Spatial Planning and Monitoring of Landscape Interventions

Maps to Link People with their Landscapes

A Users' Guide

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TerrAfrica
Regional Sustainable Land Management

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Contents

Glossary

2-D: two dimensions (length and width); i.e. a flat surface area, such as a drawing of the world

3-D: three dimensions (length, width, height); i.e. an area with relief, such as the world

Aspect: the direction of a slope (e.g. north, south, east or west)

Collaborative landscape management process: a set of interlinked phases in which stakeholders share knowledge, set goals, negotiate and plan for common action and monitor impact for landscape interventions

Ecosystem service: A benefit humans obtain from goods (e.g. timber and fodder) and services (e.g. flood protection and climate regulation) provided by the environment

Experts: in this document, this refers to people who support the team and participants with specific knowledge or insights on sectors, management techniques or areas in the landscape

Geographic Information System (GIS): a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface

Guide: refers to this document, A Guide to Spatial Planning and Monitoring of Landscape Interventions: Maps to Link People with their Landscapes

Hillshade: the assumed shadow calculated from an elevation raster file that give elevation maps a visual 3D representation

Image file: Digital images stored as, for example JPEG, TIFF, BMP or GIF files

Landscape benefit: a good (such as water, food, fodder or timber) or service (erosion control, water regulation, climate change mitigation or wildlife habitat) that is generated in the landscape and is valued by people (see Ecosystem service)

Landscape: the area of planning interest in which agriculture, natural processes and livelihood activities take place, defined by the values and interests of the stakeholders that live there (e.g. a watershed, administrative region, ecological structure or a combination of these, with a size ranging from 10 to 1,000 km2)

Legend: an explanation of the colors and symbols used on a map

Livelihoods: means of securing the basic necessities of life - food, water, shelter, fuel and clothing

Planning and monitoring process: in this document, this refers specifically to the described eight landscape planning and monitoring steps

Plugins, QGIS: a QGIS term for additional software functionalities that can be downloaded and installed within QGIS

QGIS: a free and open source desktop Geographic Information Systems (GIS) application that provides data viewing, editing, and analysis capabilities

Raster file: a GIS format that consists of a matrix of cells (or pixels) organized into rows and columns (or a grid) where each cell contains a value representing information (often stored as grid (.grd) or geoTiff (.tiff) file formats)

Resolution: the size of the pixels of a GIS raster file, i.e. the level of detail, typically expressed in meters or degrees (very high resolution maps have pixel size of 1 meter)

Satellite image: images of Earth, collected by artificial satellites. Several satellites are orbiting the Earth, mounted with sensors that capture images with different resolutions (e.g. Landsat, SPOT, RapidEye and Digital Globe)

Scale bar, map: a graphical representation of the scale of a map to give the map-reader information about the size of the area the map represents

Scale: in this document, refers to the spatial accuracy of the line feature in the GIS. Data from coarse scale maps are highly generalized. Data from fine scale maps (e.g. 1:10,000) are highly detailed.

Shapefile (.shp): a GIS format to describe geospatial vector elements such as points, lines or polygons

Sustainable Land Management (SLM): an approach that aims at integrating the management of land, water, biodiversity and other environmental resources to meet human needs while sustaining ecosystem services and livelihoods

Spatial dimensions: characteristics that refer to the concept of space, in 2-D or 3-D, including measures such as distance, area, volume, elevation, density and proximity

Spatial extent: the geographical spread, a bounding box, of an element or area

SRTM data: global elevation data obtained by Shuttle Radar Topography Mission (SRTM), an international research effort that gathered elevation information on a global scale to generate a high-resolution digital topographic database of Earth (resolution varies from 30 meter to 90 meter)

Temporal dimension: (i.e. time): temporal information describes the spatial dynamics of a landscape

Topographic map: a map representing elevation and other natural (e.g. rivers and lakes) and man-made features (e.g. roads, rail roads and populated areas)

Summary

The Spatial Planning and Monitoring Guide: Maps to Link People with their Landscapes, developed by EcoAgriculture Partners and Cornell University for TerrAfrica, is designed to stimulate the use of maps in cross-sectoral collaborations to locate, design and monitor interventions in rural landscapes. The guide presents eight steps to guide key stakeholders through a spatially explicit landscape planning process aimed at integrating goals for agricultural production, biodiversity conservation and livelihood security. The Spatial Planning and Monitoring Guide uses best available maps to facilitate this process by allowing stakeholders to specifically indicate areas where improved landscape benefits should be planned and monitored. Here the use of a wide range of maps (such as maps on water flows, suitable agricultural soils, vegetation cover and population) supports well-informed planning for placed-based interventions, of which the desired impact often depends on the spatial characteristics of a larger area.

In this document, we provide guidance on selecting, accessing and tailoring maps that form the crucial basis of this spatially explicit multi-stakeholder planning process. The use of these maps is subsequently described in eight steps of a planning and monitoring cycle, which start with the use of maps to identify important areas in terms of landscape benefit supply (such as water supply and regulation, crop production, habitat provision and moderation of extreme climate events). In a next step, stakeholders share ideas and identify areas where changes leading to improved landscape benefits flows are desired, and identify the current governance actors for these areas. The guide has a specific monitoring element that recommends stakeholders to carefully describe landscape benefits in a measurable, spatially explicit way. Based on the specified landscape benefits and selected areas where change is desired, in a subsequent step, stakeholders jointly discuss how a potential change in the landscape will affect different landscape benefits flows and beneficiary groups. After agreement is reached, stakeholders plan and implement a preferred change in the landscape using a range of maps and involving relevant governance actors. The last step guides stakeholders in setting up a strategy to monitor and evaluate changes in benefits flows after implementation of the planned intervention. Stakeholders are guided to use information about changes in making their landscape planning adaptive to possible future change.

Part 1

Introduction

In This Section

This guide explores the use of maps in planning and monitoring integrated landscape management. The scope of the guide, who it is designed for and timeframes for planning its use are described in section 1.

1.1 Scope

Awareness is growing that in order to meet the increasing societal demand for agricultural production, provision of ecosystem services and the protection of biodiversity, land management practices should be fine-tuned to the level on which many of these processes take place: the landscape. By focusing not only on single fields, but looking at the whole agricultural landscape, solutions may be found that meet multiple demands by taking into account dynamics, synergies and trade-offs among multiple objectives, land units and stakeholder interests (Mastrangelo et al. 2013, Sayer et al. 2013). This process requires good understanding of the landscape and strong stakeholder collaboration at different spatial levels, as managing landscapes implies managing numerous and diverse pieces of land owned and influenced by different people.

The Spatial Planning and Monitoring of Landscape Interventions: Maps to Link People with their Landscapes guide is designed to stimulate the use of maps in cross-sectoral collaborations to help locate, design and monitor interventions in rural landscapes. TerrAfrica is a NEPAD led platform for Sustainable Land Management (SLM) in 24 countries that aims to support innovative solutions to sustain landscapes, address land and water degradation and adapt to a changing climate. The platform is based upon a partnership model that seeks to use collaborative methods to mobilize and deliver coordinated investments, to share relevant knowledge and tools and bring together diverse stakeholders to meet these aims. This guide aims to provide TerrAfrica stakeholders and other practitioners engaged in the management of landscapes, land and water with a knowledge product that will help convene multiple stakeholders for the coordinated planning and monitoring of investments that lead to sustainable benefits.

The guide builds upon available spatial information - maps - to advance understanding about ways landscape interventions can be located, designed and negotiated for agricultural production, biodiversity conservation and livelihood security and to support enabling governance structures. These interventions could include, but are not limited to the following types of activities:

- Crop and livestock farming conservation practices that increase soil fertility, water retention, carbon sequestration and other ecosystem services at the landscape level, while reducing levels of water and energy needed and pollutants generated
- Conservation corridors, buffers and other biodiversity conservation practices that improve habitats and reduce negative interactions between wildlife, farming and other human activity and help promote local livelihood security
- Markets and marketing approaches that reward farmers for ecologically sustainable production practices
- Institutional and policy mechanisms that provide incentives and support for collaborative investment by public, private and civic sectors

This guide is aimed to be used by organizations that wish to facilitate multi-objective participatory landscape planning and monitoring processes, including local, regional or national governments, NGOs or private sector initiatives supporting sustainable rural growth.

Check your work!

Key action points and steps in this guide are marked with this empty check box symbol. Users of this guide are recommended to "check off" these elements throughout the process.

1.2 Type of Guide

The Spatial Planning and Monitoring Guide aims to help landscape leaders to collaboratively identify, plan and monitor trends and interventions in a landscape with key stakeholders. The document explicitly focuses on the use of spatial information to support this process. The role of maps is described throughout eight steps that guide key stakeholders through a multi-objective landscape planning processes aimed at agricultural production, biodiversity conservation and livelihood security. For each of the steps, we propose a number of map-based activities during that stage of the planning process. A selection of these could be included in, or adjusted to, any participatory landscape planning process.

The document also describes preparatory actions that need to be taken before starting this map-based collaborative planning and monitoring process. In the guide we explicitly focus on the role of maps, and refer to other documents developed by EcoAgriculture Partners and others for specific and in-depth reading on facilitating collaborative landscape planning processes.

1.3 Guide Requirements

To successfully use this guide, some core skills, knowledge and materials are required of the team in charge of the preparation and facilitation of the planning process, and of the participants.

Preparation Team

Skills & Knowledge: Computer skills (installing software, downloading data), preferably some background in Geographical Information Systems (GIS) applications, knowledge of natural resource management, geography and rural development (different team members can have specific skill sets)

Materials: Desktop computer/laptop with up-to-date operating system (Windows, Mac, LINUX), access to internet (able to download files from 2-180MB) and access to printing facilities (A1, A2 or A3 size paper)

Facilitation Team

Skills & Knowledge: Facilitation skills, knowledge of natural resource management, geography and rural development (different team members can have specific skill sets)

Materials: Flip chart or blackboard, facilitation materials (index cards, post-it flags and notes in different colors, small and large, sticky tags, markers and tape), laptop, projector and camera. No internet access needed during group meetings (see the handouts provided in Appendix 1: Supporting Facilitation Materials)

Maps: 3-4 copies of the same topographic map of the landscape, 1 land use/cover map, 1 soil map and 1 biodiversity map. Optional: other relevant thematic maps addressing landscape specific issues (collected by the preparation team)

Location: A meeting room/area where all key stakeholders and a facilitation team can gather during the different steps of the process

Participants of the Planning & Monitoring Process

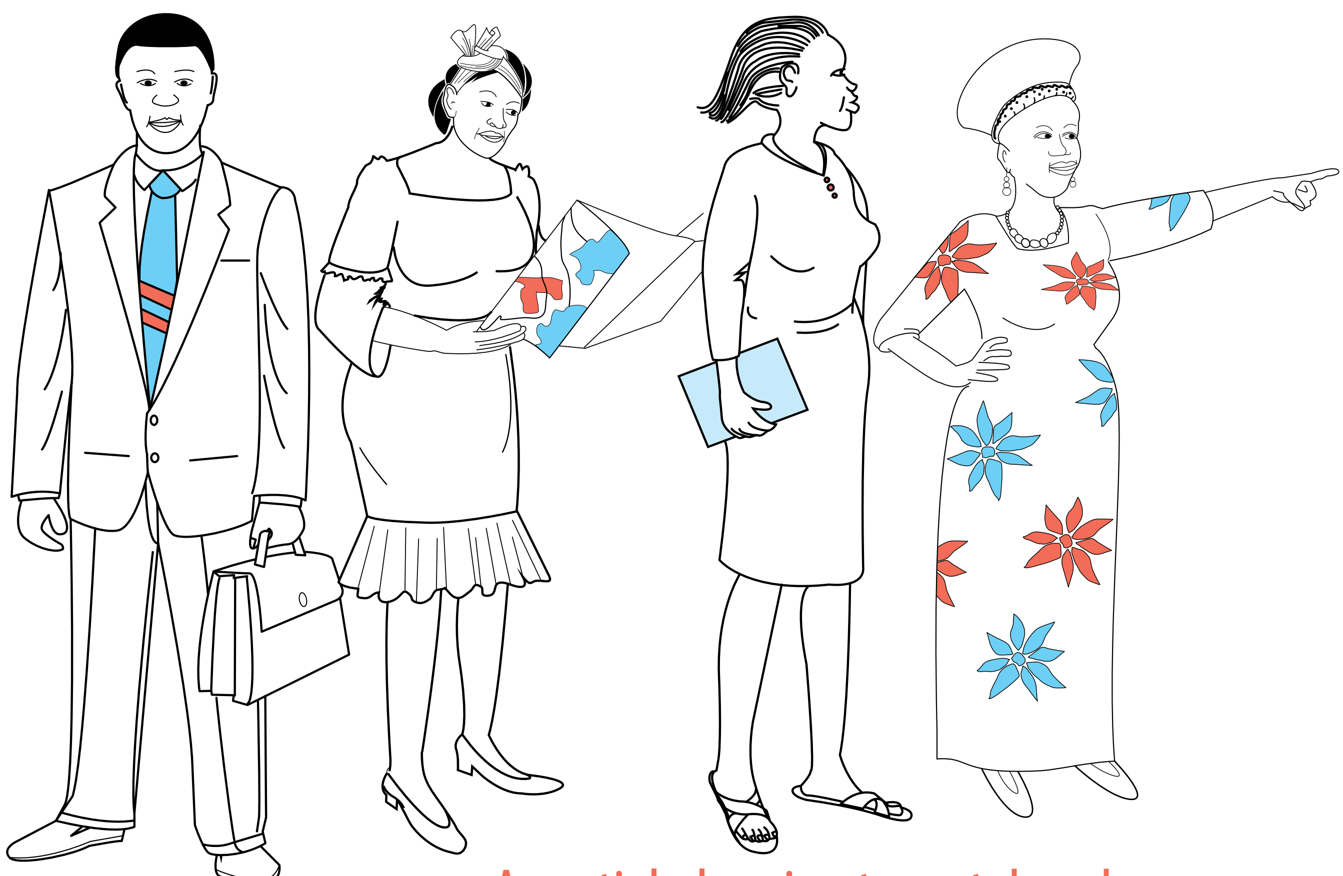
Skills & Knowledge: Good knowledge of the region and its customs, key players in their sector (agriculture, conservation, water, market or administration). The broad range of stakeholders will likely have different experiences, interests and capacities in landscape planning and monitoring. The steps described in this document allow for these differences.

1.4 Time Schedule

A landscape planning and monitoring process is a lengthy effort; the organizing team should anticipate the approximate time requirements as shown in Table 1. The estimated ranges of time requirements refer to the different sections of this document and can strongly differ per planning and monitoring process. Participants might revise their assessments and options throughout the process; time and flexibility is needed to include these adaptations.

Guide Section	Time Requirements	People Engaged	Main Tasks
Setting the scene	1-3 days	Team, regional experts	Obtain information from key informants
Collecting & preparing maps	1 to 4 weeks	Team, regional experts	Talk with local organizations, spatial data search & collection, map preparation
Participants training	1 to 7 days	Team, regional experts, participants	Learning event on maps and landscape approaches, including preparation of training materials
Planning Process: Assessment	½ to 8 weeks	Participants, Team, regional experts,	Step 1-4, Describing the landscape
Planning Process : Discussion	½ to 8 weeks	Participants, Team, regional experts,	Step 5 Discussing landscape intervention impacts
Planning Process: Planning	½ to 8 weeks	Participants, Team, regional experts,	Step 6 Negotiate and Plan landscape interventions
Planning Process: Implementation	1-26 weeks	Participants, Team, regional experts,	Step 7 Implement the landscape intervention
Monitoring and evaluation Process	Longer than 1yr	Participants, Team, regional experts,	Step 8 Monitoring change and adapt planning

Table 1. Summary of time, participation requirements and key tasks for preparing and using maps in planning and monitoring phases of a landscape collaborative management process



A spatial planning team takes shape.

Part 2

Maps and People: Making the Guide Work

In This Section

Before entering the planning process, four steps need to be taken by the preparation team. These include actions related to

1. identifying landscape-specific issues and actors,
2. collecting maps,
3. tailoring maps using GIS software, and
4. training participants in landscape approaches and the use of maps.

2.1 Setting the Scene

To initiate the landscape planning and evaluation process, the team should begin by addressing the landscape-specific questions specified below. Figure 1 highlights the focus of the landscape scoping exercise.

What? Landscape Issues: What are the main issues related to land and natural resources use and their governance in the area? These could include, but are not limited to: water availability for agriculture, habitat quality for key species, soil degradation and erosion, change in market opportunities for agricultural products, etc. Identifying the issues for which the guide will be used will allow the preparation team to collect appropriate maps and invite key people.

Where? Geography: What are the approximate boundaries of the area for which the guide will be used? These should line up with locations and system boundaries of the main issues to be addressed. These boundaries are typically crosscutting administrative areas, a watershed and natural networks. This approximate size and location of the area for which the guide will be used, will support the team to collect appropriate maps and invite key people.

Who? Participants: Based on the type of land and water resource issues in the area, who are the relevant stakeholders to participate in the planning process? Participant selection should aim at identifying candidates who are leaders, who can influence local communities and their own organizations and who are also innovators that will be able to share ideas

Figure 1. Initiating the spatial planning and monitoring process by clarifying the main actors and issues in a landscape

Thematic Maps	Description and Use
Topographic Map(s)	Shows rivers, roads, elevation and localities. These mapped landmarks will help participants orient throughout the planning and monitoring process. Elevation, rivers and localities also typically define the suitability of a location for the implementation of specific land management practices. An overview of the transportation infrastructure and location of potential market (i.e. towns) will help to locate and design landscape interventions.
Land Use/Cover Map(s)	Shows the location of stretches of agricultural land, forested area, grasslands and urban areas. Land cover, and its related land use, is a primary information source for defining provided landscape benefit at a location (e.g. timber from a forested area, food from agricultural land). Land cover can also be an indicator for non-directly visible landscape benefits (e.g. forested areas as determinant for water infiltration). The pattern of the land cover in some cases defines the provided landscape benefit as for habitat connectivity or erosion control strips.
Soil Map/Agricultural Suitability Map(s)	Shows soil properties (e.g. water holding capacity, structure and erodability), which largely define the suitability of land for a particular land use.
Biodiversity/Protected Areas Map(s)	Shows location of important nature conservation sites. These maps are crucial input for biodiversity corridor and buffer zone planning.

Table 2. Key thematic maps for cross-sectoral landscape planning

different from the "business as usual" way of doing things. Key stakeholders typically come from the following sectors: agriculture (livestock and crop), biodiversity conservation, private sectors, government at different scale levels and natural resource entities such as water boards and forest concessions. In the process of participant selection, three categories of people should be considered; i) those whose cooperation is essential to reaching landscape goals, ii) those who are in positions to prevent you from reaching landscape goals and iii) those who will be affected as you make progress toward landscape goals. Personal contact with the each of the envisioned participants of the planning and monitoring process is important to assure attendance and build mutual trust with all the participants.

How? Engagement: The team develops a strategy on how to engage key people in the landscape planning and monitoring process. What would make people enthusiastic to actively participate? What type of responsibilities do participants have? Not all key stakeholders would feel the need to participate in a landscape planning process, so how will you involve them? The team clearly communicates the expectations and roles to all invited participants.

2.2 Collecting Maps

This section describes how to collect best available spatial information to be used in the planning and monitoring process. Note that map availability will strongly depend on the location, size and landscape objectives of interest. We therefore limit our suggestions in this section to map types and sources that are generally applicable across regions.

2.2.1 Selecting the Thematic Maps

Maps of the area of interest are collected based on the identified key issues in the landscape and their approximate location. Map types that have proven to be important in a cross-sectoral landscape planning and monitoring process, because their wide availability and capacity to serve multiple purposes are listed in Table 2 (examples are provided in Figure 2). throughout the entire county and over 800 images were taken for future image comparisons.

These four maps types are, therefore, considered key spatial data sources for successful application of this Spatial Planning and Monitoring Guide. Other maps, depending on the issues in the landscape to be addressed, could include: rainfall and temperature, dam locations, wildlife migration routes, forest concessions, land ownership, tourist locations, carbon maps and population density maps.

In addition to these thematic maps, sketch maps prepared by stakeholders using participatory methods can serve a valuable role in capturing important local information and perceptions about the landscape. Sketch maps also provide a basis for tapping valuable local knowledge in designing interventions to improve landscape performance and motivating local engagement in change processes (IUCN, 2009). The case study in Appendix 3 highlights the use of sketch maps in planning sustainable land management interventions in a watershed in Tigray, Ethiopia, as well as limitations of these maps in SLM planning and monitoring. Innovative efforts to build thematic maps upon local sketch maps are worth exploring and expanding (Smith et al., 2012).

2.2.2 Map Sources

Maps can be obtained from a wide variety of sources. Hard-copy paper or digital maps can be found at local or national planning agencies, local or international universities, local water boards and national or international extension organizations. Collecting maps directly from organizations and institutes can be time consuming; however using maps from these local stakeholder groups could increase their engagement in the planning and monitoring process.

Many online map resources exist. From these websites, digital maps can be downloaded, often in a data format to be used with specialized Geographic Information System (GIS) software. These GIS data formats include vector data such as shapefiles (.shp) to describe points, lines or polygons, or raster (pixel) type files such as grid (.grd) or geoTiff (.tiff). In section 2.3, we describe how to prepare maps using GIS software. Table 3 lists some recommended websites to find maps that are key in planning and monitoring activities.

In Table 3, we also list widely available GIS map sources with a spatial detail that may be useful for planning on a landscape level. For example, we recommend land cover data from AfriCover even though it is not available on a global scale. This product provides more spatial detail (scale 1:100,000 to 1:250,000, means 1 cm on the map = 1 to 2.5km in the real word) compared to the global coarse resolution maps (i.e. GLC2000 or AFRICOVER, which have pixels of 1 x 1 km). Note that the spatial detail of raster maps is indicated by its "resolution" (i.e. the size of a pixel), while the spatial detail of vector data is represented its scale (the spatial accuracy of the line on the map).

The GEONetwork website of the Food and Agriculture Organization of the United Nations (FAO) provides a good starting point for a wide variety of additional, location specific GIS maps. See www.fao.org/geonetwork/. The data portal of EDENext provides access to GIS data on biodiversity, human safety, health and population, among others. See www.edenextdata.com/?q=data.

Summary

- [ ] Maps specifically made for the region of interest are likely to be more accurate, compared to globally available maps (as listed in Table 3), and are therefore preferred.
- [ ] Use local expertise to judge if the year and spatial detail of the map are adequate to address the key issues in the landscape. Often a compromise is needed between the two.
- [ ] Maps in a GIS or digital format are preferred as these can be tailored towards the planning and monitoring needs. Printing facilities are needed.
- [ ] Specific maps that show results from earlier studies (e.g. mapped erosion risk, yield estimates or carbon stock) could be collected too. Make sure that not only the year and resolution are adequate, but also the underlying data and models of the region are valid.

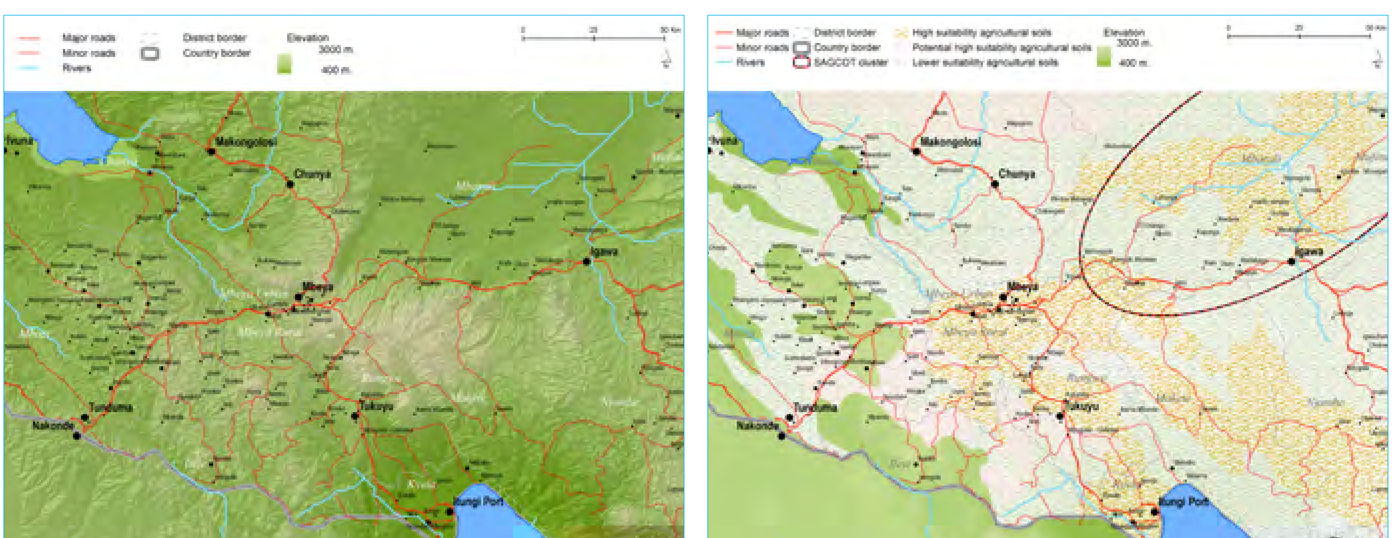


Figure 2. Example of a topographic map (left) and soil suitability map (right) of the Mbeya region in Tanzania

Theme	*Name*	*Spatial Coverage*	*Years*	*Spatial Details*	*URL*
Key Maps					
Topography	Google Earth	Global	Varies	Varies, aerial or satellite images	www.google.earth.com (viewer only)
Topographic features (roads, borders, rivers and localities)	VMAP	Global	Varies	Vector data, not very precise	www.gis-lab.info/qa/vmapo-eng.html
Land Cover	AfriCover	Republic of Congo, Egypt, Eritrea, Kenya, Rwanda, Somalia, Sudan, Tanzania and Uganda	1995-2002	1:100,000 – 1:250,000	www.glcn.org/activities/africover_en
Soil Properties	SOTER	Central and Southern Africa	Varies	Vector data, varies	www.isric.org/projects/soil-and-terrain-database-soter-programme
Protected Areas	Protected Planet	Global	Varies	Vector data, varies	www.protectedplanet.net/
Elevation	SRTM	Global	2006	90 meter resolution	www.srtm.csi.cgiar.org/
Administrative Units	GAUL	Global	2008	Vector data, country and province level	www.fao.org/geonetwork/
Additional Maps					
Population Density	AfriPop	Africa	Est.2000, 2005, and 2010	100 meter resolution at equator	www.worldpop.org.uk/
Watersheds Boundaries, Stream Networks	HYDROsheds			Vector data, varies	www.worldwildlife.org/pages/hydrosheds
Climate Data	WorldClim	Global	1950-2000 averages	1 kilometer resolution at equator	www.worldclim.org/formats
Mixed	GeoNetwork				www.fao.org/geonetwork/
Mixed	EDENext				www.edenextdata.com/?q=data

Table 3. Recommended general GIS maps sources, if accurate local maps are not available

2.3 Tailoring GIS Maps

In this section, we use downloaded data to custom-make maps using specialized GIS software. The most commonly used commercial GIS software is ESRI's ArcGIS (www.esri.com/). GRASS or QGIS are two other complete GIS software packages freely accessible at www.grass.osgeo.org/ and www.qgis.org/en/site/. These three software packages will allow users to do a range of similar analysis and map preparations. In this document, we will use QGIS to provide examples on how to create maps.

QGIS

To access the software, go online, download and install QGIS from www.qgis.org/. QGIS provides a range on support documents on their website. If you are relatively new to GIS, we recommend to work through 'A gentle Introduction in GIS' (from www.qgis.org/en/docs/).

QGIS can be extended with extra functionalities by installing "plugins" (see Figure 3). For this guide you need to have the plugin "Openlayers" installed: Go to Plugins > Manage and

Figure 3. Install plugin

Install Plugins > Get More, type "Openlayers" in the search box > select "Openlayers" > Install plugin.

Downloading Data into QGIS

A topographic map of the area is a minimal requirement for this planning and monitoring guide. Many topographic features can be downloaded from VMAP (see Figure 4, varying accuracy and resolution). VMAP has grouped their GIS data sources in four global regions. Sub-Saharan Africa is part of the VMAP SOA-zone. To download the SOA data, save the 7z file (a compressed file format) onto your computer.

To visualize the downloaded data, add the vector files (browse to the shapefiles) to QGIS. The Openlayer Plugin will allow you to add several maps as background image such as Google, OpenStreetMap, Bing, Yahoo, Apple and Stamen maps. In Figure 5, we added a satellite image made available through Google Satellite (Plugin > OpenLayers Plugin > Add Google Satellite Layer). Having a satellite image as background provides extra spatial references to the map, meanwhile providing a quality control of the added data (i.e. how precisely roads are mapped).

A topographic map typically shows elevation data; the SRTM data are the most common source for this. Elevation and slope of the land strongly determines the possible land uses and management options for the land, making this spatial information crucial for landscape planning. Additionally, people often use hills, ridges and plains as landmarks to orient themselves when using a map. To better represent these 3-D elements of the landscape, the "hillshade" can be calculated. Hillshades are made by adding dark shades to relief data, making an elevation map look more like what one would see in real life. In QGIS this can be done as follows: load the elevation raster in QGIS, Raster > Terrain Analysis > Hillshade, select the elevation data, leave the standard settings and save the new file. Before doing this, make sure you have cut the elevation data to the approximate extent of the area as SRTM data typically cover a very large area (Raster > Extraction > Clipper, clip by 'extent' or 'mask layer' with the area boundaries). Add the

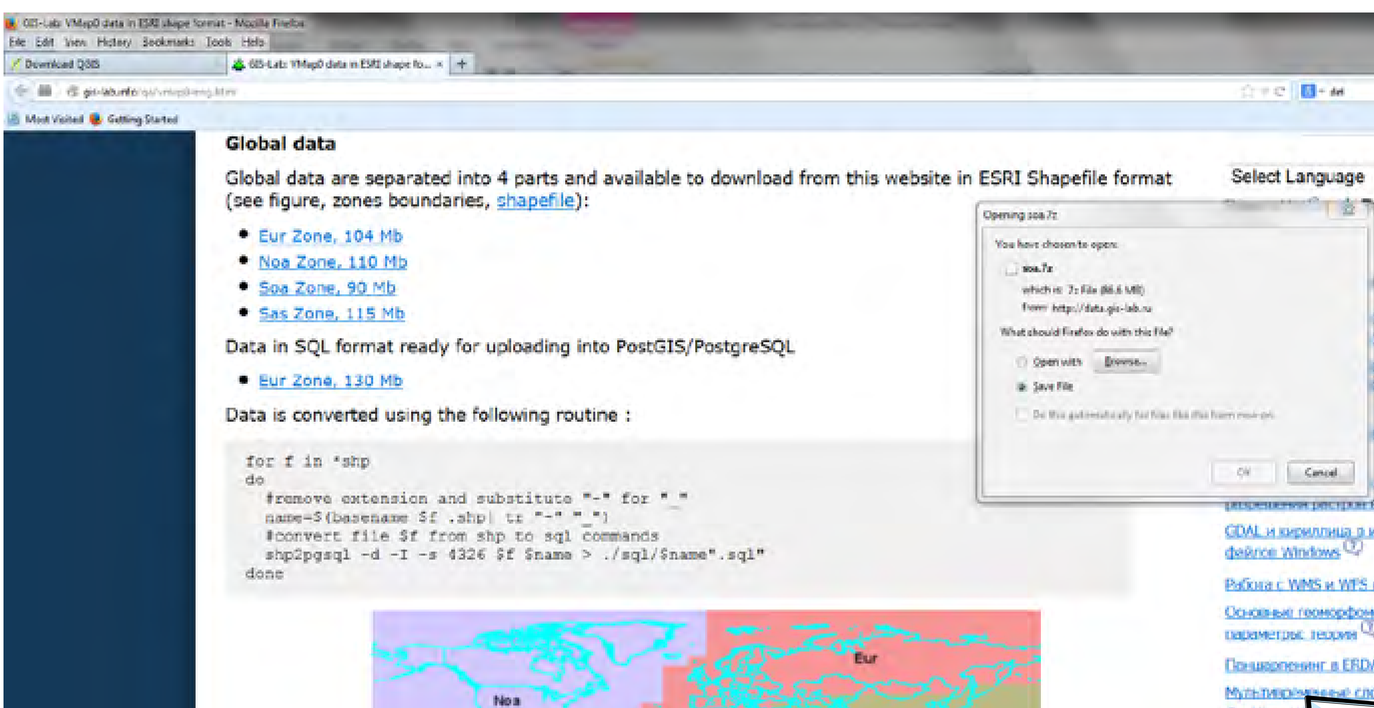


Figure 4. Data download from VMAP (www.gis-lab.info/qa/vmap0-eng.html)

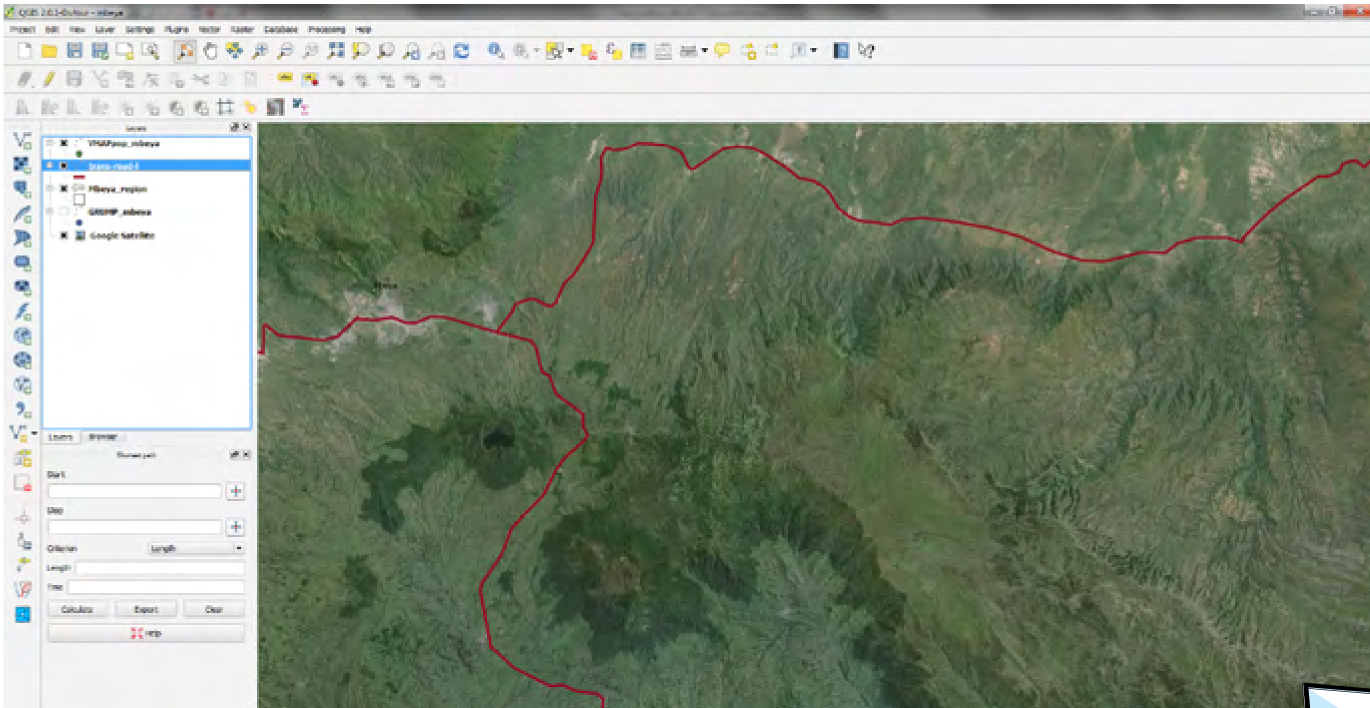


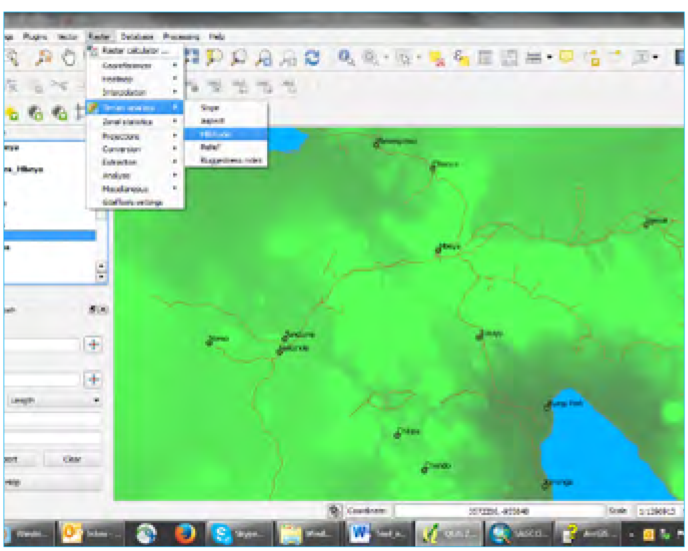
Figure 5. Data download from VMAP (www.gis-lab.info/qa/vmap0-eng.html)

new hillshade layer to the QGIS project. Drag the hillshade layer below the elevation layer. When making the elevation layer transparent (we used 30% here, double-click layer > Transparency) the landscape is depicted in a 3D perspective. Figure 6 and 7 show these steps.

Making Maps

By adding the downloaded data to QGIS, maps of choice can be made. We recommend facilitators to print the four key maps: 1. topographic map, 2. land use map, 3. biodiversity map and 4. agricultural suitability map. Use large sheets of paper to print on (A3 or larger, at a printing facility) or alternatively print on multiple normal sized sheets, taped together afterward. Large sized maps (A1 size is preferred) allow for sufficient map detail and can more easily be used in group discussion.

A printed map should show the mapped elements, and also contain a legend, a north arrow and scale bar, which are



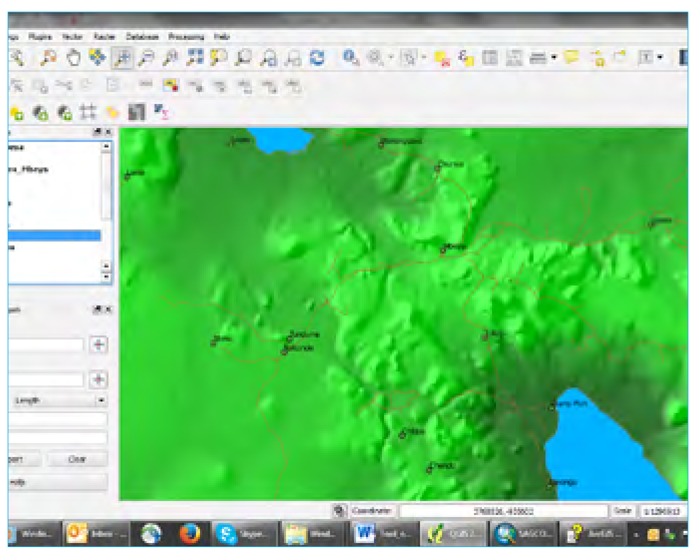


Figure 6. (Left) Calculating the hillshade from the elevation raster data - the shades of green indicate elevation from low (dark green) to high (light green)

Figure 7. (Right) The elevation map combined with hillshades creates a 3-D representation of the landscape

added to a map print layout. To create a layout in QGIS, go to Project > New Print Composer, name your map. In the Print Composer, go to Layout and click on the following items: Add Map, Add Scalebar, Add Legend, Add Arrow. Besides having clear layer names, it is good practice to add a title to your map and clearly refer to the map sources used and date when you accessed the online GIS database (click Add Label, type the text). Read the QGIS Help file for details on fine-tuning the layout of the maps. The finished map can

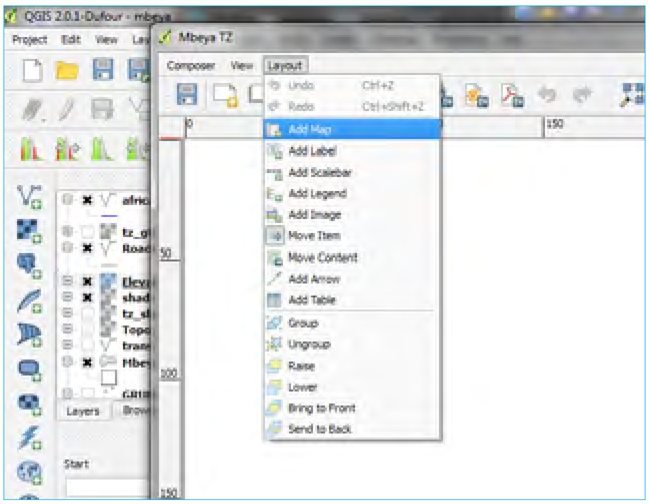


Figure 8. Before printing a map, a 'map layout' is created

Summary

- ☐ Use GIS software to add all spatial features of the landscape that are relevant for addressing the identified main issues in the planning and monitoring processes.
- ☐ Typically, four types of maps are needed: a topographic map, a land use/land cover map, a soil/ land suitability map and a biodiversity/ protected area map. Three to four copies of a topographic map area are needed during the different planning phases.
- ☐ The extent of the four maps (the area depicted on the map) is preferably the same among the maps.
- ☐ Selecting adequate data sources and making maps is a time consuming effort. Plan for enough time to define spatial data needs, search for maps, assess the usefulness of selected maps and (re-)produce maps. Typically this takes between one and four weeks, depending on map availability and quality.

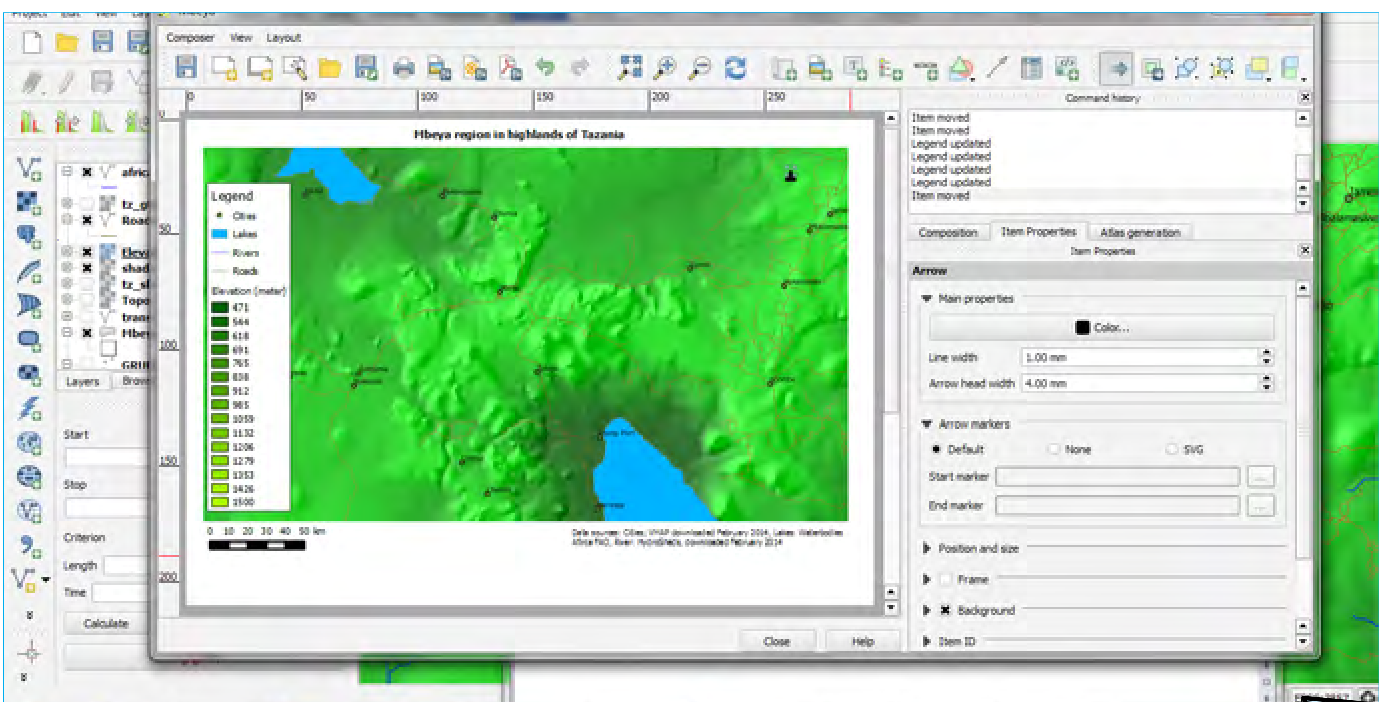


Figure 9. The layout screen with the map, legend, scale bar, north arrow, title and references to data sources added

either be printed directly from QGIS, or exported as image file or PDF (often an easier solution when printing from a different computer). Figure 8 and 9 show these steps.

2.4 Participant Training

In this section you will learn how to introduce participants to the concept of landscape approaches to support multiple objectives, and give training on how best to use maps.

2.4.1 Introduction to Integrated Landscape Management

A training event introduces all participants of the Planning and Monitoring process to the concept of integrated landscape management (ILM). During the event, foundations of ILM are addressed:

- Landscape elements have different uses, which lead to different benefits for people, who manage landscapes in different ways (governance structure)
- Land use at one location in the landscape can impact a location further away, field practices are linked to overall landscape performance
- Landscape interventions include changes in field practices, management of common areas and related site-based activities that affect land cover to
- Supportive institutions – such as secure land tenure, the legal protection of existing forests, and adequate farmer training systems, among others – are requirements for the effectiveness of site practices

What is Integrated Landscape Management?

Integrated landscape management (ILM) involves long-term collaboration among different groups of land managers and stakeholders to achieve the multiple objectives required from the landscape, including agricultural production, provision of ecosystem services, protection of biodiversity, local livelihoods, human health and well-being. Stakeholders seek to solve shared problems or capitalize on new opportunities that reduce trade-offs and strengthen synergies among different landscape objectives. There are many different approaches to integrated landscape management, with varied entry points, processes and institutional arrangements. Most share features of broad stakeholder participation, negotiation around objectives and strategies and adaptive management based on shared learning (Scherr et al. 2013).

- The collaborative integrated landscape management cycle, depicted in Figure 10, includes the following phases: assessment, visioning, planning, implementing, and monitoring & evaluation.

Having an understanding what constitutes ILM and diverse contexts in which it is practiced will help members of the preparation and facilitation teams identify appropriate trainers and adapt training materials to the local context.

A sample half day or one day training event on the foundations of a landscape approach is included in Table 4. The materials referenced for use in the training program

Session & Topic	Time Needed	Concepts Covered
Foundations for a Landscapes Approach	2-3 hours	• Broadening SLM perspectives with a landscape lens by establishing the link between SLM and landscape approaches • The components of a landscape approach: sustainable agricultural production, biodiversity conservation and improved livelihoods • The five common characteristics of a landscape approach • Relationships and functions of landscapes and how these interact with relationships and functions at other scales (e.g. community, region, etc.)
Landscape Planning and Management Cycle	45 min-1.5 hours	• Introduction to the adaptive collaborative management cycle for landscape planning and monitoring
SLM Practices for Landscape Outcomes	1.5-2 hours	• Broadening understanding of practices and benefits within a landscape perspective and landscape-scale benefits
M&E for a Landscape Perspective (optional)	45 min-1.5 hours	• The Landscapes Measures Approach – principles and components

Table 4. Sample half day or one day training event on the foundations of a landscape

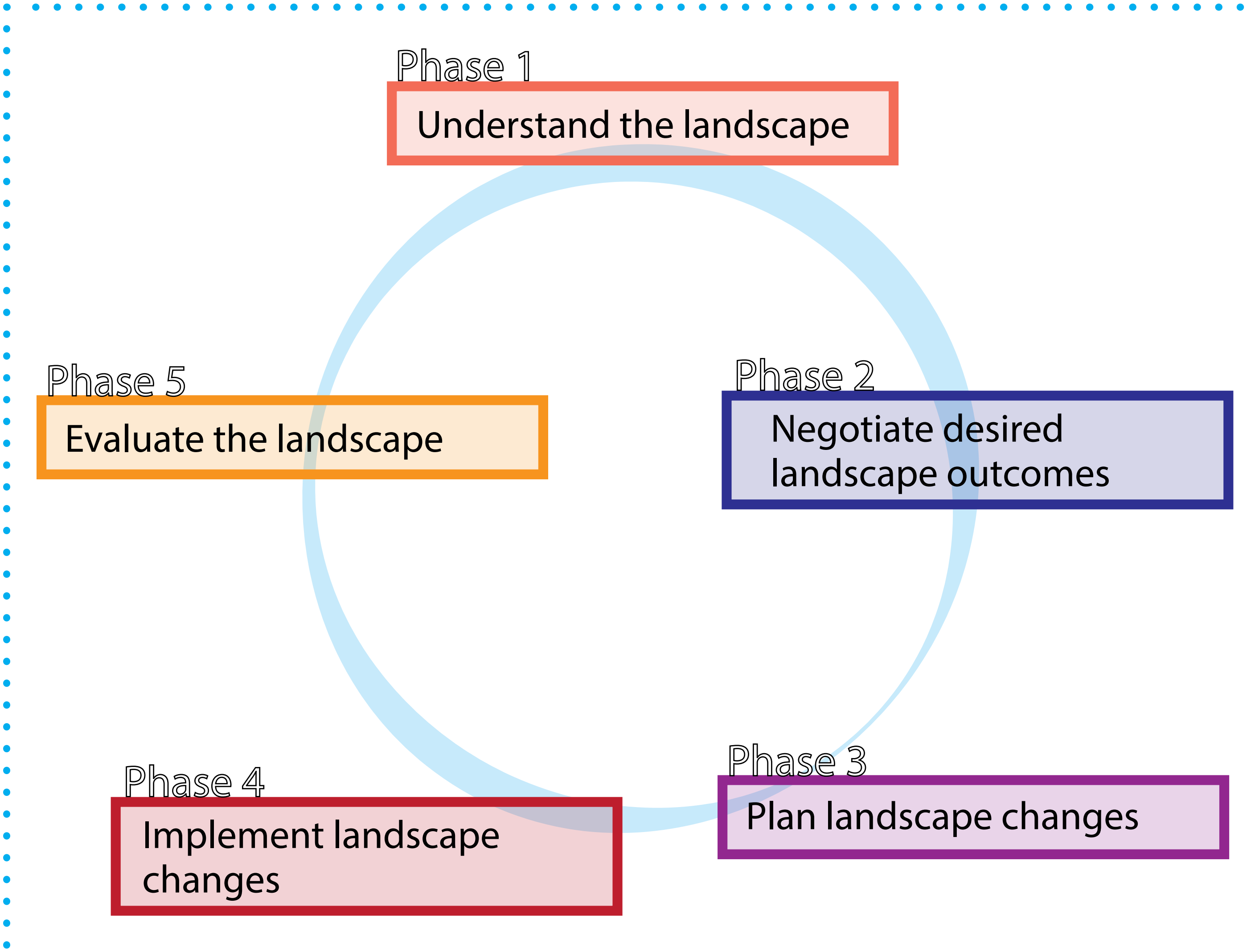


Figure 10. The five phases of adaptive collaborative management, the basis for an integrated landscape approach.

may be found in A Landscape Perspective on Monitoring & Evaluation for Sustainable Land Management: Trainer's Manual, produced by EcoAgriculture Partners and available at www.ecoagriculture.org/publication_details.php?publicationID=632. This training curriculum introduces the landscape approach as a helpful perspective for spanning different jurisdictions and stakeholders for SLM. It specifies components of a landscapes approach, the adaptive collaborative management cycle and the role of M&E in supporting integrated landscape management. Participants explore good SLM practices that lead to landscape scale benefits to help them better understand and contextualize examples of integrated landscape interventions.

Summary

- ☐ During a training event on Integrated Landscape Management, people who plan to participate in the landscape planning and monitoring process, learn about concepts and options of ILM.
- ☐ For detailed input to set up a half day or one day training, team members are referred to these documents: Sustainable Land Management in Practice – Guidelines and Best Practices for Sub-Saharan Africa (Liniger et al. 2011) and A Landscape Perspective on Monitoring and Evaluation for Sustainable Land Management: A Trainer's Manual (EcoAgriculture Partners, 2014).

2.4.2 Introduction to Maps: Enhancing Spatial Literacy

Maps are a simplified representation of a 3-D world into a 2-D object (i.e. the map). To be able to mentally make the translation from a 3-D reality to a drawn map, and the other way around, a level of 'spatial literacy' is needed. This spatial literacy can be stimulated by some exercises that will help participants to make a visual link between real-life and map objects, and improve orientation on a map.

Exercise 1

Maps: a bird's eye view on the land

Maps depict an area as seen from above. To give people a sense of this angle of view (like climbing a high mountain, or flying over), Google Earth can be used. Google Earth is a collection of aerial and satellite images of the world that can be freely accessed by downloading Google Earth onto a desktop or laptop computer (www.google.com/earth/explore/products/).

A useful feature of Google Earth is that all images are overlayed with a digital elevation model (i.e. they include elevation information). By changing the aspect (using the circle top right corner), a 3-D image of the landscape can be made (see Figures 11 and 12). Especially in areas with clear elevation changes, this will help people to orient themselves.

Google Earth is very suitable to be used in a learning event to increase spatial literacy; a facilitator can prepare the following exercise on a computer with internet connection:

1. Install and Open Google Earth
2. Make sure layers with some key landmarks are checked in the Layers View, like 'Borders and Labels' and 'Roads'
3. Zoom to the area of interest in Google Earth, making sure more or less the complete area for the planning and monitoring process is visible
4. Create a 3-D view by changing the aspect, using the little arrows in circle in the upper right corner
5. Start a Tour (Add > Tour)
6. Slowly zoom in and fly to key landmarks in the landscape: a city, a mountain range, the main road, the football stadium, the market, a river - record for 3 to 5 minutes
7. The saved tour can be shown to participants during a learning event, even without internet – make sure to 'cache' images into your computer (to increase the local storage capacity go to Google Earth, Guides > Options > Cache, then increase the number of Mb to 1000 or 2000 (see figure 13, note: the same computer that is used to create the tour must then be used during the learning event)
8. When showing the 3-D tour to participants, the facilitator points out the key landmarks and asks people if they recognize elements in the landscapes

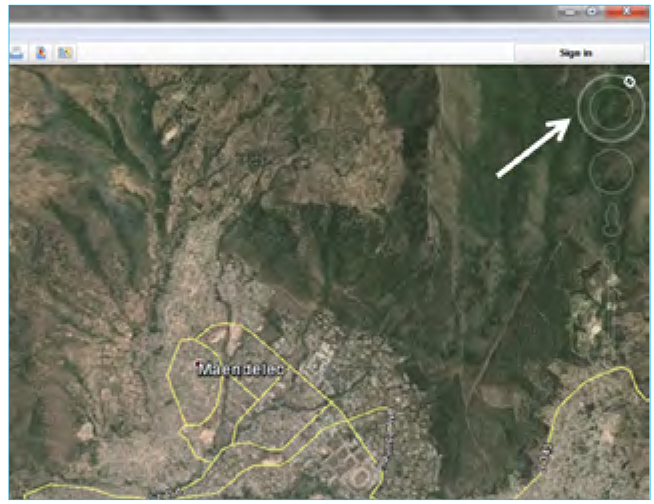


Figure 11. The earth seen from above, in the typical 2-D aspect from maps (Google Earth image) – the arrow indicates how to change the "aspect" of the image

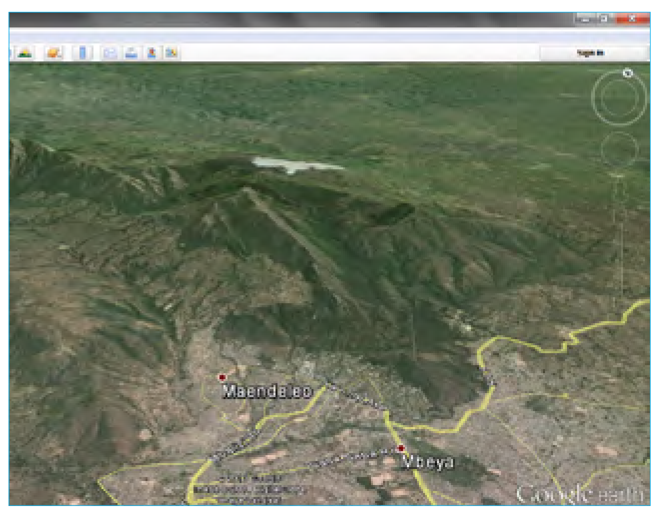


Figure 12. The same image and location as above, but with a tilted view, revealing the elevation difference (Google Earth image) – a fly-over tour can be initiated from here

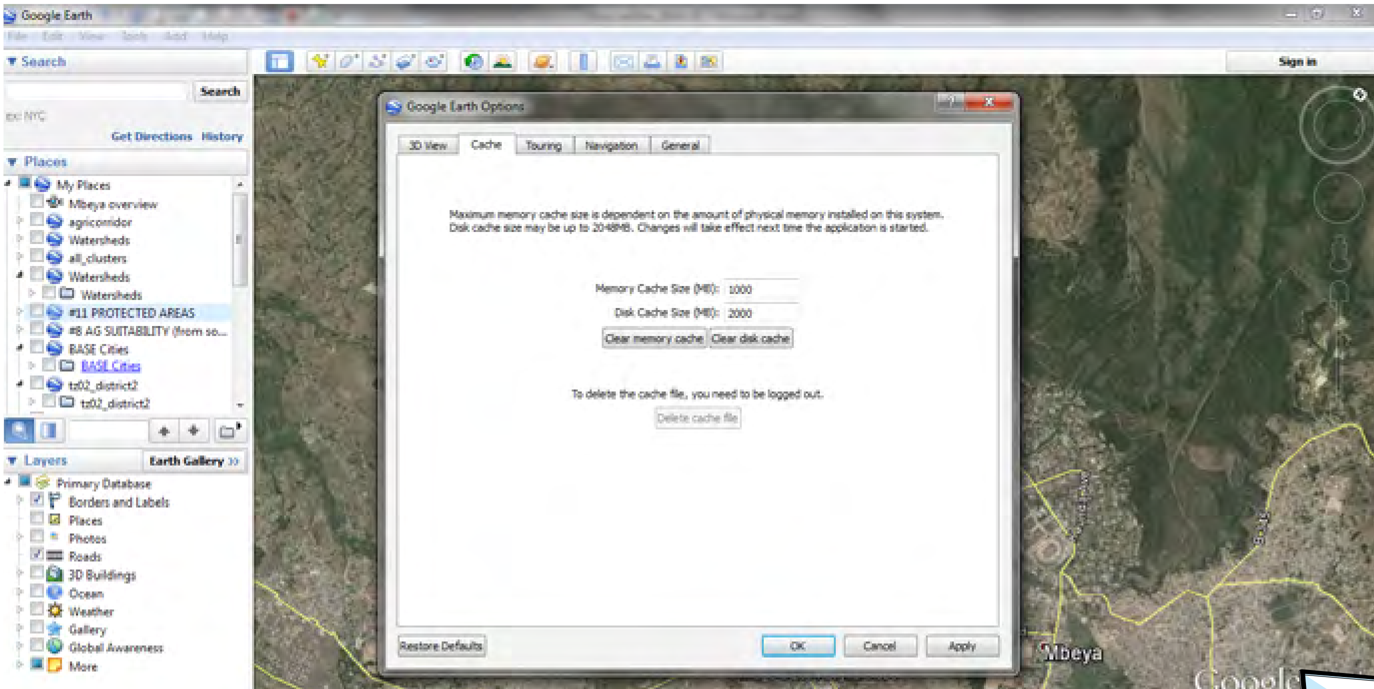


Figure 13. Set Google Earth cache options to allow for off-line usage

Exercise 2

Where are you from?

In this exercise, participants will orient themselves to locate their house, farming lands or office location on a map.

1. A large topographic map is put on the wall, the facilitator points out where the roads, rivers, villages and hills are shown on the map
2. Participants all receive small post-it notes and write their name on it
3. All participants place their post-it on the map to indicate their home, farming lands or office as accurately as possible

This straightforward exercise could simultaneously serve three objectives: 1) participants are challenged to think spatially, 2) participants get to know each other better and 3) the facilitators get a good overview of the distribution of participants in the landscape (see Figure 14).

Figure 14. Participants add post-it notes on a map to locate their homes, farms or offices

Exercise 3
Maps with different faces

Maps are made to answer the question "Where is…?". What is represented on a map depends on the mapmaker's specific interest: maps for navigation, rainfall monitoring and health care distribution. Maps vary in spatial extent, level of detail and accuracy; for the map-user it is important to be aware of this as these factors define for what purpose a map can be useful. See, for example, the wide variety of maps in Figure 15. A protected area boundary map is illustrated in Figure 16.

The third exercise involves short presentations by selected participants who are currently using maps for their work in the region. This exercise should enhance the understanding of diverse map uses and entities that use maps for different purposes and lead to an increased valuation of spatial information.

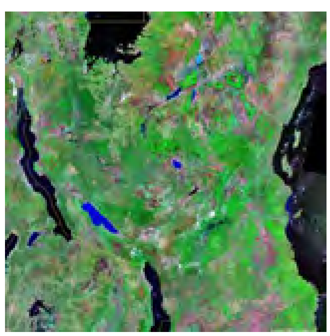
1. Prior to the training, the facilitator invites 3-5 participants to present one map they currently use
2. These maps could be community land use plans, irrigation maps, species distribution maps, roads maps for market accessibility, etc.
3. The 3-5 selected participants are asked to present their map and share with the other participants why that maps is particularly useful for their activities
4. The facilitator stimulates a question and answer session after each presentation

Figure 16. An example of a locally used map, the protected area boundary

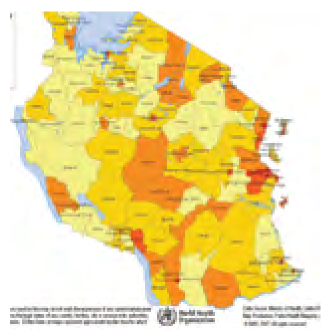
Summary

- During a training event on map literacy, participants learn to read, use and appreciate maps through exercises and facilitated discussion.
- Team members will need one to two days to prepare the described training exercises.

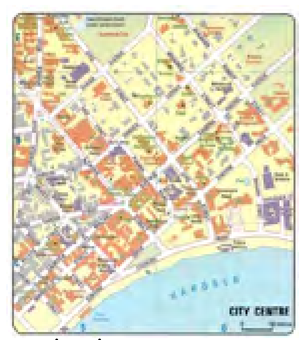
navigation



vegetation



health care



navigation

natural resource use

Figure 15. Maps with different themes, extents and levels of accuracy

Part 3

The Eight Steps of Planning and Monitoring Landscape Interventions

Part 3 will guide users through the eight linked step to locate, implement and monitor interventions in rural landscapes. These eight steps fall along the adaptive collaborative management cycle that was introduced in Part 2, and highlight the role of maps in this process. The complete planning and monitoring process typically takes place over about a year. Figure 17 shows where the eight steps of planning and monitoring landscape interventions fall within the five general phases of the adaptive collaborative management process.

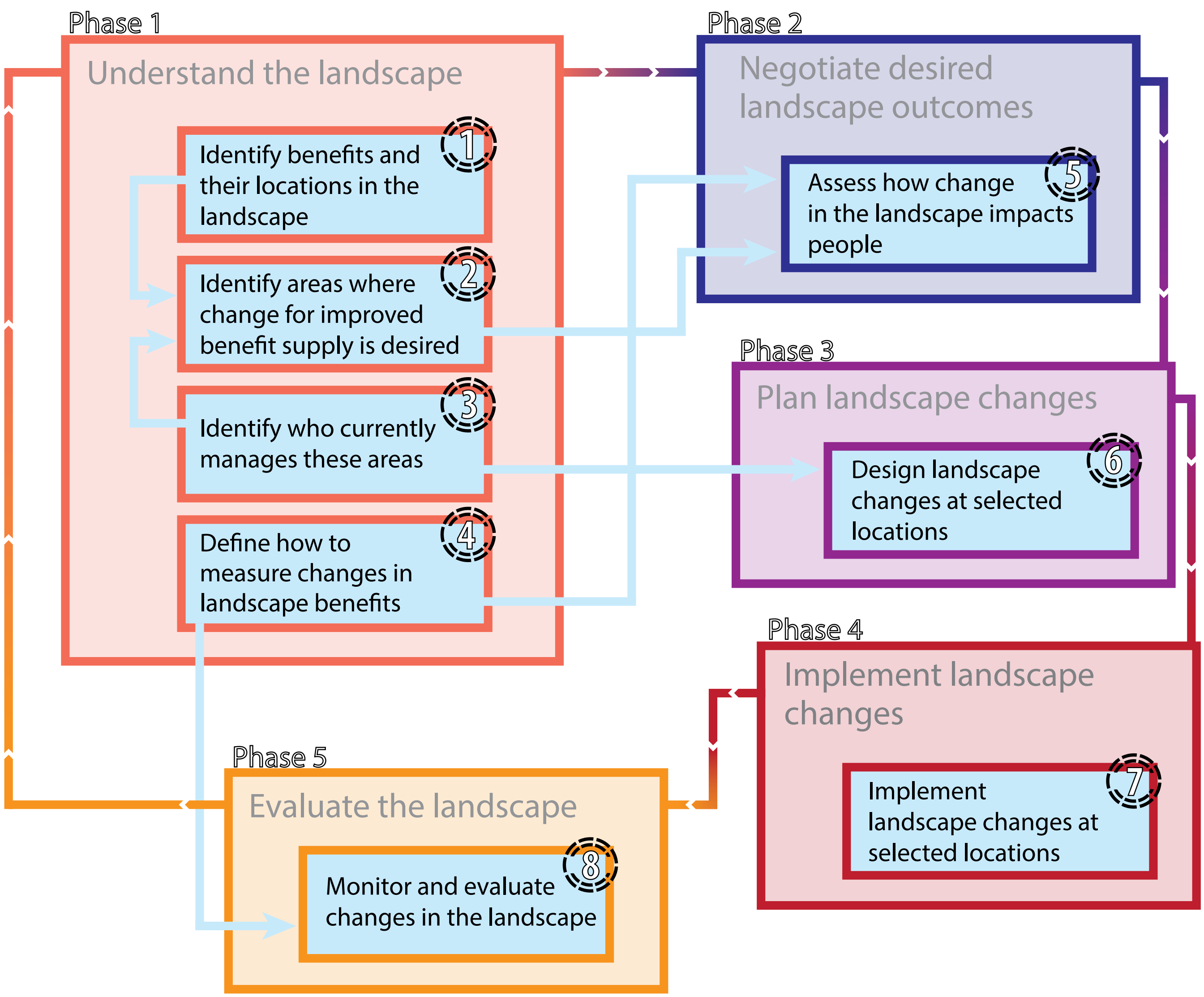


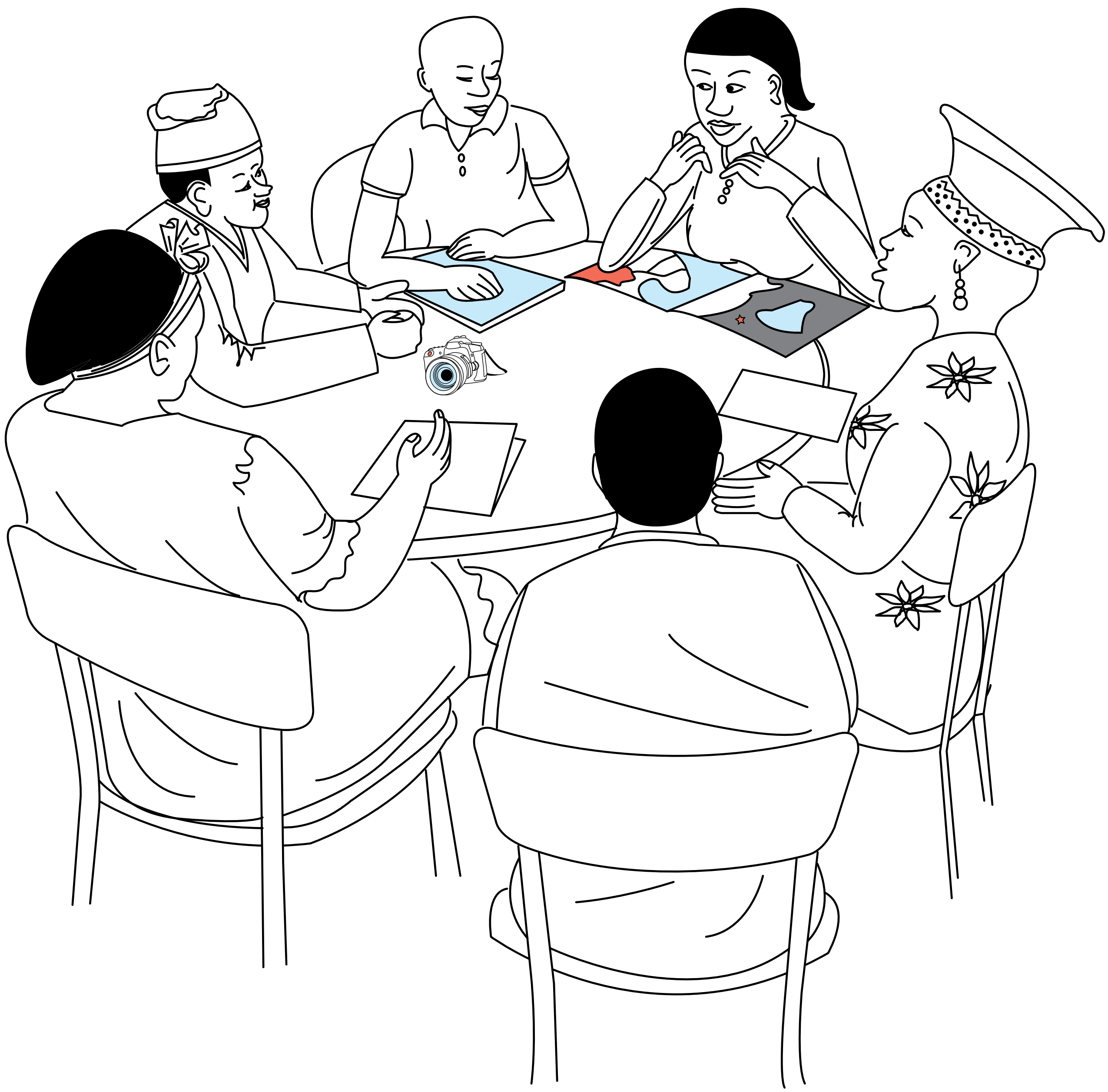
Figure 17. The eight steps of planning and monitoring landscape interventions in which maps are used within the 5-phase adaptive collaborative management process

In This Section

During the first part of the landscape planning and monitoring process, stakeholders typically take stock of the current state of the landscape; the first four steps in this guide are devoted to this stocktaking phase. First, stakeholders use maps to identify areas important in terms of landscape benefit supply (such as water supply and regulation, crop production, habitat provision and moderation of extreme climate events) and identify areas with their current governance actors where changes leading to improved landscape benefit flows are desired (Steps 1-3). This guide has a specific monitoring element that guides stakeholders to carefully describe landscape benefits in a measurable way (Step 4).

Based on the specified landscape benefits and selected areas where change is desired, stakeholders jointly discuss how a potential change in the landscape will affect different landscape benefits flows in space and time, as well as their beneficiary groups (Step 5). After consensus on desired outcomes is negotiated, in Step 6, stakeholders plan and implement preferred change(s) in the landscape using a range of maps and involving relevant governance actors.

Step 8 guides stakeholders in setting up a spatial strategy to monitor and evaluate changes in benefits flows after implementation of the landscape intervention. Stakeholders also discuss how to make their landscape planning adaptive to possible future change.



Step 1 • Identify Benefits and Their Locations In the Landscape

Phase 1

Understand the landscape

Identify benefits and their locations in the landscape 1

In This Step

Participants will make an inventory of the most important landscape benefits, according to participants, and the locations where these are generated.

Participants will learn what elements of the landscape others find important, which will facilitate communication between various stakeholders.

Materials: A topographic map, post-it notes or flags (small, single color), markers

People: Participants

Time: One day

Format: Group meeting

Figure 18. Participants locate areas that provide important benefits to them or the community

During this step the following activities take place:

1. Participants list all benefits they are aware of from their landscape, and mark the benefits that are most important to them.

   - Facilitation team makes sure all participants are comfortable with the concept of 'landscapes' and the different types of landscape benefits.
   - Participants use and add to the list of landscape benefits provided in Table 5.
   - Participants add + or ++ to the benefits they consider most important (for their own or larger community), resulting in a selection of approximately 3 to 7 'important benefits' per participant (see handout provided in Appendix 1).

2. Participants discuss the spatial dimension of these benefits: are benefits provided locally (own field) or do they come from somewhere else in the landscape, for example, from a water source.

   - Participants discuss in small groups the spatial dimension of the landscape benefits.

3. Areas that provide the most important benefits are marked on a map, as illustrated in Figure 18.

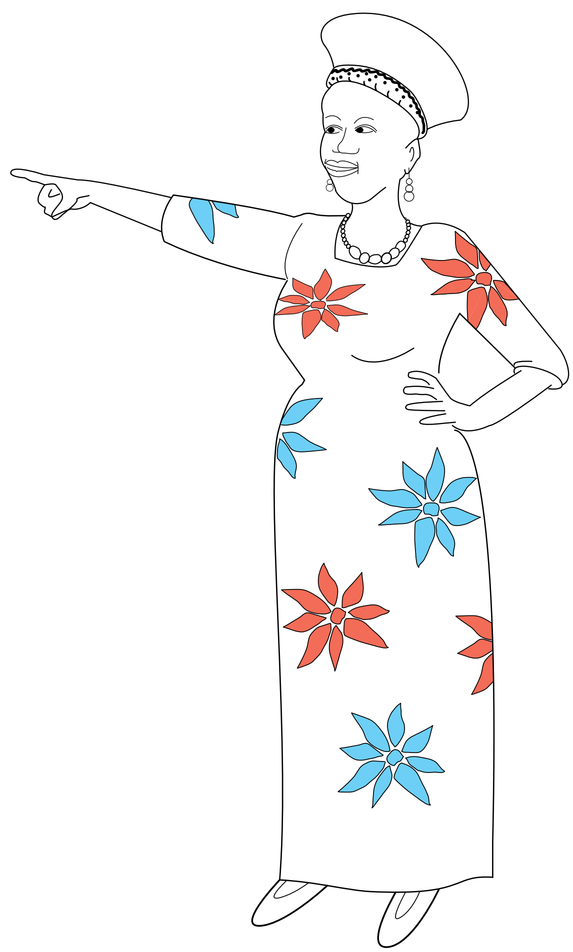
   - A way to facilitate this process: each important landscape benefit is written on one or more post-it notes. Then post-it notes are placed on the map to indicate areas that provide important benefits (not where they are used). The post-it notes can easily be placed and replaced, but are not very precise.
   - Markers can be used when all participants agree to draw more precise lines. Make sure all marks are clearly labeled with the name of the landscape benefit.
   - Single areas are likely to provide multiple benefits.
   - The facilitator takes a picture of the map for documentation.

Direct Landscape Benefits	*Indirect Landscape Benefits*
Food (e.g. collecting fruit, hunting fish and game)	Air Quality Regulation (e.g. capturing dust)
Water (e.g. for drinking and irrigation)	Climate Regulation (e.g. carbon sequestration and shade)
Raw Materials (e.g. fiber, timber, fuel wood and fodder)	Moderation of Extreme Events (e.g. storm protection and flood prevention)
Genetic Resources (e.g. wild seeds for crop improvement)	Regulation of Water Flows (e.g. natural drainage, irrigation and drought prevention)
Medicinal Resources	Waste treatment (water purification)
Ornamental Resources (e.g. artisan work and decorative plants)	Erosion Prevention
Aesthetics (e.g. joyful views)	Maintenance of Soil Fertility
Opportunities for Recreation & Tourism (e.g. attractive elements)	Pollination
Spiritual Experience (e.g. sacred forest and springs)	Biological Control (e.g. seed dispersal, pest and disease control)
	Maintenance of Genetic Diversity (esp. nursery service and gene pool protection)

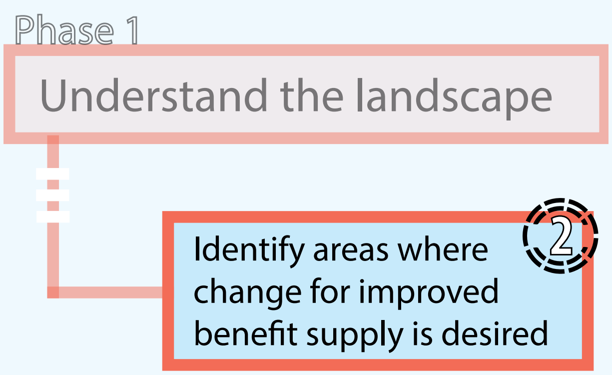
Table 5. Benefits supplied by specific locations within the landscape - Table based on the TEEB ecosystem service classification (TEEB 2010)

Summary

- [ ] The most important landscape benefits and the locations where these are supplied are identified by participants and marked on the map.
- [ ] Facilitator documents the marked and labeled map.



Step 2 ∘ Identify Areas Where Change for Improved Benefit Supply is Desired



In This Step

Participants will identify areas where change is needed in order to meet the demand for agricultural production, biodiversity conservation and livelihood security from the different participants.

Participants will likely share a wide variety of views on desired change. These should be neutrally considered as different potential scenarios.

Materials: Topographic map (unmarked), thematic maps: biodiversity map, soil suitability map, land use/ cover map, small post-it notes or flags, blackboard or flip charts

People: Participants

Time: One day

Format: Group meeting

The following proposed activities take place:

1. Participants discuss which areas in the landscape have recently changed or are currently changing, and discuss how this influences the most important landscape benefits (Step 1).

- Participants will gain insight into the temporal dimensions of a landscape during this activity
- The facilitator stimulates the discussion
- Participants discuss in small groups: What did the landscape look like 5, 10 and 15 years ago? What has changed and why? What are the trends?
- Participants discuss how these changes have had an effect (negative or positive) on the important landscape benefits (as listed in Step 1)

2. Participants share their views on their preferred development of agricultural production, biodiversity conservation and livelihood security in the landscape within the coming 5-10 years.

- The facilitator guides the discussion and collects all views for the different objectives on a blackboard or on flip charts (agreement on future objectives is not needed yet)
- Clearly different or contrasting objectives are numbered e.g. Agriculture 1: expansion on production area, Agriculture 2: change to irrigated rice, etc., while the facilitator groups similar objectives

3. Participants link the listed objectives to landscape benefits.

- Participants discuss what landscape benefits (Step 1) are needed to reach their landscape objectives (see examples in Appendix 1)
- Participants discuss what elements shown on the thematic maps will help them locate landscape benefits (Figure 19)
- Participants will realize that not all landscape benefits are visible on maps, nor are the quantity of the provided benefits (yield, water volume), therefore their knowledge of the area is crucial in this planning process (see Table 6 as guidance)
- Participants revise the list of important landscape benefits (Step 1) and add missing landscape benefits that support their landscape objectives

4. Areas where action is needed to meet these different goals are identified on a map.

- The facilitator asks participants to globally locate each area where changes are needed to increase benefits that support the different objectives – these are marked with post-it notes or drawn on the topographic map, while consulting the thematic maps
- Multiple locations per objective can be identified
- The facilitator takes a picture of the map for documentation

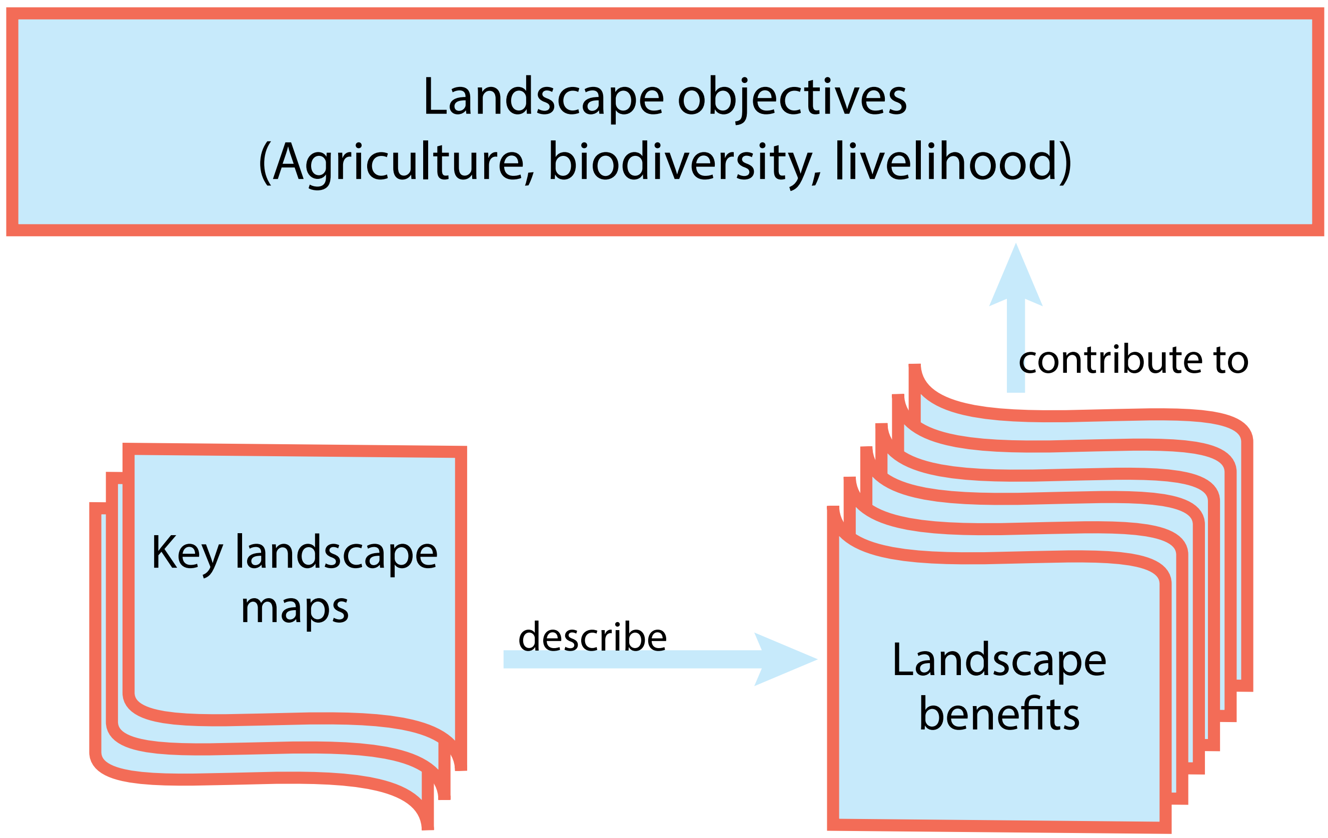
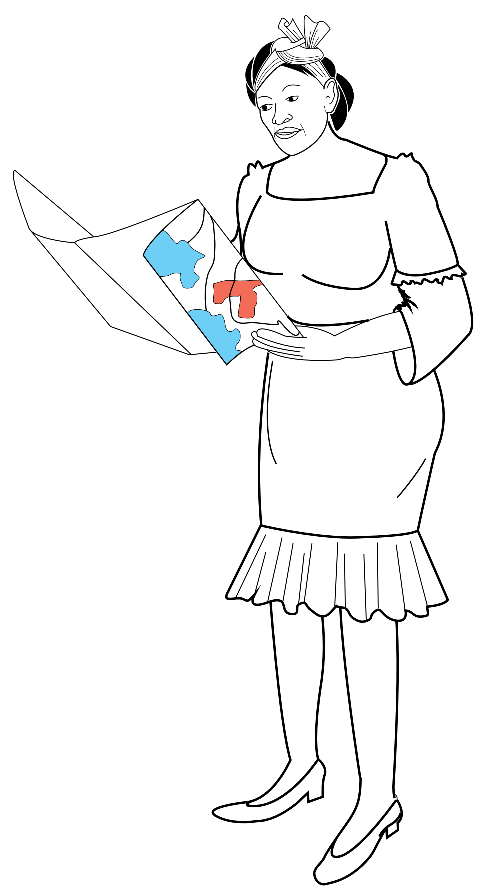


Figure 19. Linking landscape maps, benefits and objectives: Landscape maps can be used to approximately locate the area where landscape benefits are supplied. The landscape benefits contribute to the overall achievement of landscape objectives.

Summary

- [ ] Different areas where change is desired are marked on a map; contrasting objectives are labeled as different scenarios.
- [ ] The list of important landscape benefits (Step 1) is expanded with landscape benefits that support/contribute to the landscape objectives.
- [ ] The facilitator documents the marked and labeled map.



Landscape Benefits	*Supporting Maps Sources*
Direct benefits, through the provision of:	
Food (collecting fruit, hunting fish and game)	Crop land and plantations are shown on a land use map. Game and fish can be located based on their habitat seen in a land cover map (e.g. forest and lakes)
Water (e.g. for drinking, irrigation and cooling)	Land cover maps show lakes, while topographic maps are better for streams
Raw Materials (e.g. fiber, timber, fuel wood and fodder)	Land cover maps show forested areas, shrub lands and grass lands that could be used for timber and fuel wood and fodder
Genetic Resources (e.g. seeds for crop improvement)	Land cover maps could show the habitat of a specific variety that could be used for crop improvement (crop wild relatives)
Medicinal Resources	Land cover maps could show the habitat of specific medicinal species
Ornamental Resources (e.g. artisan work and decorative plants)	Land cover maps could show the habitat of specific ornamental species
Aesthetics (e.g. joyful views)	Land cover maps could show patterns in a landscape that are considered beautiful (e.g. diverse patterns or lake views); Topographic maps show the elevation for viewpoints
Opportunities for Recreation & Tourism	Multiple sources are needed: Topographic map shows accessibility of an area (i.e. roads and rivers), the land cover map could indicate the aesthetics and the biodiversity map, presence of attractive species. Locations that are accessible and attractive could supply this benefit
Spiritual Experience (e.g. sacred forest and springs)	If relevant: land cover maps indicate forested areas, the topographic map, springs and streams
Indirect Benefits, through the provision of:	
Air Quality Regulation (e.g. capturing dust)	Land cover maps show vegetation that could perform this function
Climate Regulation (e.g. carbon sequestration and shade)	Land cover maps show vegetation that could perform this function, especially forested areas
Moderation of Extreme Events (e.g. storm protection and flood prevention)	Land cover maps show vegetation that could perform this function (e.g. mangroves for coast line protection)
Regulation of Water Flows (e.g. natural drainage, irrigation and drought prevention)	Land cover maps show vegetation that could perform this function
Waste Treatment (water purification)	Land cover maps show vegetation that could perform this function
Erosion Prevention	Land cover maps show vegetation that could perform this function when on hilly terrain, which is shown on a topographic map, especially for highly erodible soils (seen on a soil map)
Maintenance of Soil Fertility	Land cover maps show vegetation that could perform this function
Pollination	Land cover maps show vegetation that could provide habitat to pollinators, within a certain distance of cropland as show on a land use map
Biological Control (e.g. seed dispersal, pest and disease control)	Land cover maps show vegetation that could provide habitat to animals providing the service, within a certain distance of cropland as show on a land use map
Maintenance of Genetic Diversity (e.g. nursery service, gene pool protection)	Land cover maps show vegetation that could perform this function, together with areas that have a special conservation status shown on the protected area map

Table 6. Landscape benefits and the maps that can be used to locate them with the addition of local knowledge - table based on the TEEB ecosystem service classification (TEEB 2010)

Step 3 • Identify Who Currently Manages These Areas

Phase 1

Understand the landscape

Identify who currently manages these areas

In This Step

Participants will make an inventory of the current decision makers in the areas where change is desired (Step 2). These are the people that currently have a say about land and water management practices, protection status, market regulations, etc. Many of them will be part of the participant team.

Materials: Topographic map, with marks from Step 2, blackboard or flip charts with notes from Step 2.

People: Participants

Time: Half a day

Format: Group meeting

The following proposed activities take place:

1. Participants define who governs, owns and manages the areas where change is desired.

- Participants add to the list of landscape objectives identified in Step 2 the different organizations, persons or management structures in place that make decisions about the listed landscape benefits or areas (see Figure 20)
- Participants take into account that decision making often takes place at different spatial levels (i.e. field, district, watershed and country)

2. Participants list current administrative mechanisms, bylaws and regulations for the area and resource management at local and national level.

- Participants identify the administrative regulations in the areas of desired changes from Step 2 and sectoral objectives that could be barriers or create opportunities for the envisioned landscape changes
- The rules and regulations do not need to be described in detail during this step
- The facilitator takes a picture of the blackboard or flip chart for documentation

Area 1: Decision Makers Agricultural Development Objective

Community: *land owner*

Water board: *irrigation water manager*

Ministry of Environment: *pesticide use regulations*

Area 2: Decision Makers Conservation Objective

Community: *land owner*

Water board: *irrigation water manager*

Ministry of Environment: *pesticide use regulations, protected area enforcement*

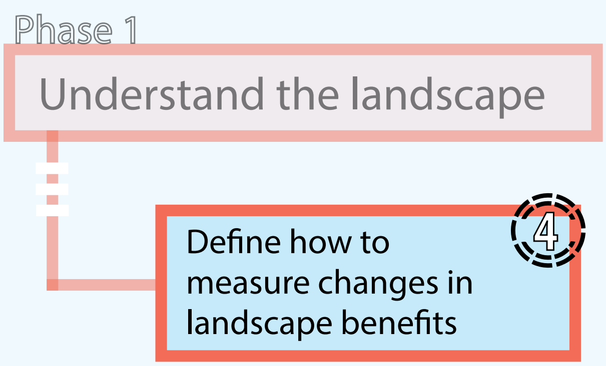
Figure 20. Example list of current decision makers at different levels for an area where change is desired in the landscape

Summary

☐ Make a list of the governance, management and administrative systems in place in areas where landscape change is desired.

☐ The facilitator documents the list of governance and management systems.

Step 4 • Define How to Measure Changes in Landscape Benefits



In This Step

After taking stock of the current benefits, changes, management objectives and governance structures in the landscape, participants will carefully describe the landscape benefits identified in Steps 1 and 2 in a measurable way.

Making landscape benefits explicit will help set and communicate landscape planning goals, collect baseline information and track changes to measure impact of the landscape interventions over time.

Materials: Topographic map, with marks from Step 1, blackboard or flip charts, list of important landscape benefits and objectives (from Steps 1 and 2), thematic maps: biodiversity map, soil suitability map, land use/ cover map.

People: Participants

Time: Half a day

Format: Group meeting

The following activities take place:

1. Participants define appropriate data types or (proxy) indicators to describe and measure landscape benefits and/or their impact on people.

- Based on the list of most important benefits (Step 1, 2), participants decide on measurable metrics or indicators for landscape benefits – these could be m3 of clear water per year, score for wellbeing, hectares of protected forest or income per year
- Participants can decide to collect 'response indicators' related to the overall landscape objectives instead of landscape benefits, since these can be more visible and easier to measure
- For example, instead of measuring soil fertility (benefit), collect yield data (agriculture objective) – the advantage of measuring these landscape objective indicators is that these directly relate to the final planning aims (the impact), however, to achieve the landscape objective, underlying landscape benefits need to be managed adequately (e.g. yield depends on pollination, soil fertility, water flows benefits, etc.)
- Describing landscape benefits in a measurable way can guide these management practices

2. Participants discuss the size of the benefit-providing area and variation in time of the benefit flows (e.g. seasonality).

- Participants discuss and add the temporal variation of landscape benefit flows (dry season, tourist season) to the description of the spatial dimension of landscape benefits (from Step 1)

3. Participants define feasible data collection methods.

- Based on the area and temporal variation, participants decide how, when and where they can best monitor changes in landscape benefits (e.g. through field measures, surveys, photography) and decide on a documentation approach (e.g. GPS to collect coordinates and plot observation on a map, lists with scores per village, etc.)
- Maps are used to locate crucial sample points for selected landscape benefits (using Table 5)
- The Landscape Measures website provides an overview of indicator selection approaches and data collection methods, see: www.landscapemeasures.info/?p=59
- Ground-based photo-monitoring and the landscape scoring card are two well documented and tested methods that could serve the objective (see Appendix 2)

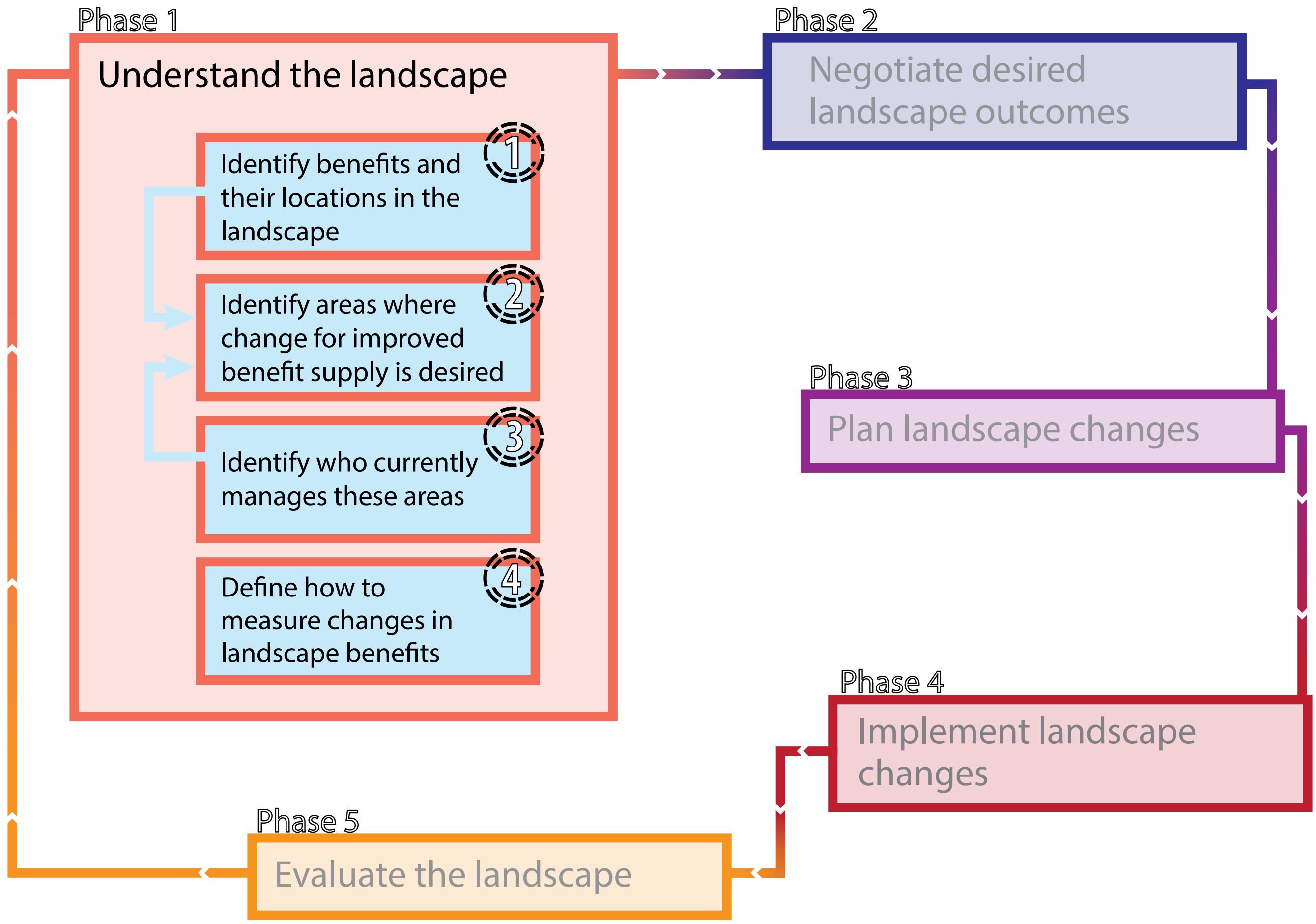
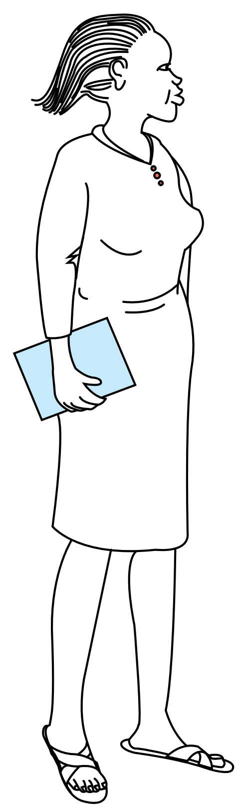


Figure 21. The four steps to understand and take stock of the landscape using maps

Summary

- [ ] For each important landscape benefit or objective, a measurable indicator and data collection method is defined.
- [ ] The facilitator documents the list of indicators and methods.
- [ ] This last step in the collaborative management phase focuses on understanding the landscape. In the next step, the different planning options are assessed and negotiated (see Figure 21).



Step 5 • Assess How Change in the Landscape Impacts People

Phase 2

Negotiate desired landscape outcomes

5 Assess how change in the landscape impacts people

In This Step

Participants will assess the impact of the implementation of a landscape intervention on a wide range of landscape benefits and their users.

Based on earlier specified landscape benefits and selected areas where change is desired to meet landscape objectives (from Step 2), stakeholders will jointly discuss how a potential change in the landscape will affect flows in different landscape benefits and beneficiary groups, and hereafter select the most desirable landscape intervention(s).

Materials: Topographic map, with marks from Step 2, thematic maps: biodiversity map, soil suitability map, land use/cover map

People: Participants, experts

Time: ½ to 8 weeks

Format: Technical consultations and group meetings

The following activities take place:

1. Participants propose interventions to improve agricultural production, biodiversity conservation and livelihood security for the selected locations.

- Participants, after consultation with technical experts, propose a range of landscape interventions to achieve their objectives at selected locations (Step 2) – these interventions can range from changes in field practices, to reforestation, to new governance structures, marketing opportunities or a combination of these and others.
- Landscape interventions aim to improve supportive landscape benefits for that specific objective (see Step 2, e.g. increased production needs pollination services, water regulation and soil erosion prevention) and supportive governance and market structures (Step 3).
- Participants assess costs (time and money) and material availability (e.g. stones, planning material).

2. Participants assess the change in future benefit flows to sectors/stakeholder groups after a landscape intervention (i.e. post-impact assessment conducted prior to implementing changes).

- Participants define for each landscape benefit the specific beneficiary groups (people that all profit in the same way and location from a landscape benefit). These could be upstream/ downstream farmers, women, retailers, non-farmer villagers, park rangers/ conservationists, etc.
- After consultation with technical experts, participants assess the impact of each proposed landscape intervention at a specific location, on all important landscape benefits (see Step 1, not just the supporting benefits for an objective) and, therefore, also assess impact on beneficiary groups. See example Table 7.
- Participants describe the impact of landscape interventions on landscape benefits as explicitly as possible using the measurable indicators as defined in Step 4.
- Participants will unavoidably discover that it will be difficult to quantify or assess impact for all benefits, however, the joint discussion on how proposed interventions will impact different landscape benefits and people will contribute to this collaborative integrated planning process.

3. Participants discuss the potential synergies or conflicts resulting from a planned change in the landscape.

- Landscape interventions that have positive effects on landscape benefits, which also support other landscape objectives have a synergetic character (e.g. grassy vegetation strips to prevent erosion, also supply harvestable fodder for livestock production), while landscape interventions that have negative effects on landscape benefits that are supportive benefits for other landscape objectives result in trade-offs (e.g. road construction to improve market access could reduce connectivity of natural areas, which negatively impacts biodiversity conservation objectives). The

Landscape Objective (Step 2)	*Needed Supporting Landscape Benefits (Step 2)*	*Supporting Governance or Market Structures (Step 3)*	*Intervention to Reach Objective*	*Impact on All Landscape Benefits (Step 1)*	*Impact on Stakeholder Groups*
Increased total crop yield in the district	Water Water regulation Erosion control Biological control Pollination	Water board Community	Flowering-tree line planting	**Positive** 1. Water regulation 2. Erosion control 3. Biological control 4. Pollination 5. Climate regulation 6. Habit **Negative** 1. Decreased area for crop growing **Neutral** 1. Medicinal resources	**Positive** 1. Farmers 2. Downstream community **Negative** 1. Farmers **Neutral** 1. Women

Table 7. Example to assess the impact of each proposed landscape intervention

desired outcome is one that optimizes benefit flows among beneficiaries, and upon which stakeholders can agree.

- Participants discuss these synergies and trade-off for the different beneficiary groups.

4. Based on the joint impact assessment, participants decide on the preferred set of landscape interventions.

- Participants aim for consensus using the impact assessment table (see Table 7).
- Participants highlight the location of the selected interventions on the topographic map.

Summary

- ☐ For each landscape objective from Step 2, interventions are proposed to reach the objective. Experts will advise participants.
- ☐ The impact of landscape interventions on all important landscapes benefits and beneficiaries is assessed. Experts will advise participants.
- ☐ Participants select a preferred set of landscape interventions.
- ☐ The facilitator guides the discussion and documents the list and map with proposed landscape interventions.

Step 6 • Design Landscape Changes

Phase 3

Plan landscape changes

Design landscape changes at selected locations (6)

In This Step

Participants will design and plan for a preferred change in the landscape using a range of maps and involving relevant governance actors.

Participants will need the outputs of the analyses done in previous steps to select the most desirable landscape interventions. These outputs include the list of most important benefits from Steps 1 and 2, the inventory of the current decision makers in the areas where change is desired from Step 3, the indicators for landscape benefits selected in Step 4 and information on how potential changes in the landscape will affect flows in different landscape benefits and beneficiary groups that was gathered and discussed in Step 5.

Materials: Topographic map with marks of Step 2 and 5, unmarked topographic map, thematic maps: biodiversity map, soil suitability map and land use/cover map, results of steps 2 through 5 in easy to understand formats

People: Participants, experts

Time: ½ to 8 weeks

Format: Consultations, group-meetings and collaborative planning processes

The following activities take place:

1. Participants plan each landscape intervention by:

- Involving the diverse stakeholders identified in Step 3 in selecting interventions to generate buy-in for the proposed interventions and prepare stakeholders to adopt the planned changes
- Using information from previous steps, the group identifies possible interventions that can maximize synergies among benefits for different stakeholders and minimize potential trade-offs
- Identifying a process for prioritization of landscape interventions; stakeholders can identify and agree upon their own criteria for prioritization of landscape interventions and an important one to consider is that the intervention will contribute to multiple landscape
- Using a range of maps and other spatial information (e.g. expert knowledge and location specific weather tables) to locate the exact location of the selected intervention(s) (based on Step 2 and Step 5)
- Designing a management (including maintenance) plan inclusive of actions, timeline, skilled and unskilled labor, materials and financial resources, and considering how these activities can be integrated into existing planning and implementation frameworks

To develop proposed landscape changes, it is useful to think of the full range of intervention types including agricultural, conservation, market, institutional and policy and training and capacity building activities. As identified in the introduction section, these categories of interventions should include types of changes that contribute to landscape outcomes or benefits.

Practitioners working on sustainable land management have developed categories of SLM interventions inclusive of crop and livestock farming, conservation and biodiversity conservation practices, as well as supporting institutional and policy mechanisms. Interventions that rehabilitate degraded land and also contribute to the enhancement of ecosystem services include for instance a) agronomic measures, such as the use of animal and green manures that enhance soil organic matter and b) institutional interventions that put in place new management structures that support a change in land use type through the development of community by-laws, such as zero-grazing areas or area enclosures (Linger, 2011).

Table 8 summarizes some of the landscape benefits that are gained from these SLM interventions.

An example of the outcomes of a landscape planning process in Mbeya, Tanzania is illustrated in Figure 22. Stakeholders have identified cross-sector interventions such as a system for rice intensification (crop and livestock conservation practice) that reduces water and energy needs and use of

Landscape Interventions that Contribute to Multiple Landscape Outcomes and Benefits

» Crop and livestock farming conservation practices that increase soil fertility, water retention, carbon sequestration and other ecosystem services at the landscape level, while reducing levels of water and energy needed and pollutants generated;

» Biodiversity conservation practices such as conservation corridors, buffers and others that improve habitats and reduce negative interactions between wildlife, farming and other human activity and help promote local livelihood security;

» Markets and marketing approaches that reward farmers for ecologically sustainable production practices;

» Institutional and policy mechanisms that provide incentives and support for collaborative investment by public, private and civic sectors;

» Training, extension and capacity building practices that strengthen knowledge and capacities for planning, implementing and monitoring any of the other four types of intervention activities or the integrated management of landscapes.

SLM practice	*Landscape-scale Benefit(s)*
Hillside Terracing	Reduces runoff velocity, minimizes erosion and increases soil fertility and forest rehabilitation
Percolation Deep/Normal Trenching	Enhances underground water recharge, controls sediments and rehabilitates degraded landscapes
Pond	Used to harvest rain water for domestic purposes, livestock and vegetable and fruit production
River Water Diversion	Enables the use of water for irrigation and regulates river water flow
Stone Bund	Reduces the velocity of runoff, minimizes erosion and increases soil moisture
Spate	Reduce the velocity of runoff, minimizes erosion, stimulates irrigation practices and increased crop production
Gully Check Dam	Enhances recharge of underground water, retains moisture, prevents land degradation and traps sediments
Tree Plantations	Improves vegetation cover, increases biodiversity, reduces runoff erosion, minimizes erosion and diversifies source of income
Grass Planting	Controls erosion, serves as source of animal feed and raw material for housing
Bee-keeping, Fattening, Dairy, Fruit and Vegetables	Reduces pressure on land and enhances watershed sustainability and livelihood diversification

Table 8. Examples of farming and biodiversity conservation practices and their relation to the desired landscape outcomes

pollutants through the sustainable intensification of rice production. Stakeholders proposed to introduce water user associations (institutional and policy mechanisms) in areas where they are not yet established to conserve and mange water efficiently and protect key water sources through biodiversity conservation structures, thereby protecting critical watershed and ecosystem services. Landscape labeling (a marketing approach intervention) for rice helps increase farmers' incomes by rewarding them with market prices that recognize the ecosystem service benefits created through the sustainable production practices. Tree planting in important biological corridors with indigenous species (biodiversity conservation intervention) increases biodiversity and provides habitat for wildlife while providing carbon mitigation benefits.

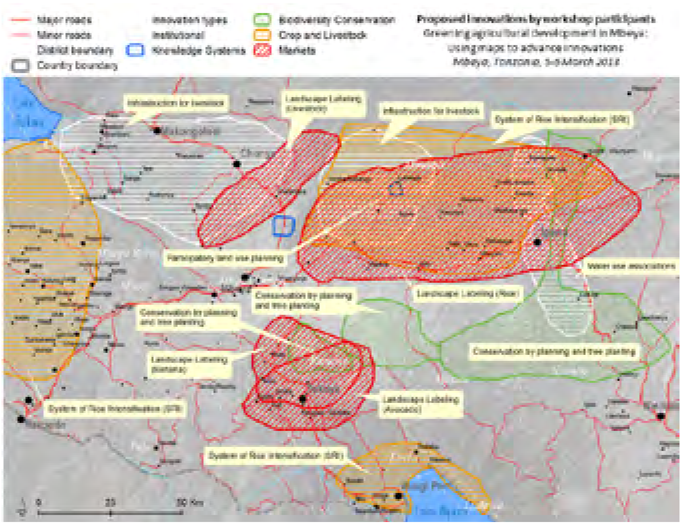


Figure 22. A landscape planning map illustrating proposed landscape changes of different types

Summary

- For each landscape intervention, a detailed implementation plan is made, including a map, scheduled technical actions, supporting governance structure and a financing plan.
- Two types of (overlapping) teams are formed: a planning and a management team.
- The facilitator makes sure all roles and actions are clearly communicated within the planning and management teams, and provides backstopping if needed.

Step 7 • Implement Landscape Changes

Phase 4

Implement landscape changes

7

Implement landscape changes at selected locations

In This Step

Participants implement and manage planned landscape interventions.

Materials: Planning map from Step 6

People: Planning and management team

Time: 1 to 26 weeks, or more, for implementation and ongoing for management and continued activity

Format: Action

Figure 23 illustrates one of many potential interventions that can yield multiple landscape benefit flows.

Summary

- [ ] Each landscape intervention is implemented and managed according to plan (Step 6).
- [ ] The collection of baseline information for monitoring (Step 8) starts.
- [ ] The facilitator provides backstopping if needed.

Figure 23. Implementing contour strips

Step 8 • Monitor & Evaluate Changes

Phase 5

Evaluate the landscape

Monitor and evaluate changes in the landscape

8

In This Step

Participants will track changes in landscape benefits by guiding stakeholders in setting up a strategy to monitor and evaluate changes in benefits flows after implementation of the landscape interventions.

During this phase, participants and stakeholders also plan a strategy for making their spatial landscape planning adaptive to possible future change.

Materials: Topographic map, with marked areas for important landscape benefits supply from Steps 1 and 4, plus the planning map from Step 6

People: Participants

Time: 1 to 3 days to design a monitoring strategy, subsequent monitoring according to strategy

Format: Consultations and group-meetings

The following proposed activities take place:

1. Participants develop a data collection strategy to monitor changes in the landscape.

- Participants revise data collection methods, for example field measures, surveys, photography, scoring tools and group interviews (Step 4), and define the location and frequency of the data collection for monitoring changes on landscape benefits (using important benefits and their location from Step 1)
- Preference is given to indicators and methods that can be used to measures multiple benefits (e.g. vegetation cover and soil organic matter)
- Participants decide on a data collection strategy and assign roles

2. Participants collect baseline information.

- In parallel with implementation (Step 7), participants start their first round of data collection to create a baseline

3. Participants discuss how to make the planning adaptive to possible future change.

- Participants decide on how to analyze monitoring data
- Participants decide on an adaptive management mechanism

4. Participants evaluate the supply of landscape benefits to support their objectives.

- Based on the new state of the landscape, participants move through the different stages of the management cycles again: assess the state of the landscape, revise management strategies, assess the impact of new management strategies, plan for changes, implement changes and monitor changes (Figure 24)

Summary

- [ ] A landscape benefit monitoring strategy and team are created.
- [ ] Indicators and measurement methods are chosen.
- [ ] Baseline data for intervention evaluation is collected.
- [ ] A strategy for adaptive management is developed, allowing participants to move through the different stage of the management cycle again.
- [ ] The facilitator provides backstopping if needed.

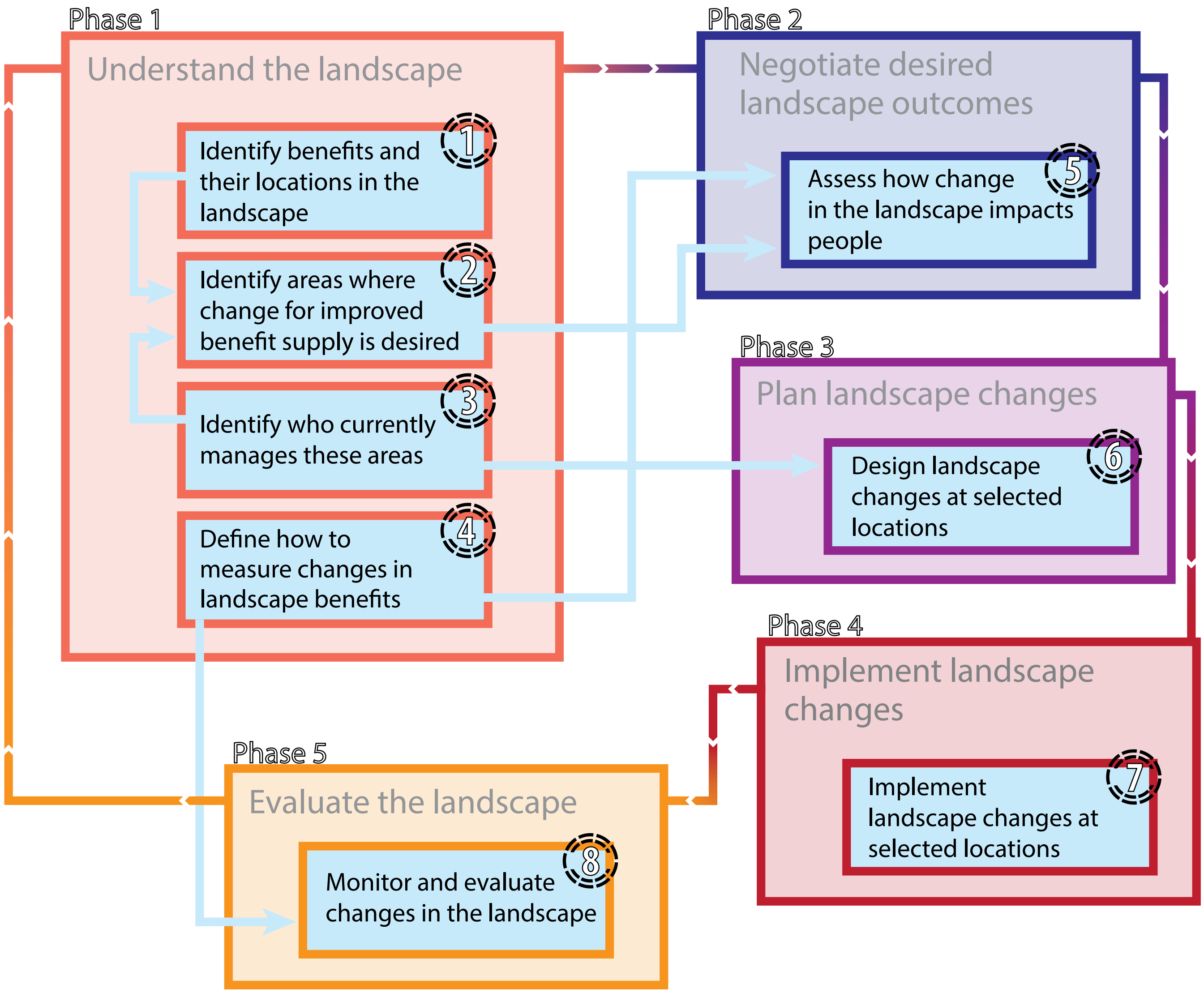


Figure 24. Adaptive management stimulates stakeholders to revise management strategies based on monitoring and evaluation practices

Part 4

A Case Study on the Use of Maps in Lower Burqa Abagabir Wejig Micro-Watershed, Southern Tigray, Ethiopia

This case study examines the current use of maps and the limitations encountered in their use for SLM planning and monitoring in the Lower Burqa Abagabir Wejig micro-watershed of southern Tigray, Ethiopia. It pinpoints challenges and opportunities that could influence the prospect of map use for SLM activities in the future. Data were collected using group discussion and semi-structured interviews with different stakeholders and analyzed qualitatively.

The inquiry reveals that practitioners of SLM in the Wejig micro-watershed are far from making good use of standard topographic maps for SLM activities. Current practices include delineation of watershed boundaries and depiction of various land use categories with hand drawn sketch maps prepared by the local community watershed teams. Although the sketch maps are valuable for indicating particular characteristics at the micro-level, they cannot be counted on to provide accurate spatial information, especially at the watershed scale. Planning, implementing and monitoring practices are exposed to mistakes and wasting of time and resources. The case study also reveals that maps are not used at all for monitoring SLM performance. Poor internet access, poor coordination among SLM stakeholders and lack or shortage of skill and knowledge to produce and use standard maps were identified as the major barriers hindering the preparation and usage of standard maps both for SLM planning and monitoring. In this regard, the promising role of the Spatial Planning and Monitoring Guide to alleviate the technical gaps of map making and using them for SLM planning and monitoring activities is noteworthy.

This case study was prepared by Ayal Yayeh Desalegn.

Introduction

Ethiopia's Lower Burqa Abagabir watershed is an area where SLM is being implemented with concerted effort and commendable results. Within this area, EcoAgriculture Partners has been testing the Spatial Planning and Monitoring Guide to plan interventions and monitor performance of SLM activities in the Wejig micro-watershed. This case study is part of EcoAgriculture Partners' initiatives that explore how the design, implementation and motoring of SLM activities must be customized according to biophysical and socioeconomic differences in various localities of the watershed. Accordingly, this study discusses how planning and managing SLM interventions in highly variable conditions across localities – due to differences in biophysical attributes (land use type, land cover change, degree of land degradation or deforestation, geology, climate, water flows, soil suitability, etc.), socio-economic conditions (literacy, population density, land hold size, type of livelihood, etc.) and infrastructure (health, education, road, market access, etc.) – can be aided by maps. Specifically, this case study presents the role of standard map preparation and proper reading of maps for better planning and monitoring of SLM practices.

Statement of the Problem

Maps are indispensable sources of spatial information about the location, size and boundary of natural resources that are critical for conflict resolution (Saipothong & Thomas, 2007). Over the last two decades, advancements in digital infrastructure, such as spatial data processing, internet and telecommunication, has contributed to the production of maps with accurate and up to date information about resources (Osundwa, 2001). Maps enhanced with satellite imagery or aerial photography are effective tools to assess the state of natural resources, climate and the cultural and physical landscape of an area (Prasad, 2001). Better cooperation on natural resource use and conservation among various stakeholders could be facilitated through the use of accurate maps (Grace, Andrew & Steven, 2008), because cataloging, processing and managing spatial information is difficult without standardized maps (Okpala, 2003; Kheir, 2002). Practices in the study area suggest that maps are used sub-optimally to identify, plan and monitor SLM. As discussed below, problems related to professionalism, logistics and coordination adversely affect the viability of maps in SLM planning and monitoring. This study highlights the valuable use of participatory sketch maps in planning SLM interventions, and summarizes problems brought about by inadequate maps for planning and monitoring the full range of SLM activities as well as measures needed to rectify the problems in the future.

Methodology

Healey (1996) noted that a sound appraisal of the merits and demerits of planning and monitoring activities is possible where data collection is inclusive of all pertinent stakeholders. Cognizant of this, in April 2014 data for this study were collected from government agricultural experts at different levels, professionals in GIZ-SLM involved in activities in the study site, researchers, the community watershed team, the Kebele watershed team and local farmers in the Lower Burqa Abagabir Wejig micro-watershed. In addition, field observations were conducted with the aid of concerned government functionaries. Because a qualitative approach permits in-depth and valuable data collection (Murtagh, 1999), thematic content analysis was performed and presented qualitatively.

Objectives

The general objective of the case study was to examine the role of maps in planning and monitoring the ongoing SLM practices in the Lower Burqa Abagabir Wejig micro-watershed. The study had the following specific objectives:

- Identify the sources of spatial data used for current SLM planning and monitoring
- Determine skills and knowledge gaps affecting the proper use of maps for SLM planning and monitoring
- Reveal factors that influence the use of maps throughout planning and monitoring processes of SLM activities
- Assess barriers that hinder application of maps in planning and monitoring SLM practices
- Recommend measures to improve the role of maps in SLM endeavors in the future

Presentation and Discussion of Data

As Hastings and Clark (1991) remarked, the production and usage of standard maps for various purposes is adversely affected by a shortage of human skill and unreliable power supply to run electronic equipment. Assessment of SLM practices in the Lower Burqa Abagabir Wejig micro-watershed shows that problems of skill and knowledge strongly affect the preparation and competent use of accurate maps for both the planning and monitoring stages. Because SLM experts lack standard maps, the information to plan SLM activities are derived from other sources including PNSP (Productive Safety Net Program), NGOs (such as the Agriculture Growth Program and MERET – a convenient name for a government program entitled Managing Environmental Resources to Enable Transitions to More Sustainable Livelihoods) and indigenous knowledge, which is applied to analyze soil and measure slope angle in situ. In addition, natural resource conservation training manuals are employed to calculate the slope of land and corresponding physical soil and water conservation structures. Among others, the PIM (Planning Implantation Manual) is used as a natural resource conservation guide to combat land degradation and increase agricultural yield. However, local level implementers of SLM in the Lower Burqa Abagabir Wejig are not conversant with scientific and technical jargon in the training manual. Without qualified personnel and proper equipment, the possibility of harnessing spatial data for scientific use is challenging.

Planning, implementing and monitoring of SLM practices is participatory. Government administrators, SLM professionals and the local community participate in all stages of SLM in various capacities and with varying responsibilities. For the sake of convenience, local people participate in SLM planning through representatives. However, no farmer is obliged to take part in any SLM activity. Figure 25 illustrates the bottom-up process.

The community, Kebele watershed team and members of the district planning and monitoring team use participatory sketch maps (see Figure 26) to delineate areas targeted for rehabilitation based on their assessment of the degree of environmental degradation. Before implementation, the proposal is tabled for public discussion. Only after duly incorporating the comments and suggestions of the community does the local steering committee submit SLM plans for approval to the regional committee, which in turn passes the plan with its comments to the federal SLM technical and national steering committee. After approval by the federal committee, disbursement of budget and implementation of SLM plans commences.

District officers mandate the collection of socioeconomic, demographic and biophysical data through a participatory approach and observation before designing and implementing SLM practices. The financial requirement of different SLM practices is among the major considerations in selecting SLM practices. Although hand drawn maps are used to locate various SLM sites, this is problematic since they rarely depict contour lines and slope angles. Thus, it is not possible to use these maps to calculate land slope to plan and implement various SLM practices in different landscapes and soil types. Ideally slope angle should be measured for every point, which is difficult without contour maps. However inadequate, the poorly sketched map (locally known as a "development optional map") is used as a guide to implement and construct various SLM structures.

Among other features, these maps show spatial information about land use type, type and severity of degradation and land slope, as well as areas selected for rehabilitation. The sketch maps also show particular SLM measures recommended for various sites. Informants noted that hydrology, climate, population, geology, vegetation and soil maps are not used, despite their awareness that such specialized maps are very helpful to obtain relevant spatial information for SLM planning and performance evaluation. This shows that SLM activities in this area hardly take geology, land capacity and infrastructure into account, which needs to be addressed. Informants also noted that the nature of an area is determined through trial and error, rather than articulation of soil type, land slope and other properties of the environment.

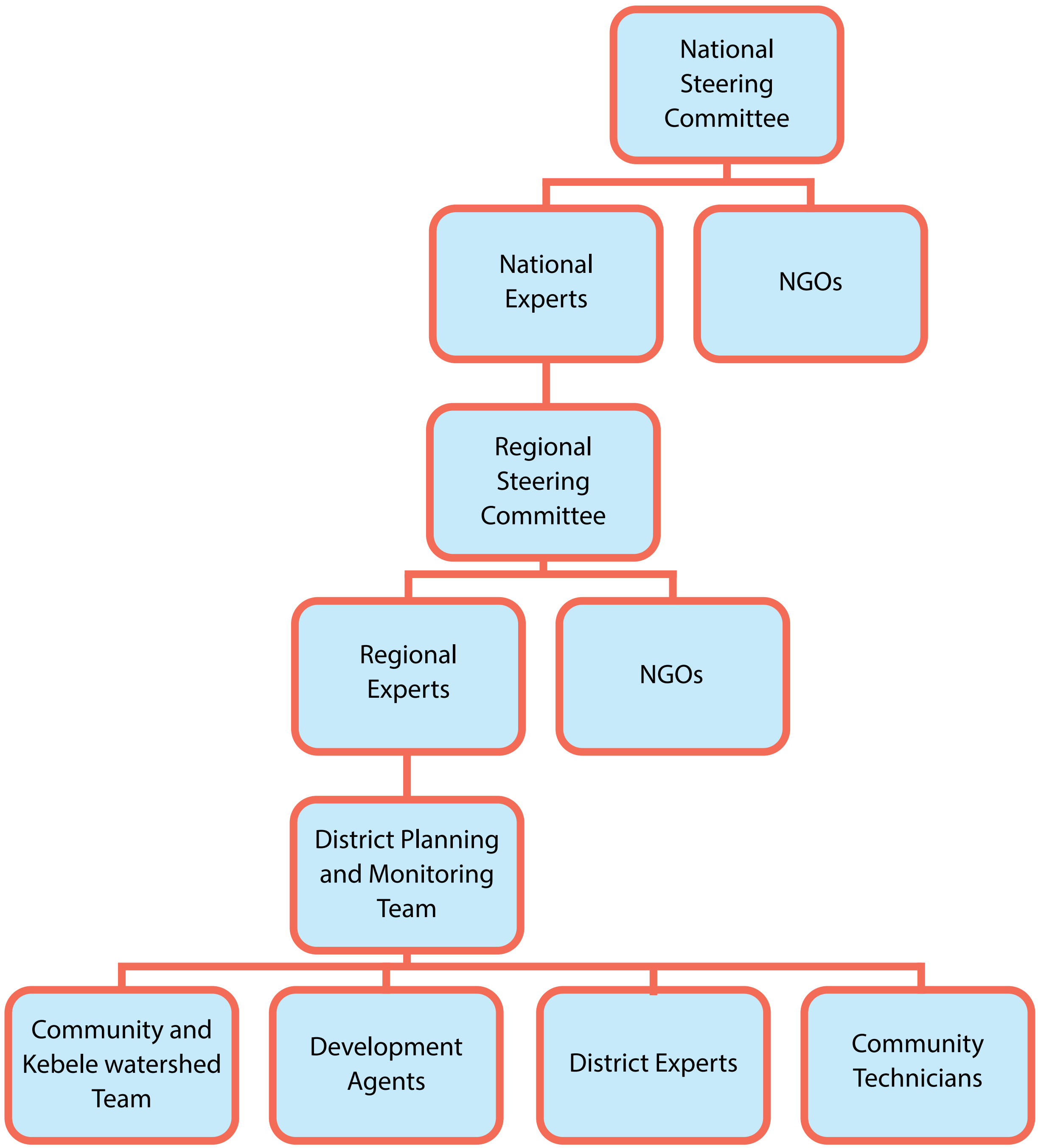


Figure 25. Bottom up process of planning and executing SLM practices

In most cases, deep trench, normal trench, gully treatment, bee-keeping, roof water harvesting, afforestation and reforestation are main SLM practices. Although such SLM plans are depicted in the sketch maps, they are not monitored on standard maps. It is not a lack of awareness about the importance of standard maps, but a lack of skill to prepare and read them that preclude their use in SLM planning and monitoring. While some local experts have some cartographic skill, they are too busy with other activities to prepare maps. District and Kebele-level experts are constrained by lack of access to digital technology. In this situation, buying maps might present a solution, but poor resolution, high prices and poor legends compound the difficulties of using maps produced by different organizations. As a result, maps, including hand sketches, are not used to monitor SLM practices.

To mitigate this problem, district officers recommend strong linkage and cooperation among regional experts, university professors, NGOs and donors. GIS data are available but communication and data sharing among institutions is poor; the spatial data sources from Mekelle University, GIZ and the Water, Land and Resource Center in Addis Ababa are cases in point. Such cooperation, informants believe, could alleviate problems in application of basic SLM monitoring tools such as GIS, maps and ILM to plan appropriate SLM interventions and map changes both in office and field. In general, local SLM stakeholders do not have sufficient spatial information to plan SLM practices, let alone to monitor changes. However, it is understood that the use of standard maps is not a panacea to every problem of SLM planning and monitoring changes. In this regard, the existing practice of planning SLM practices and documenting landscape changes based on actual observation of specific watershed points should not be criticized. Planning SLM practices and monitoring changes at the level of the entire watershed and beyond is where standard maps become indispensable.

Figure 26. This community watershed sketch map shows land use categories in Layelaye Machew. Photo courtesy of Ministry of Agriculture, Tigray, Ethiopia, 2013.

Given the above challenges of using hand drawn maps, informants expressed optimism in the Spatial Planning and Monitoring Guide as a valuable tool to obtain more precise spatial information (such as the socioeconomic, demographical and biophysical status of SLM intervention sites). Moreover, informants are aware that the guide allows for SLM monitoring, which was not the case with sketch maps, and saves time and labor invested to plan and monitor SLM interventions. Also reported by informants, obstacles to making the most use of GIS or related technologies include frequent electric power blackouts, lack of access or poor access to high resolution spatial data, lack of technical knowhow, lack of access to computers and internet and high work load. They also raised the importance of training to build the competence of experts at all levels in manipulating technologies relevant for SLM planning and monitoring. Hence, future training efforts should target computer and internet skills, GIS and map reading, geo-referencing photopoints and digital data documentation.

Such barriers will be addressed but the particulars of how to go about it needs elaboration. Coordination among different stakeholders could also foster more efficient use, management and production of spatial data. When asked what training material is suited to them, informants said that handouts, slides, flip charts, GIS software, topographic maps and reference books are very helpful instructional materials.

In order to build the level of local peoples' competence in reading and using maps, this guide gives eight steps to plan and monitor SLM practices. Of these, practical demonstrations were conducted of Step 5 and Step 8 in the Wejig micro-watershed. The site is characterized by varied topographic features ranging from very steep to moderately gentle and the presence of SLM practices. Step 5 assesses how a change in the landscape impacts people in terms of agricultural production, biodiversity and livelihood security. Accordingly, participants were asked to list the benefits of different SLM practices in different landscapes and feedback was given to correct mistakes. They also appraised the potential for cooperation and conflict from expected changes in the landscape after implementation of SLM practices. Such activities helped participants identify preferred landscape practices that are sustainable and harmonious with amicable resource sharing, better environmental impact and improved livelihoods.

Step 8 relates to monitoring and evaluating changes in the landscape, which required assigning participants to develop a strategy to collect data to monitor the impact of SLM practices on the landscape. First, district experts were asked to locate various watershed points on a standard map, which they did without difficulty. Next, participants collected data (baseline and change) and developed a strategy to harmonize SLM planning with overall anticipated changes. This is important to build local capacity to proactively mitigate the impacts of natural, social, economic and environmental changes, rather than merely reacting to hardships already being experienced. This will also ensure the sustainability of SLM interventions and positive outcomes.

Finally, informants were asked about the quality of the guide on planning and monitoring SLM design and impact. All of them appreciated the guide, noting its simplicity and the ease of use by facilitators and participants of SLM activities. The quality of the guide, according to informants, is enhanced by its clear focus on and explanations of geo-referencing. They also reported that following the steps in the guide allowed them to monitor SLM practices effectively. The prospect of using standard maps (such as topographic maps, land cover maps, soil maps and forest maps) for SLM planning and monitoring is promising.

In addition to raising awareness of the potential for using maps in planning and monitoring, efforts of the Tigray regional government in providing short GIS trainings to district experts represents a positive step towards addressing the problem. To date, six of the sixteen district experts have training in GIS, thanks to the regional Agricultural and Rural Development Bureau. Additionally, the Spatial Planning and Monitoring Guide will have practical importance in accessing and utilizing standard maps to plan and monitor SLM practices.

Conclusion

SLM practices in the Lower Burqa Abagabir Wejig micro-watershed are planned and implemented in a participatory manner, in which all stakeholders from local farmers to federal government authorities take part. Participatory sketch maps are useful in planning SLM interventions at the micro-catchment level where spatial information based on local knowledge and observation is relatively reliable. At larger spatial scales in the watershed, however, the study suggests that a lack of detailed spatial information and understanding in planning and monitoring SLM practices has resulted in haphazard natural resource conservation activities. Reliance on hand drawn maps hardly assists identification of soil type, land slope, vegetation cover and land use category, characteristics that are critical to planning and monitoring SLM interventions. However, detailed maps are largely unavailable. And while map sketches are used to plan SLM practices, they are not used to monitor them. The study suggests that practitioners of SLM in this area have little understanding of the necessity of monitoring SLM, since the major emphasis is on planning and implementing soil and water conservation mechanisms.

Fortunately, all stakeholders who were interviewed appear to understand and appreciate the role of GIS, ground-based photo-monitoring and standard maps to better design, implement and monitor SLM activities based on richer geophysical and socio-economic data of the watershed. What remains, therefore, is provision of custom-made training to tackle the technical and material problems that undermine local and regional SLM experts' ability to use digital geo-cartographic technology. Also needed is improved access to spatial data, e.g. through a regional GIS data sharing platform. Moreover, it would be highly beneficial to allocate the time needed for SLM experts with mapping skills to prepare maps and use them for SLM efforts. Given the perceived benefits of detailed contour maps to SLP programming, this may warrant such experts being relieved of office responsibilities that could be transferred to others. In addition to international resources and the time commitment of SLM experts to mapping activity, closer cooperation with regional universities, researchers and NGOs could alleviate some of the reported cartographic problems. In pursuing such aims, the role of the Spatial Planning and Monitoring Guide in refining the existing good practices and overcoming observed challenges in SLM planning and monitoring cannot be overemphasized. The guide should be put to use in addressing the varying needs of local people and experts at all levels.

Part 5

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Appendix 1: Supporting Facilitation Materials

Handout for Step 1

List of Importance of Landscape Benefits

Direct Landscape Benefits	**Importance** (++, +)
Food (including collecting fruit and hunting fish and game)	
Water (e.g. for drinking and irrigation)	
Raw Materials (e.g. fiber, timber, fuel wood and fodder)	
Genetic Resources (e.g. wild seeds for crop improvement)	
Medicinal Resources	
Ornamental Resources (e.g. artisan work and decorative plants)	
Aesthetics (e.g. joyful views)	
Opportunities for Recreation & Tourism (e.g. attractive elements)	
Spiritual Experience (e.g. sacred forest and springs)	
Indirect Landscape Benefits	
Air Quality Regulation (e.g. capturing dust)	
Climate Regulation (e.g. carbon sequestration and shade)	
Moderation of Extreme Events (e.g. storm protection and flood prevention)	
Regulation of Water Flows (e.g. natural drainage, irrigation and drought prevention)	
Waste Treatment (water purification)	
Erosion Prevention	
Maintenance of Soil Fertility	
Pollination	
Biological Control (e.g. seed dispersal, pest and disease control)	
Maintenance of Genetic Diversity (esp. nursery service and gene pool protection)	

Based on the TEEB ecosystem service classification

Handout for Step 2

List of Landscape Benefits and their Potential Contribution to Landscape Objective for Agricultural Production, Biodiversity Conservation and Livelihood Security (Other than Directly from Agriculture)

Direct Landscape Benefits	**Agriculture**	**Biodiversity**	**Livelihood**
Food (including collecting fruit and hunting fish and game)	X	X	X
Water (e.g. for drinking and irrigation)	X	X	X
Raw Materials (e.g. fiber, timber, fuel wood and fodder)	X		
Genetic Resources (e.g. wild seeds for crop improvement)	X	X	
Medicinal Resources			X
Ornamental Resources (e.g. artisan work and decorative plants)			X
Aesthetics (e.g. joyful views)			X
Opportunities for Recreation & Tourism (e.g. attractive elements)			X
Spiritual Experience (e.g. sacred forest and springs)			X
Indirect Landscape Benefits			
Air Quality Regulation (e.g. capturing dust)	X	X	X
Climate Regulation (e.g. carbon sequestration and shade)	X	X	X
Moderation of Extreme Events (e.g. storm protection and flood prevention)	X	X	X
Regulation of Water Flows (e.g. natural drainage, irrigation and drought prevention)	X	X	
Waste Treatment (water purification)	X	X	X
Erosion Prevention	X	X	X
Maintenance of Soil Fertility	X	X	
Pollination	X	X	
Biological Control (e.g. seed dispersal, pest and disease control)	X	X	
Maintenance of Genetic Diversity (esp. nursery service and gene pool protection)	X	X	

Based on the TEEB ecosystem service classification

Handout for Step 4

List of Measurable Indicators for Landscape Benefits

Direct Landscape Benefits	Measure
Food (including collecting fruit and hunting fish and game)	
Water (e.g. for drinking and irrigation)	
Raw Materials (e.g. fiber, timber, fuel wood and fodder)	
Genetic Resources (e.g. wild seeds for crop improvement)	
Medicinal Resources	
Ornamental Resources (e.g. artisan work and decorative plants)	
Aesthetics (e.g. joyful views)	
Opportunities for Recreation & Tourism (e.g. attractive elements)	
Spiritual Experience (e.g. sacred forest and springs)	
Indirect Landscape Benefits	
Air Quality Regulation (e.g. capturing dust)	
Climate Regulation (e.g. carbon sequestration and shade)	
Moderation of Extreme Events (e.g. storm protection and flood prevention)	
Regulation of Water Flows (e.g. natural drainage, irrigation and drought prevention)	
Waste Treatment (water purification)	
Erosion Prevention	
Maintenance of Soil Fertility	
Pollination	
Biological Control (e.g. seed dispersal, pest and disease control)	
Maintenance of Genetic Diversity (esp. nursery service and gene pool protection)	

Based on the TEEB ecosystem service classification

Appendix 2: Monitoring Tools

Ground-Based Photo-Monitoring Guide

Ground-based photo-monitoring is a method for documenting and assessing visual changes in landscapes over time by repeatedly taking photographs from the same location. The term repeat photography includes such methods as historical repeat photography, aerial repeat photography and ground-based repeat photography. Historical repeat photography uses old photographs (generally 25 years old or older) as baselines to document ecological, cultural and/or socioeconomic changes since the original photos were taken. Aerial and ground-based repeat photography establish a system where photos will be retaken over time to allow for comparisons to be made into the future; either one may or may not include historical photographs. Most aerial and ground-based repeat photography studies focus on land-use or ecological changes. When repeat photos are tied to an analytical framework for assessing visual changes over time, they become a useful monitoring guide.

You can download the Ground-Based Photo-Monitoring Users' Guide at www.ecoagriculture.org/publication_details.php?publicationID=619.

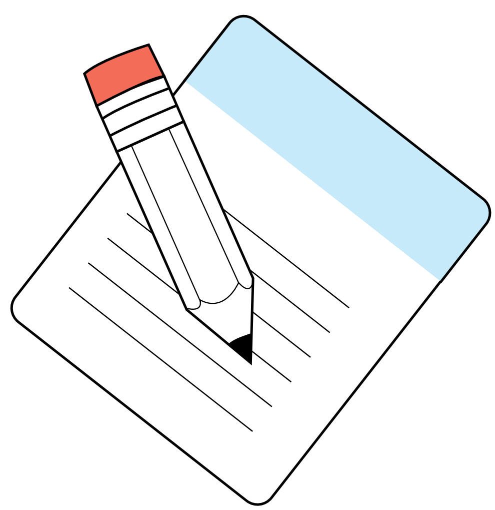
Landscape Performance Scorecard

A landscape performance scoring activity brings together stakeholders involved in managing a landscape to assess the status of their landscape with respect to key four goals: 1) ecological conservation, 2) agricultural production, 3) livelihood security and 4) institutional capacity for integrated landscape management. For instructions in how to use the tool, and examples, see the Landscape Measures Resource Center at www.landscapemeasures.info/?p=93.

Directions:

Score each question below by circling a number. A 1 indicates very poor performance and a 5 indicates very high performance. Circle two numbers together to give an intermediate score. For example, circle the 1 and the 2 together to give a score of 1.5.

The complete scorecard can be found on the following page, for easy photocopying.



Landscape Performance Scorecard

Conservation Goal: The landscape conserves, maintains and restores wild biodiversity and ecosystem services.					
Conservation Questions					
C1: Does the landscape contain an adequate quantity and suitable configuration of natural and semi-natural habitat to protect native biodiversity?	1	2	3	4	5
C2: Do natural and semi-natural habitats in the landscape approximate the composition and structure of the habitats historically found in the landscape?	1	2	3	4	5
C3: Are important species within the landscape biologically viable?	1	2	3	4	5
C4: Does the landscape provide locally, regionally and globally important ecosystem services?	1	2	3	4	5
C5: Are natural areas and aquatic resources adequately buffered from productive areas and activities?	1	2	3	4	5
Production Goal: The landscape provides for sustainable, productive and ecologically compatible agricultural production systems.					
Production Questions					
P1: Do production systems respond to demand by internal (local) consumers and buyers, and by external buyers?	1	2	3	4	5
P2: Are production systems financially viable and can they adapt to changes in input and output markets?	1	2	3	4	5
P3: Are production systems resilient to disturbances, both natural and human?	1	2	3	4	5
P4: Do production practices have a neutral or positive impact on wild biodiversity and ecosystem services?	1	2	3	4	5
P5: Are species and varietal diversity of crops, livestock, fisheries and forests adequate and maintained?	1	2	3	4	5
Livelihood Goal: The landscape sustains or enhances the livelihoods and well-being of all social groups that reside there.					
Livelihood Questions					
L1: Are households and communities able to meet their basic needs while sustaining natural resources?	1	2	3	4	5
L2: Is the value of household and community income and assets increasing?	1	2	3	4	5
L3: Do households and communities have sustainable and equitable access to critical natural resource stocks and flows?	1	2	3	4	5
L4: Are people in the landscape able to adapt to changes in human and non-human (plant & animal) population dynamics?	1	2	3	4	5
L5: Are households and communities resilient to external shocks such as flooding, drought, changes in commodity prices, disease epidemics and others?	1	2	3	4	5
Institutions Goal: Institutions are present that enable integrated, ongoing planning, negotiation, implementation, resource mobilization and capacity-building in support of the goals of integrated landscape management.					
Institution Questions					
L1: Are households and communities able to meet their basic needs while sustaining natural resources?	1	2	3	4	5
L2: Is the value of household and community income and assets increasing?	1	2	3	4	5
L3: Do households and communities have sustainable and equitable access to critical natural resource stocks and flows?	1	2	3	4	5
L4: Are people in the landscape able to adapt to changes in human and non-human (plant & animal) population dynamics?	1	2	3	4	5
L5: Are households and communities resilient to external shocks such as flooding, drought, changes in commodity prices, disease epidemics and others?	1	2	3	4	5

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