide tape, scissors, village satellite image map and 4-5 meters of transparent plastic sheet, flipchart paper, masking tape, marker pens, notebooks, pens, report template and camera. | 90 |
| Presenting the proposed land use plan and maps in the village assembly (Step 4) | • The VLUP maps, and plan are presented to the assembly for their commenting<br>• Any modifications and changes are recorded down and addressed in the final VLUP | • When the sketch maps are presented on top of the satellite image map, the assembly attendees see exactly where resources, services and boundaries of each land use area are located in the village<br>• Shared understanding can be created on the area delineations and implications of land use allocations<br>• Assembly is better informed on the proposed land use allocations in order to comment on them | 3 to 6 hours | Hand drawn sketch maps on top of the satellite image map, VLUP report draft and if already printed the draft versions of the digital maps, flipchart paper, masking tape, marker pens, notebooks, pens and camera (optional). | 96 |

| Tasks for the facilitators with GIS skills | | | | | |
|---|---|---|---|---|---|
| Task (Step in PLUM Guidelines (3rd edition)) | Outcome | Benefits of carrying out the task | Time used | Preparations and material needed | Page in the manual |
| Preparation of village satellite or aerial image map (Step 1) | • Village satellite image map for use with villagers | • Helps familiarization of and orientation to the village landscape characteristics before village visit<br>• Enables georeferenced land use mapping and detailed digitisation of areas with less GPS tracking | 1 to 6 hours; should be made one week before going to the village | Computer, GIS software, village boundary shapefile, softcopy of the satellite image, transparent tape, scissors. Printing: printing service or a plotter, printing papers and cartridges. | 18 |
| GPS tracking tips for quality spatial data (Step 3 and 4) | • Systematically and correctly collected GPS points for map production | • Proper settings on the GPS device and careful documentation of GPS points ensure no data is lost during and after the field tracking | 5 to 6 hours after existing land use mapping and 3 to 4 hours after the proposed land use mapping | GPS device, notebooks, pens and GPS coordinate collection forms. | 84 |
| Digitisation of satellite image sketch maps (Step 3 and 4) | • Digital versions of the VLUP sketch maps<br>• Systematically stored spatial data of the VLUP process | • Careful digitisation and systematic storage of the data ensure combining of the data with other spatial data sets and future use by various stakeholders | 2 to 4 hours per map | GIS software, computer, photographs of the environmental risk, existing and proposed land use sketch maps, DEM data of the area, notebook with grid readings (coordinates) and GPS data from field tracking (GPS coordinate collection forms). | 99 |
| Production of the digital VLUP maps (Step 3 and 4) | • High quality digital VLUP maps | • Reliable representation of the land uses on the ground in a map form<br>• Readability and usability of the maps is increased with clear visual map layout | 2 to 3 hours per each map | GIS software, computer and VLUP GIS data (shapefiles). | 103 |

One of the major challenges in village land use planning in Tanzania is to keep the costs of carrying out the VLUP process at minimum while ensuring high quality planning. The need to reduce the costs without undermining quality was considered during the development of the tools and practices in the manual. The manual proposes using freely available high-resolution satellite images in mapping activities (Figure 2 and Textbox 1) to decrease the time and resources needed for Global Positioning System (GPS) tracking and field visits and thereby allow for more time to conduct actual planning activities with villagers. The use of remotely sensed images enables participatory collection, analysis and discussion of location-based information about areas which cannot be accessed through field visits or by using GPS tracking (Textbox 2). More benefits of using satellite images are listed in Textbox 3 and some participants' views on mapping exercises are presented in Textbox 4. The proposed PRA tools aim to enable and encourage villagers to participate more actively and do not require any resources other than time. Depending on the number of days available for conducting VLUP process in a village, you can choose which of the practices and tools to use with the given timeframe and village needs. Furthermore, in order to ensure the needs of different social groups are considered during the VLUP decision-making, you have to involve their representatives in the activities and note this in the costs of the activities.

The tools and practices introduced in this practitioners' manual are low-cost and require basic technical expertise from the facilitators of the planning process. It is important to mention that the number of other technologies available to Tanzanian planners is increasing. Nowadays spatial planning as well as resource management and monitoring can be carried out using online mapping and data collection tools, mobile applications, and advanced spatial analysis of remotely sensed data. For example, FAO's Open Foris Toolkit (www.openforis.org) supports the monitoring of natural resources using large datasets of globally available satellite imagery without requiring significant investments in hardware. In fact, access to the Internet is all that is needed to use this tool. Another useful tool is the Mobile Application to Secure Tenure (MAST), which has been piloted in Tanzania to promote land adjudication and the issuance of certificates of customary right of occupancy (CCROs) (www.land-links.org/2016/03/usaids-mobile-application-secure-tenure-mast/). More participatory online mapping applications relevant to the VLUP process can be found in Textbox 55 on page 82.

## 1.2. Methodology used for developing the tools and practices in this manual

The tools and practices in this manual were designed based on the experiences of VLUP facilitators working in the Southern Highlands of Tanzania to address several common challenges in the planning process. The development of the manual involved a team of facilitators from the National Land Use Planning Commission (NLUPC), the Private Forestry Programme (PFP) of the Ministry for Foreign Affairs of Finland and the Ministry of Natural Resources and Tourism of Tanzania, and the Tanzania research team of the University of Turku (UTU) in Finland. This team effort began in 2015 with a study of the current VLU planning process and its limitations. Interviews and workshops were conducted by a researcher from the University of Turku with district planners from Njombe town and district councils and Makete, Mufindi, Ludewa and Kilolo district councils. After the study was complete, the researchers, together with the PFP, began to develop tools to address the identified limitations. The non-governmental organisation (NGO) RLabs Iringa joined the team to develop and test tools that could improve awareness-raising and increase villager participation during the VLUP process. In 2016, the PFP, together with district participatory land use management (PLUM) teams, started experimenting with the use of satellite images with villagers in the programme area. In June 2016, the researchers conducted a pilot study in one village to study the usability of satellite imagery and its implications for the quality of spatial data, environmental understanding and deliberative decision-making (the results of this study will be published in a forthcoming publication by Eilola et al.).

After gaining experience in the use of the tools themselves, the PFP and the NLUPC organised training in their use and in GIS skills for district PLUM team members in the programme area. In 2017, a first draft of the manual was developed and a stakeholder workshop was organized by the NLUPC, the PFP and the UTU


**Figure 1.** Recommended order of steps and activities in the VLUP process described in the PLUM Guidelines (3rd edition) and the use of practices, tools, spatial data sets and maps instructed in this manual. The spatial data sets refer to existing location-based information on for example water sources, soil and vegetation, infrastructure and land ownership, which can be combined with the spatial data produced during the VLUP process.

**Figure 2.** Satellite image as a background for mapping. The villagers use the satellite image to map their existing land uses and to discuss the future land use allocations. The satellite image engages participants to together explore their village environment seen on the image and to negotiate future land allocations with details that all can agree on.

to demonstrate the use of satellite imagery in the VLUP process. At the workshop, 35 representatives from 21 organisations, including academic institutions, government organisations, and NGOs shared their experiences and gave feedback on the tools. In November 2017, at a "write-shop" held by the NLUPC, the PFP, the UTU and RLabs, the manual was reviewed and developed further. At a second stakeholder workshop in April 2018, 33 representatives from 23 organizations conducted a final review (see annex 1 for a list of organizations which participated in the stakeholder workshops). The manual was then finalised and submitted to the Board of the NLUPC for approval. At the time of the manual's publication, the tools and practices it describes had been used by the PLUM teams in 28 villages in the Southern Highlands area (see annex 2 for a list of these villages).

**Textbox 1. What is a satellite image and are they expensive to use in the VLUP process?**

Satellite images are remote-sensing images of the earth's surface taken from the space by instruments located on observation satellite platforms in space. The images are taken from approximately 600-800 km above the earth's surface. Most common satellite images, which allow for the mapping of the land's surface, are Landsat OLI and Sentinel-2 images, which are free-of-charge environmental satellite data sets with medium-scale (10-30 m) spatial resolution. Commercial satellite images, such as Worldview or Pleiades, are able to capture details of the earth at a spatial resolution of around 0.5 m to 1 m. All of these high-resolution satellite images are most suitable for use in local mapping projects such as in VLUP.

Satellite images can be purchased or accessed from the Internet free of cost. The most recent images can be opened for free on QGIS, ArcGIS or Google Earth. They can then be worked with online to make a village satellite-image map. Free GIS software like QGIS can be used to prepare the satellite image map which can be printed and used with villagers. Since software and satellite images are free, the main cost of using satellite images is the cost of printing. The total printing cost depends on factors such as the prices of printing services and of maintaining the plotter (printer), the number of satellite image printouts needed to cover the entire village, and the size and type of paper used for the printouts. The price of printing has been steadily decreasing in Tanzania and is likely to continue to decrease, thereby rendering printouts more affordable than they currently are.

## 1.3. How to use this manual

This manual has been written for the facilitators of the VLUP process, including district PLUM teams, to guide, standardise and inspire planning activities. It is also written to help village land use management committees (VLUMCs) and other village stakeholders and district-and regional-level administrators grasp the participatory planning approach, manage their expectations, and monitor the quality of VLUP work.

The following sections consist of instructions of 17 tools and practices which you can use in the VLUP process. In addition, there are instructions for those facilitators with GIS skills to carry out four tasks to produce and store the spatial data generated during the VLUP process. The step(s) in "The PLUM Guidelines (3rd edition)" during which each tool or practice is suggested to be used is indicated in the margin of each page. Those pages that describe tools and tasks which require GIS skills, are highlighted with turquoise color page margins. Small tasks related to other tools, which require GIS skills, are indicated with turquoise color in the page margin and the word "GIS". This color-coding will help you recognise when GIS skills are required to complete a task.

Each of the 17 tools and practices are accompanied with "basic details," "addressing possible challenges," and "ways to modify" textboxes. The "basic details" textbox indicates 1) the time which the tool takes up in hours, 2) the participants that ought to be involved, 3) the outcomes of the tool, and 4) the preparations and materials which using the tool requires. This textbox helps users consider and compare various tools. The information on how much time a tool takes up in hours will help you plan which and how many activities you can carry out within one day. For example, you may be able to conduct two or three exercises in one

day if they take just 30 minutes to 2 hours each. Together with the "basic details" textbox, the "addressing possible challenges" textbox will also assist you in choosing the most appropriate tools and practices given the time and resources available. This manual describes the ideal way of using a tool. Tips on how to modify a tool are given in the "ways to modify" textbox so that users can modify the tool or practice to suit their resources and VLUP process activities. For some of the tools and practices, additional textboxes with further information are provided.

As stated above, the tools and practices in this manual are just suggestions. We encourage you to use your own experience and knowledge as a practitioner to modify the tools to fit the context, resources and skills available. We hope you will find the tools useful and be inspired to apply them with your VLUP stakeholders!

**Textbox 2. Applicability of satellite images in the diverse landscapes of Tanzania**

The use of satellite image as instructed in this manual is applicable across Tanzania, but specific characteristics of a landscape and local livelihood strategies will influence the way satellite images may be used. This manual is based on experiences in three regions in the Southern Highlands of Tanzania, Njombe, Iringa and Ruvuma. Several districts in these regions have already used the tools described and experiences with them are still accumulating. Babati District in Manyara and Bariadi District in Singida also have much experience in using satellite images in VLUP process. In these districts, the Ministry of Lands, Housing and Human Settlements Development (MLHHSD) used satellite imagery in collaboration with the local government to plan land use and carry out land adjudication in several villages.

The landscapes and characteristics of villages differ greatly in different parts of Tanzania and these unique local conditions need to be considered when planning how to carry out land use and resource mapping in villages. Village communities in the Southern Highlands are characterised by low population density, sedentary farming, and small-scale forestry production. This context differs greatly for example from rangeland areas of Tanzania such as in Dodoma, Manyara and Shinyanga regions where sedentary farming and pastoral communities live side by side. For this reason, in addition to this manual, another useful manual to look at for insight into VLUP process in rangeland areas of Tanzania is "Participatory Rangeland Resource Mapping in Tanzania" (ILC 2016).

Flexibility in livelihood strategies and seasonal variations in resource access influence the use of satellite imagery in land use planning. A satellite image, even if it is a very recent one, is a snapshot of a particular time in the landscape and thus, by its very nature, it obscures seasonal variation. In addition, since the spatial extent of a satellite image may not adequately cover the entire area within which villagers utilise resources throughout the year, both the spatial extent and the scale of the satellite-image must be well thought out. GPS tracking and mobile phone mapping applications may be used to collect spatial data on both the movements of people and the seasonality of resource availability (see Textbox 54). Instead of printouts of satellite images, users can use their digital versions on a laptop or tablet in a GIS such as QGIS (www.qgis.org), thereby enabling the collection of data and the making of planning decisions on a wider area and facilitating joint land use planning by several village communities.

### Textbox 3. What benefits do satellite images offer for the VLUP process?

The use of satellite or aerial imagery instead of blank flipchart paper for mapping village land uses with villagers has numerous advantages. Using such imagery helps villagers produce better quality land use maps and supports active villager participation and discussion. In addition, satellite and aerial images do the following:

- Provide a bird's eye view of a village and thus a more comprehensive view of the village landscape and land uses and their spatial distribution and extent.
- Enable villagers to accurately and in detail identify, map, and verify land uses, boundaries of village areas, and locally important assets on geo-referenced image maps, which is something that a sketch map on a flipchart paper does not allow for.
- Enable detailed discussions about a village area and the different resources in it, thus helping villagers and facilitators establish a shared understanding of the locations under discussion.
- Reduce the time for GPS tracking since only those sites and areas not visible on the image maps need to be GPS-tracked in the field.
- Provide a relatively low-cost way of getting more recent spatial land-use information (roads, settlements, agriculture, water bodies, and the like) than that found in the topographic standard sheets of 1976 available in Tanzania.
- Support learning about village landscapes and land uses via visual means. Show the delineation of areas in relation to the features on the landscape to everyone, thereby increasing the transparency of decisions.
- Enable the production of accurate land use maps which can be combined with other spatial datasets available at the district, regional, and national levels.

### Textbox 4. What do villagers think of the use of satellite images in planning?

Participants of the land use mapping exercises were interviewed in a pilot village of Njombe Town Council area. In total 22 participants amongst 35 people who participated in the exercises were interviewed after existing and proposed land use mapping. Following are translated statements of participants outlining positive things about the satellite image use they had noticed.

*"It [the satellite image] made the discussion easier, because we could see everything we were discussing on it."* A woman in the study village.

*"Satellite imagery allowed me to know the whole village, I am a disabled person so I cannot move around the whole village."* A man in the study village.

*"I see my village from a new persepctive; my view of it has changed. I see that my village is going to be a developed village for our children. Future land use mapping has made me think about future generations."* A man in the study village.

*"I was happy that we drew the map even though we are not experts."* A man in the study village.

About 68 % of the interviewed participants say that they learned something new about their village environment through the satellite image. Ten of the 11 interviewees who participated in the proposed land use mapping exercise said that the satellite image facilitated discussion and made it more detailed. About 41 % of the participants also said that they had initially either fear of difficulty or difficulties in understanding and using the satellite image. Initial difficulties suggest the importance of ensuring that participants are thoroughly instructed on the use of imagery before mapping exercises begin.

# 2. Suggested tools and practices for village land use planning

## 2.1. Preparations

"The PLUM Guidelines (3rd edition)" guides PLUM teams and other facilitators of the VLUP process to start the process by carrying out preparatory activities in districts and villages. According to the guidelines, the activities in the first step include, for example, building the capacity of the required land use planning authorities in the district, enhancing coordination among relevant actors, preparing a village base map, conducting a reconnaissance survey in the village, verifying the status of village boundaries, and agreeing on a plan of action for carrying out the planning process. In the following sections, you will find detailed instructions on 1) how to prepare a village satellite image map to support the production of a base map and the conduct of land use mapping in the villages, 2) what activities to carry out during a reconnaissance visit to the village, 3) how to conduct participatory stakeholder analysis to identify all relevant stakeholders in the VLUP process and 4) how to verify the status of village boundaries and identify land conflicts.

### 2.1.1. Preparation of village satellite or aerial image map for village land use mapping

#### Overview and aim

Remote-sensing data, such as aerial and satellite images, provide valuable background for VLU planning when they can be obtained at a sufficient spatial scale, such as 1:7500 or larger. Having a sufficiently large scale allows users to identify individual objects from the images, such as houses, roads, land use patterns, and large trees (Figure 3). Such images are called high-resolution satellite images. The remote-sensing images of a village familiarise the facilitators of the planning process with the village landscape and land features before and during their visits to the villages (see Textbox 9 on the preparation of landform maps, too). The images can be used to prepare a village base map as well. Moreover, the images serve as valuable background for the villagers to be able to map their land uses in a more detailed fashion than using blank flipchart paper. As it is possible to obtain a bird-eye perspective of a village landscape through these images, their use provides village inhabitants richer opportunities to learn and communicate about village land use practices, related values and future needs than does paper (Figure 4).

Preparation of the satellite image into usable mapping background needs to be started early enough, in order to have time to digitally process, prepare, print and interpret the images before the village visits start. The satellite imagery must have all the information a map does, such as a north arrow and a scale. **By inserting these map elements into the satellite image you create a village satellite image map.** The high-resolution satellite images needed to produce an image map can be obtained commercially from image vendors, but images can also be obtained free-of-charge in the QGIS software by accessing map services such as Google Maps or Bing Maps. The images are not downloaded on the computer but are instead accessed online and used to print the village satellite image map. Novel remote-sensing data production options, such as drone images, are becoming prominent, but such images, like any aerial remote-sensing images, have to be acquired separately. Drone image data production campaigns are expensive and their spatial coverage is more restricted than that of satellite images.

**Textbox 5. Basic details**

- Time: 1 to 6 hours. Prepare one week before going to a village.
- Participants: Facilitation team member(s) with GIS skills.
- Outcomes: A satellite image map printout of the village area to be used in mapping and a digital version of it to be used in GIS software.
- Preparations and materials: Computer, GIS software, village boundary shapefile, soft-copy of a satellite image, transparent tape, scissors. For printing: printing service or a plotter, printing papers, and cartridges.

**Figure 3.** Real size example of a part of a satellite image in scale of 1:7500. The houses, roads, paths, some single trees and a river can be distinguished in the image. Image capture: 14 July, 2017. Satellite image source: © 2018 Google, © CNES/Airbus.

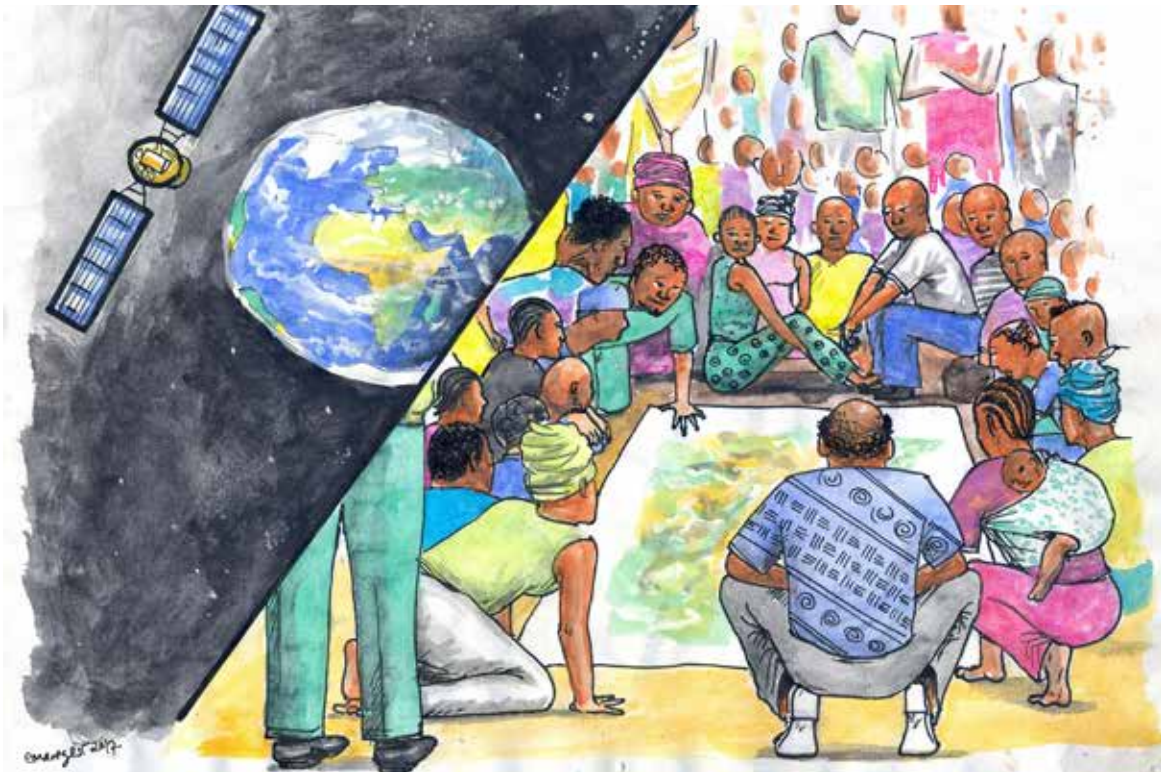


**Figure 4.** A satellite image is like a photograph of the earth's surface taken hundreds of kilometers above the earth. For villagers and facilitators they offer a bird's-eye view on almost everything seen on the village landscape.

## Working tasks

### Accessing satellite images:

1. Obtain a GIS layer (shapefile) with the boundaries of the village in which you are working. Shapefiles can be obtained from district offices or from the Division of Survey and Mapping of the MLHHSD. If the boundary does not exist in digital form, you can digitise it from the village survey plan. The boundary shapefile will show you the location and overall extent of the village while you look for a suitable satellite image for the village.

2. Look for the most recent suitable cloud-free satellite images of the village area from commercial satellite data repositories such as planet.com and Digital Globe or free-of-charge online map services such as Google Maps, Bing Maps, Esri World Imagery or any other source. Images of Google Maps and Bing Maps you can access in QGIS software and Esri World Imagery in ArcGIS. Note that to access the ESRI World Imagery, you must have ArcGIS Pro, which is a commercial software.

3. Check the dates of the images to ensure that they are the most recent images. You can find the dates of the images on the webpage of the original image provider (see Textbox 8).

4. After you have found suitable satellite images, and you purchase them from commercial satellite data repository, download them onto your computer to work with them offline.

5. If you are using free online images and your images are in Google Maps or Bing Maps you can access them in QGIS using a Tile Map Service (TMS) connection. In order to add and use the connection you need to know the TMS address for the selected map service. Remember that the connection has to be for the satellite imagery and not the map, terrain or hybrid map layers. The address is easy to find by using Google browser to search for it (for example use search terms: Google satellite tile map service). The Google Maps Tile Map Service address might look something like this http://www.google.cn/maps/vt?lyrs=s@189&gl=cn&x={x}&y={y}&z={z}. To add the Google Maps map service in QGIS simply, go to XYZ Tiles in the Browser panel (left hand side panel). Click on a New Connection, right-click on XYZ Tiles. Name the connection and add the address.

6. After this drag and drop the connection from the browser window to the layers window to open and see the satellite image in the map window.

7. If your image was from ESRI World Imagery you can open the Image in ArcGIS with the “add basemap” option. This will open the satellite image in the map window.

### Preparing a satellite image map for printing:

8. Continue working with the satellite image that you have open in the map window. Or, if you are using commercial imagery, open the downloaded satellite image in whatever GIS software you have, such as ArcGIS or QGIS.

9. Project the image to your preferred datum. For Tanzania, use WGS1984 as the map datum and then set the correct zone (35-37) depending on the location of the village within Tanzania.

10. Set the scale of the satellite image as 1:7500 or larger so that villagers can see the features of the village well during mapping activities (see Textbox 7). Using this scale enables villagers to identify houses, water sources, small paths, big trees, farms, and forests, all features that aid in locating places on the satellite image and hence in allocating land uses during the VLUP process.

11. Design an image map layout in the GIS software and select a map frame size to fit the size of paper on which you will print, whether A0, A1, A2, or A3.

12. Generate thin grid lines on the satellite image and display northings and eastings on the layout of the satellite image. It is recommended that you use a grid-cell size of 100 meters x1 00 meters. These grid cells can be used to estimate the area sizes of different land uses during proposed land use mapping (see Section 2.4.2.). The grid lines will also be used for geo-referencing the sketch map produced by the villagers (see Section 2.4.4.).

**13.** Overlay the village boundary shapefile on the satellite image in the GIS software. Make the village boundary a thin black line on top of the satellite image (Figure 5). This line indicates to villagers where the official boundary lies. They will have to verify it later (see the discussion of village boundary verification in Section 2.1.4.).

**14.** If you would like to, you can superimpose contour lines on the image as they help to describe the topography of the area. This is important as satellite images do not include topographic information. Ensure that the contour lines cover the entire satellite image layout not just the area inside the village boundary since they may help villagers verify the village boundary.

**15.** Add other essential information on the satellite image layout such as a north arrow, scale, the date on which the image was taken, the datum used, and the source of the satellite image.

**16.** Now you have produced a satellite image map layout.

**17.** Because you cannot print the whole village area shown at a scale of 1:7500 on one sheet of paper, you will have to produce several overlapping printouts and then join them together. The maximum paper size that can be printed in Tanzania at an affordable price is A0. The number of printouts which you will need to print will depend on the size of the village in question and the paper size which you can print. You can use the same layout to produce each printout.

**18.** Plan a combination of printouts which will allow you to print the entire village area at the scale of 1:7500.

**19.** To make each printout, shift the satellite image to the right location in the data frame. For printouts of village boundary areas, ensure that the satellite image printout extends outside the village boundary in case you have to modify the boundary with the villagers later on. Also ensure that the printouts overlap each other so that joining the printed hardcopy printouts together in the next work phase is possible.

**20.** Export each printout into the file format you wish to use, for example, PDF or JPEG. PDF format is recommended because it produces a smaller file size than JPG and still produces a good-quality image quality. Whether you choose JPG or PDF format, set the image quality at a minimum of 200 dpi or higher.

**21.** Print all the satellite image map printouts or use a printing service provider in your area to print the required paper size.

**Joining the printouts:**

**22.** Arrange the printouts on a clean and flat surface so that you have a good working area. Check that you have the entire printout set to cover the whole village.

**23.** Plan where you will cut the printouts to create the joints between the separate printouts. Use the gridlines to help in cutting accurately (Figure 6). Only cut the printout which is on top, overlapping one below it.

**24.** Use clear wide tape to join the printouts together. Ensure you align the gridlines correctly, because any misalignment will create errors during the digitisation of the sketch map (see Section 2.4.4.).

**25.** Since a large joined satellite image map is difficult to transport, it is recommended that you join the satellite image map printouts in the village. ■

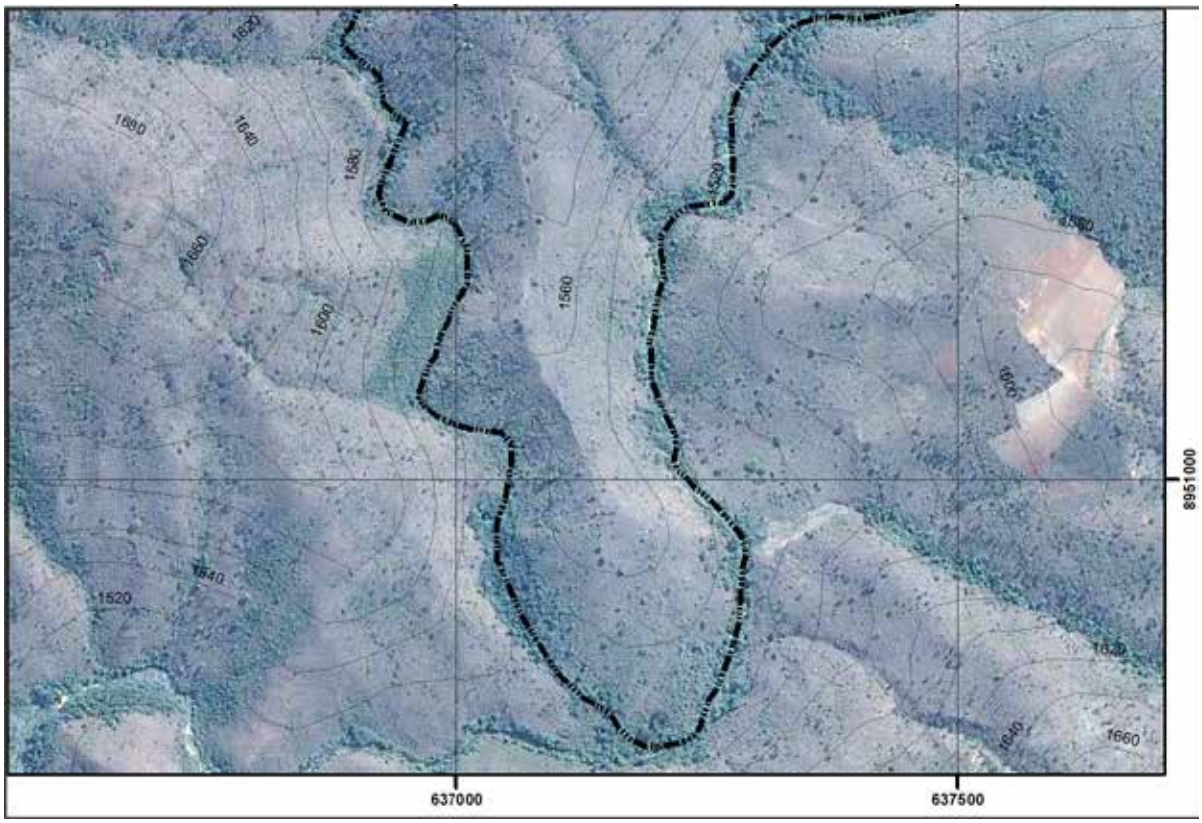



**Figure 5.** Example of the village satellite image map with thin black dashed line showing the official village boundary, and the grid and contour lines superimposed on the image.


**Figure 6.** Joining the satellite image printouts together. A) To have satellite image map which covers the entire village area, you will most likely have two or more separate satellite image printouts, B) plan well where to cut the printouts in order to do the joining, use the grid coordinates and lines to decide where the join is C) cut the printout following the grid line D) and E) use the grid coordinates to correctly place the printouts precisely on top of each other, F) use small pieces of clear tape first to keep the printouts in correct place G) finalize the join with one stretch of the clear tape, best way to do this is to start taping out side the printout on the floor and move slowly with the tape to the other side of the join, H) use your other hand to press the tape on the printout and the other hand to keep the tape roll tight so that there will be no folds in the tape, I) finish taping again outside the printout on the floor, this ensures smooth finish for the tape, J) cut off the left over ends of the tape and you have joined the satellite printouts.

### Textbox 6. Addressing possible challenges

Getting a very recent satellite image is not always possible, so some updating of information may be necessary in the villages. Some satellite images are as old as 2010 onwards, so the village landscape may have changed. It is good practice to tell villagers the year in which the image was taken to help them identify any changes that may have occurred since then. Another challenge is that clouds can hinder visibility of features in the satellite image. Thus, you should always try to find an image with as few clouds as possible or, if possible, a cloud-free image. If no cloud-free image is available you may need to resort to conventional mapping and GPS-tracking practices instead of using a satellite image map. Sometimes and in some places in Tanzania accessing satellite images through the Internet is difficult or impossible due to slow internet connection. If you cannot access the satellite image, you will have to use the conventional practice instead.

### Textbox 7. Ways to modify

A scale of 1:7500 or larger is not always feasible for use in printing a satellite image map of an entire village as some villages are enormous. For a very large village, for example one covering 200 000 ha or more, covering the entire area at a scale of 1:7500 is very challenging. One way to overcome this challenge is to produce a map with a smaller scale to cover the whole village area and the more remote areas in the village and to produce another map at a scale of 1:7500 to cover areas which require more accurate planning decisions such as intensively utilised areas around settlements. A small scale of about 1:10 000 or even smaller is suitable for covering the whole village.

### Textbox 8. On what date was the satellite image taken?

The date of a satellite image can be obtained from the original source, namely the image vendor. Depending on the image vendor and the software you are using to look for images, you will have to use different methods to see the date on which the image was taken. For satellite images from Google Maps you can find the date by opening the village boundary in KLM format in Google Earth Pro (you need to convert the village boundary shapefile into KLM format first), zooming to the village location and looking at the date given for the satellite image in the bottom of the screen. For satellite images from ESRI ArcGIS Imagery, you can find the date of the image by viewing the online image on ArcMap software, selecting the information icon tool and clicking with the tool on the area for which you want to know the image date. The information icon tool will open a table showing information about the image, including the date of the image capture.

### Textbox 9. Preparing village landform maps using the digital elevation model

Topographic information is important for making good land use allocation and management decisions during the VLUP process. Information about landforms, as determined by the steepness of the terrain, for example, can help to assess the suitability of land for intensive land use, erosion risk, and accessibility from within a village. Both village satellite image maps and village landform maps provide information on the topographic features of a village. Digital elevation model (DEM) data can be used to easily produce a topographic map depicting the elevations at different parts of a village. A topographic map will show hills and valleys in a village. DEM datasets can be obtained from the Internet free of charge. There are two global moderate-resolution DEM datasets available: ASTER GEODEM 2 and SRTM (both can be obtained at https://earthexplorer.usgs.gov/). These dataset are at the spatial resolution of 30 m x 30 m. Their vertical resolution allows for the visualization of contour lines and for a basic analysis of topographic differences within and around a particular land use area.

In order to use the DEM to produce a topographic map, obtain the DEM of the area you are working in and download it to your computer. You can use the DEM to produce either a contour or a relief map. For a relief map, classify the altitude range into desirable classes (for example with 50 m or 100 m intervals) and choose a color spectrum for the classes (Figure 7A and Annex 3A). A slope map of the village is another type of landform map that can be produced to further identify risk areas such as flat, flood-prone areas and steep slopes (Figure 7B and Annex 3B). The slope angle in degrees can be classified as flat terrain (0 - 3 degrees), stable slope (4 - 35 degree), and steep unstable slope (> 36 degrees) (IITBHU 2017; Katsube and Oguchi 1999). The slope angle indicates different types of risks. There is a high risk of flooding in areas of flat terrain that fall on the lower side of a drainage channel, while landslides and erosion are likely to occur on steep slopes. The slope angle alone, however, does not predict these hazards. Other factors such as soil type (loose or degraded soil), soil moisture, natural events, and human activities influence the risk as well.

(continues)

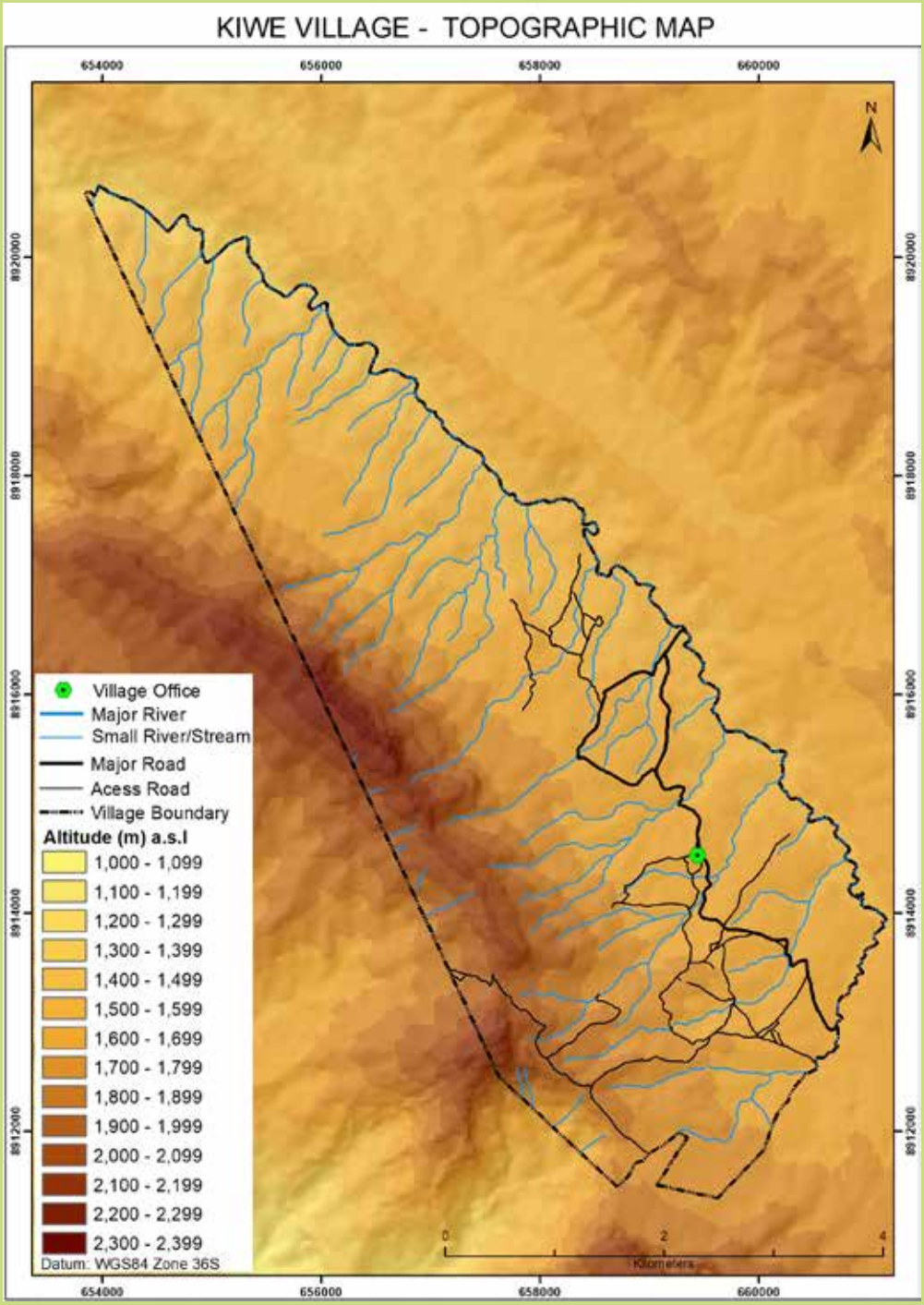
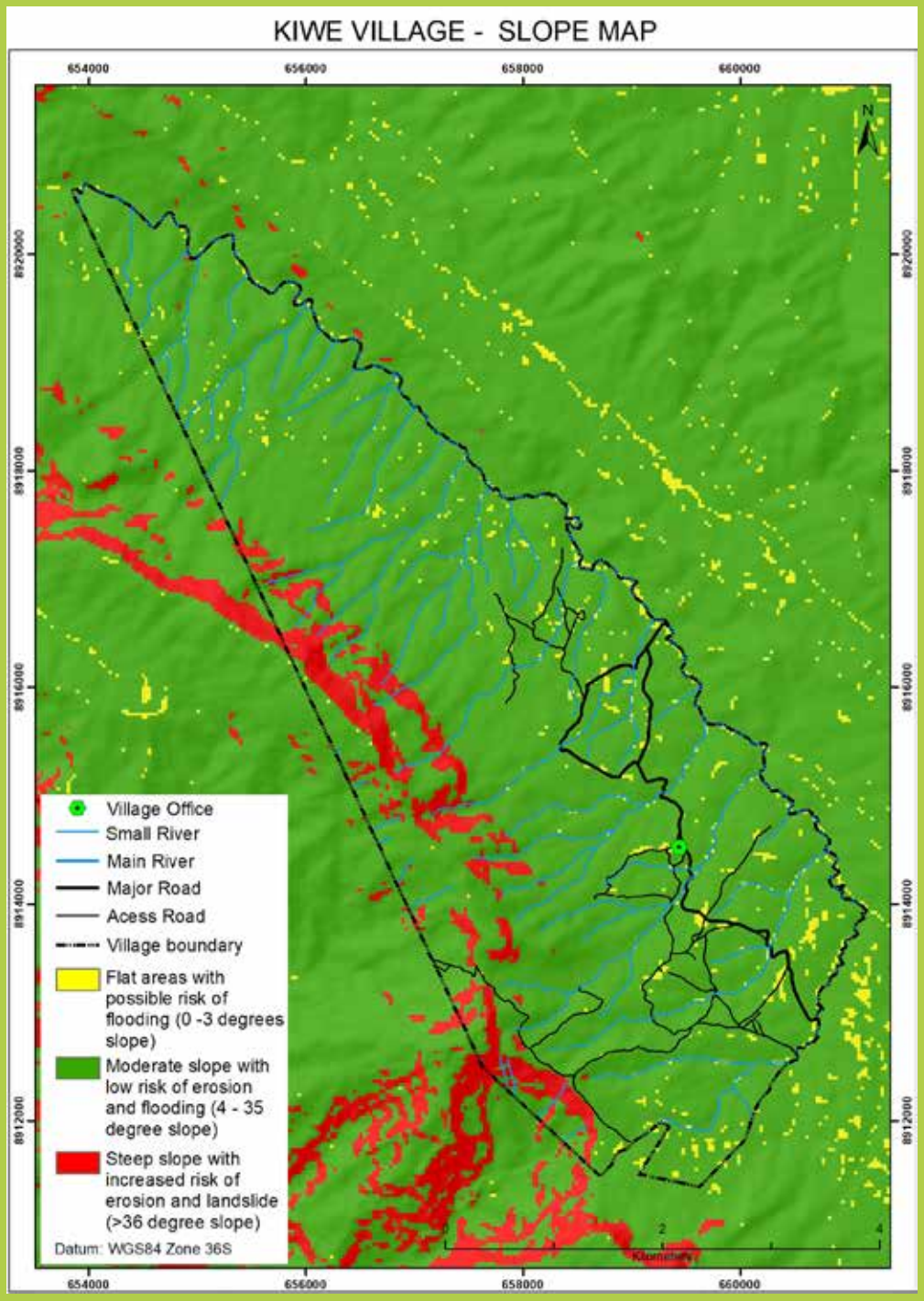



**Figure 7.** A) Village topographic map example of Kiwe village. This topographic map has been produced as a relief map with 100 meter altitude range. B) Village slope map example of Kiwe village. The slope map shows the risk areas related to slope steepness.


KIWE VILLAGE - SLOPE MAP
654000
656000
658000
660000
8920000
8918000
8916000
8914000
8912000
N
Village Office
Small River
Main River
Major Road
Acess Road
Village boundary
Flat areas with possible risk of flooding (0 -3 degrees slope)
Moderate slope with low risk of erosion and flooding (4 - 35 degree slope)
Steep slope with increased risk of erosion and landslide (>36 degree slope)
Datum: WGS84 Zone 36S
2
4
Kilometers

### Other sources of information

QGIS software - www.qgis.org

QGIS tutorials - www.qgistutorials.com

ArcGIS Pro software - https://pro.arcgis.com/en/pro-app/

ArcGIS and ArcGIS Pro tutorials - ArcGIS Help, https://mgimond.github.io/ArcGIS_tutorials/index.html and https://pro.arcgis.com/en/pro-app/get-started/pro-quickstart-tutorials.htm

### 2.1.2. Reconnaissance visit

#### Overview and aim

A reconnaissance visit is the first introduction a district PLUM team and other facilitators have to a village. Ward officials may prove to be an important source of information about the village and a valuable partner in mobilising the village community to take part in the VLUP process and awareness-raising exercises. Thus, you should consider contacting ward officials well before the first intended visit and invite them to join the visit. During the visit villagers, mostly village council members, will get to know the facilitators and learn about VLUP and their benefits. The aim of the visit is to familiarize with the village and to plan together with the villagers the procedure and schedule for the VLUP process. A participatory stakeholder analysis is an essential part of the reconnaissance visit in order to identify all relevant participants to the VLUP process (see Section 2.1.3). It is recommended that you purposefully meet and engage with women and disadvantaged groups in the village during the visit in order to get a clear sense of village socio-economic conditions. The village satellite image map will facilitate discussions and help you gain an overview of the village. It is recommended that village boundaries are verified during the reconnaissance visit, too, so that any boundary problems can be detected and resolved before the VLUP process begins (see instructions in Section 2.1.4.).

#### Working tasks

1. Contact ward officials and members of the village council, including the village chairperson and village executive officer (VEO), well in advance to arrange a visit. Doing so shows you respect their time and will allow them to mobilize to serve as hosts.
2. In the village conduct an introductory discussion with representatives of the village council about VLUP and the planning process. Include discussion of the various activities of and a possible timeframe for the process (see Textbox 12).
3. Discuss about the main economic and social activities in the village.
4. Display the village satellite image map and help participants to understand it and to orient them on it (see Textbox 13). Make sure that every participant understands and can read the image.
5. Ask them to describe and show village activities and important land-related issues such as land use challenges on the image. Give the participants at least 30 minutes to discuss around the image. Aid their discussion by asking questions about the different parts and features of the village seen in the image. Take notes on issues that can be further discussed during the VLUP process and written into the VLUP report.

**Textbox 10. Basic details**

- Time: 7 to 8 hours, meeting for 1 to 2 hours, walking up to 6 hours. Should be done some days or weeks before Step 2 starts.
- Participants: Members of the village council, teachers, extension officers, members of disadvantaged groups, including women, members of the PLUM team or other facilitators, ward officials, and, during the transect walk, random villagers.
- Outcomes: Preliminary knowledge about the resources, challenges, and potentials of the village, agreement on the dates that the VLUP process will be conducted, and establishment of respectful and friendly contact with the village council and ward officials.
- Preparations and materials: Village satellite image map, notebooks, pens, and, if you wish, a camera.

**Figure 8.** On reconnaissance visit, in addition to an overview of the village characteristics, special sites can be observed. A waterfall in a village can inspire for example ideas of tourism and recreation opportunities and inform the village future vision and proposed land use development.

6. Carry out a transect walk to see some of the social services and infrastructures available. Walking around is of great value for gaining insights into a village, especially if you talk to villagers as you go. Ensure that the transect walk is conducted at a time that women can take part in it.

7. Ask the village hosts if there are some special natural or manmade features in the village which you could see (Figure 8). Look in particular for village land and business potentials (irrigation and tourism opportunities, heritage sites, and the like). Write these down in order so that you can facilitate discussion of them during future planning activities of the VLUP process.

8. Finally, arrange time for conducting a participatory stakeholder analysis and village boundary verification activities. ■

**Textbox 11. Addressing possible challenges**

Finding time to conduct a reconnaissance visit is challenging but it is a valuable tool for planning the VLUP process well and thus saving time during the actual process. A one-day visit will not suffice for getting a comprehensive picture or learning in detail about a village if one has to walk the entire area. Using a satellite image map with villagers reduces the need to walk and enables participants to show things on the satellite image and for facilitators to see both the entire village and particular details of it.

**Textbox 12. Building villagers' capacity for carrying out technical VLUP process activities**

Among the aims of the VLUP process are to develop local capacities for decision-making and to support local empowerment. Doing so includes enhancing villagers' ability to carry out technical aspects of the VLUP process. During the preparatory step and reconnaissance visit, facilitators should identify opportunities for village members, particularly women and youth, to participate in the technical aspects of land use planning efforts. These aspects include using satellite image maps, GPS tracking, digitisation of sketch maps and reviewing geospatial information on digitised VLUP maps. Some villagers are likely to be interested in learning new technical skills and some might have technical skills that they would like to enhance.

Spatial technologies require technical skills that may at first seem inaccessible to villagers but, in fact, the basics of such technologies can be learned by anyone. Exposure to technology and the capacity to adopt technical solutions are increasing in the society, as is the recognition of the potential of technology to solve societal challenges. The Tanzanian government should consider supporting community-level training on freely available mapping applications and on the use of drone technology. In order to make sure opportunities are inclusive, women and other disadvantaged groups need to be included in all skills development training.

**Textbox 13. How to instruct VLUP participants to understand and use the satellite image**

When you introduce a satellite image map to participants during VLUP process, it is important to make them feel comfortable with the image and help them understand what can be seen in the image.

- Explain that satellite images are obtained from space by instruments which resemble cameras and which capture images of the earth that cover large geographical areas.
- Show the participants that they can see, for example, roads, farms, settlements, forests and individual trees, grasslands, and rivers on the image.
- If there are clouds in the images, explain what they are. Use the clouds to explain that the satellite is so high in space, hundreds of kilometers above the ground, that it can take photographs of the clouds.
- Orient participants onto the image by showing common features of their village in the image: main roads, village office and the place where you are gathered. Then ask them to show you where other features, like the primary school or a church, are. When you ask them to show you something, you will know whether or not they have understood the image.
- Tell them that the topography of the village, such as hills, is not visible in the image but that they can locate topographical features if they know the area well.
- Tell the participants when the image was taken (month and year). Emphasise that things might have changed since the image was taken. For example, the new dispensary will not be seen in the image. Remind them that the village might look different in the image because of the season (dry or wet) during which the image was taken.
- Tell the participants that satellite images are available all over the world and that anyone with some skills in interpreting what is seen on these images can benefit from using them. Give an example of a neighbouring or other village where you have already used it if you can.
- Forget your expert role. Remember that this is the plan of the villagers and let them lead the exercise. Steer them into owning the mapping process.
- Tell them to feel free to ask anything, including for more instructions if needed.

### 2.1.3. Participatory stakeholder analysis

#### Overview and aim

Participatory approach in the VLUP process emphasizes the importance of seeing the village community as composed of different social groups with varying interests, needs and power to voice their opinions. This is recognized also in "The PLUM Guidelines (3rd edition)", that highlights the importance of involving different socio-economic groups in the VLUP process. To put this approach into practice and ensure that all stakeholders' opinions, needs and realities are represented in the decision-making, facilitators have to actively seek out and engage all the groups in a village. You should assume that different groups exist in all villages and not that their existence is a feature unique to some villages. Furthermore, you should involve, or at least inform about the VLUP process, any people outside of the village who have a stake in the village land and the VLUP. Such outside actors may have a lot of influence on village decision-making, so their role in VLU planning needs to be decided (see Textbox 16).

One effective way to ensure that all social groups and stakeholders are identified before the actual planning process begins is to carry out a participatory stakeholder analysis during the introductory meeting with the village council before VLUP process participants and VLUMC member candidates are selected. Doing so will ensure that all stakeholder groups are represented during selection. Also consult ward and district officials familiar with the sociodemographic characteristics of a village as they can help identify disadvantaged groups in the village.

The stakeholders in the VLUP process are all of those people who are affected by or who have an interest in the VLUP. It is crucial to include among stakeholders those who are disadvantaged and less engaged in village decision-making due to, for example, their low socioeconomic status. These marginalised groups include, for example, women, young women, young men, orphans, widows and widowers, HIV-positive persons, disabled persons, minority and indigenous people, livestock-keepers, hunter-gatherers, recent immigrants and future generations. All these groups in one way or another utilise village land. One challenge to village land use decision-making is the limited ability of village communities and especially of disadvantaged social groups, to secure and enforce their access to resources and their land rights in relation to more powerful national and private interests. Since a VLUP outlines restrictions on and opportunities for village land use, it can both negatively affect access to land and services but also help different social groups secure their land rights. To ensure that positive VLUP outcomes are indeed realised, all social groups must be involved as stakeholders in the VLUP process.

**Textbox 14. Basic details**

- Time: 30 minutes to 2 hours.
- Participants: Village council members, teachers, extension officers and ward officials, women and members of other disadvantaged groups, PLUM team or other facilitators.
- Outcomes: A list of stakeholders that are affected by or have an interest in the VLUP of a given village, and the prioritisation of those stakeholders to include in each VLUP process activity.
- Preparations and materials: Flipchart paper, marker pens, and masking tape or a blackboard and chalk.

## Working tasks

**Identifying all stakeholders of the VLUP process:**

1. Organise the participants in one or two groups. You can organise groups based on gender, for example.
2. Ask participants to list all the different stakeholders both in and outside the village who have an interest in and are going to be affected by the VLUP. Give them flipchart paper and pens to write the list.
3. Ask them to think about and list stakeholders (social groups) who have the power to influence decisions in the village, who are not always included or considered in decision-making situations, or who can disseminate information widely across the village.
4. Ensure that participants consider stakeholders among private business and civil society actors that operate in the village.
5. If you had participants work in groups, have them come together, present and discuss their individual lists, and combine the lists into one mutually agreed-upon list of VLUP stakeholders.

**Prioritising stakeholders and establishing their roles in the VLUP process:**

6. When a list of all the stakeholders and stakeholder groups has been developed, the next step is to decide whether or not all the stakeholders should be involved in the entire VLUP process and, if not, in which activities each group should be involved.
7. Ask participants to decide in which VLUP activities all stakeholders should be involved. Tell them that these activities are the ones where opinions and needs are collected from people, where no expert knowledge is required and where major decisions are made, for example in problem identification, envisioning the future, existing and proposed land use mapping, and community action plan development. If resources allow, no prioritization is required and all stakeholder groups should be given an opportunity to participate in or send representative(s) to these important activities.
8. If all cannot participate, ask the participants to identify the most important stakeholders.
9. Ask the participants to decide which stakeholders do not have to participate in the VLUP process but need to be informed about the VLUP and invited to the village assembly where they can comment on it. These stakeholders may be, for example, people who do not live in a given village but who own land there and NGOs which provide certain services or run projects in that village.
10. Ask participants to decide which stakeholders should be involved in activities such as baseline data collection, GPS tracking, land suitability assessment, bylaw setting and land adjudication activities.
11. As much as possible, clearly identify barriers to the participation of different stakeholder groups and take measures to see that all stakeholders are encouraged to participate (or to send representatives) at critical steps in the VLUP process.
12. A variety of ways can be used to help participants to identify the stakeholders who should be involved in each activity. These include an interest-influence matrix, Venn diagrams and the 4Rs tool. You can find out more about each in the readings listed on page 35 and on the Internet.
13. Discuss how many representatives each stakeholder group should have. One may suffice, but some groups may need two or more, particularly if the low social status of a group will make it difficult for one representative on his or her own to comfortably express the group's opinions or if a representative is likely to be suddenly unable to attend activities. These considerations are valid for social groups like orphans, HIV-positive persons and other minority groups.

### Helping stakeholders to participate in planning

The capabilities and statuses of stakeholders affect the way in which they are able to participate in the VLUP process (Textbox 17). For example, people who have never before participated in village decision-making may find it hard to participate. The fact that some community members do not have experience in planning processes is one reason awareness-raising is part of the VLUP process. Awareness-raising and training is meant to increase the capacity of participants to participate and express their opinions. The PLUM team should also consider selecting tools and activities for the VLUP process which allow and help different social groups, especially women and disadvantaged groups, to participate. "The PLUM Guidelines (3rd edition)" suggests using focus group discussions to engage different groups of villagers. Other ways to boost participation include tools like group work, skilled facilitation, suitable timings and venues of activities, compensation for participation, asking stakeholders how they would like to participate, and providing a choice of tools and inviting at least two representatives for each social group to take part (Textbox 18). A key to active participation is making participants feel that they and their time and efforts are valued throughout the process. ■

**Textbox 15. Addressing possible challenges**

Sometimes participants might have very limited ideas about who to involve in the planning process. If this is the case, encourage them to think of people who have different abilities to access and utilise land. Most people in a village might be considered farmers or livestock-keepers but among them, people are still different in many other characteristics, including age, gender, disability, economic status, livelihood, and social status.

**Textbox 16. Importance of involving stakeholders outside of the village**

The quality of a VLUP depends to a large extent how involved stakeholders are in providing input and support to the VLUP process. The list of potential stakeholders in the VLUP process should not be limited to those that live in the village or the ward but also include those that live outside the village but still have a stake in and influence on decisions made in the village. These may include people who originate from the village and still have strong ties with villagers though they have moved away and people who have land or projects in the village and remotely manage them from elsewhere. It is sometimes important to consider the participation of these outside stakeholders.

Stakeholders who live outside the village may not necessarily be as active in the planning process as the villagers themselves, but they should at least be formally informed in advance about the VLUP process in the village and the organization financing the process. This will allow them the opportunity to participate or send their representative to do so. The involvement of outside stakeholders can be beneficial in various way: first, they can encourage villagers to cooperate in the planning and implementation of a VLUP, they can support and advise villagers to allocate land for uses beneficial for the development of the village, and third, their involvement may prevent conflicts during the issuance of certificates of customary right of occupancy and the implementation of the VLUP.

### Textbox 17. Village Land-Use Management Committee (VLUMC) and social groups

The VLUMC, together with the village council, is the main village-level institution in the VLUP process. Thus VLUMC, which, according to "The PLUM Guidelines (3rd edition)" should have 6-8 members set by the village assembly, can and should represent as many different social groups as possible. The VLUMC is responsible for assisting in problem resolution and monitoring violations of the VLUP. According to "The PLUM Guidelines (3rd edition)," monitoring requires patrolling, thereby potentially excluding social groups, like the disabled or elderly from membership in the VLUMC. Similarly, illiterate social groups may be excluded as one criterion for VLUMC members is that they be able to read and write. These social groups can and should still participate in the VLU planning not as VLUMC members, however, but as key stakeholders.

### Textbox 18. Village assembly and hamlet meetings

Settlement patterns vary from village to village: in some villages all the hamlets are close to each other and form one large settlement area, but in other villages hamlets may be up to a day's walk apart. In the latter case, it is difficult to involve representatives from remote hamlets and organising hamlet meetings during the VLU planning should be considered. One option for hamlet meetings is to allocate time during the VLUP process when the PLUM team is attending to other duties for the villagers to organise hamlet meetings. This option works only if the VLUMC is well equipped to carry out hamlet meetings in which they inform inhabitants about the VLUP, hold discussions and collect information. After the hamlet meetings, each hamlet sends its chairperson and other representatives to take part in joint VLUP activities, which commonly are organised in the main hamlet, where the village office is located.

#### More sources of information

ELD Initiative (2015). Practitioner's Guide 'Pathways and Options for Action and Stakeholder Engagement'. Available from: www.eld-initiative.org.

Geißler, G. and Löffler, G. (2007). Multi-stakeholder management: Tools for Stakeholder Analysis: 10 building blocks for designing participatory systems of cooperation. Available from: www.fsnnetwork.org/sites/default/files/en-svmp-instrumente-akteuersanalyse.pdf

IIED (2004). Power Tools of International Institute for Environment and Development for understanding policy influence; Stakeholder influence mapping, Stakeholder power analysis and the Four Rs tool. Available from: www.policy-powertools.org/Tools/Understanding

### 2.1.4. Village boundary verification

#### Overview and aim

Most of the villages in Tanzania have a village boundary which has been surveyed and approved by the Survey and Mapping Division of the Ministry of Lands, Housing and Human Settlements Development (MLHHSD). The village boundary may have changed and village boundary problems arisen since the survey was conducted in the village. Thus it is crucial that the official village boundaries are verified and, if needed, updated at an early stage in the VLUP process. This verification has to be conducted by the district land department or by MLHHSD, so it will be necessary for you to involve the required representatives from the district or town council or the regional secretariat in the activity.

Instead of laborious and time consuming field work, the printed village satellite image map (see section 2.1.1.) allows more efficient way of mapping and verifying the village boundaries with the villagers (Figure 9). The aim of the activity is to verify the village boundary and to identify and correct any possible inconsistencies in the official village boundary map. This will also help in identifying any village boundary disputes or latent land conflicts which will require conflict resolution before the VLUP process can proceed. In order to further ensure that the boundaries are mapped correctly and that no conflicts exist, arrange to meet representatives from each neighboring village. This gives them an opportunity to verify the boundary which they share with the village where VLUP process is ongoing and share any concerns they might have related to the boundary.


**Figure 9.** Village boundary verification on a satellite image map. The satellite image enables examination, discussion and agreement of the entire village boundary. The boundary delineation can be seen by everyone who can read the satellite image and the landscape features in it. Field tracking of the boundary is needed in those places where the boundary cannot be identified with certainty on the satellite image.

## Working tasks

**Preparations before the verification can be started:**

1. Check at the district level to see if the boundary of the village of interest has been established, demarcated and surveyed. Look, too, for any evidence of a boundary conflict in that village.
2. During the introductory meeting in the village, find out if there is a village certificate and a village boundary map, and ask if there are disputes over the village boundary with neighbouring villages.
3. If there is no open dispute or any other reason not to carry out the VLUP process, proceed to the village boundary verification exercise.

**Preparing the mapping background on a flat surface in the village:**

4. Make sure you have all the required material for the mapping exercise (see Textbox 19 and Figure 10).
5. Place the village satellite image map on **a flat surface**, preferably a cement floor, to be used as the background for mapping. In a village setting, such a floor can be found in village offices, schools, dispensaries, churches, and the like. Ensure that there is sufficient light in the place selected for the mapping exercise for villagers to see features on the satellite image clearly. Position the satellite image map so its north arrow faces north in the village.
6. Use clear wide tape to straighten the satellite image map to the surface or floor.
7. Place a transparent plastic sheet on top of the satellite or aerial image map and tape it to the surface using clear tape so that it will not move during the exercise.

**Marking and verifying the village boundary on the satellite image map:**

8. Describe the task to participants and orient them to on the satellite image map (see Textbox 13).
9. Tell participants that the black thin line on the satellite image represents the village boundary obtained from the official village certificate.
10. Ask participants to discuss the village boundary as they understand it and to check to see whether or not the official village boundary marked on the satellite image map is correct. Give them a black marker pen to mark the boundary as they understand it. While they are drawing the boundary, ask them also to explain its features as they draw it.
11. If you observe any discrepancies between the official boundary and the way participants understand the boundary, discuss the differences and try to establish what the problem is. Assess if the boundary inconsistency or problem is serious or manageable. Plan the next task based on the seriousness of the issue.
12. If required consult representatives from neighbouring village(s) which are affected by the problem and arrange for them to verify the boundary, too. Give each affected village an opportunity to verify its boundary separately before bringing representatives of all the involved villages together to jointly agree on the actual boundary. Use the satellite image map to facilitate the negotiations between these representatives so as to reduce time for field tracking. Visit and track with GPS only those boundary areas which are less visible on the image.
13. Ensure that any changes to the boundary delineations are marked on the sketch map of the village boundary.
14. If a boundary conflict is discovered, take appropriate measures to resolve it.
15. After any inconsistency or conflict over a boundary has been solved and the actual boundary agreed upon, take the required steps to follow official procedure to update the boundary.
16. If a village boundary is updated, the official village boundary shapefile will need to be modified accordingly. The sketch map with the new boundary will need to be photographed and digitised to produce a new boundary shapefile. This task should be carried out by a facilitation team member with GIS skills (e.g. a district land officer or an officer from MLHHSD).

**Documenting the sketched boundary on the satellite image map:**

**17.** Do not move the sketch map. Simply prepare it to be photographed. In order to geo-reference and digitise the sketch map, you need to take photographs of the sketch map from close enough that its content is clearly visible. Each photograph needs to have at least four reference points highlighted in it. This task is best carried out by a facilitation team member with GIS skills.

**18.** To take these photographs, highlight with marker pen reference points at the intersections of the gridlines at the edges of the satellite image map (Figure 11). Label the reference points with letters (A, B, C, etc.).

**19.** Write the grid readings (coordinates) of these reference points in a notebook to use in geo-referencing.

**20.** Take photographs of the sketch map to be geo-referenced and then used to digitise the modified village boundary shapefile (see Section 2.4.4.). These photographs have to be taken directly above the sketch map in order to avoid distorting the map.

**21.** If the satellite image map used is large, take several photographs, each with at least four reference points, all of whose coordinates are recorded. All these photographs need to be geo-referenced in GIS software.

**22.** Make note of those areas and locations which require GPS tracking after the mapping exercise (see Section 2.3.3.). These areas and locations are those which are not clearly visible on the satellite image and which therefore require more accurate boundary tracking.

**23.** Store the village boundary sketch map drawn on the plastic sheet and the satellite image map carefully so that they can be used again during later mapping exercises. ■

**Figure 10.** The main materials needed for the mapping exercises. The transparent plastic sheet is the surface on which the sketch map markings are drawn so that the satellite image map can be reused. Hardware stores in Tanzania sell this transparent plastic sheet. Whiteboard marker pens have been shown to be erasable on the plastic sheet so that the markings can be redrawn if needed. A whiteboard eraser or a cloth can be used as the eraser. Transparent tape is used to tape the plastic sheet on top of the satellite image map.




**Figure 11.** Marking the reference points on the sketch map to help georeferencing of the photograph later in the GIS. A) Mark several crossings of the gridlines on the satellite image, in this example reference points are named with letters A to I, B) the reference markings should be drawn with marker pen exactly on the crossing of the gridlines, they can be any crossings of gridlines on the map, C) ensure, that in each photograph you take of the sketch map, you have at least four of these reference points so that the georeferencing of the photographs is possible. Because the photographs need to be taken close enough to the map to see and digitize the land use areas in detail, you may have to take several photographs at different parts of the map to photograph the whole map.

### Visiting neighboring villages for village boundary verification

It is recommended that even if no village boundary problem is observed in a given village, you should allow representatives of neighboring villages to verify the boundary which they share with that village, too. Therefore, after you have verified the boundary of a village, arrange a short visit to the neighbouring villages. During these visits display the village satellite image map for representatives of the neighboring villages and ask them to discuss and verify the shared boundary. Ensure that these representatives include women and members of disadvantaged groups. Consulting neighbours will ensure that they agree with the boundary and that there are no hidden boundary disputes which were not revealed by the village making its VLUP. ■

**Textbox 19. Basic details**

- Time: 1 to 5 hours. Preferably done in the early stages of the VLUP process before any VLUP process activities begin. The verification will take a long time if a boundary conflict is discovered and requires that measures be taken to resolve it.
- Participants: Village council, elderly men and women and other village representatives familiar with the village boundary, and PLUM team members. When required, representatives of neighboring villages and ward officials.
- Outcomes: The village boundaries are verified and any boundary conflicts resolved in a participatory way before carrying out the VLUP process. If needed a request for the updating of the boundary is send to the concerned high-level officials.
- Preparations and material: Whiteboard marker pens (the ink should be erasable but not too easily) and something with which to erase markings from a plastic sheet, clear wide tape, scissors, a village satellite image map (with a thin black line denoting the official village boundary obtained from the village certificate), 4-5 meters of transparent plastic sheet, notebooks, pens, a report template, and a camera.

**Textbox 20. Addressing possible challenges**

You may not be able to identify some boundary locations on the satellite image map. These you will have to verify in the field using GPS. Sometimes it is difficult to obtain a digital copy of the village boundaries. In that case, survey plans can be used to digitise village boundaries into a shapefile in GIS software.

## 2.2. Participatory rural appraisal tools for land use planning

After preparations have been made in Step 1, "The PLUM Guidelines (3rd edition)" instructs VLUP facilitators to conduct Step 2, carrying out a participatory rural appraisal (PRA) of the village. The PRA emphasises raising awareness in a community in order to build its capacity in land use decision-making, and the participatory data collection and discussion exercises required to reach inclusive and informed land use decisions. The following sections present detailed instructions of useful PRA tools, including 1) a knowledge-gap tool which helps to plan awareness-raising topics, 2) some general participatory tools to actively engage participants in planning, 3) tools to envision future opportunities for the village, and 4) tools for identifying problems and solutions to them in the village.

### 2.2.1. Knowledge-gap tool for awareness-raising and sensitisation

#### Overview and aim

Because many individual actors in Tanzania are not yet familiar with village land use planning, awareness-raising and sensitisation on the objectives, benefits and procedures of the VLUP process are needed for different levels of administrative actors, including district officials, PLUM teams, village councils, ward officials, VLUMCs, and village land councils, as well as village communities as a whole. District officials need to be made aware of the participatory approach, the VLUP process and its objectives and benefits for district strategic planning, while village actors require more detailed awareness-raising on the VLUP, policies, various responsibilities related to them and inclusiveness in decision-making.

Village awareness-raising and sensitisation is an important early step in the VLUP process. If the awareness raising and training of villagers is done well and adequate time is allocated to them, the rest of the VLUP process is likely to go smoothly and outcomes are likely to be reached in a participatory way. In order to extend the reach of your efforts, you should raise awareness first in hamlets and then at the village level. To be effective, awareness-raising must be continued over long periods of time. Thus, villagers should be equipped to continue raising awareness in the community even after the VLU planning is over (Textbox 23). Awareness-raising has the following objectives:

- Ensure that participants in the VLUP process and members of the community at large understand the objectives and benefits of a VLUP, the legislation that pertains to it, and their land rights.
- Motivate people to take part in the planning.
- Provide participants with the skills, knowledge and confidence they need to fully participate in planning activities and decision-making.
- Promote transparency and the recognition of the rights of women and disadvantaged groups in VLUP process.
- Inform the wider community that a VLUP is being developed in their village.
- Allow villagers to monitor and ensure the quality of the VLUP process and its outcomes once they know what to expect from them.

There are different ways to conduct awareness-raising and sensitisation and the style of different members of the PLUM team and various other facilitators will vary. Providing details on how to raise awareness is not within the scope of this manual, so we will not go into detail. Instead, we will emphasise the participatory approach in VLUP process with reference to one simple tool which can be used when a new topic is introduced: the knowledge-gap tool. Its use is explained below.

**Textbox 21. Basic details**

- Time: 30 minutes to 1 hour depending on the topics and time available.
- Participants: A variety of stakeholders depending on the targeted audience.
- Outcomes: A better understanding of the existing knowledge level of participants and increased motivation of participants to learn.
- Preparations and material: Optionally flip-chart paper and marker pens.

### Working tasks

1. Have participants work as one large group or divide them into groups depending on the number of questions or topics you have.

2. If there are several topics to cover, divide participants into groups. Give each group a topic to discuss and ask them to write down on flipchart paper all they know about it (Figure 12). Even if there is just one topic for discussion, it can also be discussed in groups if there is enough time to share and compile afterwards. Otherwise, simply have all participants sit in one group and ask them to raise their hands and share their ideas (Figure 13).

3. So before you start explaining a topic during awareness-raising and sensitization, first ask participants what they already know about it.

4. If several topics were discussed in groups, have each group present what they discussed to the rest of the participants, who should then be allowed to add any further inputs they may have.

5. Facilitators should avoid making any comments on or correcting the views offered, because participants may feel less free to share their ideas if they are corrected. Facilitators should consider participants' answers to be the knowledge reality of the participants about the particular topics and respect that reality by not questioning it.

6. Note which issues participants know a lot about already and which they lack knowledge of. Also ask if there are particular issues they would like more information on and include them among your other awareness-raising and training topics.

Asking people what they already know will help you to give special attention to the needs and knowledge gaps of the participants and to correct any misunderstandings people might have. Using this approach will help participants unlearn informal practices and change existing misconceptions. For example, when asked how conflict resolution should be conducted, villagers might refer to traditional land transaction and conflict resolution procedures which contradict with formal procedures. Once both options are on the table, formal practices can be adjusted to accommodate aspects of traditional practices. The knowledge-gap tool helps participants to appreciate their existing knowledge and motivates them to learn more. Using flipcharts and handouts which are given to participants and to the village office after training assists participants in applying new information in future situations. People can refer to these materials when questions later arise and when situations in which the information is applicable arise. ■

**Textbox 22. Addressing possible challenges**

In some cases, village council members and villagers have very little knowledge about VLUP and land rights, and will need more extensive awareness-raising and training than limited time and funding allows for. Attendance at village meetings and assembly meetings is sometimes low and difficult to boost. Emphasising the importance and benefits of a VLUP in your communications with villagers is one way to help increase attendance. Time constraints can also reduce the interactivity of awareness-raising meetings because fewer people than you intend will warm up to talk and have time to share their opinions.


**Figure 12.** Using knowledge gap tool in group work setting. The participants are asked to share their understanding and opinions on the topics at the beginning of the awareness raising event. The answers indicate what the participants already know about the topics and enable the facilitators to design the awareness raising on the knowledge gaps and interests of the participants. The groups can discuss and write their ideas down first on a flipchart paper and then share the ideas to the whole group.


**Figure 13.** Using knowledge gap tool in the village assembly.

**Textbox 23. Using representatives of different social groups to carry out awareness-raising among the community**

In many fields of extension services, particularly agriculture, lead farmers and community trainers have become common. To facilitate the VLUP process, the representatives of different social groups, together with VLUMC members, could be mobilised and trained to continue to carry out awareness-raising in the community. Each representative could also act as a focal point for the social group he or she represents and could raise the VLUP-related issues with the village council. If such representatives are to be successful, facilitators must advocate that the community recognise them as knowledgeable, legitimate, and able to train and raise awareness, especially if a representative does not already have considerable status in the community. These representatives should feel that they benefit from and enjoy being focal point and community trainer as these responsibilities may consume so much time and so many resources that they feel the reward is not worth the effort. If such dissatisfaction develops, a community trainer's motivation and commitment to raise awareness will decline.

### 2.2.2. General participatory tools and approach

#### Overview and aim

For many participants and even facilitators of the VLUP process, group work and other participatory tools are not yet common practice. Indeed, there is still a tendency to use mainly top-down tools such as **a classroom setting** where the facilitator stands in front of a large group of participants to ask questions and allows for little interaction between participants. Using participatory tools requires participants to get used to being more active and vocal and facilitators to let go of their control of activities and step back to give participants more opportunities to discuss. Good facilitation skills are also required (see Textbox 26). This section introduces three participatory tools: group work, dialogue, and learning cafés, all general tools which can be applied to a variety of VLUP activities. You can compare the tools and choose that which is most appropriate for the situation and objectives you face in any given exercise.

#### GROUP WORK

Group work is a general term for various kinds of activities in which participants work or discuss together to reach to the objectives of the exercise. Groups can be established randomly or purposefully. For example, they can be based on gender, age, hamlet or vulnerability. Groups can also be formed purposefully as mixed groups, in which, for example older people are mixed with youths. The composition of each group will depend on the objectives of the exercise and the cultural habits of the community and can be decided by the facilitators or by the participants themselves. The size of any given group can vary from pairs to large groups but the optimum size for ensuring that all participants have an opportunity to contribute is between two and six people (Figure 14). The **advantages** of group work in the VLUP process are listed below:

- Group work allows participants to discuss their ideas freely in a secure environment with peers. For example, women might feel more comfortable speaking in a women's group than a mixed group and members of disadvantaged groups might feel similarly more empowered in their own group.
- Group work produces more information and more nuanced information on a topic.
- When participants feel free to express themselves, ideas flow fast, so small-group discussion is more time-efficient than one large-group discussion.

**Textbox 24. Basic details**

- Time: Depends on how much time you have, say 30 minutes to 1 hour.
- Participants: Different VLUP stakeholders in or outside a village. The optimal size of one group is two to six people, and you can have as many groups as you need.
- Outcomes: Gather information from participants, facilitate participants to discuss an issue, give suggestions and feedback.
- Preparations and material: Alternatively no note-taking material or flipchart paper and marker pens or blackboard and chalk.

- Each individual group can be assigned with a unique topic and later on share its ideas with the group as a whole. This procedure can save time, especially if groups are selected to include members knowledgeable about the assigned topic.

**What group work can be used for in the VLUP process**: Almost any discussion in the VLUP process can be organised as a group-work activity. If you need to gather information from participants or get them to discuss a topic, group work is a good option. In particular, identifying and listing of village challenges and needs and existing and proposed land use are best done as group work. Group work is not, however, recommended for meetings, like introductory meetings in which facilitators are the ones providing information to participants.

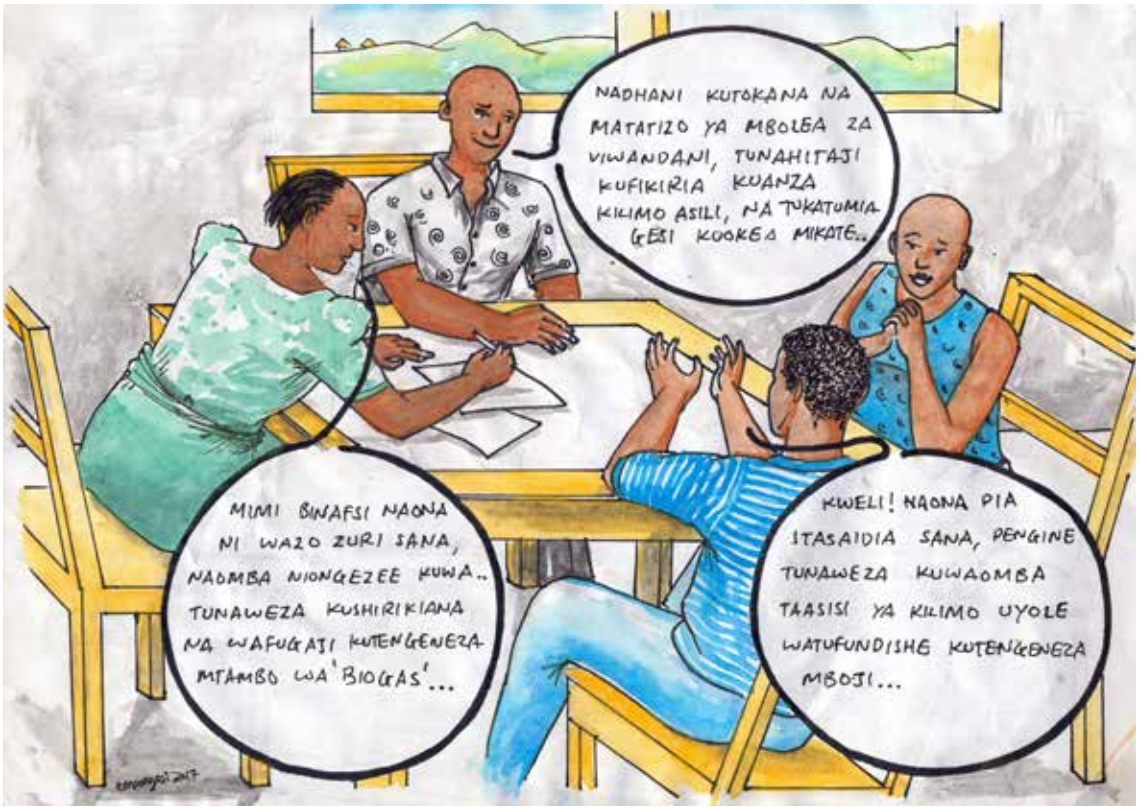



**Figure 14.** The group work tool. In a small group there is more time and lower threshold for each participant to talk, provided that the group has been formed amongst people who feel comfortable and free to discuss together about the topic.

### Working tasks

1. Explain the exercise and provide instructions to participants.
2. Divide people into groups in a suitable way. If you have several topics that you want discussed, you may wish to divide participants into groups based on their familiarity with or interest in a topic.
3. Tell participants how much time each group has to complete the exercise and distribute any material you have for them to take notes on.
4. Remind them at the halfway point how much time they have left.
5. End the group exercise.
6. Ask each group to present its outcomes to the whole group or collect the notes they have taken and explain that you will later share the combined outputs of all the groups. ■

**Textbox 25. Addressing possible challenges**

Having small groups work individually and then the entire group jointly compile the outputs of each small group can take more time than working in a single large group. You may wish to save time by instructing groups to write their ideas on flipchart paper and then compiling those ideas yourself to present to participants later.

**Textbox 26. Qualities and practices of a good facilitator**

Good facilitation is key to getting people to participate actively, even when time is short. As a good facilitator you should do the following:

- Show respect to participants and fellow facilitators.
- Be tolerant, patient and flexible enough to make adjustments to find the best way to ensure that the objectives are met.
- Create a comfortable atmosphere in which participants feel encouraged to discuss their ideas freely.
- Give instructions in simple, easily understandable language.
- Do not rush participants but do ensure that activities are completed within the agreed upon time.
- Provide detailed instructions so that participants know exactly what to do and can carry out the activity well.
- Observe, listen and learn: a facilitator should keenly read individual participants and the assembly as a whole to assess whether participants understand what is being discussed or whether they have doubts, questions or mistrust on what is said to them.
- Be sensitive to participants' needs and manage power imbalances so that all have the opportunity to participate without feeling marginalised or forced.
- Encourage and respond to questions from participants. At the end of an exercise, participants should not be left with any doubt or confusion.

### DIALOGUE TOOL

Dialogue is another useful tool similar to group work. Dialogue is an improved way of organizing a group conversation, one that increases the quality of participants' input by creating a comfortable and easy environment for discussing ideas. However, while a facilitator does not participate in group work, in dialogue, a facilitator is part of the conversation. The **advantages** of dialogue for the VLUP process are as follows:

- Having facilitators sit with participants in a circle puts all on the same level and breaks some common barriers that may prevent participants from sharing their opinions.
- In a dialogue conversation, participants do not need to agree with others. They only have to try to understand and to respect others' views.
- Dialogue can be used with different numbers of people, from 3 up to 25 people, depending on the space available.
- Unlike in group work, the facilitator can moderate the conversation, for example, to control people who dominate or to prevent the discussion from digressing from the given topic.
- Facilitator can ask questions about aspects of a topic that participants aren't touching upon. They can also ask individual participants to clarify an issue he or she has spoken about.

**What dialogue can be used for in the VLUP process**: The main difference between dialogue and classroom setting is that, in the former, chairs are arranged in a circle. Thus, as dialogue changes only the group dynamics, it can be used in any exercise in the VLUP process where a classroom setting is used. Dialogue is particularly good for facilitating discussions which require exploration of and negotiation of sensitive topics like in problem analysis, land conflicts resolution, and identification of future needs. You can also apply dialogue together with other tools in the VLUP process. For example, dialogue can be used with problem-tree analysis by assigning someone to write down the outcomes of the dialogue on a problem-tree matrix while others sit in a circle and discuss problems and their effects and causes (see the problem-tree tool in Section 2.2.4.).

**Textbox 27. Basic details**

- Time: Depends on how much time you have, say 30 minutes to 2 hours.
- Participants: Different VLUP stakeholders in or outside a village. Preferably two facilitators, one to moderate the dialogue and one to take notes.
- Outcomes: Facilitate participants to discuss or solve an issue or to give feedback on some matter.
- Preparations and material: Chairs or other things to sit on, optionally notebooks and pens.

**Textbox 28. Addressing possible challenges**

Holding a dialogue does not guarantee that all people will talk or that some people will not dominate the discussion. The facilitator has a big role in ensuring that all have an opportunity to express their opinion. The setting discourages instant note taking while everyone is engaged in the discussion. In dialogues with participants from different social groups, it is not advisable to tackle difficult or sensitive topics because some people will feel too shy or too intimidated to speak in front of the others. For sensitive topics, dialogue tool can be used with groups of particular social group such as farmers with farmers and livestock-keepers with livestock-keepers.

### Working tasks

1. Arrange the chairs in a circle.
2. Ask participants to sit anywhere they wish, but, if possible, encourage women to sit among men (Figure 15).
3. In the role of a facilitator-participant, sit in the circle among the other participants.
4. If possible have two facilitators for dialogue. One should sit among the participants and moderate the discussion and the other should sit to the side and take notes on the discussion.
5. Start by setting rules of communication like listening to others, letting others speak, and respecting others' opinions.
6. In order to create a sense of equality, inform participants that they can talk without standing up and that they do not have to raise their hand when they want to say something. Instead, as soon as one person finishes sharing his or her views, another person can just start talking.
7. Introduce them to the topic and let them start the conversation. Alternatively, ask them what they would like to discuss.
8. As a facilitator, moderate the discussion gently. If someone doesn't give others the opportunity to talk, politely remind him or her of the rules of communication. If someone doesn't seem to be getting the opportunity to talk, help him or her by asking if he or she has something to say.
9. Remember that the most important skill required from a facilitator in dialogue is the ability to create a secure environment in which people feel comfortable to express their opinions. People are usually encouraged to air their views when they are assured that what they are going to say is going to be respected, so make sure you establish that respecting others is a basic rule.
10. When the time allocated for dialogue lapses, as a facilitator briefly highlight or summarise what has been discussed so that participants remember the main issues addressed. ■


**Figure 15.** The dialogue tool. In the dialogue the sitting arrangement plays a major role in supporting participants to actively engage and helping facilitators to manage participants who tend to dominate discussions. In a circle of chairs the sitting arrangement gives a sign to participants that all participants should be in an equal position to talk. By sitting in the circle also the facilitator is in the same position with the participants.

## LEARNING CAFÉ TOOL

A learning café is a creative tool to host conversations on different matters. The facilitator should arrange chairs and tables in a café-style for participants to gather and have discussions in conversational clusters, just as happens in a café. At each table there is a different set of questions or topics for the group sitting there to discuss. The groups will rotate so that they all have a chance to sit at each table and discuss each topic. At each table, the discussion will be written on flipchart paper, and each group adds on to what is already written. The **advantages** of a learning café for the VLUP process are as follows:

- A learning café is a good way to bring people from different backgrounds together to think about a complex issue and to find imaginative ways forward.
- In a short time lots of ideas and views for several different topics or questions are generated.
- When well facilitated, a learning café makes an exercise fun.

**What learning café can be used for in the VLUP process**: Like group work, a learning café can be used when you need to receive information from the participants or wish to have them discuss a topic. The tool is an efficient way to deepen the discussion as each group discusses a topic only after reading what other groups have already discussed. It is good to use when you want to get a diverse set of views on several topics and to encourage participants to be ambitious in their thinking (Textbox 31). Activities to use it with include problem analysis, envisioning the future, preparing a community action plan, and getting feedback on a VLUP draft from the village council or at an assembly meeting. The tool works best with a mix of diverse people who can bring different experiences and views into the discussion.

### Working tasks

1. Decide the questions or topics which will be at each table. Depending on the number of topics and how much time you have, decide how many tables you need. Each table should have one or two topics.
2. Assign a facilitator to each table to make sure the participants' ideas are clearly written on the flipchart paper. You can decide whether the facilitator will him or herself write or whether participants will write.
3. Create a special environment modelled after a café. In other words, set tables separate from each other and place a few chairs around each table. If you do not have tables or chairs, you can use, for example, logs or carpets on which people can sit comfortably. Provide each table with flipchart paper and pens.
4. Introduce the participants to the procedure for the learning café exercise and to the questions at each table.
5. Encourage participants to relax and divide them into the same number of groups as there are tables.
6. Agree with participants how much time they will have to discuss at each table. It is good to decrease the amount of time for each round, say, for example, allocating 20 minutes for the first round, 15 for the second, 10 for the third, and 5 for each round after that. Providing a constant amount

**Textbox 29. Basic details**

- Time: Depends on how much time you have, say 1 to 2 hours for all rounds of group conversations and a discussion of the results.
- Participants: Different VLUP stakeholders in or outside a village.
- Outcomes: Facilitate participants to discuss or give feedback on different topics.
- Preparations and material: Flipchart paper and marker pens, chairs and tables or other things to sit and write on.

of time for each round is not ideal because new ideas are normally generated during the first rounds and ideas in subsequent rounds tend to complement and refine what has already been mentioned.

7. Start the first round of conversations, ask each group to sit at one table and give them the agreed time to discuss the topic of that table. The facilitator at each table should ensure that the main points of the conversation are written down on the flipchart.

8. When the allocated time is up, ask each group to move to the next table and start the second round of conversations (Figure 16). The facilitator, the "table host," should remain at the same table and briefly explains to the new group what the main ideas of the previous group were. Then the new group should discuss the topic of that table and the facilitator should ensure that any new ideas are written on the same flipchart paper.

9. Continue the rounds until each group has visited each table and discussed its topics. Thus, if there are four tables of topics, you should have four rounds of conversations.

10. After the last round, ask the participants to remain seated at the table where they are and invite a representative of each group to tell to the whole group about the ideas raised at that table. The speaker can use the flipchart paper to help explain all the ideas. Alternatively, the facilitator hosting the table can share the ideas.

11. Have a general discussion about the outcomes and end the exercise.

You can either have mixed groups or groups defined by certain features (for, example, groups of women and men or groups of council members and non-members) carry out this exercise. Because participants get to see and hear what each group said through the flipchart and the table host, the ideas of different groups will naturally be shared. ■


**Figure 16.** The world café tool. After each discussion round the groups move to the next table to discuss a different topic. The table host will brief the new group about the ideas which others have already raised. It is important to keep time so that all groups will have time to go and discuss each topic during the exercise.

**Textbox 30. Addressing possible challenges**

The learning cafe tool requires several facilitators, the exact number depending on how many tables you have. Facilitators need to be skilled in and knowledgeable on the topics which they are hosting at their table. If ideas and outcomes are not shared and analyzed immediately after the exercise, some of the emerging themes and imaginative solutions of the whole group may be lost.

**Textbox 31. What types of issues are good to discuss using the learning café tool?**

- Easy to understand, but not too simple: for example, what problems are facing livestock-keepers in the village?
- Inspiring or even provocative: for example, how could women's access and control over land be increased?
- Encouraging deep reflection: for example, why do inhabitants continue to cultivate along rivers and streams despite sanctions?
- Creating new questions and new possibilities: for example, what alternative livelihoods could be developed in the village?

## Further information sources

World Cafe tool on Knowledge Sharing Toolkit - www.kstoolkit.org/The+World+Cafe

Chambers R. (2002). Participatory Workshops: a sourcebook of 21 sets of ideas and activities. London: Earthscan.

Participatory methods website of Institute of Development Studies - www.participatorymethods.org

Publications of Coady International Institute on Asset Based Community Development (ABCD) approach - http://coady.stfx.ca/knowledge/publications/

### 2.2.3. Tools for envisioning past and future village development

#### Overview and aim

One of the aims of the VLUP process is to gain understanding of the past and current village situation in order to plan for the future. In addition to considering the village history and current situation, villagers need time to think carefully about their vision of the future of their village. People will be more motivated to participate and implement their VLUP if they share a common vision of the kind of village and life they want to have in the future.

Information about the past can be collected using the village-history timeline or the river-of-life tool. The timeline or river of life will then be the basis of the villagers' vision of the future of their village. With the trip-to-the-future tool, participants can combine the past and present to imaginatively envision the future. All three of these tools will create a visual chronology of events, both positive and negative. The display, which will emphasise changes already made in the village, will help participants believe in possibilities for the future and come up with new and innovative land uses and development projects they could strive to implement.

#### VILLAGE-HISTORY TIMELINE

A village-history timeline is a simple way to collect and display information about the past of a given village. It requires only basic drawing skills and is an easy-to-understand documentation of village history. The tool captures significant events as well as changes in the condition of the village life and environment from past to present. The village satellite image map can be used to aid discussion of environmental changes that have occurred in different parts of the village (see Textbox 34).

#### Working tasks

1. Either have participants gather in one group, or, after reading the situation and observing the power dynamics, divide them into small groups. Encourage everyone to participate and create an atmosphere in which members of disadvantaged groups, too, will feel comfortable enough to express their ideas.
2. Draw a horizontal line in the center of a piece of flipchart paper or blackboard. Ask villagers when was the village established and write the year and the name of the event (the village was established) in the middle or first quarter of the line.
3. Ask participants about significant events which occurred in the area of the village before and after the village was established and record them

**Textbox 32. Basic details**

- Time: 2 hours.
- Participants: VLUMC and other stakeholders, especially disadvantaged groups and elderly and middle-aged men and women though also young people might have things to contribute.
- Outcomes: A timeline of events and conditions in the village from past to present which reveals threats to the village and the direction in which it might be going.
- Preparations and material: Flipchart paper, masking tape and marker pens or blackboard and chalk.

chronologically on the timeline (Figure 17). Mark the time, usually a year, and the name of the event. You can also write a short description of the event if needed.

4. After you record all the significant events participants want to show on the timeline, ask them about conditions in the village in the past. Ask them, in particular, what the environment was like and what natural resources, such as forests or water, were available and how readily available they were at different times in the past. Ask, for example, about conditions in colonial times, before and during the establishment of the village, 20 years ago, and during a particular event. Record both the conditions and changes in those conditions on the timeline.

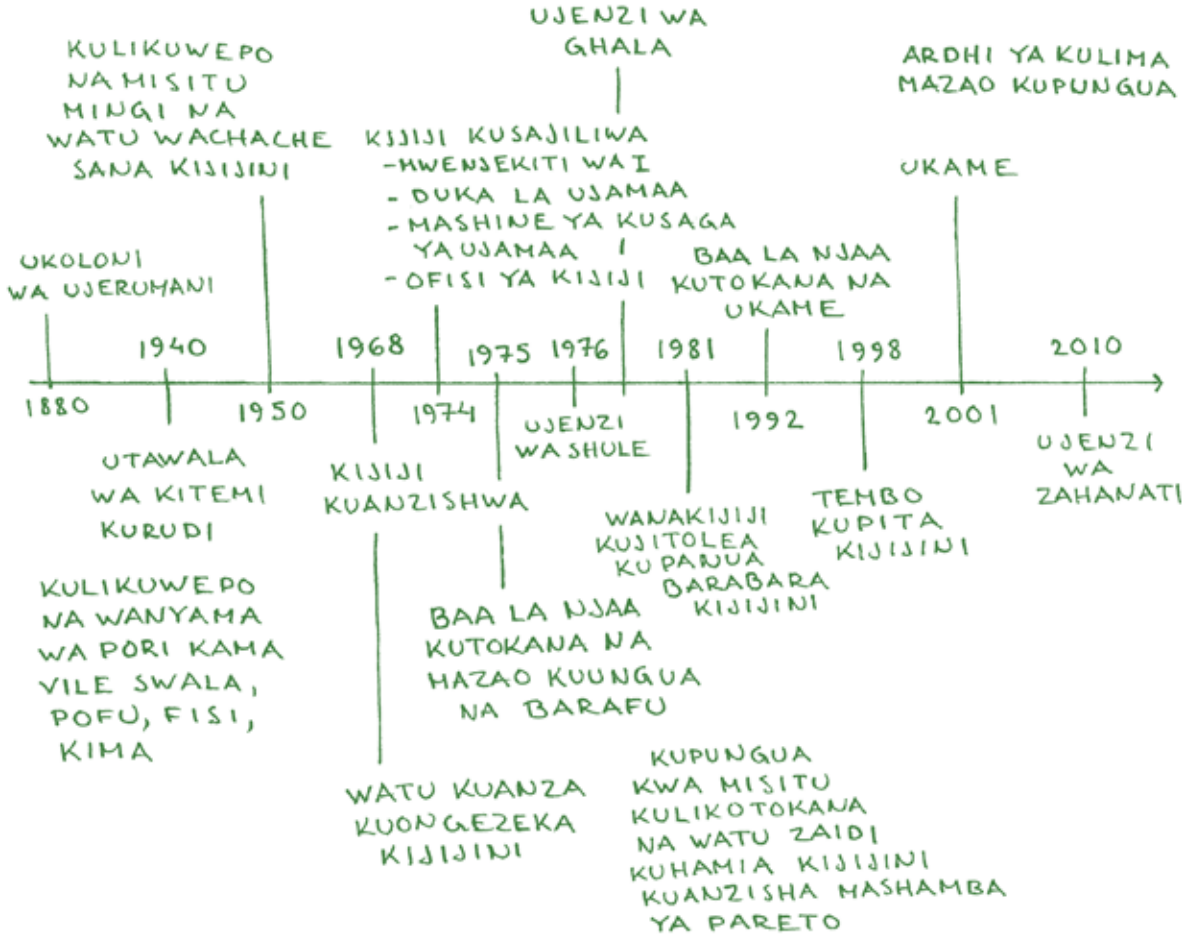



**Figure 17.** An example of a village history timeline. The important past events in the village are collected onto the timeline and remarks about the past village environment and socioeconomic conditions can also be noted down. The timeline gives an overview of past changes in the village and is also a good documentation of village history for future generations.

5. Ask participants whether or not they want to add more details of their village past and fill in any more details they come up with.

6. When participants are finished, ask them to reflect on the picture. Ask them questions about what they have learnt and what conclusions they can draw from the timeline to be used in developing the future vision of their village.

7. Ensure that participants take note of any recurring natural events, such as large floods or droughts, and remind participants that their future plan should try to address these events.

8. Once the timeline is finished, agree with villagers that you will photograph it and leave the original with them. If the timeline was drawn on a blackboard, discuss with the participants how they can conserve it by, for example, transferring it to paper.

9. Then use the timeline to start envisioning and planning the future of the village with the villagers in the next exercise. ■

**Textbox 33. Addressing possible challenges**

Participants might not be able to remember the timing of events and changes very well. It helps to ask who the village chairperson, VEO or school headmaster was at that particular time in the past and then check in the village records when that person was in charge to get an approximate date for the event. People also tend to remember past events and conditions differently, so it is important to remember that the timeline represents one view of the past, the way people remember it, not an absolute record of past events and conditions.

**Textbox 34. Socio-ecological history mapping**

Use the village satellite image map with the villagers to discuss the environmental and socio-cultural history of the village. Have them reflect on past vegetation (forests and grasslands), water sources and wetlands as well as their cultural history and traditional practices and beliefs. Often the environmental and cultural histories of a village go hand in hand and explain each other because village life has been and still is intertwined with nature and natural resources. You can combine the use of the satellite image map with the history timeline tool so that the satellite image map enriches timeline details with locations of the past changes. The timeline records those visible changes in words. The environmental changes mapped on the satellite image map allow identification of possible and needed rehabilitation areas of, for example, natural forests, primary grasslands and water sources as well as watersheds. Capturing the socio-cultural history of a village can lead to the revitalisation of traditional professions, a greater appreciation of the village past and tourism opportunities.

## RIVER-OF-LIFE TOOL

The river-of-life tool is another group facilitation tool which uses visual narrative to help people tell stories of the past, present and sometimes the future. A river of life is more complex than a timeline and requires more abstract thinking than a village history timeline to develop but it gives a clearer picture of the direction in which village development might be going. By imagining that the village or its people are a river, participants can depict the major events and milestones in the village using features of the landscape, water, boats, and the like as their symbols (Figure 18). The tool enables villagers to bring several stories together and immediately shows the big picture created by individual events and changes. Through visualisation the river of life indicates the future direction of the village. It serves as a guide because it captures the milestones, failures and successes over time. In the VLUP process the river-of-life tool is useful in highlighting the major events which have shaped village life and in planning the future. It also offers participants the possibility to identify their roles in and where they fit in the big picture of their village and where they have made and can make the most impact on events.

### Working tasks

1. Either have participants gather in one group, or, after reading the situation and observing the power dynamics, divide them into small groups. Encourage everyone to participate and create an atmosphere in which members of disadvantaged groups, too, will feel comfortable enough to express their ideas.
2. Introduce the exercise and explain that a river is a metaphor for the life of a village and its inhabitants. Indicate that life, like a river, sometimes flows slow and sometimes fast and that just as a river, life also has obstacles, challenges and causes for celebration.
3. Explain that in the exercise they will draw a river that represents the life of their village. Make participants understand that their task is to identify and draw the significant events and conditions that over time contributed to the shaping of the river of life of the village to make it what it is in the present.
4. Give participants time to think about what they would like to show on their river of life and to use their drawing skills to draw the river and its elements.
5. Tell them to feel free to ask if they do not understand the task.
6. Give them 30 minutes to 1 hour (or more) to create the picture.
7. When they are finished with their river of life, ask them to reflect upon it. Ask them questions about what they have learnt, what conclusions they can draw from the picture and what they could use the picture for in developing the future vision of their village.

**Textbox 35. Basic details**

- Time: 2 to 3 hours. For example, 2 hours for small-group work and 1 hour for the group as a whole.
- Participants: VLUMC and other stakeholders, especially disadvantaged groups, elderly and middle-aged men and women though young people might also have things to contribute.
- Outcomes: A timeline in the form of a river depicting events and conditions in the village from past to present which reveals threats to the village and forecasts the direction in which it might go.
- Preparations and material: Flipchart paper, masking tape and marker pens or blackboard and chalk.

8. Make sure villagers take note of any recurring natural events in the village such as large floods or droughts and address these events in their future plan.

9. Agree with the villagers that you will photograph the picture and leave the original with them.

10. Use the river of life next to start envisioning and planning the future of the village with the villagers. ■

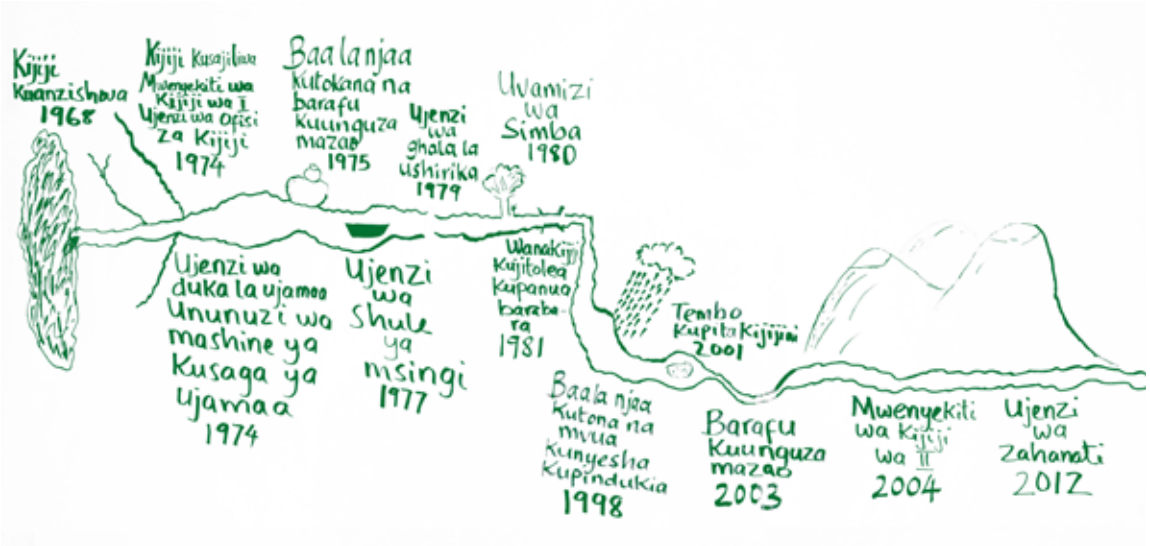



**Figure 18.** An example of a river of life. The positive events can be depicted as wide well flowing stretches of the river and the negative events can be depicted as obstacles like rocks and waterfalls along the river. The river will show the ups and downs of the village from which the village and its inhabitants have survived during the course of time.

### Textbox 36. Addressing possible challenges

As is the case for creating a village-history timeline, participants might fail to remember the exact time that some events happened. A river-of-life picture is less detailed than a village history timeline because participants are told to draw the story of their village and not, as for the village-history timeline exercise, to include details on every significant event and change. The river motivates people to think of the village as their collective effort and as a place where challenges can be overcome and where things will change for the better. The metaphor of a river might not be easily understood in arid areas where rivers are seasonal or non-existent.

### Textbox 37. Ways to modify

Instead of a river of life, you can ask villagers to make a village-history timeline, which is simpler to make and includes more details. You can have different social groups, for example men and women or disadvantaged groups, draw their own village rivers of life separately. The experiences of and significant events for different groups can be quite different. Having small groups draw separately will capture this diversity of experiences; drawing as a whole group may not. If you have small groups draw separate pictures, have them share their pictures with the whole group so that they can learn from each other and discuss each other's experiences.

## TRIP-TO-THE-FUTURE TOOL - CONTINUATION OF THE HISTORY TIMELINE AND RIVER OF LIFE

The trip-to-the-future tool helps participants to create the course of life events that they wish to have in the future. In the case of the VLUP process, participants create the course of events and developments they wish to happen in their village. The tool is helpful for the VLUP process, especially for encouraging villagers to come up with many potential new land use ideas which can be adopted as the proposed land uses in their VLUP. In the trip-to-the-future participants are asked to freely name events without considering their own ability to actualise them. Then, as participants estimate the years in which these events could occur, they can see what it takes to actualise what they wish for. The tool also allows participants to think about how they can influence the development direction of their village with their own actions. As a group exercise this tool creates joint understanding and shared goals for the future more vividly than a simple list of future needs.

The outcome of the trip-to-the-future tool is an extension of a river of life or a village-history timeline as it extends the present to the future. Thinking freely, participants generate a list of wishes about future events and village developments and estimate when they might happen. They present these events and developments in a drawing like a river of life or a village-history timeline. They can even continue drawing on the same flipcharts or blackboard on which they drew their river or timeline (Figure 19). The resulting sequence of future events written on a timeline or river in the trip-to-the-future drawing generates ideas which can then be used to analyse problems and develop a community action plan.

### Working tasks

1. Either have participants gather in one group, or, after reading the situation and observing the power dynamics, divide them into small groups. Encourage everyone to participate and create an atmosphere in which members of disadvantaged groups, too, will feel comfortable enough to express their ideas.
2. Display the village-history timeline or river of life on a wall for participants to see.
3. Tell them that in this exercise they will extend the river of life or village-history timeline with what they wish to have in the village in the future.
4. Tell participants to think freely about what they wish to happen in the village in the future. It is important to remind participants that, at this stage in the exercise, the list is just **a wish list**. Encourage them to list events and developments without considering whether or not it is possible to actualise them. Ask them to think what they would need in the village to increase their wellbeing and to include solutions to recurring challenges such as large floods and droughts.
5. All the wishes which the participants name should be noted down. Alternatively, if you have participants work in small groups, have each group create its own list and then combine all the individual wish lists into a single wish list.
6. Tell the participants to consider everyone's wishes and combine them together. Discuss if any wished are not acceptable and discuss why. Make sure that the future wishes and needs of disadvantaged groups are also heard and addressed.

**Textbox 38. Basic details**

- Time: 2 to 3 hours.
- Participants: VLUMC and different VLUP stakeholders in or outside a village.
- Outcomes: A wish list for future developments in the village and understanding of the capacity of the villagers, the need for outside assistance and the time needed to achieve each development. Villagers are encouraged to think broadly (outside the box) about what they want to have in their village in the future.
- Preparations and materials: Flipchart paper, masking tape and marker pens or blackboard and chalk.

7. Ask them to assign to each future wish an estimate of the time they think is needed for the wish to be actualised. For example, they might predict constructing a village health center will take 5 years; building two houses for teachers, 6 years; and establishing a village market, 2 years. The participants should consider the capacity of the village and its inhabitants to provide for themselves in development projects as well as possible future assistance from outsiders.

8. Convert each estimate in years to a likely date of achievement. For example, if a village health center is estimated to be achievable in 5 years, it will be achieved in 2023 (2018 + 5 years).

9. Ask participants to arrange the events and development wishes they envision in order off their expected years of completion and to present them chronologically in a drawing similar to a river of life or a timeline. They should begin with those events that they hope will happen soonest and proceed to those they think will happen further in the future, moving, for example, from 2019 to 2020 to 2023 and so on.

10. Agree with the villagers that you will take photographs of the picture and leave the original with them.

11. Then use the trip-to-the future wish list and picture in making the community action plan and future VLUP sketch map later in the VLUP process. ■

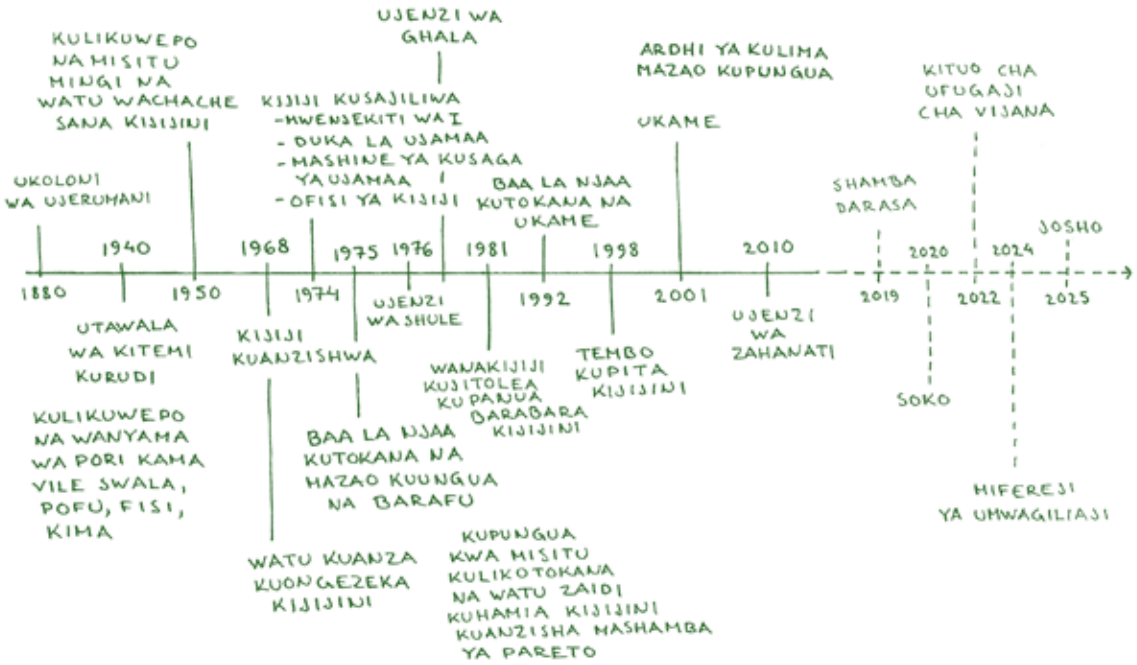



**Figure 19.** Example of a trip to the future. The village history timeline has been extended to include future wishes of the villagers. The villagers have imagined together what they wish to have in the village in the future and estimated when they could achieve these wishes.

**Textbox 39. Addressing possible challenges**

The trip-to-the-future tool works best if a history timeline or a river of life has already been prepared. This exercise takes quite a lot of time and captures only the positive side of development, though, in reality, downturns like disease outbreaks or abnormal rain distribution, will most likely also occur. Having the freedom to wish for anything will probably result in there being unrealistic wishes which will need to be discussed.

**Textbox 40. Ways to modify**

If you have limited time, you can ask participants simply to discuss and list their wishes and estimate the time they will take to achieve and not have them draw a picture of their trip to the future as drawing is the most time-consuming part of the exercise. As was the case with the river-of-life tool, you can have different social groups draw their own trip-to-the-future pictures and then combine them through whole-group discussion.

### 2.2.4. Tools for identifying problems and solutions

#### Overview and aim

By identifying the problems and challenges facing a village, villagers can plan their VLUP so that it addresses these issues and gives them tools to overcome them in the future. This identification can be accomplished using various ways. This section presents two such tools: problem-tree analysis and the community leaky bucket. Problem-tree analysis helps villagers see the cause-and-effect relationships between problems and a community leaky bucket identifies activities which will help a village to improve its economic performance. These two tools do not substitute each other and can be used to complement each other.

It is important to remember to identify village challenges in different sectors and to look at challenges and solutions beyond land because, oftentimes, problems and the opportunities to solve those problems are one way or another connected to land. For example, the plight of HIV-positive community members can be alleviated by arranging for their families or associations to get farm plots and agricultural training so they can increase the incomes and improve the nutritional statuses of the HIV-positive. Furthermore, one way to address high youth unemployment rates is to set aside an area on which youth can start small projects. The identified challenges and opportunities will inform the development of the community action plan, at which point solutions will be discussed in more detail.

#### PROBLEM-TREE ANALYSIS

Problem-tree analysis is a tool which helps in the identification of problems and their causes and effects. Imagine that the major problem is the tree trunk, the causes of the problem are its roots and the effects of the problem are the branches of the tree (Figure 20). By identifying the cause-and-effect relationships of its problems, a village can address the root causes of and the linkages between the problems and recognise that sometimes a problem is only a symptom of a bigger issue. The problem-tree tool allows for a better understanding of village problems and their interlinked and sometimes contradictory causes. It can also reveal whether or not more information or evidence about the problems is needed in order to understand them fully. The problem-tree tool can also be used to identify ways to solve the problems by reversing the problems into objectives to be achieved (Textbox 44). The identified problems and objectives will form the basis for the development of a community action plan which identifies actions to solve problems.

**Textbox 41. Basic details**

- Time: 2 to 3 hours.
- Participants: VLUMC and different VLUP stakeholders from different social groups in a village.
- Outcomes: The problems facing different sectors of village life and the cause-and-effect linkages among them are identified on a picture. The picture helps to demonstrate the root causes of problems in the village and to suggest possible actions to address them in the community action plan.
- Preparations and material: Flipchart paper, masking tape and marker pens or blackboard and chalk.

### Working tasks

1. Divide the participants into groups. Each group will discuss the challenges and problems related to a different sector, such as farming, social services, and livestock-keeping. It is important to remind participants that they need to consider the problems, needs and challenges of the community as a whole or of the social group they represent, not only their personal problems, needs or challenges.

2. Ask the participants in each group to start by discussing and writing on a flipchart paper all the problems which the sector is facing in the village. Ensure that all groups have one person who can write or help them by writing on their behalf.

3. After they have listed all the problems and challenges related to a particular sector, ask them to select one main problem to focus on.

4. Ask them to write that main problem in the middle of the flipchart paper to represent the trunk of the problem tree.

5. Ask them to consider which of the other problems they listed are linked to this main problem. Ask them to identify which problems are direct **causes** of the main problem and write them below the trunk on the paper to represent the roots of the problem tree.

6. Then ask them to identify problems which are direct **effects** of the main problem and tell them to write those at the top of the paper to represent the branches of the problem tree.

7. Sort all the problems in the same way. Use the guiding question "what causes what" to help participants to identify causes and effects.

8. After they have established all the possible links between the problems on their original list of problems, ask them to discuss whether or not the main problems has even more causes and effects and to add any that exist to the problem tree.

9. After all the problems have been written on the problem tree, connect the problems with cause-effect arrows showing the direction of the links.

10. Ask the group to review their problem tree and ensure they are satisfied with it (Figure 21).

11. Then have each group present its problem trees to the whole group as a whole so they get an overview of problems concerning different sectors.

12. Ask the group as a whole to identify whether or not some problems are common to all sectors. If there are, villagers can solve the problems of several sectors at once by focusing on these common problems.

13. Agree with the villagers that you will take photographs of the problem-tree pictures and leave the originals with them.

14. Use the problem trees for different sectors of village life to develop a community action plan. ■

**Textbox 42. Addressing possible challenges**

Sometimes some participants are slow to understand the tool and will require more instruction. It may be difficult to identify the effects and causes of a problem right from the start, so it is good to give participants ample time to think and discuss and not to rush them.

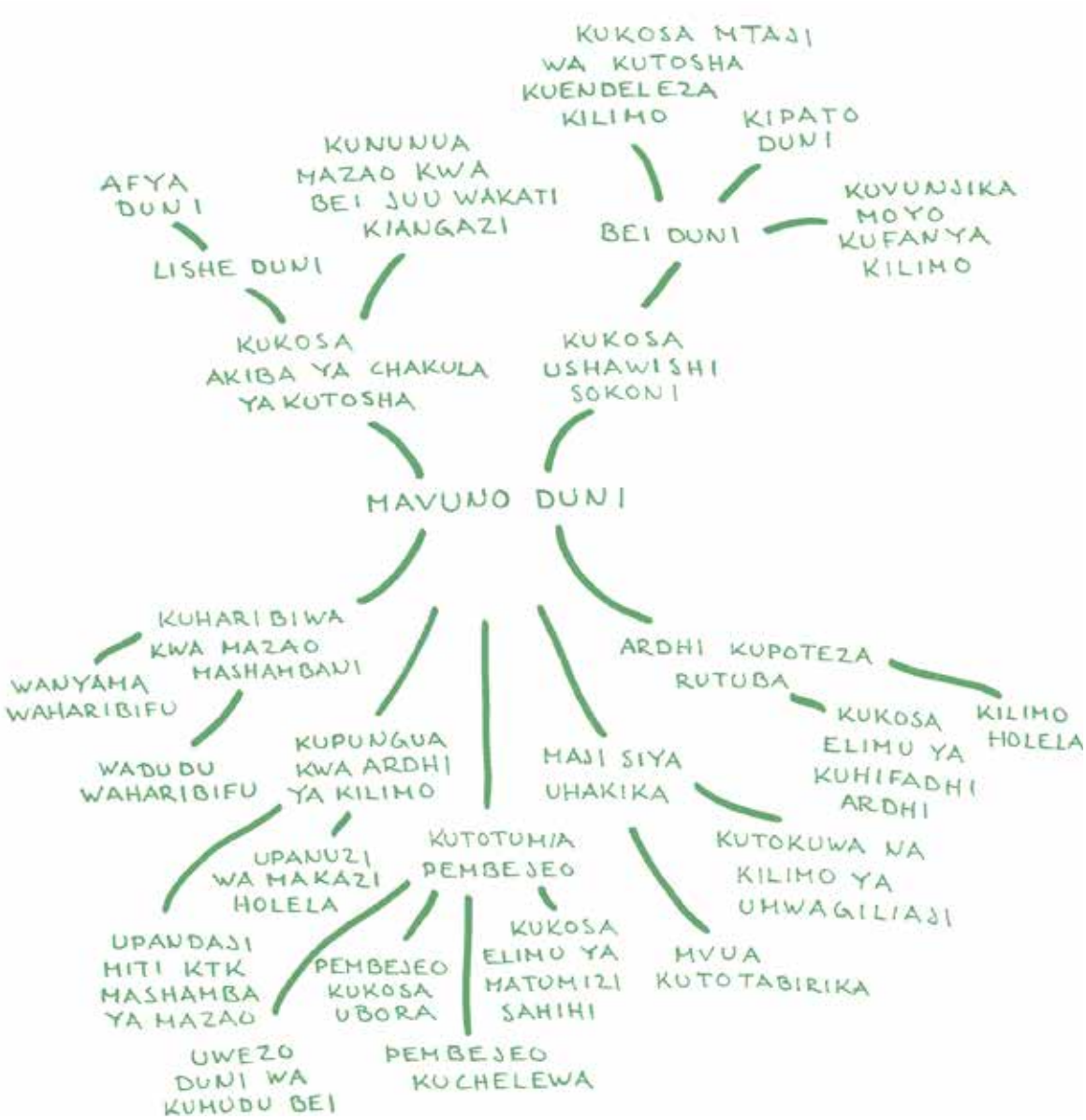



**Figure 20.** Example of a problem tree. The main problem is the tree trunk, the causes of it are the roots and the effects of it are the branches. The problem tree picture will help to identify causes of problems. In the example low awareness of better farming techniques and land use allocation are causes of poor harvests. Awareness raising and training of farmers on these topics are thus important.


**Figure 21.** Problem tree analysis. Shared discussion on the problem tree will deepen the analysis while views of all participants are welcomed.

### Textbox 43. Ways to modify

If there is not much time in the VLUP process the problem- and objectives-tree tool is a good substitute for the river-of-life and trip-to-the-future tools which still allow participants to discuss and decide upon village objectives for the future.

### Textbox 44. Turning problems into objectives

The problem tree can be turned into an objectives tree by transforming problems into objectives. A problem and its causes and effects are restated to form problem-intervention targets to achieve to solve the problem. Stating objectives is especially rewarding when the root causes of problems are found because solving one root cause may simultaneously address many other problems as well. An objectives tree shows the means-and-end relationship for undoing the problem under analysis. Converting problems into objectives will help villagers to identify the future achievements they hope for and the kinds of activities they must carry out in order to achieve them. Having this knowledge will, in turn, assist participants in identifying actions to solve problems in the village which can then be incorporated into the community action plan.

## COMMUNITY LEAKY-BUCKET TOOL

The community leaky-bucket tool helps communities to better understand their local economy and to consider how to achieve a healthy economy which supports village development (Cunningham 2011). The community leaky-bucket tool depicts the economy of a community as a bucket that has holes at its bottom. The fluid that flows into the bucket through its mouth and leaks out of the bucket through the holes symbolises the flow of money in and out of that community in a year. The bucket reflects the fact that any community is ultimately linked with the rest of the world through the inflow and outflow of income, goods and services, raw materials, jobs, investment profits, ideas, and the like. A community uses inflows as resources to produce the output it sells and to carry out development projects within the village. These resources can be available locally or obtained or purchased elsewhere.

The community's money is usually income from the sale of goods and services, employment or transfers from government or family members (see also Textbox 47). Money leaves the community, typically in the form of expenditures on goods and services purchased outside the community. The size of the economy of different communities varies depending on the relative sizes of the inflow of income from outside and the leakage of income out of the community. The level of fluid in the bucket represents the overall level of economic activity. The fuller the bucket, the more money is circulating in the community and the healthier is its economy and the greater the opportunities to support village wellbeing.

The leaky-bucket tool helps communities to identify ways to improve the local economy. There are three different deliberate strategies to do so: to increase inflows of income, to reduce the outflow and or to increase the circulation of money within the community. Ideally, both increasing inflows and reducing outflows directly increase the circulation of money within the community. In addition, the circulation of money can also be targeted deliberately. The community leaky bucket-tool exercise should always be ended with ample time for discussion about which strategies the community should choose and what kind of activities community members can do to carry them out.

### Working tasks

1. Either have participants gather in one group, or, after reading the situation and observing the power dynamics, divide them into small groups. Encourage everyone to participate and create an atmosphere in which members of disadvantaged groups, too, will feel comfortable enough to express their ideas.

2. Explain to participants that a leaky bucket represents the economy of their village.

3. Ask the participants to choose one participant from among them to draw a bucket and depict the estimates of the income flows of different activities in the village as participants point them out during the discussion.

4. Ask participants to identify sources of income that bring money into the village such as sales of crops and livestock, salaries, government grants, and support from other organisations. Then ask them to estimate how much money (in TZS) comes in from each source each year. Display the estimated amounts at the top of the bucket with the arrows pointing into the mouth of the bucket. Instead of estimating the amount of money, they could show the

**Textbox 45. Basic details**

- Time: 1 to 2 hours.
- Participants: VLUMC and different VLUP stakeholders from different social groups in the village.
- Outcomes: Community leaky-bucket picture of the components and state of the village economy. Information on the actual and potential contributions of different economic activities to the village economy, including opportunities for income generation and savings.
- Preparations and material: Flipchart paper, masking tape and marker pens or blackboard and chalk.

relative importance of each income source (Figure 22) by using the thickness of the arrows to show the relative importance of each income source.

5. Ask participants to identify expenditures responsible for money flowing out of the village, such as household appliances, clothing, lighting, school fees, medical expenses, farm inputs, communication, transport, and TV subscriptions. Ask them to estimate how much money is spent on each expenditure item each year or the relative importance of each expenditure. Each estimated expenditure should be shown at the bottom of the bucket with arrows pointing out of the bucket to depict the outflow of income.

6. Ask participants to identify activities that involve money exchanging hands within the village. Ask them also to estimate how much money circulates internally in each activity each year. These activities, with their estimates of total amount or relative importance should be shown inside the bucket.

7. If you are estimating the inflows and outflows in terms of amount of money, ask the participants to sum the inflows and outflows separately and calculate the difference of their totals. The amount of surplus of inflow is the level of the village's economy in one year; it is, in other words, the amount of money which stays in a community each year.

8. Next, ask participants to discuss how to increase that surplus so that they will have more money for investing in the development of their village and their wellbeing. Ask participants to discuss which of the existing income-generating activities can be improved and how in order to increase village income inflow. For example, they can consider which activities can be expanded, either by increasing production or by enhancing quality and storage. Ask them also to consider new income-generating activities.

9. Ask them how they could change the expenditure pattern to reduce the unnecessary outflow of income. They can consider reducing expenditures,

**Textbox 46. Addressing possible challenges**

Sometimes understanding the idea of the leaky bucket may be difficult at first. Thus, it is a good idea to start by listing different economic activities in the village and then identifying what products and services people sell in the village. The village council should list the types of programs or services it delivers in order to identify its income. It may be difficult to estimate the amounts of money (in TZS ) involved in different inflows of income and outflows of expenditure, so the prepared bucket may not reflect the real status of the village economy. One option is to estimate the proportions of different income sources and expenditures instead of exact amounts of money (see the example in Figure 22). However, this option does not reflect the exact status of economic surplus or deficit either.

**Textbox 47. Unpaid work and subsistence activities in the local economy**

Community members carry out a lot of unpaid work and work, such as subsistence agriculture, which does not generate any income. This work, which is often carried out by women, contributes substantially to the daily wellbeing of households and the community as a whole. The community leaky-bucket tool does not take this contribution into account because it does not generate any inflow of money. This work can, however, be considered in household leaky buckets, which have been used in countries like South Africa to help households increase their incomes. When creating a household leaky bucket, in addition to monetary income, household members calculate how much time women, men and children spend each day on unpaid work, assign a value to this work (what would it cost them to hire someone to do it?) and then calculate how much money that translates into monthly or annually. These figures for unpaid work are written and shown inside the bucket. By considering this work in their household leaky bucket, people begin to appreciate how much unpaid labour contributes to the household economy and therefore how much women contribute to household wellbeing.

for example, on alcohol and tobacco or investing under-utilised savings into more productive activities.

**10.** Agree with the villagers that you will take photographs of the leaky-bucket picture and leave the original with them.

**11.** Ask participants to decide which of the activities they have identified to improve their village economy they think can be implemented and included in their community action plan. During the development of a community action plan, incorporate them into the plan. ■

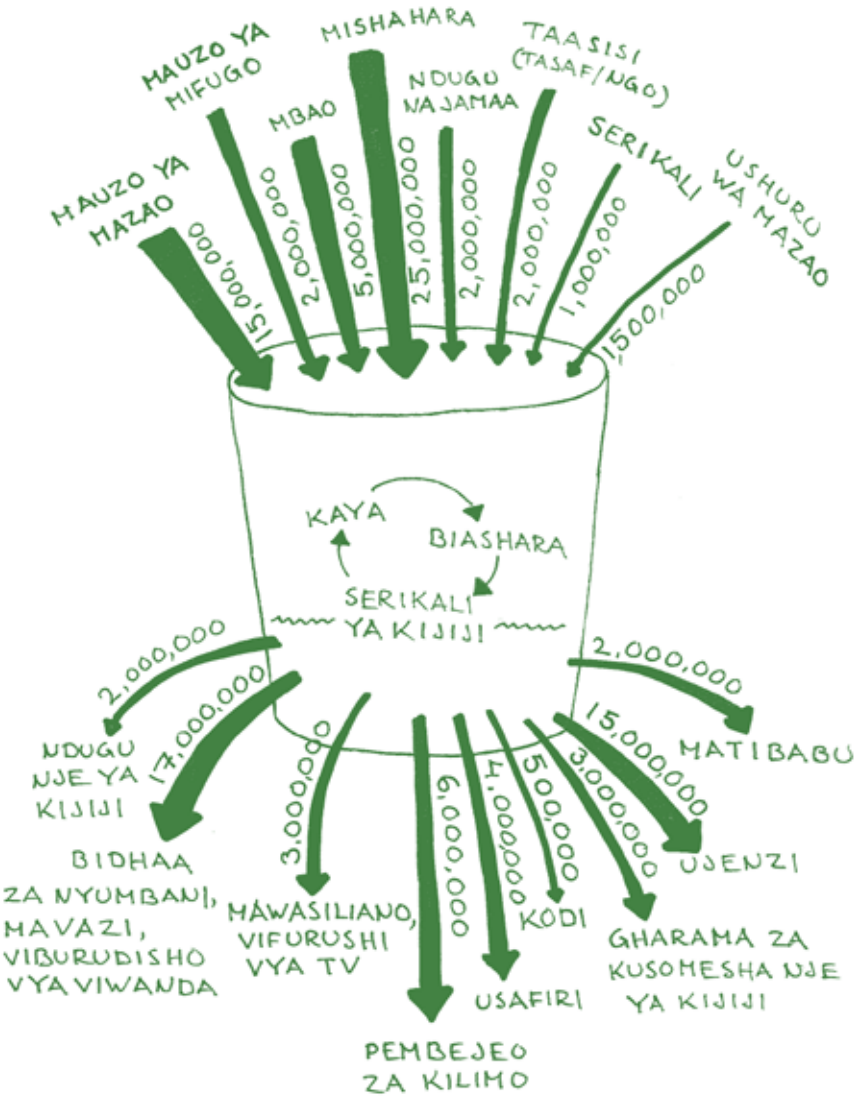



**Figure 22.** Example of a community leaky bucket. In this example the income and expenditure are estimated in Tanzanian shillings and illustrated by the thickness of the arrows. Depending on the participants' ability to estimate the amount of income and expenditure in one year, you can either ask them to estimate in Shillings or with arrow thickness. In this example village the total income is 53,5 million TZS and total expenditure 52,5 million TZS, thus the size of the village economy is only 1 million TZS. The leaky bucket is then used to discuss with participants how they can improve their village economy: for example block some of the expenditure flows to keep more money within the village.

## 2.3. Mapping existing village land situation

"The PLUM Guidelines (3rd edition)" instructs facilitators to complement PRA activities with participatory mapping exercises in order to map existing land uses in a village as well as any land management problems, including the impacts of climate change, that the village faces. Mapping activities are conducted in Step 3. The following sections describe how to use a village satellite image map (see Section 2.1.1.) with the villagers as the background for mapping. The sections below provide detailed instructions on 1) how to map the environmental risks of a village, 2) how to map existing village land uses, and 3) some tips on how to ensure GPS tracking produces good-quality spatial data.

### 2.3.1. Mapping areas of environmental risks on a satellite image map

#### Overview and aim

VLUP is made to guide the secure and sustainable allocation of village land use. Different natural hazards, human-caused environmental changes, and climate change impacts may all pose risks to community well-being unless their anticipated impacts are considered in a VLUP. If the suitability of land and potentially risky areas are identified and mapped, it is more likely that potential losses of life, damage to property, and risks to food security will be considered in, and thereby mitigated through, planning.

The environmental risk map of a village is an important tool for supporting decisions about land allocation in that village (Figure 23). Such a map depicts areas at risk of, for example, flooding, erosion, landslides, volcanic activity, drought, and forest fires. Based on its expertise and prior knowledge, the facilitation team will have some ideas of where natural hazards may occur and where environmental risks are high. Participatory mapping with villagers then allows the team to gather local experiential knowledge about the occurrence of these hazards. If village landform and slope maps showing topographic variations in a village are available, they will add valuable information to the risk mapping and assessment exercise (Textbox 9). Together the village satellite image map, local knowledge of experienced hazards, and landform and slope maps, will give a facilitation team enough information to produce a map of the environmental risks in a village. This map is an indicative one that shows where environmental risks are greatest and where hazards are most likely to occur.

#### Working tasks

**Listing natural and human-caused hazards and risks in the village:**

1. Have all participants gather in one group, or, after reading the situation and observing the power dynamics, arrange participants in several small groups (see Textbox 52 on page 80). Encourage all people to participate and create a comfortable atmosphere so that members of disadvantaged groups won't hesitate to express their ideas.
2. Ask participants to list all the natural and human-caused hazards which occur in the village. Write them on a flipchart. Ask them to have a look

**Textbox 48. Basic details**

- Time: 1.5 to 2.5 hours, with listing lasting 30 minutes to 1 hour and mapping 1 to 1.5 hours. Hazard mapping should be done before existing land use mapping and some days before proposed land use mapping so a facilitation team member with GIS skills has time to digitise the map and calculate projections of future area needs.
- Participants: VLUMC and village council members, hamlet leaders, elderly men and women, ward officials, and representatives of other relevant stakeholders and social groups.
- Outcomes: Sketch map of areas of environmental risk on a satellite image background to be used for identifying suitable areas for different land use allocations which will minimise the damage caused by hazards.
- Preparations and material: Whiteboard marker pens (the ink should be erasable but not too easily) and something with which to erase markings on a plastic sheet, clear wide tape, scissors, a village satellite image map, 4-5 meters of transparent plastic sheet, flipchart paper, masking tape, marker pens, notebooks, pens, a report template, and a camera.

at the village-history timeline or the village river of life as well as the problem-tree analysis to see whether or not any hazards are already mentioned there.

3. While participants are listing hazards, make sure you ask them to consider the possible occurrence of the following: landslides, erosion, volcanic activity, earthquakes, flooding, storm water runoff, drought, tsunamis, and forest fires (see further examples in "The PLUM Guidelines (3rd edition)).

**Preparing the mapping background on a flat surface:**

4. Make sure you have all the required material for the mapping exercise (see Textbox 48 and Figure 10).

5. Place the village satellite image map on **a flat surface**, preferably a cement floor, which can be used as the background for mapping. In a village setting, cement floors can be found in village offices, schools, dispensaries, churches, and other similar buildings. Ensure that there is sufficient light in the place selected for the mapping exercise so that villagers can see features on the satellite image map clearly. Position the satellite image map so that its north arrow is oriented to the north in the village.

6. Use clear wide tape to straighten the satellite image map to the surface or floor.

7. Place a transparent plastic sheet on top of the satellite image map and tape it to the surface using clear tape so that it will not move during the exercise.

**Mapping areas of environmental risk:**

8. Have the participants gather in one group or several smaller groups around the satellite image map(s). To modify this exercise for work in small groups, read Textbox 52.

9. Orient the participants to the satellite image map and explain it to them (Textbox 13).

10. Display the list of hazards near the satellite image map for participants to see.

11. Carefully explain to participants how to carry out the mapping of environmental risks. Make sure that you spend sufficient time instructing them so that everyone understands how the mapping is done.

12. Ask participants to select one person from among them to draw on the transparent plastic sheet. Remind them that others can also draw if they are more familiar with an area under discussion than the selected drawer.

13. Ask participants to start mapping where in the village the different hazards they listed occur.

14. Ask how frequently each hazard occurs and if the locations are always the same. Ask about any other relevant information, tailoring your questions to the nature of the phenomenon in question.

15. Label each mapped hazard area with a unique code. The code should be short in order to save space on the sketch map. You can, for example, use a letter-number combination (see the example in Figure 27). Note the codes on a flipchart to serve as a map legend for all participants to see and carefully explain how this coding works.

16. A facilitation team member with GIS skills should carefully note the codes and their description as well and use them as entries in the attribute table when he or she creates GIS data (a shapefile) of the areas of environmental risk (Section 2.4.4.).

17. Give participants time to map all the listed hazards.

18. Ask participants if they are satisfied with the sketch map or if they still want to add or modify something.

19. Have participants finalise their sketch.

20. Finally, encourage participants to discuss how they could mitigate the hazards or prevent the damage the hazards cause. Ask participants who depends on these risky areas and what will happen to them and their livelihoods if these areas and the resources they hold are no longer available. Write down participants' suggestions for use in developing a community action plan and map of proposed land uses.

**Documenting and finalising the sketch map for use in producing a digital map**

**21.** Once the sketch map is finished, do not move it. Simply prepare it to be photographed. In order to geo-reference and digitise the sketch map you will need to take photographs of the sketch map from close enough to be able to see its content clearly. Each photograph you take must have at least four reference points highlighted in it. Photographing is best done by a facilitation team member with GIS skills.

**22.** Highlight with a marker pen four reference points at the intersections of the grid lines at the edges of the satellite image map (Figure 11) and label them with letters (A, B, C, etc.).

**23.** Record the grid readings (coordinates) of these reference points in a notebook for use in geo-referencing.

**24.** Take the photographs of the sketch map so that they can be used to digitise the areas of risk depicted on the sketch map (see Section 2.4.4.). The photographs have to be taken directly above the sketch map in order to avoid distortion of the digital map.

**25.** If the satellite image map used is big, you will need to take several photographs, each of which has to have at least four reference points, all of whose coordinates must be recorded. All these photographs should be geo-referenced in GIS software.

**26.** Make notes of those areas and locations which require GPS tracking after the mapping exercise is finished (see Section 4.3.3.).

**27.** After the sketch map has been photographed, erase the markings of risk areas from the plastic sheet or use a new transparent plastic sheet in order to map existing land use in the next exercise. ■

**Textbox 49. Addressing possible challenges**

Capturing hazards which occur in a village may be challenging if villagers do not understand what kinds of events the word "hazards" include. For this reason, it might be good to also ask ward officials if they have any information about the occurrence of hazards in the village. Furthermore, it may be difficult for facilitators to assess the magnitude of the hazards from villagers' explanations. That said, the effects of some hazards, like landslides, forest fires, and erosion can be seen on the landscape, so you can use field verification to test your understanding.

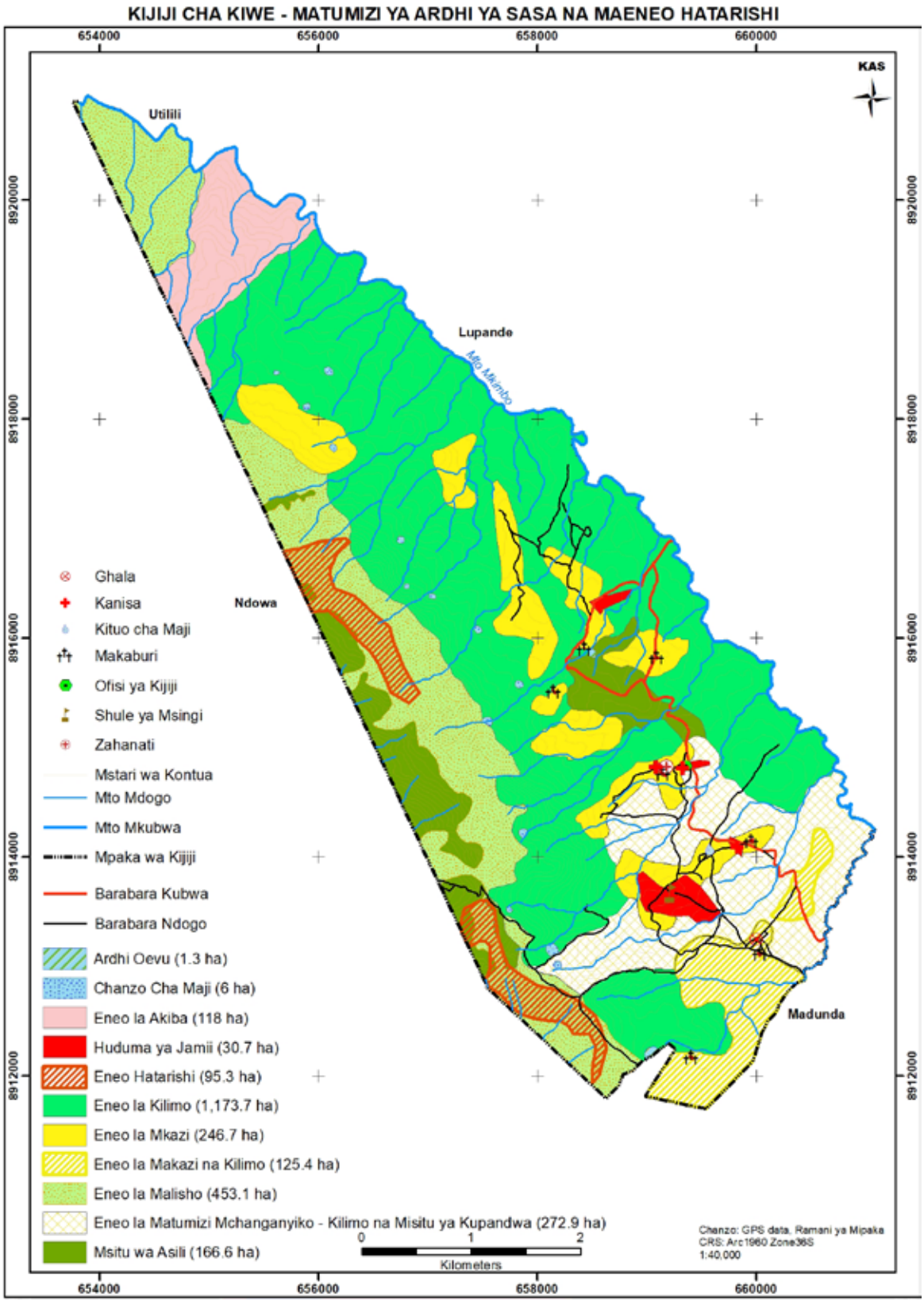



**Figure 23.** Example of a environmental risk map. The environmental risk map is to show hazard and other risky areas identified in the village together with the existing village land use areas (mapping the existing land uses is instructed in section 2.3.2.). The map helps to see which land use areas are under environmental risks and where mitigation efforts need to be considered during the proposed land use planning.

### 2.3.2. Mapping existing land uses on a satellite image map

#### Overview and aim

Step 3 in the VLUP process aims to map existing village land uses with villagers. Since the existing village land use map depicts the current land uses and resources in a village, it is very valuable map helping villagers and stakeholders understand how land is used and how resources are distributed in their village (figure 24). The existing village land use map is also used to calculate projections for future area needs and to discuss and map proposed land use allocations.

This section explains how a village satellite or aerial image map (see Section 2.1.1.) can be used as a background for mapping existing land uses. Participants will draw a sketch map of existing village land uses on a transparent plastic sheet which is placed on top of a satellite image map. Since the background image is geo-referenced, the sketch map will also automatically be drawn in cartographic scale. Using this method is more beneficial than drawing a sketch on a blank piece of paper (see Textbox 3). One major benefit is that the image map allows participants to relate what they see in the image to actual locations on the ground, thereby enabling them to develop a shared understanding of the locations under discussion. During the mapping exercise, they can travel mentally on the image to explore different parts of their village and thus build comprehensive picture of the village landscape (Figure 25). Delineating land use areas using the image map enables participants to achieve a level of accuracy and detail which is difficult to reach using GPS tracking of land use area boundaries in the field. This level of accuracy and shared understanding is important since establishing detailed and jointly agreed upon land use area boundaries will mitigate land use disputes during the implementation of the VLUP.

#### Working tasks

**Listing existing land uses and resources:**

1. Have all participants gather in one group, or, after reading the situation and observing the power dynamics, arrange participants in several small groups. Encourage all people to participate and create a comfortable atmosphere so that members of disadvantaged groups won't hesitate to express their ideas.
2. Ask participants to list the existing land uses and resources of their village. Write them down on a flipchart. So that you do not repeat working tasks,

**Textbox 50. Basic details**

- Time: 3.5 to 7 hours, listing 1-2 hours and mapping 2.5 to 5 hours. It is advisable to conduct existing land use mapping some days before conducting proposed land use mapping in order to allow enough time for a facilitation team member with GIS skills to digitise the map and calculate and make projections of future area needs.
- Participants: VLUMC and village council members, hamlet leaders, and representatives of all other identified stakeholders.
- Outcomes: Sketch map of village land uses on a satellite image map background.
- Preparations and materials: Whiteboard marker pens (the ink should be erasable but not too easily) and something with which to erase markings from the plastic sheet, clear wide tape, scissors, a village satellite image map, 4-5 meters of transparent plastic sheet, flipchart paper, masking tape, marker pens, notebooks, pens, a report template and a camera.

ask them to start with the ideas they generated during PRA activities.

3. While participants make their list, make sure you ask them to consider land uses (settlements, agricultural land, grazing land, forestry, wildlife and tourism, fishery, mining, and the like), infrastructure, social services and public places, water sources, and other relevant resources and land uses. (See "The PLUM Guidelines (3rd edition)" and Textbox 53 for more ideas.) If there are local names for land uses and sites, they should be included. For example, name each separate agricultural area with its local name as using these names will help participants to remember which areas are being discussed.

**Preparing the mapping background on a flat surface:**

4. Make sure you have all the required material for the mapping exercise (see Textbox 50 and Figure 10).

5. Place the village satellite image map on **a flat surface**, preferably a cement floor, which can be used as the background for mapping. In a village setting, cement floors can be found in village offices, schools, dispensaries, churches, and the like. Ensure that there is sufficient light in the place selected for the mapping exercise so that villagers can see features on the satellite image map clearly. Position the satellite image map so that its north arrow is oriented to the north in the village.

6. Use clear wide tape to straighten the satellite image map to the surface or floor.

7. Place a transparent plastic sheet on top of the satellite image map. Tape the sheet to the surface using clear tape so that it will not move during the exercise.

**Mapping existing land uses and resources:**

8. Have participants gather in one group or in several smaller groups around the satellite image map(s). To modify this practice to work in small groups, see Textbox 52.

9. Orient participants to the satellite image map and explain it to them (see Textbox 13).

10. Carefully explain to participants how to do the mapping. Make sure that you spend enough time instructing them so that everyone understands how the mapping is done.

11. Ask participants to select one person from among them to draw on the plastic sheet. Remind them that others can also draw especially if they are more familiar with a particular area than the selected drawer.

12. Ask participants to first verify the village boundary and write the names of the neighboring villages on the map which they will sketch on the plastic sheet.

13. Display the list of the land uses and resources in the village near the satellite image map for participants to see.

14. Ask participants to start locating the listed land uses (in the same order as they are listed) on the satellite image map. Ask them to mark them on the transparent plastic sheet using a marker pen. Instruct them to mark boundaries of areas with lines and point information with points.

15. Ask participants to carefully use the features they see on the satellite image to mark boundaries and locations on the map as precisely as possible (Figure 26). Observe the level of detail. If they draw the boundary quickly, ask what features on the satellite image map they used to delineate the boundary. If participants are not careful, they can easily draw a boundary line without basing it on any features on the satellite image map.

16. Tell them that if they make a mistake they can erase and correct what they have drawn. Usually, after participants get used to the exercise, they no longer need much facilitation and can draw a sketch map by themselves.

17. Label each mapped area and location with a unique code. The code should be short in order to save space on the sketch map. You can, for example, use a letter-number combination (see the example in Figure 27). Note the codes on a flipchart to serve as a map legend for all participants to see and clearly explain to them how this coding works.

18. A facilitation team member with GIS skills should also note the codes and their description in a

notebook to enter in the attribute table when he or she creates the GIS data (a shapefile) of existing land uses.

**19.** If seasonal changes in land use are relevant to the village, ask participants to consider what these changes are and to mark the changes using, for example, arrows or dashed lines.

**20.** When they have finished marking all the land uses and resources they listed on the sketch, there will most likely be areas which have not been assigned any land use. Ask the participants what is done in these areas and how the participants would label land use in these areas. Oftentimes these are areas of mixed use or unused land reserves. Alternatively, participants may have forgotten to mention some land use. Mark these areas with a code and update the legend with these land use categories as well.

**21.** Ask the participants if they are satisfied with the sketch map or if they want to add or modify something.



**Documenting and finalising the sketch map for use in producing a digital map**

**22.** Do not move the sketch map when it is finished. Instead, prepare it to be photographed. In order to geo-reference and digitise the sketch map, you need to take photographs of the sketch map from close enough that its content is clearly visible. Each photograph needs to have at least four reference points highlighted in it. This task is best carried out by a facilitation team member with GIS skills.

**23.** To take these photographs, highlight with marker pen four reference points at the intersections of the gridlines at the edges of the satellite image map (Figure 11). Label the reference points with letters (A, B, C, etc.).

**24.** Write the grid readings (coordinates) of these reference points in a notebook for use in geo-referencing.

**25.** Take photographs of the sketch map so that the photographs can be used to digitise the entire sketch map (see Section 2.4.4.). Take the photographs directly above the sketch map in order to avoid distortion of the digital map.

**26.** If the satellite image map used is large, take several photographs, each with at least four reference points, all of whose coordinates are recorded. All these photographs need to be geo-referenced in GIS software.

**27.** Make notes of those areas and locations which require GPS tracking after the mapping exercise (see Section 2.3.3.). These areas and locations are those which are not easily visible on the satellite image map and therefore require more accurate boundary tracking.

**28.** After the sketch map on the plastic sheet has been photographed, store it and the satellite image map carefully so that they can be used again during proposed land use mapping.

Instead of using printouts of village satellite image maps, you may wish to consider several other mapping techniques which may suit the context better. For example, creating a resource map in the form of a mind-map works especially well in rangeland areas of Tanzania (see Textbox 54). Whereas, new mobile mapping applications which enable participants to map using smartphones and tablets in the field (see Textbox 55) can be used with participants who are familiar with these devices and capable of adopting technical tools. ■

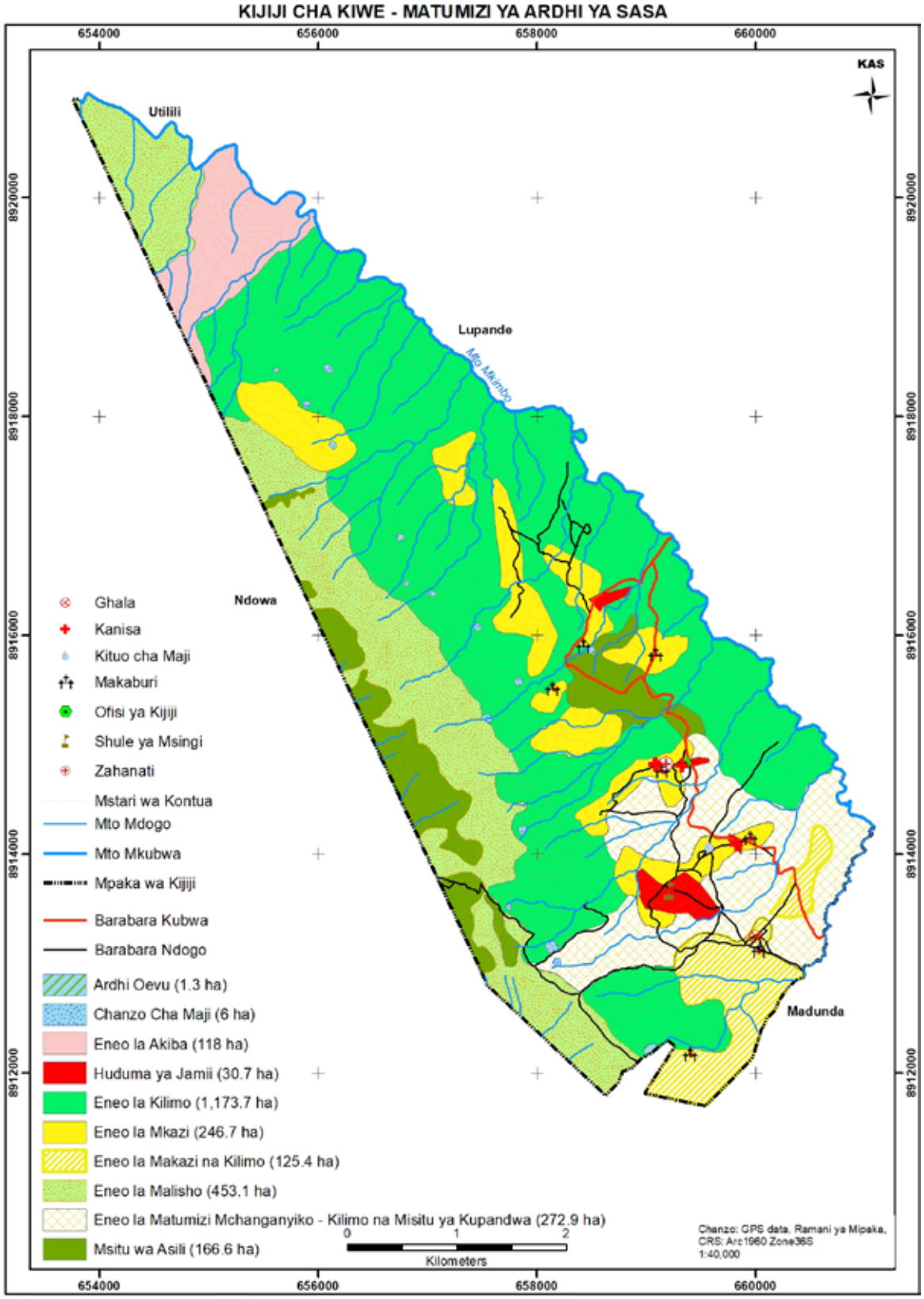



**Figure 24.** Example of a existing village land use map. Existing village land use map shows the land use areas and resources in the village. The colors and symbols used in the map are instructed in the PLUM Guidelines (3rd edition).

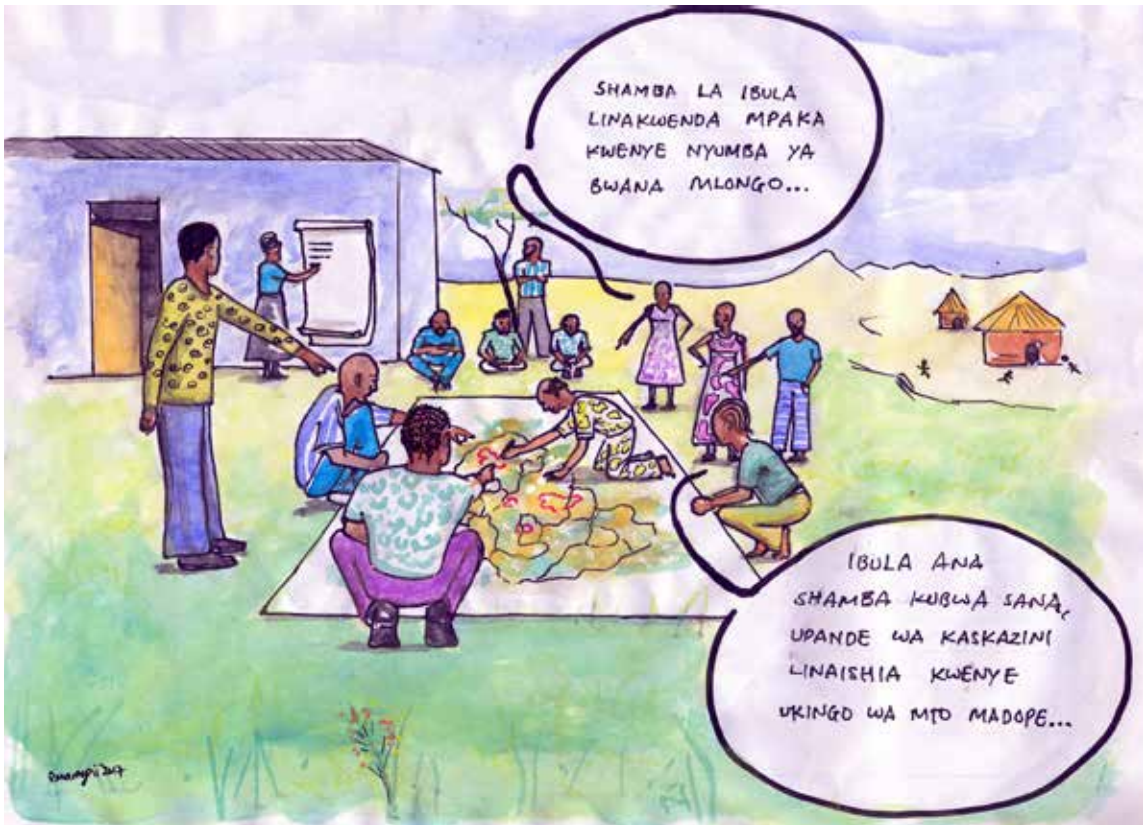



**Figure 25.** Mapping existing land uses on the village satellite image map. One of the participants can draw on the sketch map while others instruct him or her to ensure the boundaries of land use areas are correct and everyone can agree on them. One facilitator or participant writes the legend for the map on a flipchart paper. The legend shows which code on the map means which land use area and location in the village.

### Textbox 51. Addressing possible challenges

Finding a flat well-lit and large enough place for the mapping exercise can be challenging. Explaining a satellite image map and map legend so that all participants understand takes time and you must observe carefully to see if all have indeed understood. A facilitation team member with GIS skills has to be present during the mapping exercise to take notes on the mapped land uses and the codes assigned to each so that he or she will be able to digitise the sketch map markings correctly in a digital map.

**Figure 26.** Drawing the existing land use sketch map in a detailed way. The satellite image in scale 1:7500 enables very detailed land use area delineations and it allows everyone to see and agree where the land use area boundaries are located. The features seen on the image such as houses, forest patches, roads and rivers, should be used to discuss, agree and draw the land use areas on the map.

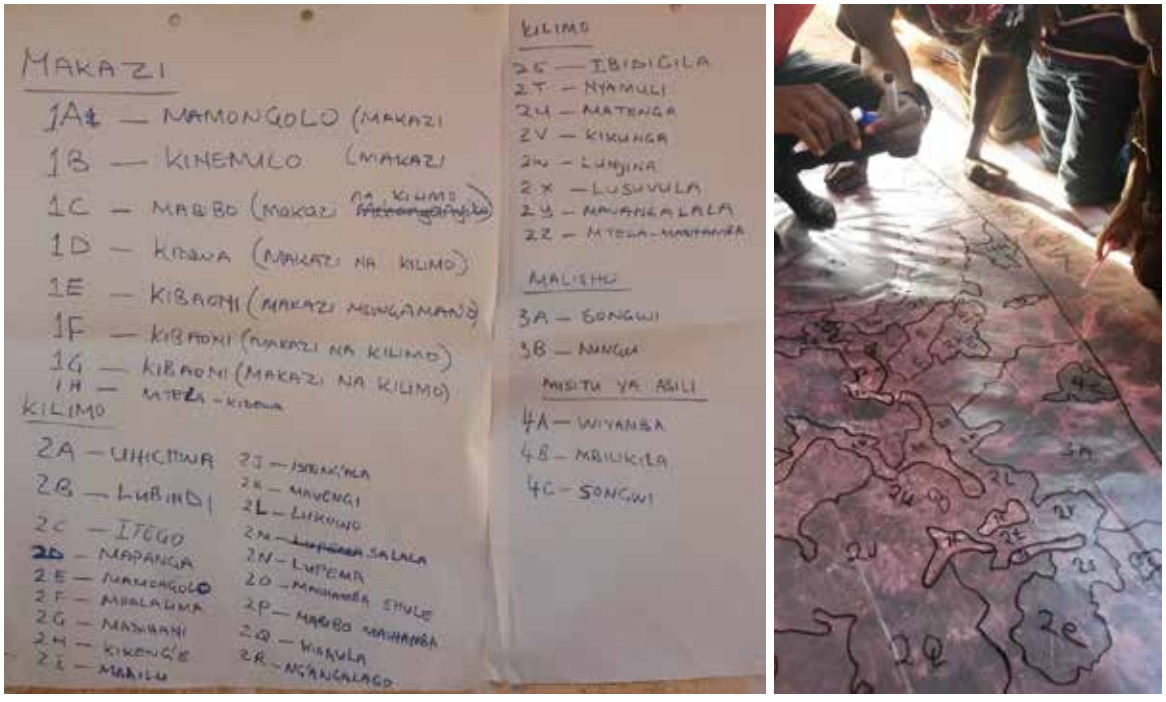



**Figure 27.** Example of a map legend with unique codes for each land use area and location on the map. A) the legend with each code and its explanation, B) The same codes written on the sketch map. The codes have to be used because the whole names of land use areas and locations would not fit into the sketch map.

**Textbox 52. Ways to modify**

Listing and mapping can be done as small-group work so that, for example, women and men or VLUMC members and representatives of disadvantaged groups work in separate groups where they are comfortable freely to express their opinions and needs. If you decide to have participants work in groups, either have several printouts of the village satellite image map so that all the groups can work simultaneously or have groups work turn by turn using a single printout. The hand-drawn sketch maps of each group can then be combined by having all the participants together to compare the maps, negotiate the markings and jointly create a single sketch map. Making comparisons is easy if the transparent plastic sheets with the sketch maps are overlaid on top of each other or placed next to each other on the ground (Figure 28). As a facilitator, you will have to ensure that the sketch maps and opinions of each group are respected and taken into account while producing a single map.

**Figure 28.** The exercise of combining the sketch maps of existing land use drawn by two groups. The two sketch maps are placed on the ground next to each other so that the participants can compare them and agree how to combine the information in them. First the participants can choose which one of the sketch maps will be modified into a joint sketch map and then the information on the other map is used to modify it.

### Textbox 53. Mapping environmental problems and conservation needs

"The PLUM Guidelines (3rd edition)" instructs VLUP facilitators to map the environmental problems of villages. Doing so is important as such problems are often related to unsustainable land and resource use which villagers might be able to mitigate by adopting better strategies for land use planning and climate change adaptation. In addition to mapping problems, villagers should map areas and sites of conservation value since they contribute to community wellbeing and environmental resilience. Ask participants to map the following features on the sketch map with a satellite image map background:

- **Environmental problems such as deforestation, land degradation, encroachment, and the depletion and pollution of water sources**. These problems should be included in the community action plan. In addition, their impacts on people and livelihoods should be discussed and their solutions identified and mapped on the proposed land use map. To address the problem of degraded soil, for example, the proposed land use map should show measures to stop and reverse such degradation, like ensuring year-round vegetative cover or limiting tillage. To tackle deforestation, the rehabilitation of natural forests and the promotion of woodlots for firewood and timber could be considered.
- **Culturally, historically and environmentally important sites and recreational and beautiful sites.** Mapping these sites can help villagers start thinking about how to ensure that, in the future, there will be places for community wellbeing such as green areas, conserved natural habitats, and, sites with touristic and educational potential. Possible sites include wetlands, natural grasslands and forests, caves, and waterfalls.
- **Areas where natural resources such as firewood, medicinal plants and construction materials are collected**. These resources contribute to village wellbeing and subsistence. After identifying where natural resources are primarily collected, ask if they are abundant or declining in the village as knowing the trends will help you to identify both resources on which to base alternative income-generating activities on and resources that might not be readily available in the future. Collection areas do not have to be shown in the digitised existing village land use map but do mention them in the VLUP report as text.

### Textbox 54. Resource mapping to capture resource utilisation outside village boundaries

Resource mapping is a way to capture and plan the use of resources which lie outside of the administrative boundaries of a village. The utilization of such resources is common in Tanzania when the resource is shared between villages and livelihood strategies are mobile. "The PLUM Guidelines (3rd edition)" and the "Rangeland management manual" (ILC 2016) provide instructions on how to conduct this exercise. Resource mapping relies on a mind-map done without geo-referencing and on a flipchart or on the ground. While a satellite image map could be used, it is better not to use one because its limited extent and recognisable boundary features may limit the imaginations of participants. The purpose of a mind-map is to allow participants to freely map the use of resources without fear of being accused of resource exploitation or of encroaching on neighboring villages. Thus, the resource mapping exercise can be a good start for developing joint resource planning and management arrangements between villages that mitigate and even resolve land use conflicts.

### Textbox 55. Using web and mobile mapping applications

Web and mobile applications are future options for data collection and participation in the VLUP process. Access to the Internet is gradually improving in rural Tanzania and more and more inhabitants have smartphones and tablets, both of which allow for the digital collection of land use data. In some VLUP mapping tasks, the use of printed satellite or aerial images may, in the future, be substituted with online and standalone mapping applications. Some software and applications worth testing are described below.

**OpenStreetMap** (www.openstreetmap.org) is a map of the world created by registered users and free to use under an open license. It allows registered users to create thematic data based on the visual interpretation of and mapping on satellite images. OSM can be used offline with mobile applications. It has been used as a platform in several community mapping initiatives in Tanzania, such as Ramani Huria and Crowd2Map. Much of the basic mapping of villages could be done using OSM and could be used to substantially improve and facilitate further VLUP work.

**Maptionnaire** (maptionnaire.com) and **Harava** (dimenteq.fi/en/services/harava) are two similar commercial software programmes which allow collection of local information from the residents into a map form. The software works directly through the Internet and does not require installation on a device. Both programmes are designed to promote public participation in planning and local data collection by gathering location-based information from ordinary people. Both software programmes could be used in VLUP process to for example, facilitate the collection of location data on land use activities or ideas about the service and development needs of a village.

**Mapillary** (www.mapillary.com) is a software programme designed to capture street-level photographs with reference to locations. It works well on mobile phones and allows users to collect image data on the move as well as to upload data for sharing on different platforms. Mapillary could be used in VLUP process to collect field data from different sites in a form of photographs and sharing the data in this intuitive form among participants in the land use planning process.

**Ushahidi** (www.ushahidi.com) is crowd-sourcing software which enables the conduct of customised surveys and the collection of data from multiple sources, including social media and emails. It is designed to improve information flow from the grass-root level to decision-makers and has been used, for example, in crisis-response situations, where knowledge from the ground is needed immediately and efficiently. Ushahidi data can be presented on top of maps when the data harvested has a location link available. In VLUP process, Ushahidi could be used, for example, to collect villagers' opinions about development plans.

**Open Data Kit (ODK)** and **Open Map Kit (OMK)** (opendatakit.org and openmapkit.org) are open-source software produced for collecting, managing, and using spatial and non-spatial data in resource-constrained environments. With OMK, for example, you can create mobile data collection surveys to collect field data. In the VLUP process, OMK and ODK could be used, for example, to track, collect and store information on individual parcels of land and buildings for the purposes of land adjudication and environmental monitoring.

In addition to these seven software applications, there are many more mapping- and planning-related participatory software tools offered on the Internet. Depending on the tasks which you are to do and the technology you have access to, you may wish to have a look at the increasing number of tools freely available in the internet and adopt them if they suit your needs.

A good example of how communities have used mobile mapping applications in Tanzania is the Ramani Huria project in Dar es Salaam (ramanihuria.org). Ramani Huria, a Swahili term for "Open Map," is a community-based mapping project building flood resilience in communities across the city. In the project spatial information of informal settlements were collected and uploaded into the OpenStreetMap using hand-held devices such as smartphones (Figure 29A). Over 300 community members were trained to collect, edit and upload data, which includes locations of buildings, household sizes, flood-prone areas, drainage systems, and land uses. As of August 2018 the mapped area comprised of over

continues

4 million people, 450,000 buildings, and 1,700 schools, and more than 50 % of the total land area of Dar es Salaam. Students from Ardhi University and the University of Dar es Salaam have been trained to use the data and simple open-source tools with local government officers in local-level spatial planning. Since most communities had not used maps before, the maps have increased understanding of the vulnerabilities of settlements and infrastructures (Figure 29B). This detailed spatial information has helped communities to improve their flood resilience through better planning and maintenance.

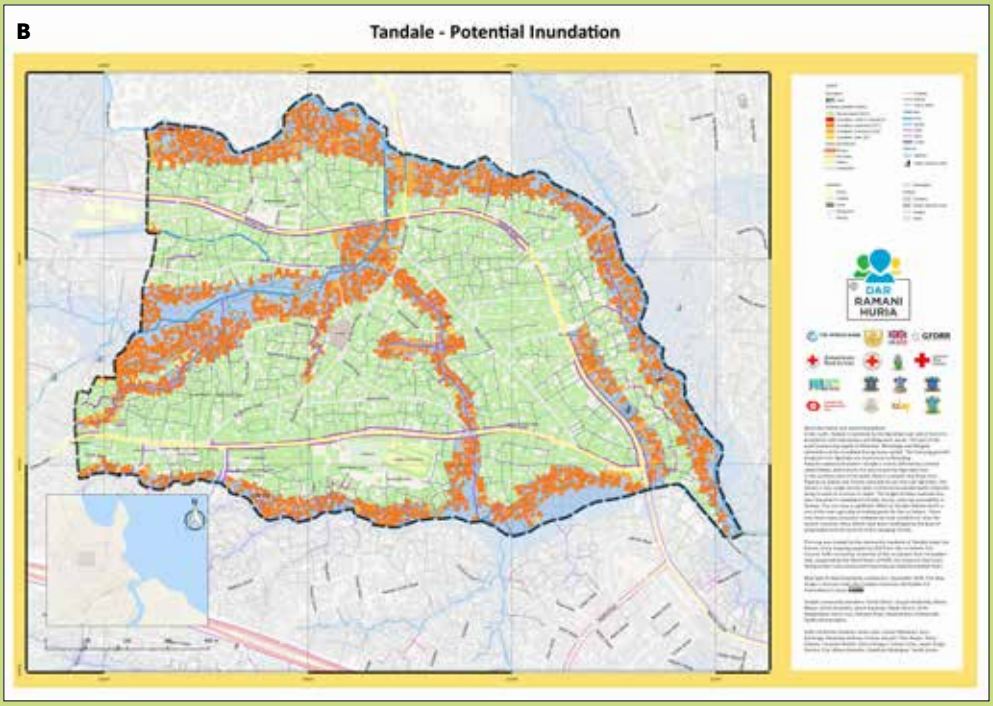




**Figure 29.** A) Community members are interviewing inhabitants and mapping various information of their neighbourhood onto OpenStreetMap using smartphones. (Copyright Ramani Huria) B) Example map produced during the Ramani Huria mapping project in Dar es Salaam. The map shows every building in the area of Tandale and its potential to be inundated during flooding. It also shows updated locations of infrastructure, amenities, land uses and water ways. (Copyright Ramani Huria)

## Further information sources

International Land Coalition (2016). Participatory Rangeland Resource Mapping in Tanzania: A Field Manual to support planning and management in rangelands including in Village Land Use Planning. 97 p. Available from: www.landcoalition.org/en/resources/manual-participatory-rangeland-resource-mapping

International Land Coalition (2013). Village land use planning in rangelands in Tanzania: good practice and lessons learned. Rangelands Issue Paper No. 3. 83 p. Available from: www.landcoalition.org/es/resources/village-land-use-planning-rangelands-tanzania

### 2.3.3. GPS tracking tips for good-quality spatial data

#### Overview and aim

In order to finalise digital maps of areas of environmental risks as well as existing and proposed land uses for inclusion in the VLUP report, some areas and sites need to be verified and tracked in the field with a global positioning system (GPS) device. Although using satellite image maps lessens the need to track sites in the field, some areas and site locations can only be verified with local experts in the field. Not all important areas and sites can be seen and identified in an image.

To facilitate efficient field work and mapping, the team should plan beforehand how many sites and which areas need to be accessed with the GPS. Typical examples of sites you may need to visit and whose exact locations and boundaries you may need to map are village offices, schools, and churches and mosques, all of which may be too small to be demarcated with certainty on a satellite image map at the scale of 1:7500. Furthermore, it is recommended that GPS points be collected for all other unclear areas in order to establish their exact locations and boundaries. For example, establishing a boundary on a grassland area where there are few distinct features visible in the image, the best option is to collect GPS points of the boundary with local experts who know the location on the ground.

Using a GPS device is fairly straightforward after being instructed on how to use it. It is important to ensure that GPS points are systematically and carefully recorded in order to provide good-quality data for the production of the VLUP map. The GPS coordinate collection form introduced in this section is a convenient way to ensure that points are recorded correctly for the facilitation team member with GIS skills to use them to produce the digital maps.

#### Working tasks

1. Make a list of all the locations which need to be GPS tracked. Estimate how far apart they are and how much of the village area you need to visit in order to minimise the amount of time you need to spend in the field.
2. Divide the PLUM team and the VLUMC into teams. Give each a GPS device and decide which group will collect GPS points from which locations.
3. Before the teams depart, check that the GPSs are configured with the appropriate datum (for Tanzania, use WGS84).
4. Select a geographic coordinate system (UTM UPS).
5. Make sure you document and communicate the datum setting in the GPS to a facilitation team member with GIS skills.

**Textbox 56. Basic details**

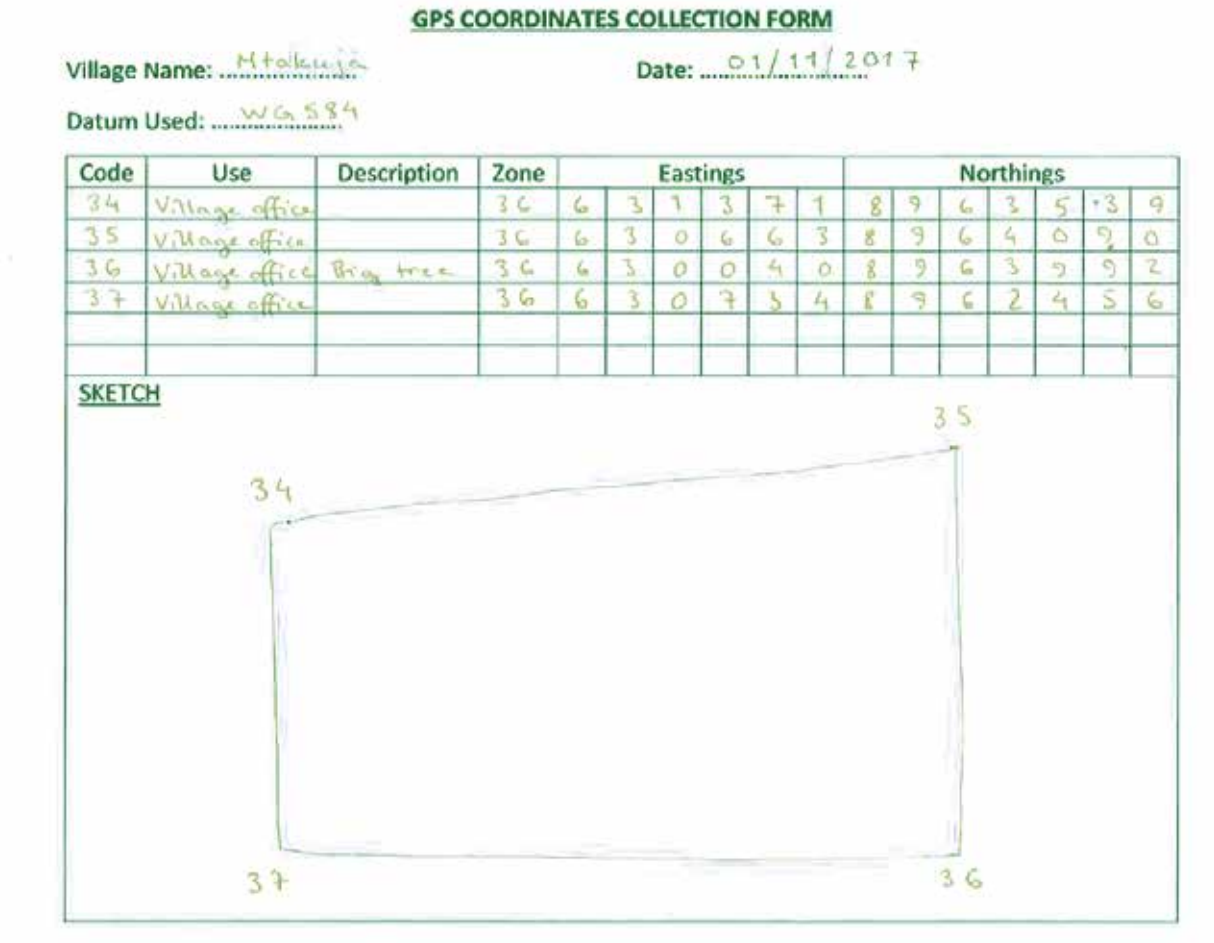
- Time: 5 to 6 hours after the existing land use mapping and 3 to 4 hours after the proposed land use mapping.
- Participants: VLUMC and village council members, elderly men and women, and other villagers who are well familiar with the village area, as well as members of the PLUM team.
- Outcomes: GPS coordinates of land use areas and social-service locations which are not visible or cannot be verified on the satellite image map.
- Preparations and materials: GPS devices, notebooks, pens and GPS coordinate-collection forms.

6. GPS coordinates can be written on a GPS coordinate-collection form (Figure 30 and Annex 4) and saved directly into the GPS. This will make sure the coordinates are correctly documented. It is recommended that you save the coordinates in the device and deliver them to a member of the facilitation team with GIS skills through the device. Note down the coordinates also in the coordinate-collection form to serve as backup in case there is a problem with the GPS device.

7. In order to recognise which GPS point applies to which area or location, label each GPS point with the name of the location. For example, label the GPS point of a school with the word school. If number labels are used for GPS points, note down a description of the location for each number label to know what location the number stands for.

8. Whether you record coordinates in a notebook or on the coordinate-collection form, you should stick with this format in order to minimise error and ensure that every number in the coordinates is captured.

9. Deliver the GPS coordinates you collect to the facilitation team member with GIS skills both on the device and in the form. Coordinates saved in a GPS device can be uploaded to a computer with a cable. ■



**GPS COORDINATES COLLECTION FORM**

Village Name: Mtakuja  Date: 01/11/2017

Datum Used: WGS84

| Code | Use | Description | Zone | Eastings | | | | | | Northings | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 34 | Village office | | 36 | 6 | 3 | 1 | 3 | 7 | 1 | 8 | 9 | 6 | 3 | 5 | 3 | 9 |
| 35 | Village office | | 36 | 6 | 3 | 0 | 6 | 6 | 3 | 8 | 9 | 6 | 4 | 0 | 9 | 0 |
| 36 | Village office | Big tree | 36 | 6 | 3 | 0 | 0 | 4 | 0 | 8 | 9 | 6 | 3 | 9 | 9 | 2 |
| 37 | Village office | | 36 | 6 | 3 | 0 | 7 | 5 | 4 | 8 | 9 | 6 | 2 | 4 | 5 | 6 |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

SKETCH



**Figure 30.** Example of a filled GPS coordinate collection form. Coordinates of each area which is GPS tracked should be written on a separate form. A sketch of the area shape should also be drawn to help the GIS expert to ensure the GPS information is correctly stored.

**Textbox 57. Addressing possible challenges**

Cloud cover and bad weather might affect the accuracy of the coordinates given by a GPS device. The team members who utilise the device need to be familiar with using the device so that they will be able to record the data accurately and solve any malfunctions. Difficult terrain, long distances, and thick vegetation might restrict access to some areas where GPS points need to be collected.

**Textbox 58. Ways to modify**

Some smartphone applications enable users to collect location information with GPS points. With these applications, smartphones instead of regular GPS devices can be used to collect the points. However, the smartphones have to have an external GPS device because the locations determined by the built-in GPS devices on smartphones have large errors.

## 2.4. Developing a village land use plan

After finalising the described activities to understand the prevailing village situation, "The PLUM Guidelines (3rd edition)" instructs the VLUP facilitators to carry out participatory land use planning with the villagers. This step, Step 4 aims, to solve and mitigate land use conflicts and aid villagers to plan sustainable land use allocations which take into consideration future needs and opportunities, different stakeholder interests, environmental conservation and climate change adaptation, and mitigation measures. The following sections provide detailed instructions on 1) how you can help villagers to combine all available information into a community action plan which is based on a comprehensive understanding of village resources, land uses, challenges, and opportunities, 2) how you can map proposed land uses using a village satellite image map (see section 2.1.1.), 3) how you can use the maps to present the planning decisions to the village assembly, 4) how you can digitise the sketch maps, and 5) how you can produce digital VLUP maps.

### 2.4.1. Tips for community action plan development

#### Overview and aim

After the village vision, existing land uses, resources and opportunities are laid out and the problems and challenges of the village are identified, a community action plan (CAP) is prepared. The action plan addresses the challenges utilizing the existing resources, opportunities and assets of the village and steers the villagers to think what they need to do in order to achieve the village they want in the future. It lists the actions which have to be carried out in order to achieve the future vision and sustainable land use described in the VLUP. The document also helps villagers to show high-level actors which issues need to be addressed in a village. For these reasons, it is **important to include in the CAP all challenges and future changes raised during the various discussions and not only those which are directly related to land**. A government agency or a development program working on health matters, for example, can utilise a village's CAP to find out which issues need addressing in a particular village and to identify how their organisation can assist in addressing them. With a CAP, resources can be targeted to those issues most in need of urgent action.

A CAP comprises of future objectives and desired projects that a village has identified, the actions or activities required, the time and resources needed, the responsible actors within and outside the village and the expected results of the actions (see "The PLUM Guidelines (3rd edition)"). A common way to identify each objective is to make a table on a flipchart and then facilitate a discussion with the participants to fill in the table. This work can be assisted by taking advantage of group work or learning café tools, the outcomes of the problem-tree analysis, the sketch maps of environmental risk and existing land uses on satellite image maps, and the outcomes of the trip the future tool. Below are examples of how to use these various tools to develop the CAP.

#### USING GROUP WORK TO DEVELOP A COMMUNITY ACTION PLAN

#### Working tasks

1. Consider dividing the participants into groups and asking each group to discuss and develop a CAP for a set of problems or for a set of future changes they wish for. Groups can be formed based on participants' interests or expertise. The participants are more likely to express their ideas in a small group than in front of a large group.
2. Give each group 20-40 minutes to develop a CAP for the problems or changes which were assigned to them.
3. Ask all participants to come together and have each group to present its outcomes. Ask the whole group to discuss if they have any suggestions or modifications to the individual CAPs, and then combine the group work into one CAP.

**Textbox 59. Basic details**

- Time: Some additional time depending on the group-working tool used.
- Participants: VLUMC and some village council members and different VLUP stakeholders from different social groups in the village.
- Outcomes: A CAP is developed, which integrates all previous information collected and discussed with the participants.
- Preparations and material: Flipchart papers, masking tape, and marker pens or blackboard and chalk, documentation of outcomes from the previous exercises.

## USING THE LEARNING-CAFE TOOL TO DEVELOP A COMMUNITY ACTION PLAN

### Working tasks

1. Consider using the learning-cafe tool to develop a CAP. Each table could have one or two problems or future wishes written on a flipchart. This would allow a smaller group of participants to discuss each problem and wish and give their suggestions for the CAP. Then, as the groups rotate, each smaller group will also see the suggestions of other groups and develop the CAP further. This might generate more suggestions than in one large group or in groups which only discuss their own set of problems or wishes.
2. In the first round give participants 20 minutes to discuss before asking them to move. Reduce the time for discussion in each round as most ideas are generated during the first rounds and the last rounds are used mostly to refine ideas already generated.
3. After the small groups have visited all the tables ask them to come back together and allow the participants as a whole to discuss any modifications or additions. Then combine the individual CAPs into one document. Combining is easy if flipchart papers are taped together to form a full CAP document.

## UTILISING INFORMATION FROM PREVIOUS ACTIVITIES IN CAP DEVELOPMENT

- Display the trip to the future picture at the beginning of the CAP-development session. Instruct participants to discuss and revise their aspirations and wishes for the future, suggesting that they narrow down suggestions by identifying which are the more implementable ones. Engaging in this activity will help participants to think about how their CAP is linked to the future vision they developed during the trip-to-the-future exercise and what they should do to ensure that they achieve it.
- Display the problem tree or community leaky-bucket picture during the CAP discussion and ask participants to refer to it to transfer already identified problems and solutions to the CAP. This exercise will help participants to link up earlier exercises, thereby saving time and helping villagers to gain ownership of their local knowledge.
- Display the sketch map of existing land uses during the CAP discussion. Refer to the sketch map while asking whether or not there are still other challenges or problems in the village which have not been mentioned, and whether or not there are some areas, places, or resources which could assist in solving the problems or which offer opportunities to achieve the village vision. The sketch map acts as a reminder to participants and links the earlier exercise of mapping to the CAP. ■

### Textbox 60. Addressing possible challenges

Often there is not enough time to conduct a comprehensive discussion of a CAP or to look for fresh new ideas for developing the village or livelihood alternatives. Participants can get stuck on old ways and ideas. In this case inspirational facilitation is important. Such facilitation should not cut the wings of imagination but encourage participants to think that the status quo can be changed. Group working tools can energise participants and help them to think and discuss freely. When participants might come up with solutions which seem to be beyond their capabilities, you will have to help them to identify feasible solutions.

### 2.4.2. Mapping proposed land uses on a satellite image map

#### Overview and aim

Once villagers have established a community action plan and developed a shared understanding of the future needs and wishes of their village, proposed land uses can be mapped. Mapping proposed land uses aims at ensuring that there is land allocated sustainably for the future needs of the village. These needs include addressing land productivity and land disputes as well as environmental problems and climate change effects through land use planning. You will need to facilitate villagers to discuss, agree on and map proposed land use areas which ensure the best possible allocation of land uses for community wellbeing and environmental conservation (Figures 31 and 32).

Proposed land use allocation has to consider the areas required both to achieve the community action plan and to accommodate any anticipated future needs for the sizes of land use areas, or, in other words, projections of future areas calculated based on the sizes of existing land use areas. These projections will include, for example, estimates of how much the total settlement area need to be extended in order to accommodate the housing needs of the growing population. The proposed land use map also must address existing and potential land use conflicts as well as areas of environmental risk in order not to perpetuate them in the future. PLUM team members should use their sectoral expertise, such as expertise in agriculture and environmental matters, to provide advice to villagers on sustainable land use allocation decisions like how to sustainably manage or protect areas identified as having environmental risks.

#### Working tasks

**Discussing and listing proposed land uses:**

1. Either have participants gather in one group, or, after reading the situation and observing the power dynamics, divide them into small groups. Encourage everyone to participate and create an atmosphere in which members of disadvantaged groups, too, will feel comfortable enough to express their ideas.
2. Ask participants to identify and list proposed land use needs in the village.
3. Display the community action plan and future vision of the village (trip to the future outcomes) for participants to use to identify and list issues which need to be added into the proposed village land use map. For example if the plan says a dispensary is needed, one future land use has to be land for a dispensary. Similarly, if the future vision says villagers aspire to have a crop-processing industry and a milk factory in the village, land needs to be allocated for these ambitions,

**Textbox 61. Basic details**

- Time: 2 to 4 hours, listing 1 hour and mapping 1 to 3 hours.
- Participants: VLUMC and village council members, hamlet leaders, and representatives of all other identified stakeholders.
- Outcomes: Sketch map of proposed village land uses on a satellite image map background.
- Preparations and material: Whiteboard marker pens (the ink should be erasable but not too easily) and something with which to erase markings from the plastic sheet, clear wide tape, scissors, a village satellite image map, 4-5 meters of transparent plastic sheet, flipchart paper, masking tape, marker pens, notebooks, pens, a report template, and a camera.

too. In addition, display a summary of projected land requirements in order for the participants to discuss the sizes of land use areas they will need in the future.

4. Place the existing land use sketch map so participants can refer to it during their discussions.

5. Remind participants to discuss the need to allocate land for the following uses (see more examples in "The PLUM Guidelines (3rd edition)"):

   a. Sites for new business opportunities and land for investments in practices like horticulture and forest plantation.

   b. Forest, grassland, watershed, wetland, and soil conservation areas (e.g. buffer zones and green spaces).

   c. Land reserve areas for future use.

   d. Environmentally friendly land use alternatives such as small water reservoirs and sites for biogas production, composting, demonstrating sustainable agriculture, agroforestry, and beekeeping.

   e. Other land uses considered relevant to coping with environmental problems and the effects of climate change.

**Preparing a mapping background:**

6. Make sure you have all the material required for the mapping exercise (see Textbox 61 and Figure 10).

7. Position the satellite image map on a **flat surface** and place the transparent plastic sheet with the sketch of the existing land use map on top of it. The already made sketch map of the existing land uses and underneath it the satellite image map are used as the background for the proposed land use mapping.

8. Using the village boundaries as a guide, ensure that the transparent plastic sheet is placed in the same position on the satellite image map as it was during the existing land use mapping exercise.

9. Tape the plastic sheet on the surface using clear tape so that it will not move during the exercise.

**Allocating and mapping the proposed land uses:**

10. If needed and especially if any new participants join the mapping exercise, orient the participants to the satellite image map and explain it to them again (see Textbox 13).

11. Explain to participants how to carry out the proposed land use mapping, spending enough time to ensure that everyone understands what to do.

12. Display the list of proposed land uses for the participants to see.

13. Ask participants to select one person among them to draw on the sketch map.

14. Ask participants to start mapping the proposed new land uses and proposed land use changes on top of the existing land use sketch map. Allocate areas for all the proposed land uses on the list. Instruct participants to use a dotted line to mark proposed land use areas to differentiate between these areas and existing land use areas (figure 33).

15. Advise participants to use both the existing land use sketch map markings and the features on the satellite image map carefully so that they can mark the boundaries and locations of proposed land uses on the map as precisely as possible. Observe the level of detail. If participants draw the boundary quickly, ask them what features they used to delineate the boundary. If the participants are not careful, they could easily draw a boundary line without basing it on any features on the satellite image map.

16. Tell participants that if they make a mistake they can erase and correct the drawing. Knowing that nothing they mark is permanent will make participants more comfortable about drawing on the image map.

17. Update the map legend by naming each new proposed land use area with a unique code. Use the same coding that you used in the existing land use sketch map, a letter-number combination, for example (see the example in Figure 27). Explain the coding clearly to new participants.

18. Make sure any changes in the sizes of land use areas, whether extensions or reductions, shown by the projections are marked accurately on the map. Use the area projections calculated using

existing sizes of land use areas and information obtained during PRA exercises to do so (see "The PLUM Guidelines (3rd edition)").

**19.** You can use the 1 hectare (100 m x 100 m) grid cells on the image map to help allocate approximately the right amount of land for each area extension or reduction. To estimate the area sizes, you need to count the number of full grid cells within the area you are estimating and multiply that number by 1 hectare. Then count the number of cells only half covered, divide that number by two and multiply it by 1 ha. Add the two numbers to have an estimate of the total area of the proposed land use.

**20.** Take time to share with participants the advice of the district PLUM team experts on environmental conservation needs and land suitability and ask them to consider what to do with areas that are at environmental risk. In particular, they need to consider if those areas can be used sustainably or if they need to be converted into protection areas. Sustainable land uses of flood areas, for example, include fish farming and paddy cultivation and of steep slopes, fruit-tree and contour farming.

**21.** Ask participants whether they are satisfied with the sketch map and whether they still want to add or modify something.

**Documenting and finalising the sketch map in order to produce a digital map:**

**22.** Do not move the sketch map. Simply prepare it to be photographed. In order to geo-reference and digitise the sketch map, you need to take photographs of the sketch map from close enough that its content is clearly visible. Each photograph needs to have at least four reference points highlighted in it. This task is best carried out by a facilitation team member with GIS skills.

**23.** To take these photographs, highlight with marker pen reference points at the intersections of the gridlines at the edges of the satellite image map (Figure 11). Label the reference points with letters (A, B, C, etc.).

**24.** Write the grid readings (coordinates) of these reference points in a notebook to use in geo-referencing.

**25.** Take photographs of the sketch map to be geo-referenced and then used to digitize the entire sketch map (see Section 2.4.4.). These photographs have to be taken directly above the sketch map in order to avoid distorting the map.

**26.** If the satellite image map used is large, take several photographs, each with at least four reference points, all of whose coordinates are recorded. All these photographs need to be geo-referenced in GIS software.

**27.** Make note of those areas and locations which require GPS tracking after the mapping exercise (see Section 2.3.3.). These areas and locations are those which are not clearly visible on the satellite image and which therefore require more accurate boundary tracking.

**28.** After all required information and photographs are taken, you can leave the satellite image map and the sketch map with the village council so that they can utilize them in the future decision-making. The village council should be instructed to store the maps carefully for future use. ■


**Figure 31.** Example of the proposed land use sketch map showing proposed land use areas with dotted line. The existing land use areas are shown on the sketch map as solid lines in black and red as well as blue for water sources.

### Textbox 62. Addressing possible challenges

Some villages might have very little land available for new land uses or area extensions of existing uses. In this case, give participants time to consider where land could be found. This discussion might need to be continued in the village assembly meeting where the VLUP is presented and the assembly is given the opportunity to consider the land available for use. In addition, solutions which intensify land use or increase the productivity of land per hectare should also be considered in order to avoid the need for area extension. Zero-grazing and the densification of settlement areas are examples of options a village might consider aiming for in the future.

### Textbox 63. Ways to modify

Listing of proposed land uses can be done separately by different social groups in order to better capture their preferences. If the plastic sheet used in existing land use mapping is too full you can copy it onto a new plastic sheet to make more space to draw and write proposed land use areas and markings.

**Figure 32.** Mapping proposed land uses on the sketch map of existing land uses on top of the village satellite image map. Discussion, negotiation and agreement are crucial in allocation of proposed land use areas. Discussion using the satellite image map allows the land rights and interests of different community members and stakeholders to be considered before land allocation decisions are made.

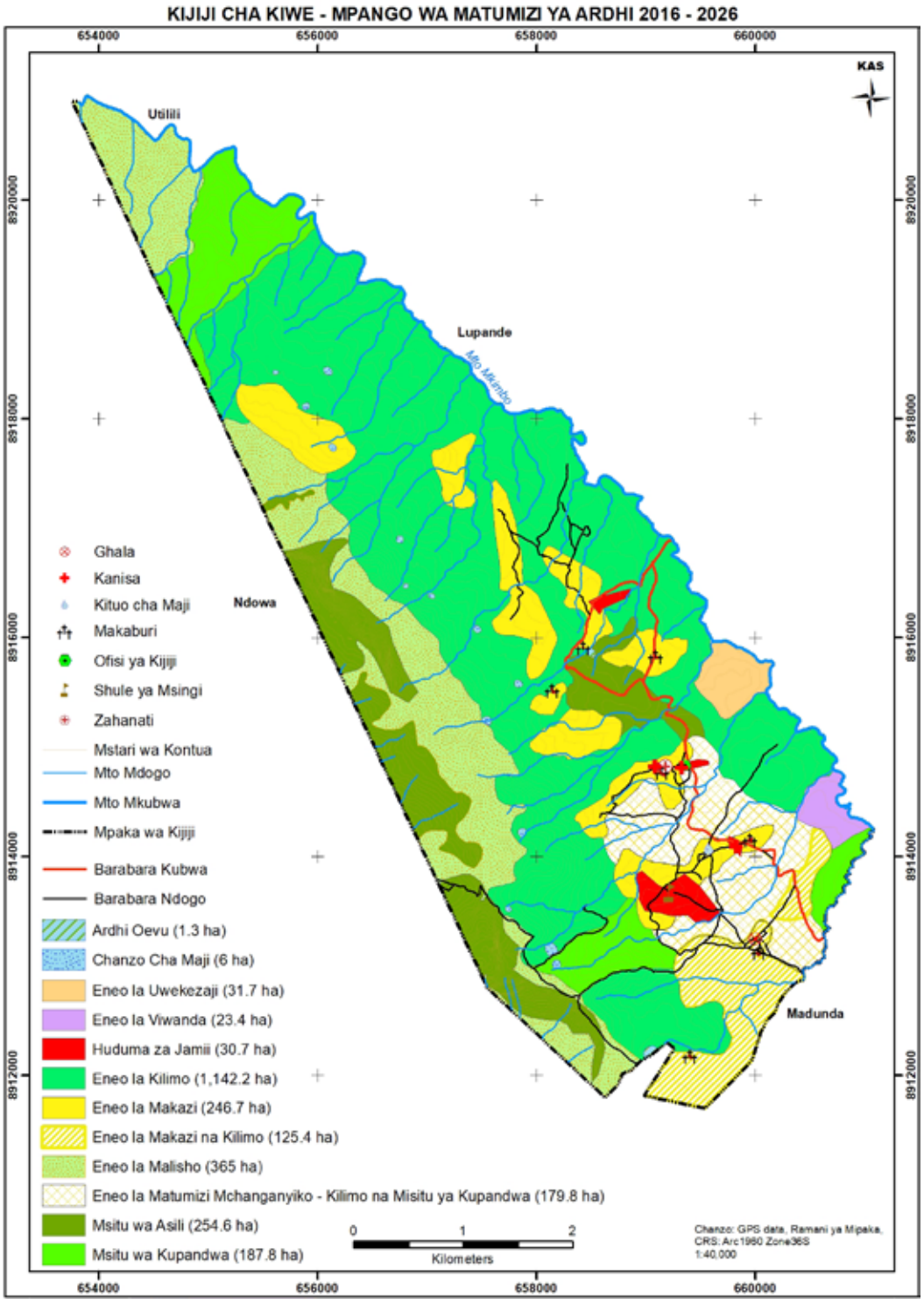



**Figure 33.** Example of a proposed land use map. In this village the villagers had decided to extend the settlement areas and allocate some land for tree planting and other investments in the future. You can see these changes by comparing this map to the existing village land use map (figure 24). They had also decided to extend the natural forest into the risk areas shown on the village environmental risk map (figure 23) in order to mitigate and avoid damages due to erosion and landslides.

### 2.4.3. Presentation of the proposed land use plan and maps in the village assembly

#### Overview and aim

At the end of the VLUP process in a village, a village assembly meeting must be organised so that the whole community gets the opportunity to see and comment on the VLUP and the land use maps. The maps (the hand-drawn sketch map of proposed land uses on top of the satellite image map and the printed digital VLUP maps) can be used in the village assembly to convey the plan and decisions for the assembly to discuss and decide to approve or ask to modify the plan. The hand-drawn sketch map on top of the satellite image map will enable assembly attendees to see exactly where resources, services, and the boundaries of each land use area are located in the village (Figure 34). The sketch map of proposed land use on top of the satellite image map will allow the VLUMC and village council to create shared understanding with the assembly attendees on area delineations and the implications of proposed land use allocations. They will be able to, for example, ensure that individual land rights are respected in the VLUP since everyone can see exactly where, in reality, boundaries have been drawn (Figure 35). When the assembly has a good understanding of the delineations and their implications, they have a meaningful opportunity to evaluate whether or not they agree with the VLUP maps or want them to be changed.



#### Working tasks

1. Organise the assembly in a place where you can display the sketch map and the VLUP maps on a wall or flat surface on the ground for the assembly to see.
2. Decide on the best way to enable all attendees to see the maps. Consider whether they should all come at the same time or whether they should be divided into small groups which come at their own time to see the maps.
3. When the time comes to show the maps, explain them clearly to attendees so that they will understand both the maps as a whole and the markings in them (see Textbox 13). Give them some time to familiarise themselves with and study and discuss the maps. Remind them that they can freely ask questions.
4. Ensure that the assembly acknowledges and discusses any changes in land uses and land use area boundaries made in the proposed land use map. You can summarise the changes and display the summary to the assembly to increase clarity.

**Textbox 64. Basic details**

- Time: 3 to 6 hours.
- Participants: VLUMC and village council members, village assembly, and ward officials.
- Outcomes: VLUP maps and bylaws and the VLUP itself is presented to village assembly for comments and approval. Any modifications requested by the assembly are recorded and incorporated into the final VLUP and VLUP maps.
- Preparations and materials needed: Hand-drawn sketch map of proposed land uses on top of the village satellite image map, VLUP draft report, and, if they have been printed, the draft versions of the digital VLUP maps, flipchart paper, masking tape, marker pens, notebooks, pens, and a camera (optional).

5. Discuss in the whole assembly any suggestions regarding the land allocations on the map and any possible modifications to them.

6. If the assembly requests modifications, write them down and come to an agreement that the proposed VLUP will be changed accordingly. Make sure that the VLUP and the VLUP map are finalised according to the assembly's comments and that all important information is incorporated into the VLUP report. ■


**Figure 34.** Village assembly attendees discussing around the proposed land use sketch map on top of the village satellite image map. The assembly is able to see the details on the sketch map and discuss if they agree with the information on the map or not.

### Textbox 65. Addressing possible challenges

Sometimes assembly meetings have low attendance and it takes time to get enough people to come that the assembly is representative of the whole village. It is recommended to advertise or conduct awareness-raising about the meeting in the village and hamlets well in advance so that people will mobilise themselves to attend to the assembly. Sometimes it is necessary to postpone the assembly meeting in order for it to be representative.

**Figure 35.** A village assembly meeting where the community action plan, and the sketch map of proposed land uses and the village satellite image map are shown on top of each other to the assembly. The village satellite image map together with the sketch map on top of it, allow assembly attendees to see where the VLUMC and other community representatives have decided to delineate different land use areas in the village. They can see the detailed boundary delineations and they can ask for modifications if they do not agree with these boundaries.

### Textbox 66. Ways to modify

In order to involve the whole assembly closely and get as many people as possible to comment on the VLUP and the VLUP maps, consider using small-group discussions in the assembly. Working in small groups will allow people to discuss the VLUP and the maps more freely than they would before the assembly as a whole. Then each group could express its opinions to the whole assembly. Group discussions might take more time, but the quality of participation and comments will increase considerably. You can also consider organising hamlet meetings before holding a village assembly meeting (see Textbox 18).

### 2.4.4. Digitisation of sketch maps on the satellite image map

#### Overview and aim

The sketch maps of areas of environmental risk and existing and proposed land uses have to be converted into digital geospatial information, which can then be used to produce digital maps. This is done in GIS software by digitising the sketch map information using the photographs taken of the sketch maps. Digitising requires having basic knowledge of GIS and is best carried out by a facilitation team member with GIS skills. Digitisation has to be done carefully and in detail to achieve good-quality spatial data. High-quality spatial data will ensure that calculations for area projections are accurate and that VLUP maps are reliable. Moreover, GIS data has to be stored properly so it can be shared and used in the future (Textbox 69). Digitisation of the sketch maps should be started while facilitators are still in the village because the sketch map of existing land uses has to be digitised so that facilitators can calculate the area projections which are required for mapping proposed land uses.

#### DIGITISING THE SKETCH MAP OF ENVIRONMENTAL RISKS

#### Working tasks

1. Import the photographs of the sketch map of environmental risks (Section 2.3.1.) into GIS software.
2. Geo-reference the photographs and, when prompted by the software, specify the same datum you used to prepare the satellite image map. Use the grid readings (coordinates) of the four reference points you marked on the satellite image map to do the geo-referencing.
3. Create a polygon layer (shapefile) for the areas of environmental risk and digitise into polygons all the boundaries of the areas of risk shown in the photographs of the sketch map. Digitise all the areas into one layer.
4. Make sure all the polygons join correctly and do not overlap each other or create sliver polygons. It is recommended that you set the zoom level in the software to 1000–3000 while you digitise. GIS software tools for advanced digitisation, such as the trace tool, can be used to bind land use polygons together exactly so to avoid overlapping or sliver polygons.
5. Import all the GPS data related to the environmental risks and digitise into polygons all those GPS points which delineate area-based land uses. Incorporate these polygons into the same environmental-risk-area polygon layer.
6. Open the landform and slope map shapefiles which you produced earlier to the background of the environmental-risk-area polygon layer.

**Textbox 67. Basic details**

- Time: 2 to 4 hours per map.
- Participants: Facilitation team member(s) with GIS skills.
- Outcomes: GIS data produced for making an environmental risk map and existing and proposed land use maps. Well-stored and properly named and arranged GIS data.
- Preparations and materials: GIS software, computer, photographs of the environmental risk, existing and proposed land use sketch maps, DEM data of the area, the notebook with grid readings (coordinates), and GPS data from field-tracking (GPS coordinate collection forms).

7. Compare the landform and slope information with the polygons of areas of risk to determine what kind of terrain the areas of risk are in. Use the terrain information to estimate the area that may be affected by each hazard and, if needed, modify the extents of the digitised risk areas based on the terrain. For example, you can estimate the extent of an area at risk of erosion by looking at areas where the slope is steep.

8. Name all the environmental-risk-area polygons in the attribute table of the layer based on the type of the hazards.

9. Label any environmental-risk-area polygons for which you have a local name in the attribute table of the layer.

10. You have now digitised all the areas of environmental risk in the village and can use them to produce the environmental risk map.

## DIGITISING THE EXISTING LAND USE SKETCH MAP

### Working tasks:

1. Import the photographs of the existing land use sketch map (Section 2.3.2.) into GIS software.

2. Geo-reference the photographs, and, when prompted by the software, specify the same datum you used to prepare the satellite image map. Use the grid readings (coordinates) of the four reference points marked on the satellite image map to do the geo-referencing.

3. Create a polygon layer (shapefile) for existing land uses and digitise into polygons all boundaries of land use areas shown in the photographs of the sketch map. Digitise all the existing land use polygons into one layer.

4. Make sure all the polygons join correctly and do not overlap each other or create sliver polygons. It is recommended that you set the zoom level in the software to 1000–3000 while you digitise. GIS software tools for advanced digitisation, such as the trace tool, can be used to bind land use polygons together exactly so to avoid overlapping or sliver polygons.

5. Import all the GPS data for existing land use map collected in the village and digitise into polygons all those GPS points which are area-based land uses. Incorporate these polygons into the same existing land use polygon layer.

6. Digitise also all the other area-based information, such as lakes and wetlands, and incorporate them into the same existing land use polygon layer.

7. Name each land use polygon in the attribute table of the layer based on land use type.

8. Calculate the sizes of the areas of the existing land use polygons. In order to calculate the area sizes, project the existing land use layer into WGS84 Zone 35-37 South.

9. Export the existing land use attribute table into an Excel or a comma-separated values (CVS) file and sum all the individual area calculations of the same land use to find the total area of that land use.

10. In order to reduce the future risk associated with and the damage caused by hazards in the existing land use areas, you will need to advice villagers to propose a new land use for areas of environmental risk. Thus, you need to also calculate the sizes of existing land use areas which do not face risks by subtracting the sizes of risk areas from the existing land use area sizes. You can calculate the area sizes of existing land use without any areas of environmental risk by using GIS software and the shapefiles of both the environmental risk and of existing land use areas.

11. Write both areas—that of each existing land use and that of areas without risk in the VLUP report, display them both on the digital maps, and use them both to estimate future land use needs (projections).

12. Create a line layer (shapefile) for all linear features, including rivers, roads, pipelines, railway lines, and high voltage power lines. Digitise and classify all these linear features according to the land use feature type.

13. Create a point layer (shapefile) for all the village facilities which will be illustrated as point information on the existing village land use map.

14. Label map features with the local names if you obtained them while making a sketch map with the villagers.

15. Create a contour layer (shapefile) using a digital elevation model (DEM). Use 20 m intervals for contours as in the topographic standard sheet.

16. Now you have all the data you need to make an existing village land use map and can go ahead and make the existing land use map.

## DIGITISING THE PROPOSED LAND USE SKETCH MAP

### Working tasks

1. Import the photographs of the proposed land use sketch map (section 2.4.2) into GIS software.

2. Geo-reference the photographs, and, when prompted by the software, specify the same datum you used to prepare the satellite image map.

3. Use the "save as" option to save the existing land use polygon layer as the proposed land use polygon layer. Using this already created existing land use layer will minimise your work as you can simply edit it to create the proposed land use layer.

4. Open the copied existing land use layer (now named as the proposed land use layer) on top of the geo-referenced proposed land use sketch map photographs.

5. Edit the proposed land use layer polygons based on the areas shown in the geo-referenced photographs of the proposed land use sketch map.

6. Import all the GPS data collected in the village for the proposed land use map, digitise them, and incorporate them into the same proposed land use polygon layer.

7. Name each proposed land use polygon in the attribute table of the layer.

8. Calculate the sizes of the areas of the proposed land use polygons. In order to calculate the area sizes, project the proposed land use layer into WGS84 Zone 35-37 South.

9. Export the proposed land use attribute table into an Excel or CSV file and sum all the individual area calculations of the same land use to find the total area of that land use.

10. Write these calculations of the sizes of areas in the VLUP report and display them on the digital proposed land use map.

11. Create a point layer (shapefile) for all the proposed village facilities which will be illustrated as point information on the proposed village land use map.

12. Use the same layers as are in the existing village land use map to display information on roads, rivers, and contours.

13. Now all the data you need for making a proposed land use map are ready, and you can go ahead and make the map. ■

**Textbox 68. Addressing possible challenges**

You may face challenges or limitations in carrying out these tasks which stem from the GIS software you choose to use. Since tools and functions vary from software to software, you are advised to use common software or the software you are most familiar with.

### Textbox 69. Organising and storing the digitised VLUP GIS data

The digitised VLUP data has to be stored properly for future use. The VLUP-related information is not only the information included in the VLUP report but also all the digital geospatial data produced during the VLUP process. In the future, either your team or someone else will need the data. The data has to be available for government, civil-society, and private-sector actors. Only if it is available can the data be used to carry out steps 5 and 6 of the VLUP process as well as to revise the VLUP after several years. Thus, the data has to be properly arranged, named, and stored. The best way to preserve the data is to organise it in folders labeled with the village name and date or year of production (see Figure 36 for an example). The data for the existing village land use map and the data for the proposed land use map should be stored into separate folders. The data within each folder should be named to reflect the content of the data; in other worlds, each folder and file should bear the name of the village it refers to and the type of the data it contains. After arranging and naming the data properly, make sure you store it carefully and that you also save back-up copies in another location. Remember to send all the GIS data you produce to the NLUPC together with your VLUP report. Tanzania is developing a database for VLUP spatial data. In fact, in the future you will be able to store your data directly to this national database, which will be accessible to all relevant actors in Tanzania.

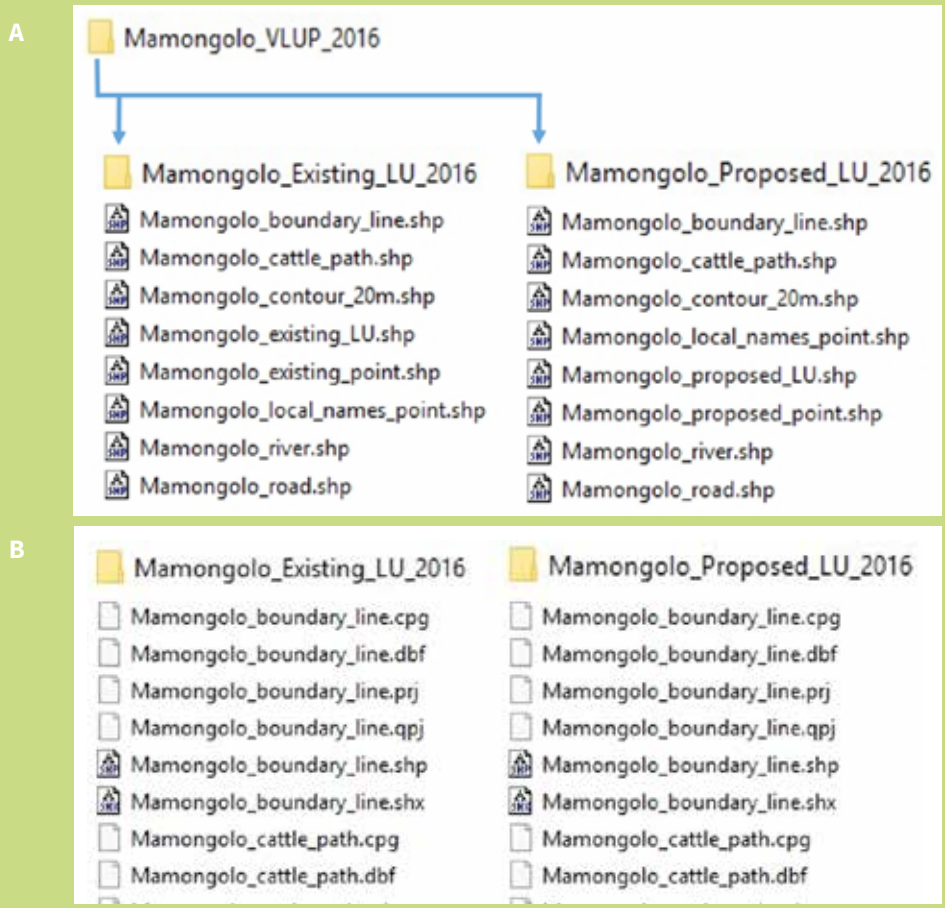



**Figure 36.** Example of the VLUP GIS data storage structure and folder and file naming. A) The main folder is named with the village name, data type and year of production and the data inside it are separated to existing land use map folder and proposed land use map folder with corresponding folder and file naming. B) When the same folders and files are viewed through the GIS software they will look like this. Remember that the GIS software automatically stores each shapefile with other accompanying files in different file formats. Ensure you do not delete any of these accompanying files because if one of them is missing the shapefile will not open properly or at all anymore.

### 2.4.5. Production of digital VLUP maps

#### Overview and aim

Digital environmental risk, existing land use and proposed land use maps can be produced after the original sketch map information has been digitised. At this stage it is assumed that all the required GIS data has been created. When they are ready, the digital maps should be printed and included as part the VLUP report. These maps will show all relevant village land use information in an easily understandable and standard way (Figure 37). Like the text of the VLUP report, these maps will convey information about the village land use areas and guide land use decisions in the village. The village community can refer to the maps when it implements its VLUP. The maps provide information about the village not just to the villagers themselves but also to people who visit the village, such as district authorities, NGOs, and prospective investors. For this reason, the maps need to be user-friendly to all these various stakeholders.

In order to ensure that the maps are indeed user-friendly, the map components must be clearly visible and understandable on the printed versions. Accomplishing this requires that you consider, among other things, paper size, labeling with local place names, and using standard land use categories, symbols and colors. In addition to the maps you include in the VLUP report, if funds allow, print large maps on durable material to display in the village office. It is recommended that these maps be delivered to the villages as soon as possible after the VLUP process is complete to ensure that VLUP decisions are not forgotten and to avoid delays in the implementation of the VLUP.

#### Working tasks

1. Open all the data you want to show in the existing or proposed land use map in the layout view of the GIS software which you are using. To produce the proposed land use map, modify the existing village land use map saved as a new project file which you can modify. The working tasks of map production listed below can be applied to the production of a variety of maps, including location, landform, slope, and environmental risk.

2. Decide and set the paper size of the map layout to the desired paper size. Consider using A3 paper because it allows for good visibility of the map content for inclusion as a printed map in the VLUP report. To find out more about map layout, refer to "The PLUM Guidelines (3rd edition)" and the sample maps in this manual (figures 7, 23, 24, and 32).

3. Position and balance the village area well in the layout frame. Utilise the entire area available in the layout frame so that the village area visible in the frame is as big as possible. Depending on the shape of the village area, select either portrait or landscape paper orientation so that the layout frame is oriented most suitably.

**Textbox 70. Basic details**

- Time: 2 to 3 hours for each map.
- Participants: Facilitation team member(s) with GIS skills.
- Outcomes: All the VLUP maps are ready to be included in the VLUP report and displayed in the village for VLUP implementation.
- Preparations and material: GIS software (ArcGIS, QGIS or other), computer, and VLUP GIS data (shapefiles).

4. Decide and set a feasible scale for the village map. The scale depends on the size of the village and can vary from hundreds of hectares to hundreds of thousands of hectares.

5. Add the symbols required and customise the colors of each land use as well as of roads, rivers, contours, and other features. Use the standard colors and symbols outlined in "The PLUM Guidelines (3rd edition)".

6. Add a grid, in either tick or box format, to the map layout and display its coordinates at the sides of the layout frame.

7. Add all basic map elements, including a map legend, north arrow, scale bar, map title, data source, datum, the date of map production, and the name of the person who produced the map.

8. When labeling the legend of land uses, consider displaying the sizes of the areas of each land use category in the village. You calculated these areas when you digitized the sketch maps (Section 2.4.4.) and you can obtain the values from your Excel or CSV files.

9. If possible, produce existing and proposed land use maps in large size (A1 or A0) so they can be displayed in the village office.

10. If you produce a large map to display in the village, consider using local names to label places and social facilities on the map to make it easier for people to orient themselves to the maps.

11. Save all the maps you produce in, for example, JPEG or PNG picture file format in high resolution (dpi 200) and ensure that you send these picture file format copies of the maps to the NLUPC as well.

After you have finished all the maps for the VLUP, include them in the VLUP report. The produced maps as well as the village satellite image map can continue to be utilised in the next two steps of the VLUP process, steps 5 and 6, which include detailed village land use management planning and the implementation of village land administration and enhancement of the security of land tenure respectively. It is recommended that the village council be given and instructed to store the maps so that they will be easily available for the implementation of the VLUP and subsequent steps. Having the maps clearly displayed in the village (for example village office) will inform any outside actors, such as investors or new development project staff, about the existence of a VLUP in the village and assist villagers in implementing the plan. The maps can also be used to help identify and locate the right locations for land use signboards in the village (Textbox 72). These signboards and VLUP maps displayed in a public place in the village will assist the village council in enforcing the VLUP. ■

**Textbox 71. Addressing possible challenges**

The standard colors and symbols provided by "The PLUM Guidelines (3rd edition)" were developed based on ArcMap GIS software. Thus it may be difficult to produce exactly the same VLUP map layouts using a different software, such as QGIS, which may not have exactly the same standard colors and symbols available.

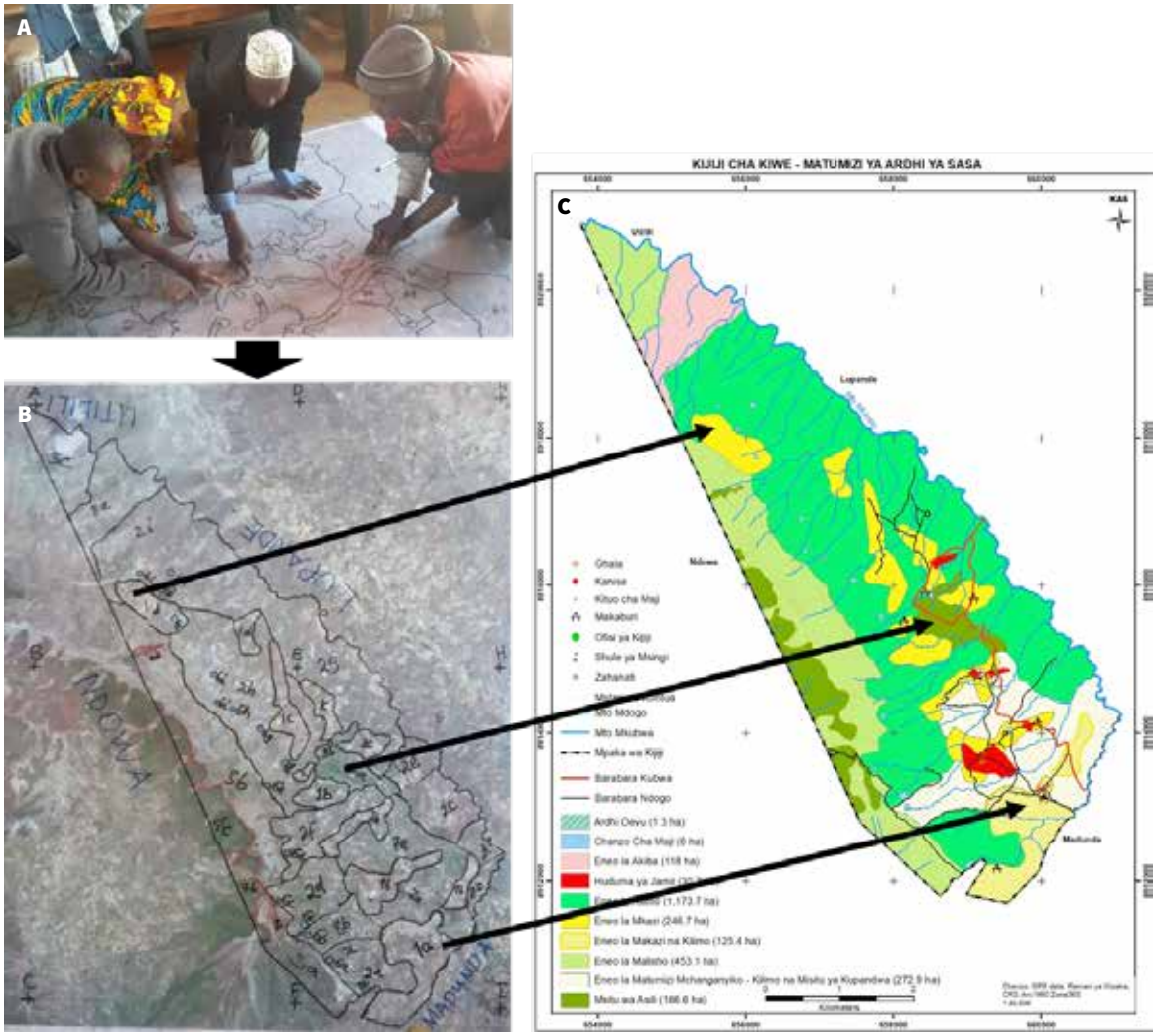



**Figure 37.** The phases of producing the digital VLUP maps. A) In the first phase village participants jointly draw a sketch map B) in the next phase the sketch map is georeferenced in the GIS software and each map element is carefully digitized into GIS data C) in the last phase the GIS data is used to produce the digital maps with easily understandable and standard colors and symbols.

**Textbox 72. Using the VLUP map and GPS to identify appropriate locations for land use signboards**

The produced VLUP maps can be used to identify appropriate places in which to erect land use signboards in the village. By using the VLUP map shapefiles and the satellite image in GIS software, you can identify locations for each signboard and transfer the coordinates of these locations to GPS devices to take with you in the field. In the village, have villagers erect signboards based on these coordinates. The satellite image helps you to identify the best locations for signboards which, according to "The PLUM Guidelines (3rd edition)," are along the roads that lead into and out of a particular land use area.

First, you need to create a point layer (shapefile) with the same datum as the VLUP GIS layers (e.g. WGS84 Zone 36). Open the planned land use GIS data and roads shapefiles in the background and identify where signboards should be erected and mark them as points on the layer. Then create an attribute table for this point layer. Label one column as "name." It is in this column that you will label each signboard, for example, "grazing area." This column of signboard names will be automatically displayed in your GPS device when you download data to it.

After you have identified and marked all the points, save your work and convert the signboard point layer to GPX file format, a format which can be used on a GPS device. Set the datum for this GPX file as WGS84, which is global and preferred by GPS devices. Load the GPX file to the GPS devices and when you get to the village navigate to the signboard locations on the ground. Use the "go to" function in the GPS device to enable the GPS to guide you to each correct signboard location in the village. An alternative way of locating the signboard locations is to note down the signboard coordinates in a notebook and manually feed them to the GPS device.

# 3. Further information sources

## Books and e-books


Boedhihartono, A.K. (2012). Visualizing Sustainable Landscapes: Understanding and Negotiating Conservation and Development Trade-offs Using Visual Techniques. 56 pp. Gland, Switzerland: IUCN. Available from: www.iucn.org/content/visualizing-sustainable-landscapes-understanding-and-negotiating-conservation-and-development-trade-offs-using-visual-techniques

Chambers R. (2002). Participatory Workshops: a sourcebook of 21 sets of ideas and activities. London: Earthscan.

Cunningham G. (2011). Community Economic Literacy and the "Leaky Bucket". Coady International Institute's Occasional Paper Series, No. 9. http://coady.stfx.ca/knowledge/digital_tools/dlb/

ELD Initiative (2015). Practitioner's Guide 'Pathways and Options for Action and Stakeholder Engagement'. Available from: www.eld-initiative.org

Eilola S., Käyhkö, N., Ferdinands, A. & Fagerholm, N. (forthcoming). Bird's eye view into my village – developing participatory geospatial methodology for local-level land use planning in the Southern Highlands of Tanzania.

Geißler, G., & Löffler, G. (2007). Multi-stakeholder management: Tools for Stakeholder Analysis: 10 building blocks for designing participatory systems of cooperation. Available from: www.fsnnetwork.org/sites/default/files/en-svmp-instrumente-akteuersanalyse.pdf

IITBHU (2017). A chapter in course material at the Indian Institute of Technology (BHU) in mechanical engineering on causes of slope failure. Available from: www.iitbhu.ac.in/faculty/min/rajesh-rai/NMEICT-Slope/Pdf/02%20Causes%20of%20slope%20failure.pdf

IIED (2004). Power Tools of International Institute for Environment and Development for understanding policy influence; Stakeholder influence mapping, Stakeholder power analysis, and the Four Rs tool. Available from: www.policy-powertools.org/Tools/Understanding

International Land Coalition (2016). Participatory Rangeland Resource Mapping in Tanzania: A Field Manual to support planning and management in rangelands including in Village Land Use Planning. 97 pp. Available from: www.landcoalition.org/en/resources/manual-participatory-rangeland-resource-mapping

International Land Coalition (2013). Village land use planning in rangelands in Tanzania: good practice and lessons learned. Rangelands no. 3. 83 pp. Available from: www.landcoalition.org/es/resources/village-land-use-planning-rangelands-tanzania

Katsube K. and Oguchi T. (1999). Altitudinal Changes in Slope Angle and Profile Curvature in the Japan Alps: A Hypothesis Regarding a Characteristic Slope Angle. Geographical Review of Japan, 72 (Ser. B): 1, 63-72. Available from: https://www.jstage.jst.go.jp/article/grj1984b/72/1/72_1_63/_article

National Land Use Planning Commission (2018). The Guidelines for Participatory Land Use Planning, Administration and Management. 3rd edition.

Ujamaa Community Resource Team (2010). Participatory Land Use Planning as a Tool for Community Empowerment in Northern Tanzania. IIED Gatekeeper Series 147.

## Websites

ArcGIS Pro software - https://pro.arcgis.com/en/pro-app/

ArcGIS and ArcGIS Pro tutorials. ArcGIS Help, https://mgimond.github.io/ArcGIS_tutorials/index.html and https://pro.arcgis.com/en/pro-app/get-started/pro-quickstart-tutorials.htm

Participatory methods website of the Institute of Development Studies. www.participatorymethods.org

Publications of Coady International Institute on Asset Based Community Development (ABCD) approach. http://coady.stfx.ca/knowledge/publications/

QGIS software. www.qgis.org

QGIS tutorials. www.qgistutorials.com

World Cafe tool on the Knowledge Sharing Toolkit. www.kstoolkit.org/The+World+Cafe

# Annexes

## Annex 1

List of organizations, which attended stakeholder meetings in June 2017 and April 2018, and commented on the manual:

Agrinfo
Ahadi Productions
CARE Tanzania
Chama cha Wafugaji Tanzania CCWT
Department of Agricultural Engineering and Land Planning, Sokoine University of Agriculture
Department of Geography, University of Dar es Salaam
Department of Social Sciences, State University of Zanzibar
Department of Urban and Regional Planning, Ardhi University
Department of Urban and Rural Planning Zanzibar
Forest Development Trust
Haki Ardhi
Institute of Resource Assessment, University of Dar es Salaam
Kilombero District Council
Landesa
Lecide
Ludewa District Council
Makete District Council
Ministry of Agriculture, Livestock and Fisheries Tanzania
Ministry of Land, Housing and Human Settlement Development Tanzania
Ministry of Water and Irrigation Tanzania
Mkurabita
Mufindi District Council
Oxfam Tanzania
PELUM Tanzania
Tanzania Forest Conservation Group TFCG
Tanzania Forest Service, Arusha
Tanzania Natural Resource Forum TNRF
Tanzania Wildlife Authority TAWA
Ujamaa Community Resource Team UCRT
United Nations Development Program Tanzania
Wildlife Conservation Society Tanzania
World Bank Tanzania

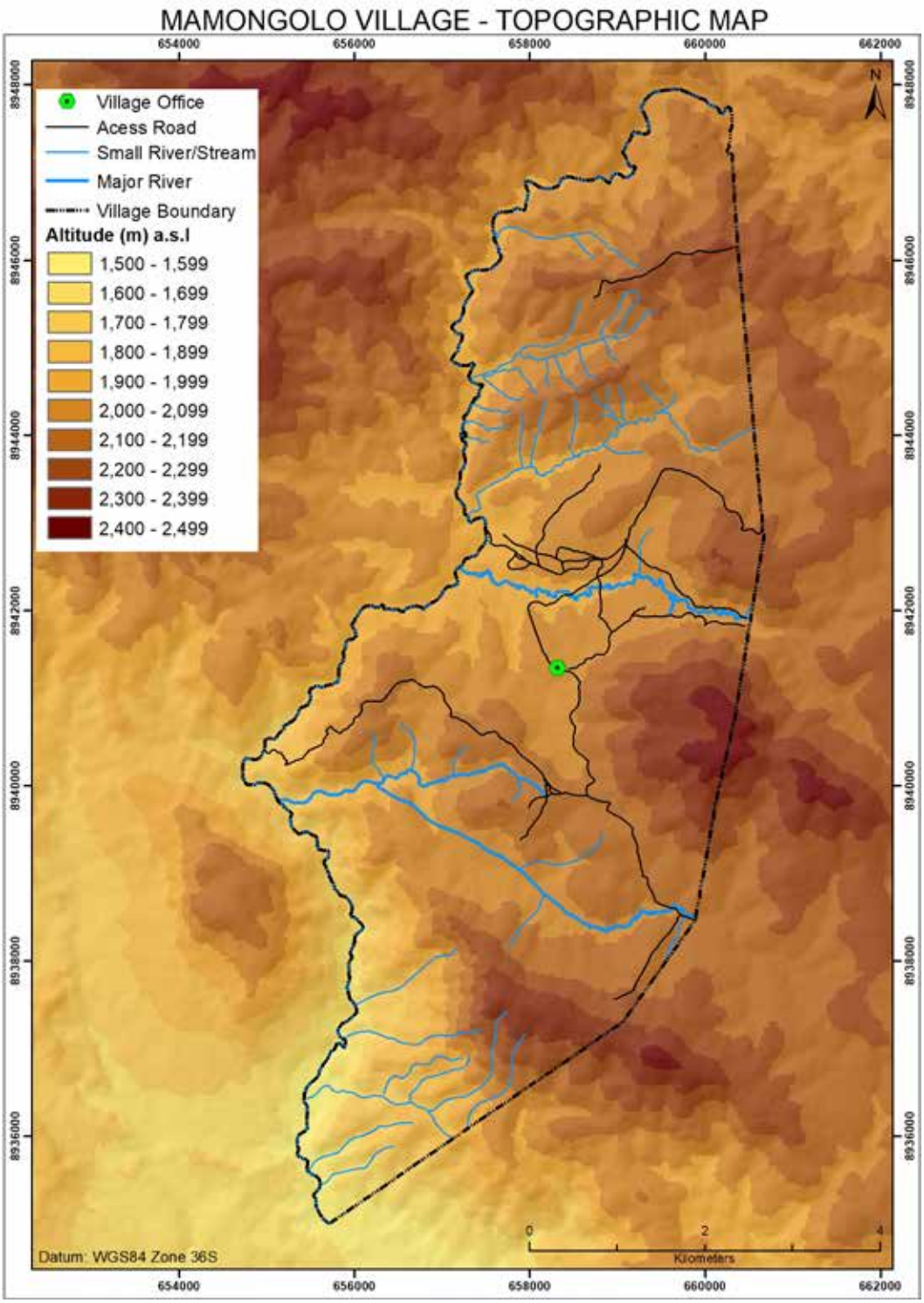
## Annex 2

List of villages, where participatory mapping has been done using the tools described in this manual by the time of publication of the manual:

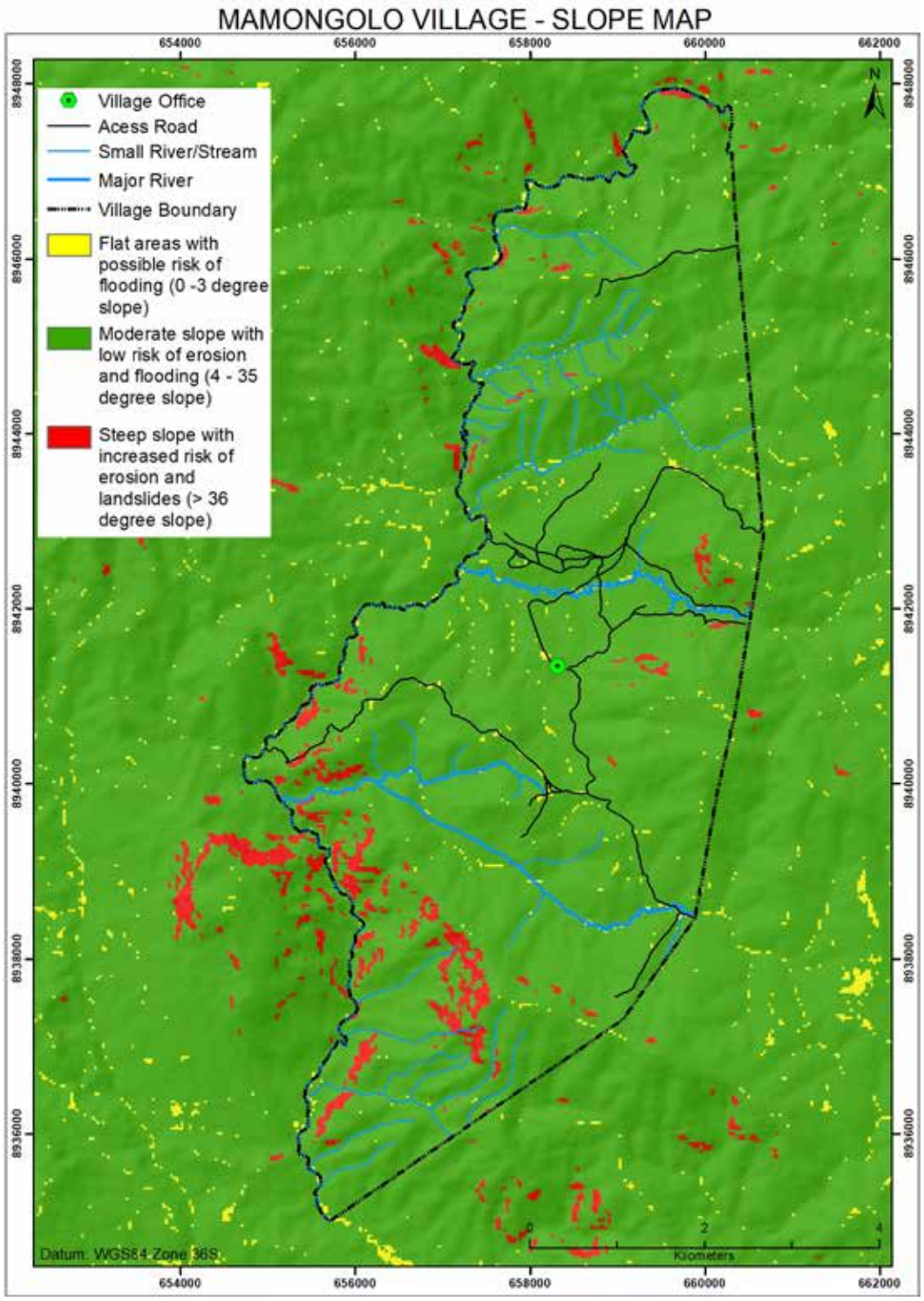
Ibaga, Makete district
Iboya, Njombe Town Council
Igumbilo, Makete district
Ihanga, Makete district
Ihela, Makete district
Ilindiwe, Makete district
Ipilimo, Mufindi district
Kijyombo, Makete district
Kitewele, Ludewa district
Kiwe, Ludewa district
Kiyowela, Mufindi district
Lipilipili, Mbinga Town Council
Ludende, Ludewa district
Lugema, Mufindi district
Lugolofu, Mufindi district
Lupila, Makete district
Lyamko, Kilolo district
Mago, Makete district
Malembuli, Makete district
Mamongolo, Njombe Town Council
Mfriga, Njombe district
Mundindi, Ludewa district
Ng'onde, Makete district
Ngoje, Makete district
Ukange, Makete district
Ukimo, Mbinga Town Council
Usungilo, Makete district
Utweve, Makete district

## Annex 3

A) Village topographic map example of Mamongolo village.



B) Village slope map example of Mamongolo village.



## Annex 4

**GPS COORDINATES COLLECTION FORM**

Village Name: .....  Date: ……

Datum Used: …….

| Code | Use | Description | Zone | Eastings | | | | | | Northings | | | | | | |
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SKETCH