AFROMAISON

Tools and Approaches for Integrated Natural Resource Management

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Tools and Approaches for Integrated Natural Resource Management

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List of Acronyms

APEX	Agricultural Policy / Environmental Extender
ART	Analytical and Research Tools
BRP	Bio-Resources Programme
BSC	Balanced Scorecard
CMap	Conceptual Mapping
CNT	Communication and Negotiation Tools
DeMax	Design Matrix
DPT	Decision-aid Policy Tools
DST	Decision Support Tool
EMF	Environmental Management Framework
ES	Ecosystem Services
ESM	Ecosystem Services Mapping
IA	Impact Assessment
IDP	Integrated Development Plan
IND	Inner Niger Delta
INRM	Integrated Natural Resource Management
InVEST	Integrated Valuation of Environmental Services and Tradeoffs
IP	Innovation Platforms
IT	Information Technology
LEIS	Local-scale Environmental Information System
LULC	Land Use and Land Cover
NR	Natural Resources
NRM	Natural Resource Management
PES	Payment for Ecosystem Services
PPGIS	Public Participation Geographical Information System
PROCA	Participatory Rapid Opportunities and Constraints Analysis
RPG	Role Playing Game
SCP	Systematic Conservation Planning

SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
SEMP	Strategic Environmental Management Programme
SITE	Simulation of Terrestrial Environments
SLM	Sustainable Land and Water Management
SWAT	Soil Water Assessment Tool
SWIM	Soil Water Integrated Model
TWGs	Thematic Working Groups
USLE	Universal Soil Loss Equation
VA	Vulnerability Assessment
WAG	Wat-A-Game
WEAP	Water Evaluation and Planning
WPs	Work Packages within the Afromaison Project

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PART 1: INTRODUCTION

The Afromaison project is concerned with developing adaptive and integrated tools and strategies for integrated natural resources management (INRM). INRM can be defined as:

"*An approach that integrates research of different types of natural resources into stakeholder-driven processes of adaptive management and innovation to improve livelihoods, agro-ecosystems resilience, agriculture productivity and environmental services at community, eco-regional and global scales of intervention and impact*" (Ochola *et al*, 2010)

INRM encompasses the concept that natural resources are not only important for direct use, but are critical in supporting basic service provision, local economic development and social wellbeing. In so doing, it aims to contribute to integration of landscape functioning (regarding the delivery, use and access to goods and services provided); livelihood and socio-economic development (including vulnerability to global change); and institutional strengthening and improved interaction between sectors, scales and communities.

The Afromaison project addresses INRM through three means: meso-scale management; participatory planning; and an ecosystem services (ES) approach to planning and management.

- **Meso-scale** is a management scale that localised enough to incorporate both decision makers and actors on the ground while covering a large enough geographical area to encompass large natural systems such as water catchments.
- **Participatory planning** emphasizes involving all stakeholders in defining a common agenda for development, taking into account multiple perspectives: indigenous knowledge and practices; the requirements of local communities; modern technologies for natural resource management (NRM); and scientific understanding of systems and system dependencies.
- **Ecosystem Services (ES) approach** acknowledges the importance of the natural environment in terms of the benefits it provides to society, and explicitly takes into account the value (market and non-market) of these benefits, and the potential trade-offs inherent in transforming natural systems.

This report focuses on the following three groups of tools in achieving the above:

- Tools for spatial planning: covering different categories of tools used in spatial planning in five case studies, their assessment for suitability and sustainability, as well as application of some tools in the case studies. (Section 2);
- Approaches for restoration and adaptation of natural resources (NR): covering technologies for sustainable land management, embedded within a context of broader economic and social development objectives (Section 3);
- Economic tools and incentives: covering incentives for the uptake and implementation of restoration and adaptation interventions by local resource management actors and stakeholders to address priority environmental challenges (Section 4).

The tools and an operational framework for integration were developed based on lessons learned from investigating and applying different tools in the five case studies across Africa, namely Ethiopia (headwaters of the Blue Nile / Fogera), Mali (Inner Niger Delta), South Africa (uThukela District), Tunisia (Oum Zessar Watershed), and Uganda (Rwenzori Mountains).

The Afromaison operational framework is described in detail in Ferrand and Ducrot (2011). Approaches to participatory planning were built around the use of participatory role play games (RPG) and social simulation, as well as more traditional modes of consultation. Vulnerability of the case studies to changing conditions, driven by both climate and socio-political factors, and the repercussions for planning in each region, are discussed in Liersch and Reinhardt (2013).

1.1 Spatial planning tools

Spatial planning is defined as a comprehensive cross-sectoral process (e.g. spatial planning, land use planning, environmental planning, integrated river basin management planning) in which different land use interests are addressed by assessing the economic, social and environmental viability of land decisions and the collaboration and integration of the relevant sector policies. Spatial planning offers a long or medium term strategy for territories in pursuit of common objectives, incorporating different perspectives of sectoral policies.

Spatial planning tools support INRM by addressing multiple stakeholders' objectives, and information on natural resources interdependencies and complexities (Bryan and Crossman, 2008; Ive and Cocks, 1983). These tools are used at different phases of spatial planning process to ensure sustainable use of the land and natural resources, by providing a framework for land-use planning. In the Afromaison project a number of spatial planning tools such as SITE, Ecosystem Services mapping, OPIDIN etc. are implemented. SITE, which is a land use componential tool, is applied in the uThukela District (South Africa) and Fogera (Ethiopia) case studies, OPIDIN is applied in the Inner Niger Delta (Mali) case study, while Ecosystem Services mapping is implemented in all the five case studies. The implementation of these tools pursued a systematic methodology that included inventorizing spatial planning tools already in use, assessing the feasibility of tools to address a particular natural resources problem, and understanding stakeholder's interests. Furthermore, a number of shortlisted tools were also assessed to review their suitability and sustainability, as well as their potential transferability to other case studies. A number of assessment criteria, drawn from a review of literature, were also used for the assessment of the shortlisted tools.

Section 2 of this report addresses the analysis, evaluation and application of spatial planning tools in the Afromaison project more detail by covering:

- A review of existing spatial planning tools in the case studies
- A suitability assessment of shortlisted spatial planning tools
- Examples of implemented spatial planning tools within Afromaison project
- Best practice tools and the discussion of the potential transferability of spatial planning tools to other case studies.

1.2 Identifying and assessing sustainable land management interventions

Management of natural resources to sustain and restore resource condition, while adapting to changing demands of growing populations, expanding economies and climate variability, poses a major challenge for each of the case study areas. The principles of INRM, and the strong emphasis in Afromaison on stakeholder participation opened up the discussion of NRM in the case studies to encompass a wide range of socio-political, institutional and economic development issues and solutions. While traditional approaches to NRM often tend to address the symptoms, rather than causes, of land degradation, INRM attempts to identify underlying drivers of mismanagement, and looks for common causes and solutions across issues and sectors. The INRM strategies formulated by the Afromaison case studies are thus very broadly based, and embed technologies for land and water management within the context of social and economic development initiatives and actions.

This component of Afromaison (WP3) was concerned specifically with identifying and evaluating sustainable land and water management (SLM) interventions within this broader framework. The aim was to support case studies to identify, select and assess SLM technologies and approaches in different landscape zones which not only address priority land and water management issues, but also combine (as strategies) and provide synergies across the landscape, and increase resilience of livelihood systems at both farm and landscape scale. Appropriate interventions cannot be selected without considering spatial relationships and priorities for management (Section 2); and the incentives and approaches needed to implement and apply the identified technologies / interventions (Section 4).

Identifying appropriate SLM interventions must thus take account not only of the suitability at farm or local scale, but also of the cumulative impacts across the landscape. To address the complexities of working across scales, an ES approach was used to give a landscape-scale perspective of benefits, trade-offs and threats / pressures of different management choices. An assessment framework was formulated to assess suitability of interventions (individually and combined) across scales, based on principles of INRM and using ES as an integral part of the assessment. Section 3 of this report describes:

- The assessment framework developed under Afromaison, and the use of an ES approach in prioritising and assessing interventions
- Resources and tools for identifying SLM interventions
- Approaches for selecting, screening and analysing suitability of SLM interventions
- Methods for ex-ante assessment of impacts of SLM interventions

The report discusses the impact and feasibility of the tools and approaches used in the Afromaison project, drawing on the case studies, and provides recommendations for future INRM initiatives.

1.3 Economic tools and incentives

Economic instruments aim to provide incentives that will induce a change in the behaviour of people to improve the way they use and manage environment and natural resources. This is achieved by changing the extent to which people feel or experience the cost associated with the use of resources, or the consequences of their decisions about how to manage or protect the environment. An economic instrument, or combination of instruments, provides financial and other incentives so that users of natural resources pay for the social costs of that use, or benefit from the sustainable management of the resource and environment.

The effectiveness of an economic instrument in providing an incentive for improved environmental management is not only determined by the value of the benefit (incentive) it generates. There are a number of other factors that will also influence the effectiveness of an instrument, for example:

- Extent to which the instrument matches or complements the social, political and economic contexts.
- Extent to which the instrument incentivises an intervention that corresponds with the environmental challenge.
- Extent to which incentive is recognised as meaningful or worthwhile by the target agents or institutions whose behaviour or management approach needs to change.

It is important that a conscious selection process is undertaken to ensure that the economic instrument is a good fit to the context. Poor 'context-instrument' matching could result in the selection of an ineffective instrument that does not result in the desired behaviour/management change by the target agents or institutions, or may even act as a perverse incentive and result in a change contrary to the desired response.

The Afromaison project developed a Decision Support Tool (DST) that aims to assist the process of context-instrument matching, and to support the selection of the economic instrument(s) that will have the greatest potential to provide effective incentives for interventions that result in improved environmental management. Fourteen economic instruments are included in this Decision Support Tool. While there are many other types of economic instruments, the 14 included in this DST were selected on the basis of their relevance to the INRM objectives of the Afromaison project[1].

Furthermore, the Afromaison project also developed a Design Matrix (DeMax). The DeMax is applied to inform (i) the assessment of the local potential to implement a selected economic instrument in a given context, (ii) key design considerations for the application of an economic instrument in a specific context, (iii) the evaluation of the likely impact and sustainability of the economic instrument in that context, and (iv) highlight potential flaws or barriers to the implementation of the selected economic instrument[2].

[1] This Decision Support Tool can be accessed on the Afromaison Project website at: http://afromaison.net/index.php?option=com_content&view=article&id=72&Itemid=184

[2] This Design Matrix can be accessed on the Afromaison Project website at: http://afromaison.net/index.php?option=com_content&view=article&id=85&Itemid=185

Section 4 of this report discusses approaches to selecting and designing economic instruments to provide incentives for priority sustainable land management interventions. Section 5.2.3 highlights a number of key conclusions relating to the impact and sustainability of economic instruments, and recommendations for best practice in designing and implementing economic instruments as incentives towards INRM are discussed in Section 6.

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PART 2: APPROACHES FOR SPATIAL PLANNING

2.1Introduction

The local populations in Africa are highly dependent on natural resources from their direct environment. These natural resources, such as water (quantity and quality), soil (structure, fertility, and water holding capacity), land use cover/ vegetation, and flora / fauna / biodiversity, are essential for maintaining and improving people's livelihood, the resilience of agro-ecosystems, agricultural productivity and environmental services. An integrated approach of the management of natural resources is needed to prevent and/or reduce degradation of natural resources, for poverty reduction and sustainable economic development. In view of the current decentralization in Africa, this integrated approach should be aimed at authorities and communities at an appropriate scale. A comprehensive management approach will integrate landscape functioning, livelihood- & socio-economic development (including vulnerability to global climate change), local knowledge, institutional strengthening and improved interaction between sectors, scales and communities.

Increasing population growth is causing natural resource depletion and environmental degradation, threatening the ecosystems and ecological services people depend on. Sustainable natural resources management requires planning for provisioning and use of these resources, in time and space. Spatial planning has such overall objectives. Land use planning is gradually shifting to a proactive, integrated and a multi-sectoral approach to also cope with the anticipated effects of climate change (e.g. water shortage and increased vulnerability of the natural environment and human population). The multiple uses of landscapes coupled with the immense pressure on natural resources, create a need for mainstreaming actions to coordinate across sectors and scales whilst ensuring stakeholder participation.

Spatial planning is a systematic and comprehensive cross-sectoral process, in which different land use interests are addressed by assessing the economic, social and environmental viability. Spatial planning is also a means for collaboration and integration of the relevant sector policies in the land use decision making. It offers a long or medium term strategy for territories in pursuit of common objectives, incorporating different perspectives of sectoral policies. This strategy spells out planning procedures which are easy to implement, monitor and manage.

The purpose of spatial planning tools in this project is to support INRM by addressing multiple stakeholders' objectives, and by collecting and sharing information on natural resources interdependencies and complexities (Bryan & Crossman, 2008; Ive and Cocks, 1983). These tools may comprise of simple maps, drawings or simulation tools, or any other tools which provide insight into impacts of change at different spatial and temporal scales (Eikelboom and Janssen, 2012).

Within the context of Afromaison, spatial planning tools are defined as instruments that can be used:

- in a comprehensive planning process to analyse and/or evaluate data to support decision-making;
- to make decisions for the use of natural resources in INRM more systematic (in a structured planning process), and transparent for the stakeholders and the public (a crucial task is to mitigate conflicts between policy and planning objectives from different sectors, i.e. agriculture, forestry, water management, nature conservation, transport and urban development etc);
- to facilitate communication and negotiation between different actors;
- to promote sustainable development: the spatial planning process for natural resource management is characterized by different phases of communication, negotiation, and decision making. Spatial planning tools are used at different phases to ensure sustainable use of the land and natural resources, by providing a framework for land-use planning at the temporal and spatial scale.

2.2 Spatial planning tools and processes

This subchapter is a follow up of the report on spatial planning tools[3] in Integrated Natural Resource Management which focused on the analysis of existing spatial planning tools and available in tools the case studies. This report deals with the methodology of how spatial planning tools are selected and implemented in some case studies. It also describes the evaluation of suitability and potential sustainability of selected tools with the aim to identify best practices tools, which could potentially be transferred to other case studies. The report concludes with lessons learnt from this research and recommendations.

2.2.1 Methodology

As Brooksbank (2001) declared: "*a bad decision support tool*, (...) *an aid that produces wrong or misleading information, is worse than no tool at all*." Therefore a need has arisen for a way to systematically evaluate potential decision support tools. In the following the methodology, assessment criteria and results for an evaluation of selective Afromaison spatial planning tools will be illustrated.

Figure 2.1 provides an overview of the methodology of selection, assessment, inter-comparison and discussion of transferability of tools for spatial planning in the Afromaison project (Work Package 5). The process is divided into five phases:

- Phase 1: Reviewing and listing all spatial planning tools being used in the five case studies and internationally available spatial planning tools.
- Phase 2: Short listing spatial planning tools to be evaluated according to selection criteria.
- Phase 3: Implementing Afromaison tools in case studies.

[3] Please refer to Deliverable 5.1 (Hamdard *et al*, 2012) of the Afromaison Project for more details on spatial planning tools and processes

- Phase 4: Assessing the suitability and potential sustainability of the selective spatial planning tools according to assessment criteria.
- Phase 5: Inter-comparing 3 best practice spatial planning tools to another case study.

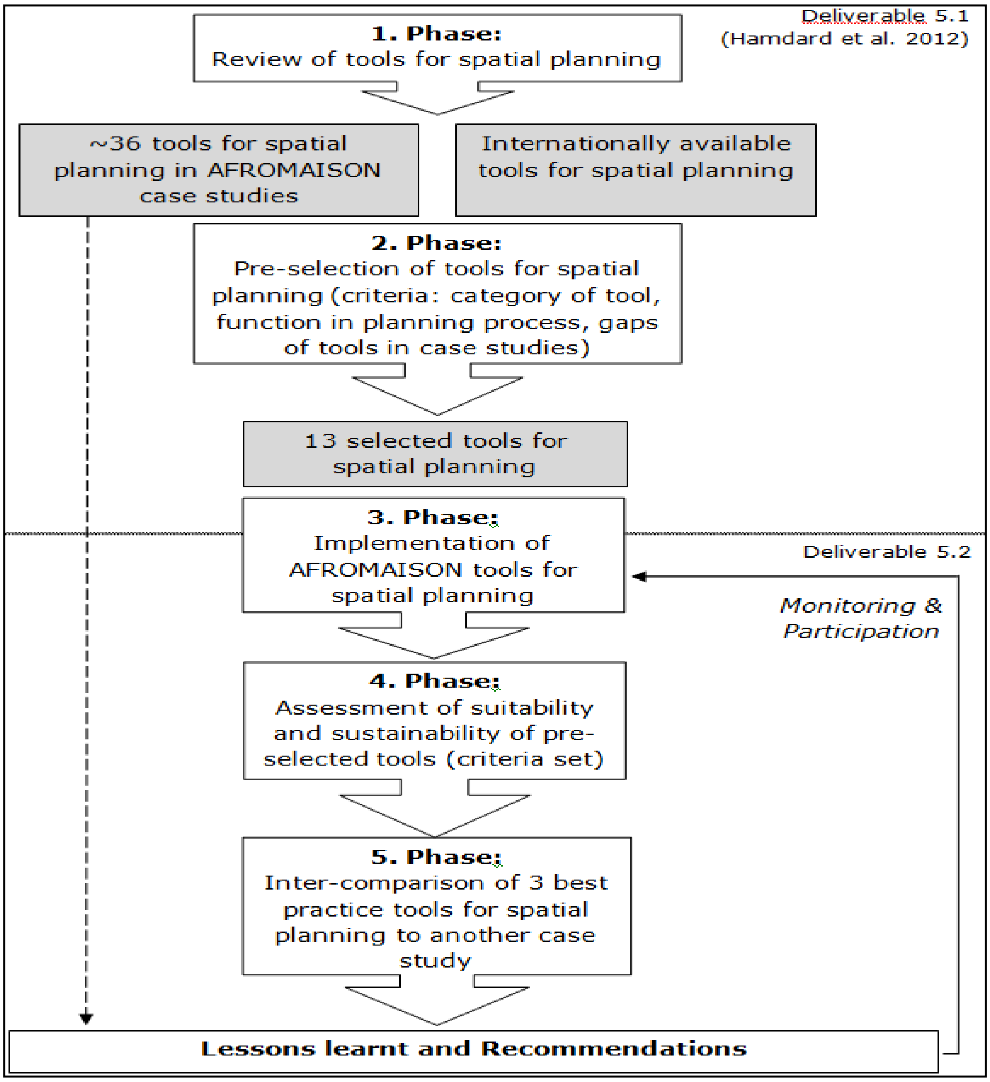


Figure 2.1: Overall methodology for assessing tools and approaches for spatial planning (Work Package 5 of the Afromaison project)

Finally lessons learnt and recommendations are given specifically for spatial planning tools, which ideally are approved by local end-users and stakeholders in a participatory process before being implemented. The aim is that the sustainable use and implementation of suitable tools in spatial planning processes at the meso-scale is continuously improved. In order to achieve an improvement and optimisation of the implementation and use of spatial planning tools, the cross-scale and cross-sector governance system must be effective. Further research is needed on its importance for a sustainable spatial planning and INRM in the five case studies.

In **Phase 1,** an intensive review of internationally available spatial planning tools and processes was carried out. Results in combination with the review of existing spatial planning tools and processes in the case studies are documented in the Afromaison Deliverable Report 5.1 (Hamdard *et al.* 2012)

A web-based survey was conducted to get thorough review of the available spatial planning tools in the case studies and internationally available tools, so that appropriate tools for the case studies could be selected. The process of selecting appropriate tools was implemented in cooperation with the local case study team and other stakeholders. The criteria set for the selection of a spatial planning tool in the case studies can be found in Deliverable Report 5.1 (Hamdard *et al,* 2012).

In **Phase 2,** spatial planning tools were pre-selected to be assessed. Ideally all tools should have been further assessed for their suitability and potential sustainability, but due to limitation of time and information pertaining spatial planning tools, 13 tools were selected for further assessment. The tools are selected from the entire pool of spatial planning tools, to be evaluated on their suitability and potential sustainability. The selection was carried out according to 6 selection rules, which are shown in Figure 2.3.

In **Phase 3,** selective spatial planning tools were implemented in the case studies.

In **Phase 4**, an assessment of spatial planning tools on their suitability and potential sustainability was conducted. The assessment methodology, objectives and assessment criteria in this framework have the intention to guide analysis and assessment of spatial planning tools within a spatial planning process and system. The addressee was a team of users, experts and stakeholders including:

- scientists to comment on the validity of the framework, objectives and criteria;
- the case-specific local users to comment on whether or not the checklist fits their needs, and whether or not they have the skills to use it;
- planners and land/resource managers at meso-scale to comment on the usefulness of the output.

This assessment is not meant as an assessment of the performance of spatial planning tools, which would for instance have to include a longer time period of their use, and could consist of a performance management tool such as a balanced scorecard (BSC) (Wynder 2010). Rather the aim is a checklist to guide the users and implementers of tools to select, assess and monitor an adequate tool.

For the assessment methodology a post-implementation review of the suitability of spatial planning tools, which are applied in spatial planning processes at meso-scale embedded between the national and local scale, were selected. A post-implementation review of the suitability of spatial planning tools is defined as a process for users, stakeholders and supervising bodies to fill in a checklist for tools in the spatial planning system, which are currently in use (were established and implemented in the system) or which were newly introduced and implemented with the Afromaison project.

Additionally to the checklist a survey can be conducted among the users and stakeholders with the aim to get an impression of their preferences of spatial planning tools and the support offered to implement and use them. Participants can be asked to rate their experience and express their preference (see also Arciniegas and Janssen 2012).

In the following **Phase 5,** the potential transfer of the 3 best practice tools, which are a result of the assessment, to the same planning phase in another case study, will be discussed.

Table 2.2.1: Comparison of spatial planning systems in the case studies (modified from EASES 2006)

Elements / Case study	Spatial Planning Law/ Regulation	Issued date	Competent spatial planning institution	Oversight (supervising) institution	Meso-scale	Area	Plan	Sectoral integration	Alternatives study	Public participation	Information Disclosure	Plan preparation timing	Strategic environmental assessment	Follow-up monitoring
uThukela District (South Africa)	Spatial Planning and Land Use Management Act	2013	Municipal Planning Tribunal	Ministry of Environment	District Municipality	11 500 km²	Environmental Management Framework	Neutral	Yes	Stipulated in the guidance documents	Stipulated in regulation and well implemented	12 months	Yes	Neutral
Inner Niger Delta (Mali)	Law No. 01-004, Ordinance No. 00-27/P-RM (2000)	2001	Office du Niger, Ministry of Housing, Land Issues, and Urban Planning	National Office of Control and Regulation	Commune level	600 km²	Esquisse de Schéma national d'Aménagement du Territoire (National Land Use Planning Outline)	Neutral	Yes	NA	Stipulated in regulation	NA	NA	Neutral
Fogera (Ethiopia)	The Rural Land Administration and Land Use Proclamation	2005	Woreda Environmental Protection, Land Administration and Use, Woreda Administration	Regional Bureau of Agriculture and Rural Development	Woreda (District)	1029 km²	NA	NA	NA	Neutral	Stipulated in regulation	NA	NA	NA
Rwenzori Mountains(Uganda)	The Land Act of 1998, amended in 2004 and 2010	2010	Communal Land Associations, District Council	Ministry of Lands, Housing & Urban Development	District	13970 km2	National Environmental Action Plan (NEAP)	Negative	NA	Positive	No provision in current regulation	NA	Exists but not stipulated in regulations	Negative
Oum Zessar Watershed (Tunisia)	Decree No. 92-2160	1992	Regional department of the State domain, Collective land management Council	Ministry of Environment and Land Use Planning, Agricultural Development Grouping, Office National de l'Assainissement	Province	9168 km²	The National Action Plan to Combat Desertification (PANLCD)	Positive	Yes	Positive	Stipulated in regulation	NA	NA	Neutral

2.2.2 Spatial planning system in the case studies

The spatial planning system varies in each case study (see Table 2.1). In countries like Ethiopia and Tunisia, spatial planning mainly addresses rural development, agriculture extension and land restoration, and the plans are developed at national level. In the case of Mali and Uganda, spatial plans are also developed at national level but in addition to (rural) land use, the plans address housing and urban planning issues. South Africa has a relatively stronger institutional framework for spatial planning, and has more specific legislations on spatial planning and land use management. Spatial plans are developed at different administrative levels, including the Environmental Management Framework (EMF) at meso-level (district level).

Sectoral integration is an important aspect of spatial planning, but it is not clearly stipulated in the spatial planning regulation of all case studies, except Tunisia and South Africa. In the spatial planning guidelines of South Africa, sectoral integration is emphasized, but due to some factors, such as lack of political commitment, financial issues, and unclear roles and responsibility of different sector, has resulted in poor integration of sector's interests. Public participation and information disclosure are stipulated in the spatial planning regulations of all the case studies. In Uganda's spatial planning regulations, information dissemination is not clearly stated, but information is accessible on demand. Follow-up and monitoring appear to be the weakest mandate of spatial planning in all the case studies. In the Ethiopian and Ugandan case studies, there is no clear clause on monitoring and follow-up in the regulations, while in other case studies monitoring and follow-up is not effectively implemented.

2.2.3 Existing spatial planning tools in the case studies

Spatial planning tools within Afromaison project are divided into three categories based on their objectives and function in the spatial planning process. These are:

- Analytical and Research Tools (ART);
- Decision-aiding and Policy Tools (DPT);
- Communication and Negotiation Support Tools (CNT);

Analytical and research tools (ART) are particularly used in the early phases of the spatial planning process to help diagnose and analyse the main issues at stake. These tools usually aim at identifying management objectives, criteria and requirements, and developing the analytical framework. In subsequent steps in the planning progress, DPTs, such as conflict maps, multi-criteria analysis and analytical hierarchy processes, are used for priority setting and optimisation, particularly in the case of competing management objectives or criteria. In addition, communication and negotiation support tools (CNT) such as participatory and ecosystem services mappings are aimed to facilitate and support stakeholder participation in the decision-making and planning process (Arciniegas and Janssen, 2012; Duncan and Lach, 2006). These tools are used in different phases of the planning process for NRM. Table 2.2 presents an overview of potential spatial planning tools which could be used in different phases of a spatial planning process.

Table 2.2: Categories of spatial planning tools used in various phases of the planning process

Planning phase (PP)	(Potential) Spatial Planning Tools			Purpose of spatial planning tools in INRM
	Decision-aid Policy Tools	Analytical & Research Tools	Communication & Negotiation Tools	
Vision (PP1)	Conceptual maps	Trend Analysis	Conceptual maps, participatory serious gaming	Significance, scale and nature of the (future) problem
Setting Objectives (PP2)	National Strategic plans	GIS	Serious gaming, Stakeholder Analysis, Ecosystem Services Mapping	Merging interests, objectives, desires of stakeholders
Situation Analysis (PP3)	Problem tree, thematic maps	Scenarios, Trend Analysis	PGIS,	With reference to current situations projecting future under different variables
Alternative Strategies (PP4)	Multi Criteria Analysis,	Optimization	Conflict maps	Identification of different possibilities for achieving desired objectives
Impact Analysis (PP5)	Environmental Impact Assessment,	Dynamic modeling, simulations, Impact matrix	Serious gaming, participatory mapping	Identification of potential environment, social, economic impacts under different alternatives
Evaluation of Alternative Strategies (PP6)	Trade-off Analysis,	Dynamic modeling, simulations, Impact matrix	Serious gaming, participatory mapping	Identification of appropriate, sustainable and pragmatic strategies
Selection of Strategies (PP7)	Socio-economic damage and risk assessments	Suitability Analysis, Operational rules analysis, Network Analysis etc	Serious gaming, participatory mapping	Shortlisting and selections of appropriated strategies to achieve planning objectives
Implementation and Monitoring (PP8)	Integrated Spatial Decision Support System, Environmental Management Plans	Spatial indicators etc	Stakeholder analysis	Setting indicators to track the progress or observe changes over time assessments etc

Table 2.2 lists standard tools representing each categories and the purpose it could serve in the spatial planning process. Ideally, a combined use of all three categories of tools in different phases of the planning process is recommended, but this is rarely the case in any planning system. Some tools are also seen as a hindering factor in the planning process, e.g. participatory tools often delay the planning process and raise more stakeholder expectations, the outputs of analytical tools usually rely on data availability as well as accessibility, and without the right fit-for-purpose data the results are not reliable.

Table 2.3 provides an overview of different categories of existing spatial planning tools used in all the five case studies. Overly the table indicates that not many tools are available to support the visioning phase of the planning process in all case studies. Similarly limited tools are available in the impact analysis phase of the planning process. A good number of spatial planning tools are available to support the situation analysis and monitoring phase of the planning process. Analysed data in Table 2.1 suggested that monitoring of the spatial planning process is relative ineffective in the case studies, whilst table 2.3 shows that a good number of tools is available to support the monitoring phase. One reason for this contradiction is that not all existing spatial planning tools are necessarily used effectively in one formal planning or other decision-making process. Another reason for a weak monitoring and follow-up may be an ineffective implementation and enforcement of monitoring plans and measures.

Table 2.3 reveals that all case studies are familiar with, and are applying ARTs in various phases of their spatial planning processes. Competent planners in South Africa, Tunisia and Mali are using advanced computerized ARTs. The availability of DPTs in Ethiopia and Uganda is very limited, whilst a reasonably good number of such tools are available in Tunisia and Mali. Mali and South African case studies have a limited number of CNTs, whilst Uganda is relatively advanced in the application of similar tools.

Even all existing spatial planning tools are not necessarily applied in one planning process, but instead they are scattered among different sectors and responsible organizations, and are not well integrated in a partly formalized spatial planning process, nor communicated to all stakeholders. In general the information about availability of spatial planning tools is limited in all the case studies; there is no centralised inventory or toolbox, or any dissemination platform.

A number of spatial planning tools are also introduced and implemented under different work packages (WPs) within the Afromaison project, this includes ecosystem services mapping, which is implemented in all the case studies. In Ethiopia and Uganda, Wat-A-Game (WAG), a participatory spatial planning tool is implemented. In Mali, OPIDIN is implemented, which is a flood forecasting spatial planning tool. In South Africa, a land use computational spatial planning tool is used to support the EMF at uThukela District Municipality.

Table 2.2.3: Existing spatial planning tools used in the case studies in the INRM planning

Case Study / Planning Phases (PP)	Ethiopia (Cs1)			Mali (Cs2)			South Africa (Cs3)			Tunisia (Cs4)			Uganda (Cs5)		
	DPT	A&RT	C&NT	DPT	A&RT	C&NT	DPT	A&RT	C&NT	DPT	A&RT	C&NT	DPT	A&RT	C&NT
Vision (PP1)	NA	No tool	No tool	No tool	No tool	No tool	No tool	No tool	No tool	LEIS2.0	No tool	LPCD	No tool	No tool	No tool
Setting Objectives (PP2)	NA	WAG(E)	WAG(E)	No tool	No tool	WAG(E)	SCP, BRP	BRP, ESM	AmanziGame	LEIS2.0	No tool	LPCD	SPS	WAG (U)	WAG (U), FGDs
Situation Analysis(PP3)	NA	SITE (E)	ESM	PDSEC, SAP,SIGMA , EWS, SIFRON	DECID-AID, OPIDIN	ESM	BRP	BRP, ESM, SITE (SA)	ESM	Carte-Agricole, LEIS2.0	SWAT	ESM, LPCD	No tool	PaLA, DriLUC, RAFT	ESM, PRA, PRM, FGDs, SANA
Alternative Strategies(PP4)	NA	WAG(E) SITE (E)	WAG(E)	EWS, SIFRON	DECID-AID,	WAG(E)	No tool	ESM, SITE (SA)	AmanziGame	No tool	No tool	No tool	No tool	WAG (U)	WAG (U), FGDs
Impact Analysis (PP5)	NA	No tool	No tool	EWS, SIFRON	No tool	No tool	BRP	BRP	No tool	Carte-Agricole, LEIS2.0	No tool	No tool	No tool	PaLA, DriLUC, RAFT	No tool
Evaluation of Alternative Strategies (PP6)	NA	WAG(E) SITE (E)	ESM, WAG(E)	No tool	No tool	ESM , WAG(E)	BRP	BRP, SITE (SA)	ESM, AmanziGame	LEIS2.0	SWAT	ESM, LPCD, PPGIS	SPS	WAG (U)	ESM WAG (U)
Selection of Strategies (PP7)	NA	WAG(E) SITE (E)	WAG (E)	PDSEC, EWS, SIFRON	No tool	WAG(E)	SCP	SITE (SA)	AmanziGame	No tool	No tool	PPGIS	SPS	WAG (U)	PRA, PRM, WAG (U)
Implementation and Monitoring (PP8)	No tool	SITE (E)	ESM	SAP,SIGMA, EWS, SPOT, Radarsat	ROSELT, OPIDIN	ESM	SCP	BRP, ESM, SITE	ESM	LEIS2.0	SWAT	ESM , LPCD,PPGIS	No tool	No tool	ESM, FGDs

Abbreviations used in the table: A&RT (Analytical and Research Tools), **BRP** (Bio-resources Programme), **Carte-Agicole** (Agriculture Map), **C&NT** (Communication and Negotiation Tools), **DECID-AID** (Multi sector decision aid tool develop for the Niger Delta), **DPT** (Decisions-aiding Policy Tool), **DriLUC** (Rapid Appraisal of Drivers of Land Use Change) **ESM** (Ecosystem Services Mapping), **EWS** (Early Warning System), **FGDs** (Focus Group Discussions) **LEIS** (Local-scale Environmental Information System), **LPCD** (Local Plan to Combat Desertification), **SANA** (Stakeholder Analysis and Network Analysis), **SPS** (Spatial Planning System), **OPIDIN** (*Outil de Prédiction des Inondations dans la Delta Intérieur du Niger*), **PDSEC** (*Plan de Développement Economique, Social et Culturel*), **ROSELT** (Long Term Ecological Monitoring Observatories Network-translated from French), **PaLA** (Participatory Landscape Appraisal), **PP** (Planning Phase), **PPGIS** (Public Participation Geographical Information System), **PRA** (Participatory Rapid Appraisal), **PRM** (Participatory Rural Mapping), **RAFT** (Rapid Agroforestry Systems and Technology), **SAP** (Locally used hydro-economic model), **SITE** (Ethiopia), **SITE** (South Africa), **SCP** (Systematic Conservation Planning), **SIFOR** (Forest Information System), **SIGMA** (*Système Informat ique de Gestion des ressources en eau du Mali*, , Water Resources Management Information System for Mali), **SWAT** (Soil Water Assessment Tool), **WAG (E)** (Water Game, Ethiopia), **WAG (M)** (Water Game, Mali), **WAG (U)** (Water Game, Uganda)

2.2.4 Implementation of spatial planning tools in case studies

Within the scope of the spatial planning tools component of the Afromaison project, a few tools were implemented in the case studies. This includes Ecosystem Services Mapping[4], SITE (Land use model), and OPIDIN (flood forecasting model). Ecosystem Services Mapping is implemented throughout the five case studies, while SITE is implemented in the South African and Ethiopian case studies, and OPIDIN is implemented in the Mali case study. During the implementation the role of local partners, stakeholder and expert guidance was crucial.

This section provides detailed description of the implemented tools i.e. OPIDIN, and SITE Box 2.1 describes OPIDIN while Box 2.2, in addition to explaining SITE, also explains how SITE and Ecosystem Services mapping supported NRM planning process in the South African case study.

Box 2.1 Spatial planning tool OPIDIN (Mali)

(input from Wymenga, Klop, Weert (2013))

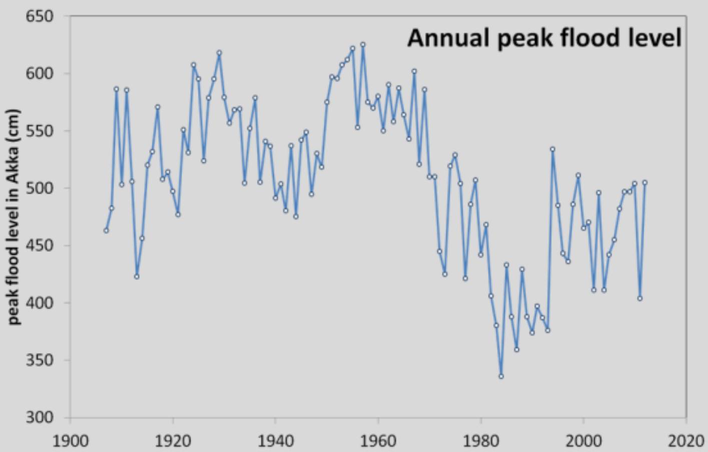
OPIDIN (*Outil de Prédiction des Inondations dans la Delta Intérieur du Niger*)

OPIDIN is a tool developed for the Inner Niger Delta to predict the level and the timing of the flood peak as well as the maximal flood extent.

The Inner Niger Delta is a vast seasonal floodplain in central Mali, where the water level ranges between zero in the dry season (March – June) and more than 5m in the wet season (September – December). The patterns of inundation, i.e. the levels, timing and spatial coverage of the floods are of paramount importance to both the people and ecology of the Delta. The livelihood of almost 1.5 million fishermen and farmers depends largely on the annual floods. The Inner Niger Delta is also an ecological hotspot. Reduction of the river discharge of the Niger river – through upstream water extraction for irrigation or retention for hydropower reservoirs – will directly affect the flood-dependent ecosystems and economy of the Inner Niger Delta.

Rationale behind OPIDIN

Rural development in the Inner Niger Delta, as well as the state of the natural resources (production, health, biodiversity) fully depends on the annual floods. The annual production of the natural resources is closely linked to inundation patterns, and governs the livelihoods of the communities in the delta. As can be seen in the figure below, there is considerable annual variation in flood levels. Fish catch and rice production is good in years with high flood levels, as well as the availability of fodder for cattle in the form of *bourgou* (floating grasslands). Both cattle and fish production are of significant importance to the national economy while the rice production is of regional importance, in economic terms. In years with low floods, low production can lead to overexploitation of resources and serious bottlenecks in the livelihoods of the local communities. Extremely dry conditions may lead to food shortages and starvation, particularly in the poorer rural communities. During dry years bird populations are heavily exploited as alternative source of income and protein.



As the use of the natural resources is completely dependent on the height and duration of the flood, it is worthwhile to forecast the flood as early as possible. Not only for the local communities to adapt their economic activities to the forecasted flood levels, but also for (inter)national authorities and donors to prepare in time for low flood seasons. This tool makes informed decisions for example to the timing of grazing in relation to de-flooding, the timing of settlement of temporary camps (fishermen), and the spatial distribution of natural resources.

[4] For more details on Ecosystem Services Mapping, please refer to Deliverable 5.2 (Hamdard *et al*. 2012)

Since July 2013, OPIDIN is accessible to end users by means of an interactive website which allow users to predict flood patterns throughout the Delta. In addition, an inundation atlas is available and bi-weekly radio bulletins on flood levels are broadcasted.
Within Afromaison, OPIDIN was selected as a focal tool in the strategies because of the dominance of flooding patterns in governing the use of natural resources, and the need to predict these patterns. The Afromaison study zones have a geographical spreading over the Delta with a large variation in the timing of flooding. The selection reflects the different uses of natural resources by different users groups. The most important issues in the study zones addressed in Afromaison and its relation to flood level are listed in the matrix below:

Study zone	Agriculture	Cattle grazing	Fisheries	Other use
Diafarabé		Timing of cattle crossing		
Mopti	Rizicultures, timing of sewing			
Akka		Bourgoutieres	Timing temporary settlements, Over-exploitation, zones de mise en defence	Management of Flood forests, bird exploitation
Lacs Nord	Timing sewing, spatial distribution		Fishing in relation to water management	Water management, bird exploitation

Example of ecosystem services mapping in the EMF Process in the uThukela district case study in South Africa

The draft high level Afromaison strategy was included in the Draft EMF products in the following way:

- Land degradation was identified as one of the key environmental sustainability issues in the status quo phase of the EMF.
- The ES mapping formed part of the sensitivity mapping with ES priority areas included as their own sensitivity zone i.e. where land degradation is of greatest concern.
- The sustainable land management approaches (refer to section 3) – recommended interventions and the approaches for economic tools and incentives (refer to section 4) - recommended economic instruments were included in the Strategic Environmental Management Programme (SEMP), i.e. how to address land degradation in these sensitive areas.

The development of the EMF process is categorized into four main phases (i.e. Inception, Status Quo, Desired State, SEMP), while stakeholder participation is at the core of the whole process. There are a number of both policy tools and research tools applied in different phases of the EMF development process. Figure 2.2 presents these different phases and spatial planning tools used in the EMF process.

The EMF process with integrated Afromaison spatial planning tools can be described as follows (see Appendix 2):

Inception phase:

- Refining the scope of work, the methodology, schedule, nature and format of deliverables.
- Spatial planning tools applied: scoping checklists

Status quo phase:

- Baseline analysis of natural resources, socio-economic status, land tenure etc.
- Spatial planning tools applied: ecosystem services mapping with a documentation of spatial strategy of natural resources

Desired state phase:

- Development of desired state based on status quo for ES vulnerability
- Spatial planning tools applied: ecosystem services mapping
- Spatial planning tools not yet fully applied: SITE land use model with different management scenarios and their impacts

Strategic Environmental Management Plan (SEMP):

- Management zones and implementation strategy
- Spatial planning tools applied: ecosystem services mapping to inform management zones and guidelines

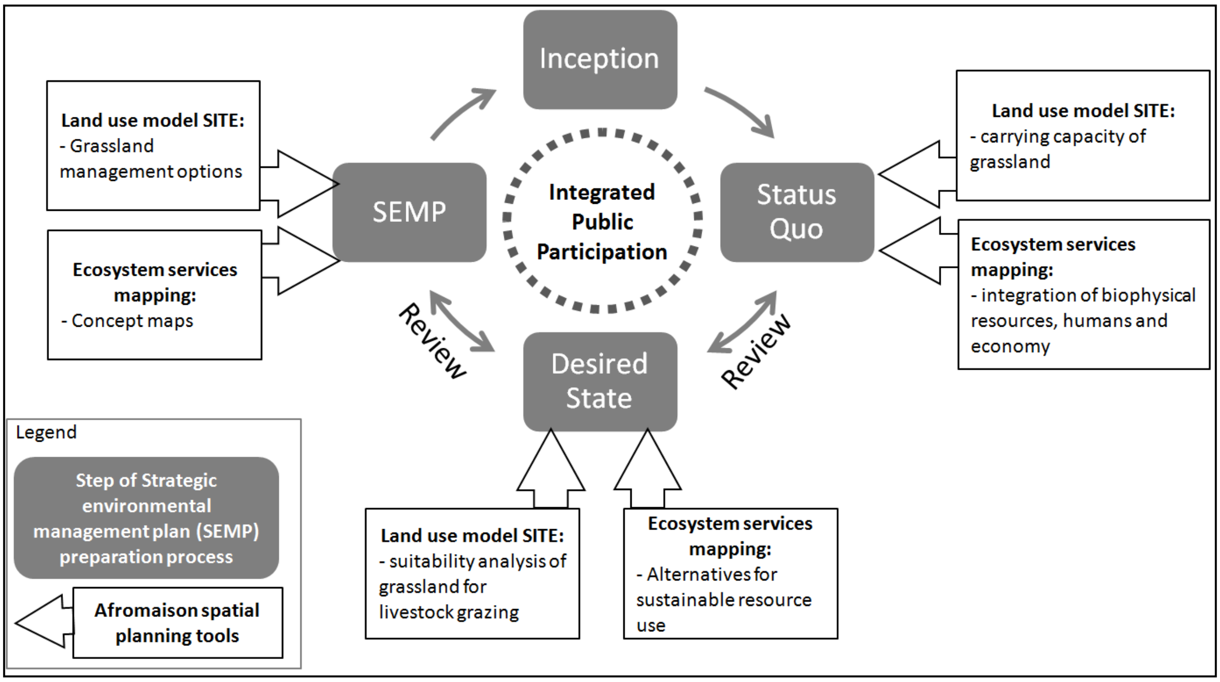


Figure 2.2: Environmental Management Framework Development Process with Integrated Spatial Planning Tool

Box 2.2 Spatial planning tool SITE (South Africa)

(input by Clouting, Cox, Dickens, Hamdard, vd Kwast, Yalew (2013))

Application of ecosystem services mapping in the EMF development process

Ecosystem Services Mapping (ESM) in the Afromaison project is a spatial planning tool, which analyses and communicates the importance and value of natural resources for humans and the economy. By doing this, for example, in the EMF development process in uThukela Municipality District, it contributed to achieving a common understanding of priorities across the various inputs to the Integrated Development Plan (IDP) (Dave Cox, 25.06.2012). Dave Cox further explained that this link between natural resources, humans and economic development is essential, as the underlying sustainability issue in South Africa is poverty alleviation. With this integration of biophysical resources, humans and economy, the chance to achieve environmentally sustainable growth increases (i.e. moving away from overweighting of socio-environmental concerns by economic concerns). As a consequence, and in combination with strict environmental regulations and their enforcement, on-going negative implications for the natural resource base will likely decrease in the future.

As lessons learnt from the EMF development process, to fulfil its potential for achieving integration, the ES mapping and assessment needs to:

- be undertaken at the right scale – which depends on the availability of base data and information at appropriate resolution;
- document value to both local users, but also external demand at a national and even international level, because this is necessary to prioritise natural resources management responses and planning guidelines – e.g. what resources to protect/restore to meet a demand;
- be undertaken in a way that a wide range of stakeholders and sectors can understand the concept of ES, the various services and their value;
- be developed in a spatial format that aligns with the form in which the Spatial development framework (SDF) is developed (Dave Cox, 25.06.2012).

Application of SITE in the EMF development process

SITE is a land-use modeling framework based on extended Cellular Automata and multi-criteria concepts. It employs a rule-based approach for assessing land-use suitability based on various criteria: ecological, economic, cultural and demographic factors as well as neighborhood effects. It simulates land-use dynamics in an annual time steps.

SITE is an open source, flexible and extendible land-use modeling framework. Taking in to account socio-economic as well as biophysical aspects, it has a capability of simulating land-use suitability, dynamic land-use changes, vulnerabilities and potential consequences of various land-use management measures biomass and bioenergy demand and consumption computations. The framework has been used to assess socio-environmental and land-use dynamics in the context of natural resources management on case studies in various parts of the globe. It has been applied, among others, in Indonesia (Priess *et al*, 2007) to simulate land focusing on socio-economic and environmental effects of different strategies of resource use; in India (Das *et al*, 2012) to analyze tradeoffs of land-use change with regard to the production of bioenergy; in Mongolia (Priess *et al,* 2011) to study regional land dynamics with a strong focus on the linked impacts on water resources and Ethiopia (Yalew *et al*, 2012) to simulate land-use suitability based on multiple socio-environmental factors.

This modeling framework is highly relevant for incorporating socio-economic as well as biophysical drivers in modeling interactions of land-use and water resources in the catchment. The model will be applied on this case study to capture, based on various socio-environmental inputs, the major trends in land-use dynamics in the region, to identify vulnerable areas for environmental and ecosystem services decline, with a special emphasis on the grassland land-use class, which is believed to be a major part of the case study area undergoing continual degradation.

The land use model SITE is not yet fully applied in Afromaison in the EMF Process in South Africa. The model is pending on coupling with the SWIM model. Coupling a land-use model and a hydrological model is proposed for quantifying interactions of grassland ecosystem services and water resources. The services of livestock provision and water regulation services are to be analysed in detail for the UThukela District case study. The SITE model can for instance deliver the carrying capacity of grassland and with this a suitability analysis of ecosystem services of the grassland for livestock grazing. Maps showing the dynamics of such ecosystem services can be produced once the coupling is finished (Seleshi Getahun, 13.01.2014).

Preliminary conclusions

- A variety of spatial planning tools is used in the uThukela case study formal EMF process.
- The availability of tools has been well communicated, but the tools have not been used in the engagement and the level of engagement is inadequate. Therefore many stakeholders are not aware of the potential of existing tools, because the level of EMF engagement did not provide for this.
- Participatory spatial planning tools such as Participatory GIS were only used in the Afromaison engagement, not in the development of the EMF process. Normally (depending on consultant and budget) the EMF would not use participatory tools.
- There are synergies in spatial planning and natural resource management planning, where spatial planning is a formal process to regulate land use and is fixed in the spatial planning act while INRM has less formal roots, yet both demand stakeholder engagement.

To further optimize the use of spatial planning tools in participatory INRM in uThukela District municipally it is recommended to;

- Better communicate among stakeholders the importance of participation in the EMF development process
- EMF is a strategic process that should apply Strategic Environmental Assessment (SEA) principles.
- Since the importance of the meso-scale for natural resources management is evident, the resources to effectively implement plans should be made available, and capacity to implement these plans should be strengthened.
- Monitoring and Evaluation tools should be used for the EMF to ensure the achievement of sustainability goals.
- Further research will be required to assess the implementation of the EMF and to assess the role of spatial planning tools used in the EMF process.

2.2.5 Shortlisted spatial planning tools

Figure 2.3 presents the rules for a short listing of spatial planning tools in the Afromaison project. As indicated, 13 tools representing all categories of spatial planning tools were further assessed with more detailed assessment.

The tools shortlisted for further assessment are SIGMA, LEIS, SCP, BRP, DECID-AID, SITE (Ethiopia), SITE (South Africa), OPIDIN, ES mapping (South Africa), WAG (Uganda), WAG (Ethiopia), PPGIS, ES mapping (Uganda). Water Game was also implemented in Mali and in South African case studies within the scope of Afromaison project, but due to lack of timely information these two tools are not selected for further assessment.

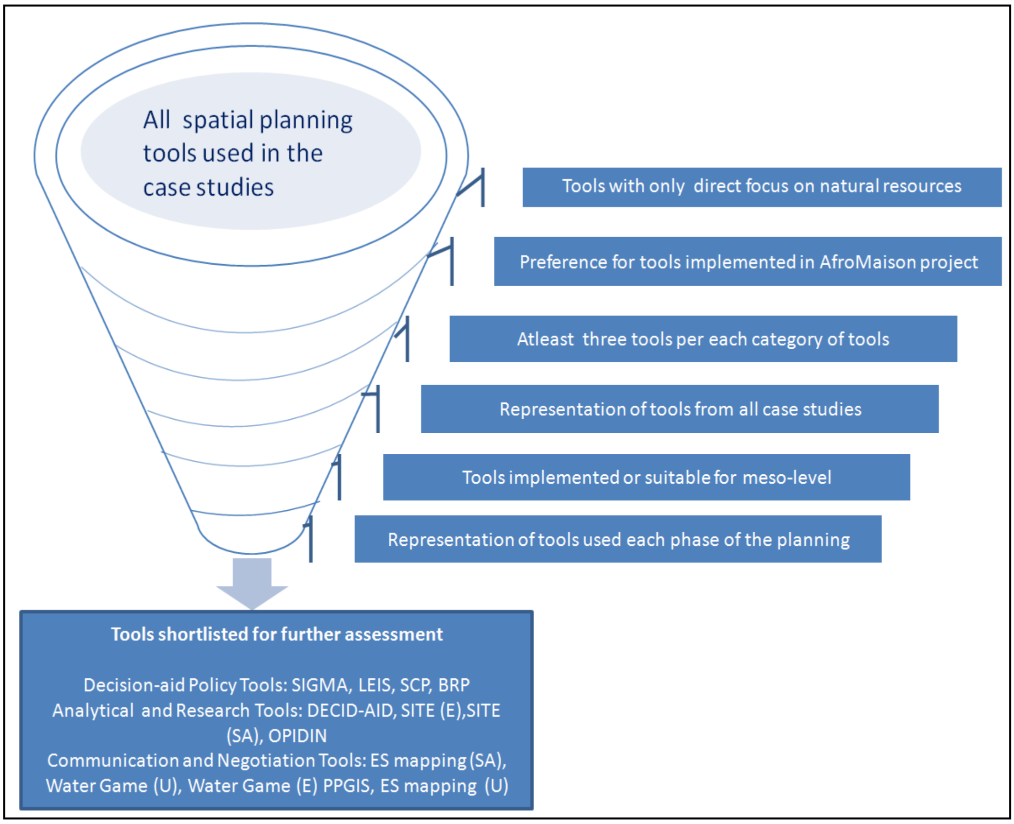


Figure 2.23: Rules set for short listing of spatial planning tools for further assessment

2.2.6 Assessment of suitability and potential sustainability of tools

The evaluation of the suitability and potential sustainability of the selective spatial planning tools was done with a checklist of 10 assessment criteria (see table 2.5) and defined ranges. The results rely on expert judgement of local project partners and are mainly qualitative.

Suitability of tools for spatial planning is defined as those factors, which mostly influence a sustainable use and implementation of these tools. The focus in this evaluation lies on a support of the user (i.e. spatial planners, environmental planners, water planners) to be able to implement (selection, installation, data needs, application etc.) and use a tool at a certain planning phase, for a certain objective, to achieve a desired result.

A definition for successful tools as mentioned in the Afromaison Project (WP5) is derived from Thomas and Fernandez (2008), who evaluated the success of Information Technology (IT) projects. They quote a team leader from IT Project Management, who explained, that ‘‘typically success equals implementation and use. If the project goes to term and gets delivered (a lot do not) and people are using it, it would be judged a success” (Team Leader IT Project Management, F12; in: Thomas and Fernandez 2008, p. 738). In this context a successful tool is considered as a suitable tool in a case study. Therefore key components of suitability of spatial planning tools are identified as implementation and use of these tools. It is concluded that if they are implemented and used (this includes user-friendliness), local end-users benefit from them (otherwise they would neglect them and no longer use them). Assessment criteria to assess these two components are selected.

Suitable spatial planning tool:

A successful spatial planning tool, which is implemented and used.

As stated in the Afromaison Project (WP5 Task 5.6), "suitability" includes contextual factors in a respective case study: "(...) specific aim to identify best suited tools according to the issues at scale, socio-economic and institutional context". These aspects are not considered in the assessment criteria, but will have to be considered during the actual implementation of a tool transferred from one case to another case.

Potentially sustainable tools for spatial planning are defined as those tools, which jointly take into consideration the three main components of the sustainability concept, economic, social and environmental (Calderón 2000), include needs of future generations and stakeholders, as well as long-term alternatives, and which are integrated in existent planning processes. A sustainable spatial planning tool is a tool that promotes spatial sustainable development at the meso-scale.

Sustainable spatial planning tool:

A spatial planning tool, which takes up and produces contents with respect of needs of future generations and local stakeholders, and is integrated into a planning process.

No strict line was drawn between suitability and sustainability as these concepts overlap and influence each other. A suitable tool will likely be used in a more effective way and thus will have better outputs and will be used in a longer time.

The assessment criteria displayed in table 2.5 were used to evaluate selective spatial planning tools on their suitability for use, implementation and sustainability. The shortlisted tools are all scored against these criteria by expert judgement in combination with validation from case study representatives. These assessment criteria will have to be further specified and adapted case-specifically in the future for monitoring purposes. The list is not exhaustive, but has the aim to facilitate discussion on the suitability (use and implementation) and sustainability of tools for spatial planning.

Table 2.24: Assessment criteria to evaluate selective spatial planning tools on suitability for use and implementation and potential sustainability

Assessment Criteria	Description of Objectives	References
C1- Function in the spatial planning process*	The tool functions as: A) Negotiation and Communication Tool B) Analytical and Research tool C) a decision-aiding Policy Tool	Afromaison project inventory for spatial planning tools D 5.1
C2- Level of access	The tool and required hard- and software are easily accessible to users.	Thomas and Fernandez 2006
C3- Level of acceptance	The tool meets the objectives of INRM and delivers benefits for the user. The outputs are acceptable to decision-makers, stakeholders and the scientific community.	EC (1999) European Spatial Development Perspective (ESDP): economic and social cohesion
C4- Cost effectiveness	The costs of the use of the tool stay within the available budget. The benefits justify the costs.	Thomas and Fernandez 2006; IAIA 2002
C5- Level of capacity to implement	The users have the required skills and experience, and facilities(GIS) to use the tool	Brooksbank 2001
C6- Extent of data availability required for the tool	Fit-for-purpose data is available at the meso-scale and accessible to use the tool	João 2005
C7- Level of stakeholder involvement	Involvement of stakeholders to ensure all participants sees problems and potentials of tools in the same way. Stakeholder input is important to help make outputs relevant and acceptable to users. Stakeholder for example could be from sectors such as Water; Agriculture; Nature/ Landscape; Forestry; Soil protection; Land use; Recreation; other?	George 2012; IAIA 2002; Song et al. 2011; Fischer 2007:54, 2010; Chaker et al. 2006: 21; WB 2007
C8- Level of timely outputs to support the planning process	The output of the tool expected and integrated in the planning process on-time.	Calderón 2000
C9- Level of integration in continuous planning process	The tool can be applied for long or short term predictions, visions, scenarios, which feed into the planning process	Afromaison project Conceptual framework WP5, Sect. 1.2
C10- Number of proposed reasonable alternatives	During the spatial planning process reasonable alternatives are analysed, assessed and compared.	IAIA 2002

**Criteria 1, is used to categorize the spatial planning tools, with the aim to select best practice tools from each category as part of the assessment.*

The ranks – judged from experts in the case studies for each tool – are assigned a numerical score on a strength of preference scale (e.g. A=5; B=3; C=1) for each tool for each criterion. "Better" practice (more suitable and potentially more sustainable) tools score higher on the scale, and "worse" (less suitable and potentially more sustainable) practice tools score lower. The criteria C1-C10 are equally weighted.

The overall rule was that there is a representative tool for all three categories (policy, research, and communication tools) of spatial planning tools in each phase of the planning process. The assessment is therefore carried out for different categories of tools used in the planning process.

2.2.7 Results and Discussion

Results of the assessment are presented in table 2.6. This multi-criteria analysis of the tools for suitability for use, implementation and potential sustainability indicate that among policy tools, Systematic Conservation Planning (SCP) has scored the highest after Bio-resource Programme (BRP). Both highly scored tools are used in South Africa, and they contribute to various planning phases such as in setting objectives, situation analysis, selection of strategies, and for implementation and monitoring of selected strategies. SCP scored best in criteria C4, C6 and C8. This tool is used to support NRM strategies and policies expansion areas and protected areas, and inform where to focus financial and human resources. It is developed by provincial conservation agency; cost and time effective and qualitative data is available in South Africa. Some reasons, which back up this overall highest score of SCP in this category, are that it is locally developed, it is used in meso-level planning and the operational skills required are not too high.

Among analytical and research tools, OPIDIN has scored the highest. OPIDIN as a tool to predict the level and the timing of flood peaks as well as a maximal flood extent (see Box 2.1 OPIDIN), scored highest in criteria C2, C6 and C7. In the planning phase of situation analysis, OPIDIN is a very effective tool as it allows the stakeholders to plan ahead based on the flood forecasts produced by this tool. The tool is easily accessible for users, is cost effective, and the required data is available in Mali. There are some concerns about the capacity of local authority to run OPIDIN without external support, but in the future Direction Nationale de l'Hydraulique (DNH) will host and operate this tool independently.

Among Communication and Negotiation Tools, Wat-A-Game (Uganda) has scored the highest. The same tool is also applied in Ethiopia but is relatively poorly scored there. There are two main reasons, why similar tools scored differently in different case studies. The tool addressed the natural issues at stake in the Uganda case study, while in Ethiopia the main natural resource management issue is soil erosion, which is not within the scope of Wat-A-Game. Also, the scores where different because of the stakeholder’s interest in the game: in Uganda stakeholders have shown more interest in this tool compare to Ethiopia. The tool in general is cost effective, time efficient, easy to operate with some basic training, but is not integrated in any formal spatial planning process yet.

The data collected was collected based on expert judgement by representatives of the case study partner organisations. This makes the evaluation in three classes from A-C (high to low) subjective. Furthermore thresholds for these three classes were not defined in detail, which again leaves some space for subjectivity. Therefore it is recommended that a more objective survey is carried out, which is combined with a long-term monitoring of aspects of suitability and sustainability. Further aspects which then additionally could be included are aspects such as carbon footprint or energy efficiency of tools, material used, recycled and wasted; pollution related to the use and implementation of a tool (e.g. waste paper, ink), etc. These aspects were not covered in this evaluation. The local partners and users of the tools would be responsible for proper evaluation and monitoring their tools, in order to continuously improve their tools, the contribution of these tools to INRM at meso-scale, and the suitability and sustainability of their tools.

Table 2.2.5: Evaluation results evaluate selective spatial planning tools on suitability for use and implementation and potential sustainability (expert judgement by stakeholders users with A = most preferred, B = neutral, C = less preferred. Criteria C2 to C10 are equally weighted in the multi-criteria evaluation)

Categories of Tools C1	Assessment Criteria / Tools	Application in Planning Phase (s)	C2	C3	C4	C5	C6	C7	C8	C9	C10	Final score per tool (A = 5 B = 3 C = 1)	3 best practice tools to be inter-compared
Decision-aid Policy Tools	SIGMA (Mali)	- PP 3, PP 8	C	B	A	A	C	C	A	B	B	3A; 3B; 3C = 27	
	LEIS (Tunisia)	-PP 1, PP 2 -PP 3, PP 5 -PP 6, PP 8	B	A	C	C	C	B	B	B	B	1A; 4B; 3C= 20	
	SCP (S.Africa)	-PP 2, PP 3 - PP 7, PP 8	C	B	A	B	A	B	A	B	B	3A; 5B; 1C = 31	**31**
	BRP (S.Africa)	-PP1, PP2, - PP3, PP 5, -PP 6,PP8	C	B	A	B	A	B	A	B	C	3 A; 4 B; 2 C = 29	
Analytical and Research Tools	DECID-AID (Mali)	-PP3, PP 4	C	B	B	C	B	C	A	A	B	3A; 3B; 3C = 27	
	SITE (Ethiopia)	-PP 3, PP 4 -PP 7, PP 8	B	B	B	B	B	C	C	B	A	1A; 6B; 2C = 25	
	SITE (S.Africa)	-PP 3, PP 4 -PP 7, PP 8	B	B	A	B	B	C	B	B	A	2A; 6B; 1C = 27	
	OPIDIN (Mali)	-PP 3, PP 8	A	B	B-C	B-C	A	A	B	B	C	3A; 3B; 2B-C; 1C= 29	**29**
Communication and Negotiation Tools	ES Mapping (S.Africa)	-PP 2, PP 3 -PP 6, PP 8	B	A	A	A	B	B	B	C	C	3A; 4B; 2C= 29	
	WAG (Ethiopia)	-PP 2, PP 4 -PP 6, PP 7	B	C	B	B	B	A	A	B	C	2A; 5B; 2C = 27	
	WAG (Uganda)	-PP 2, PP 4 -PP 6, PP 7	A	A	A	A-B	A	B	A	B	B	5A; 3B; 1A-B = 38	**38**
	PPGIS (Tunisia)	-PP 6, PP 7 -PP 8	B	A	A	A	B	A	A	B	B	5A; 4B = 37	
	ES Mapping (Uganda)	-PP 2, PP 3 -PP 6, PP 8	B	B	A	C	A	B	B	B	C	2A; 5B; 2C = 27	
	Average score/criteria		B-C	B	A	B	A-B	B	A	B	B		

2.3 Inter-comparison of best practice spatial planning tools

In the following the potential transfer of the 3 best practice tools (see Table 2.7) to the same planning phase in another case study will be discussed (Phase 5). It is important to mention here that the different planning systems and characteristics of the meso-scale and other factors of governance influence the up-take and effective use and implementation of a transferred tool. This requires more research and monitoring, which was not part of this project. The following transfers of tools are discussed (see Table 2.8):

(1) SCP (South Africa) in the planning phases of setting objectives, selection of strategies and implementation and monitoring to Ethiopia
(2) OPIDIN (Mali) in the planning phases of situation analysis and implementation and monitoring to Uganda
(3) WAG (Uganda) in the planning phase of alternative strategies to Tunisia

A transfer of a spatial planning tool to South Africa was not discussed, as the case study is the one with the most implemented tools and therefore least gaps in the planning system.

Table 2.36: Best practice Afromaison spatial planning tools (expert judgement by stakeholders/ users with A = most preferred, B = neutral, C = less preferred. Criteria C2 to C10 are equally weighted in the multi-criteria evaluation)

Categories of Tools C1	Assessment Criteria / Tools	Application in Planning Phase (s)	C2	C3	C4	C5	C6	C7	C8	C9	C10
Decision-aid Policy Tools	SCP (S.Africa)	-PP 2, PP 3 - PP 7, PP 8	C	B	A	B	A	B	A	B	B
Analytical and Research Tools	OPIDIN (Mali)	-PP 3, PP 8	A	B	B-C	B-C	A	A	B	B	C
Communication and Negotiation Tools	Water Game (Uganda)	-PP 2, PP 4 -PP 6, PP 7	A	A	A	A-B	A	B	A	B	B

(1) SCP SA <-> Ethiopia

Systematic conservation planning (SCP) scored highest in the category of decisions-aiding policy tools.

In Ethiopia particularly decisions-aiding policy tools are needed or not accessible (i.e. no data was available on existent tools). SCP is cost- and time-effective (see Sect. 2.2.7), but at this moment not easily accessible for stakeholders who only have access to outputs. It is used and implemented by a governmental body (provincial conservation agency) to share knowledge, analyse data, decisions and financial resources used for nature conservation and protected areas. As an integrative tool, it could be effectively used to set objectives and select strategies for resource protection and restoration in Ethiopia. It also delivers indicators for monitoring of natural resources. However, it requires an effective planning system at different scales.

(2) OPIDIN Mali <-> Uganda

OPIDIN is a best practice analytical and research tool.

It is easily accessible for users, high quality data is available in Mali, and stakeholders can be well integrated with this tool (see Sect. 2.2.7). In Mali, OPIDIN has been used before the Afromaison project, which supports its effective use and implementation. It would be newly introduced in Uganda as a modified tool. In Uganda flooding is not the major issue, but an analytical and research tool with similar functions in the planning process, which could be used for predictions for overuse of vegetation or for yields in agriculture, would be very valuable. The data availability for such issues would have to be analysed.

In the planning phase of implementation and monitoring, OPIDIN assists in decreasing uncertainty and can deliver indicators for a monitoring system (e.g. timing of sowing in dependence to water availability).

OPIDIN is least strong in proposing alternatives (see Sect. 2.2.7), but this phase is covered well by WAG (Uganda).

(3) WAG Uganda <-> Tunisia

WAG (Uganda), scored best on average (see Sect. 2.2.7). It covers a wide range of planning phases and could be needed to identify and analyse alternative strategies in the case study of Tunisia and demonstrates that this phase lacks an adequate tool. The focus of WAG would have to be modified (e.g. to soil degradation issues), but the function of the game remains very valid.

2.4 Conclusions

Some conclusions drawn are listed below:

- The methodology used for selection and assessment of tools is based on expert judgment, a more comprehensive case specific method is required to assess the performance and sustainability of the spatial planning tools. The assessment revealed that the use of tools is influenced by planning system and contextual factors. Thus both contextual factors and planning systems need to be incorporated to assess the performance and sustainable of particular tool.
- The tools applied within this project helped in addressing natural resources problems, as well as in communication and negotiation among the stakeholders.
- From the assessment as well as from the project experience in terms of tools uptake, endorsement by partners and implementation, the selected best practice tools proved to be strong, and can be potentially transferred to other case studies with slight tailoring to local circumstances.

Table 2.47: Transfer of spatial planning tools to other case studies

Case Study / Planning Phases (PP)	Ethiopia (Cs1)			Mali (Cs2)			South Africa (Cs3)			Tunisia (Cs4)			Uganda (Cs5)		
	DPT	**A&RT**	**C&NT**	**DPT**	**A&RT**	**C&NT**	**DPT**	**A&RT**	**C&NT**	**DPT**	**A&RT**	**C&NT**	**DPT**	**A&RT**	**C&NT**
Vision (PP1)	**No tool**	**No tool**	**No tool**	**No tool**	**No tool**	**No tool**	**No tool**	**No tool**	**No tool**	LEIS2.0	**No tool**	LPCD	**No tool**	**No tool**	**No tool**
Setting Objectives (PP2)	**(1)**	WAG(E)	WAG(E)	**No tool**	**No tool**	**No tool**	BRP, SCP	BRP, ESM	**No tool**	LEIS2.0	**No tool**	LPCD	SPS	WAG (U)	WAG (U)
Situation Analysis(PP3)	**No tool**	SITE	ESM	PDSEC, SAP,SIGMA	DECID-AID, OPIDIN	ESM	BRP	BRP, ESM, SITE	ESM	Carte-Agricole LEIS2.0	SWAT	ESM, LPCD	**No tool**	**(2)**	ESM, PRA, PRM
Alternative Strategies(PP4)	**No tool**	WAG(E) SITE	WAG(E)	**No tool**	DECID-AID,	**No tool**	**No tool**	ESM, SITE	**No tool**	**No tool**	**(3)**	**(3)**	**No tool**	WAG (U)	WAG (U)
Impact Analysis (PP5)	**No tool**	**No tool**	**No tool**	**No tool**	**No tool**	**No tool**	BRP	BRP	**No tool**	Carte-Agricole, LEIS2.0	**No tool**	**No tool**	**No tool**	**No tool**	**No tool**
Evaluation of Alternative Strategies (PP6)	**No tool**	WAG(E) SITE	ESM, WAG(E)	**No tool**	**No tool**	ESM	BRP	BRP, SITE	ESM	LEIS2.0	SWAT	ESM, LPCD, PPGIS	SPS	WAG (U)	ESM WAG (U)
Selection of Strategies (PP7)	**(1)**	WAG(E) SITE	WAG (E)	PDSEC	**No tool**	**No tool**	SCP	SITE	**No tool**	**No tool**	**No tool**	PPGIS	SPS	WAG (U)	PRA, PRM, WAG (U)
Implementation and Monitoring (PP8)	**(1)**	SITE	ESM	SAP,SIGMA	ROSELT, OPIDIN	ESM	SCP	BRP, SITE	ESM	LEIS2.0	SWAT	ESM, IS	**No tool**	**(2)**	ESM

Abbreviations used in the table: A&RT (Analytical and Research Tools), **BRP** (Bio-resources Programme), **Carte-Agicole** (Agriculture Map), **C&NT** (Communication and Negotiation Tools), **DECID-AID** (Multi sector decision aid tool develop for the Niger Delta), **DPT** (Decisions-aiding Policy Tool), **ESM** (Ecosystem Services Mapping), **LEIS** (Local-scale Environmental Information System), **LPCD** (Local Plan to Combat Desertification), **SPS** (Spatial Planning System), **OPIDIN** (*Outil de Prédiction des Inondations dans la Delta Intérieur du Niger*), **PDSEC** (*Plan de Développement Economique, Social et Culturel*), **ROSELT** (Long Term Ecological Monitoring Observatories Network-translated from French), **PP** (Planning Phase), **PPGIS** (Public Participation Geographical Information System), **PRA** (Participatory Rapid Appraisal), **PRM** (Participatory Rural Mapping), **SAP** (Locally used hydro-economic model), SITE (Ethiopia), SITE (South Africa), **SCP** (Systematic Conservation Planning), **SIGMA** (*Système Informat ique de Gestion des ressources en eau du Mali*, , Water Resources Management Information System for Mali), **SWAT** (Soil Water Assessment Tool), **WAG (E)** (Water Game, Ethiopia), **WAG (U)** (Water Game, Uganda).

PART 3: APPROACHES FOR IDENTIFYING AND ASSESSING SUSTAINABLE LAND MANAGEMENT INTERVENTIONS

3.1 Introduction

The strong emphasis in Afromaison on stakeholder participation opened up the discussion of NRM in the case studies to encompass a wide range of socio-political, institutional and economic development issues. The INRM strategies formulated by the Afromaison case studies are thus very broadly based, with many of the proposed actions in the domain of local economic and social development, rather than NRM *per se*. Proposed technologies for land and water management are embedded within the context of social and economic development initiatives and actions. The formulation of these broader INRM strategies is discussed Ducrot et al (in progress). This report is concerned specifically with identifying and evaluating sustainable land and water management (SLM) interventions within this broader framework

The terminology used in this report follows that of WOCAT (2007), where SLM is used to denote practices relating to management of soil, water, vegetation and land systems; with interventions distinguished as SLM **technologies** (physical measures) and SLM **approaches** (methods to support and implement technologies, including economic incentives, as discussed in Section 4).

3.2 Assessment framework for sustainable land management interventions

The overall evaluation of Afromaison case study strategies (comprising SLM interventions as well as proposed actions in other management domains) is framed as assessment of a complex socio-ecological system, since the success or failure of INRM is a complex function of socio-political as well as biophysical and economic outcomes, and depends on both planned and unplanned change. The assessment framework for SLM interventions nests within and is consistent with the complex systems framework, but explicitly addresses suitability as well as impacts, and uses a more traditional approach that does not explicitly capture feedback and adaptation. Evaluation of strategies in Afromaison is described in Ducrot *et al* (in progress), and the vulnerability of strategies to unplanned externally imposed change is explored in Liersch and Reinhardt (2013).

The assessment framework for SLM interventions developed for Afromaison is described Johnston (2012b). The key elements of the assessment framework (system, values and criteria) (Weaver and Rotmans, 2006) remain fixed throughout the all phases of the project, but with different emphasis and methods at different stages. The Afromaison values against which both strategies and interventions are assessed are encapsulated in the concept of INRM, which aims to "improve livelihoods, ecosystem resilience, agricultural and natural resources productivity and environmental services" (Ochola *et al*, 2010). Interventions must be evaluated in terms of their social, economic and environmental impacts and outcomes, as well as their technical feasibility and social and cultural suitability. There are thus three main components to assessment:

- **Suitability assessment** (SA): covering fitness for purpose, technical feasibility, social and cultural appropriateness, cost-effectiveness and affordability.
- **Impact assessment** (IA): covering the likely outcomes in terms of contribution to livelihoods and environmental impacts. In Afromaison, an ES framework has been used to make the links between landscapes and livelihoods explicit.
- **Vulnerability assessment** (VA): focuses on the response of the system to external forces; in particular demographic change; national / global economic conditions; and climate change. Vulnerability assessment is discussed in detail in Liersch and Reinhardt (2013) and Liersch and Reihardt (in prep).

The criteria for assessment fall into five key domains, reflecting INRM values:

- Livelihood impacts (income, food security)
- Ecosystem impacts (ecosystem health, ES provision)
- Vulnerability (resilience, vulnerability to externally imposed change)
- Technical suitability: feasibility, cost, scalability
- Social suitability: equity, cultural acceptance

In implementing the Assessment Framework to select interventions, it became apparent that assessment of options and selection of interventions is not a linear process, but is iterative and organic, and that the criteria for choice are often implicit rather than overt. Given the participatory nature of the strategy formulation process in most case studies, selection of interventions was often informal, based on the emergence of community preferences from workshop discussions. Decisions were revisited at successive workshops, as the process of fitting a "wish-list" of interventions together into a coherent strategy proceeded. At this stage more rigorous description and evaluation of potential interventions could be included as part of the decision process. Decisions as to the suitability of particular interventions were often based on discussion of community preferences rather than explicit ranking or evaluation. This emphasizes the importance of establishing an agreed set of values for selection as part of the participatory process.

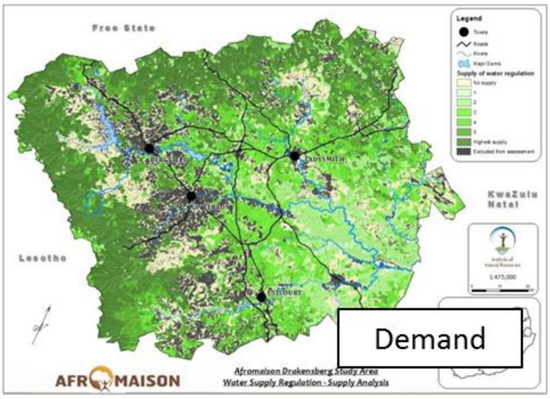
3.2.1 Ecosystem services approach in the Afromaison assessment framework

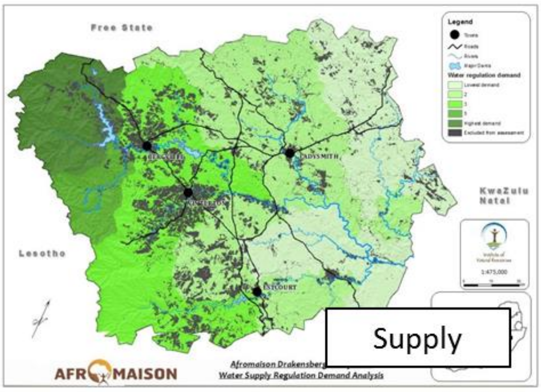
Afromaison adopted an Ecosystem Services (ES) approach to provide an integrating framework for NRM, based on the understanding that landscapes provide a range of goods and services for different groups, that changes in management can change the balance and distribution of benefits and that changes in production and flows of ES can be used to assess the effectiveness, sustainability and equity of NRM at landscape scales. At meso-scale, the impacts of management on both livelihoods and environment can be described in terms of ES. Changes in environmental functioning will be reflected as changes in the overall type and extent of ES provided by natural systems; decrease in overall services, or loss of specific services signals environmental degradation. At landscape scales, overall system productivity, as the basis for livelihoods, is reflected as total provisioning services, and the balance between different types of provisioning services (for example, cropping versus wild capture and collection).

Box 3.1 Defining priority areas for interventions using ES mapping: uThukela

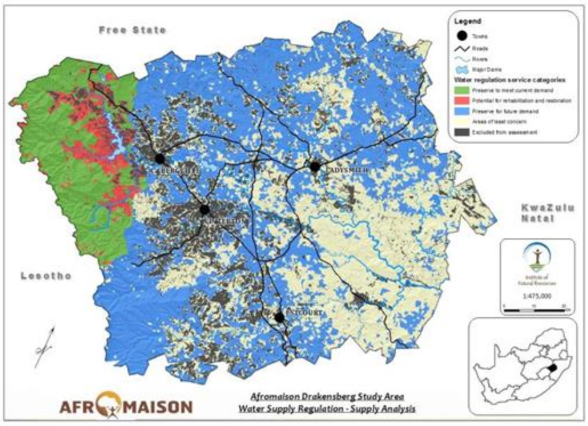
Maps of supply and demand for individual ES were overlain to determine the spatial patterns of interaction between availaiblity of the service, compared to current and likely future use. Management priorities for specific services – and hence, the need for particular interventions for conservation, restoration or rehabiliation – can then be determined according to the matrix below. (See Quayle and Pringle 2013).

ES: water regulation





Priority domains



		Supply	
		High	Low
Demand	High	Retain to meet current demand. Mange to limit impact of heavy demand	Restore and rehabilitate to help meet current demand
	Low	Retain to meet low current and possible future demand	Areas of least concern

The ES approach used in Afromaison is described in Vandenbroucke *et al* (2013). ES concepts were included in the process for identifying and selecting SLM interventions in the following ways:

- Assessment of ES values and benefits formed an integral part of the **initial problem diagnostic** for each case study. ES concepts were used to explicitly link landscapes and livelihoods, describe the dependence of livelihoods on natural systems, and the potential trade-offs and threats to livelihoods from conversion or degradation of ecosystems
- Mapping and spatial analysis of the flow of ES benefits in terms of both supply and demand were used to **prioritise areas for intervention** (see Box 3.1)
- Evaluation of interventions and strategies in terms of
    - livelihood impacts (reflected as changes in provisioning ES)
    - environmental impacts (reflected as changes in the overall provision of ES, and in the types of ES) – see Box 3.6
    - equity of interventions, in that changes in the type and distribution of ESs may benefit different groups (for example, shifting of benefits from local to external stakeholders).

3.3 Selecting appropriate SLM interventions

3.3.1 Situation analysis (diagnostic)

The starting point for identifying SLM interventions as part of INRM strategies is situation analysis/diagnostic, to define the objectives and drivers for management, since this defines the types of technologies or approaches needed. In Afromaison, the following approaches were used;

- **Review and analysis of literature** and interviews with local authorities. This formed the basis for the Rapid Assessment Report (undertaken as an initial phase in the Afromaison Project)on context, opportunities and constraints for operational INRM (Catacutan *et al* 2012)
- **Consultation with stakeholders** to identify issues and priorities. This was conducted both as part of Wat-A-Game, and within more formal stakeholder platforms , such as the Innovation Platforms in Fogera (http://nilebdc.wikispaces.com/innovationplatforms); and the technical and regional working groups in Oum Zessar (IRA/OSS 2013) - see Box 3.2
- **Conceptual mapping (Cmap)** to identify causal links and feed backs (see Liersch and Reinhardt, 2013)
- **Ecosystem services mapping and analysis** was carried out in all case studies as an input to understanding the spatial relationships between land use, and the benefits derived from and threats to resources.

3.3.2 Spatial planning

In Afromaison, INRM strategies are designed as "packages" of interventions combined to take account of synergies, interactions and offsite impacts at landscape-scale. Selection and assessment of SLM interventions is thus an explicitly spatial process, requiring an understanding of the way that proposed interventions and their potential impacts are distributed in the landscape. The approaches used for spatial planning in Afromaison are described in detail in Section 2 above.

Box 3.2 Modes of consultation: Rwenzori - Oum Zessar – Fogera / Blue Nile

Consultation with local stakeholders was integral to identifying and assessing SLM technologies, but the mode of consultation differed in each case study.

In **Rwenzori,** consultation was structured around the use of participatory role play Mpangame (see REF),working with more than 30 community organisations across 35 villages in 5 districts. Mpangame was used to build understanding of NRM issues and interactions.; NRM actions were built into the game in an iterative way, in response to interventions proposed to address issues identified during the game sessions. Following the Mpangame sessions and discussion, around 20 SLM practices were selected for further investigation and inclusion in the final strategies.

In **Oum Zessar**, consultation was structured around a series of local and regional meetings. On the technical side, five thematic working groups (TWGs) were formed by researchers, technicians and representatives of local stakeholders and regional services. At a community level, three working groups of local actors representing civil society were trained , representing the three districts (Sidi Makhlouf, Médenine North and Blessed Khédache) covering the three watershed zones. Each of these groups identified SLM actions and options relevant to their respective sector or region.

Fogera / Blue Nile used a mixed model, combining formal meetings and PRPGs. Afromaison worked with the existing Innovation Platforms (IPs) established under the Nile Basin Development Challenge project, at national and woreda (district) levels. IPs are network of stakeholders , including government officials, farmers, researchers and community representatives. The local IP at Fogera village was the platform for running Watagame sessions, from which one outcome was identifying locally relevant issues and interventions.

In terms of the spatial dimension of identifying and assessing SLM interventions, there are three key questions: where are proposed interventions relevant? Where will the impacts of interventions be felt? And, what are the spatial interactions and dependencies between them? To address these questions, a range of spatially based approaches were used.

First, each case study was divided into management zones which reflecting local understanding of landscape systems, and the different land management needs and options in different land units. The zones provide the base unit around with strategies were built. The basis for the zonation differed in each case study, depending on local priorities and issues. Topography was a key factor in most cases, as a major constraint on land use options, as well as encapsulating upstream – downstream relationships. Land tenure and administrative divisions were also important, representing domains for implementation by different actors. These zones also formed the main spatial units around which the WAG boards were conceptualized, and the games explicitly considered the interactions between zones, in terms of physical flows of water and related sediments and nutrients, as well as conceptual flows of production, labour and profits.

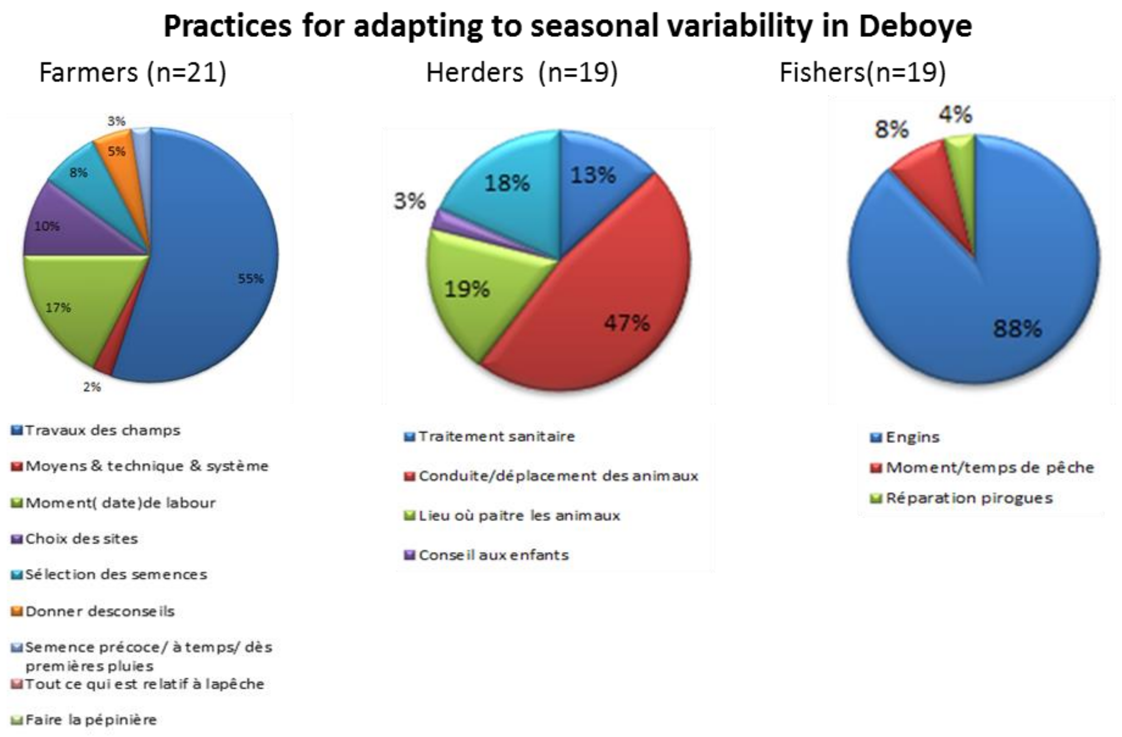
Participatory spatial mapping was used to identify issues and areas for intervention, as part of WAG or separately. This varied from an abstract conceptualization of the landscape as linked units (as in WAG), to accurate spatial representation of the area using imagery (see Box 3.5). Stakeholders identify on the map the main issues in each area, and connections between zones, as input to identifying interventions and management strategies.

Suitability mapping for specific interventions was explored, using GIS-based approaches (see below, Section on tools). Suitability maps were derived by defining biophysical and socio-economic conditions for success, transforming these into proxies for which spatial data are available, and constructing maps by aggregating the layers for each condition to give an overall rating of suitability. However, application of this approach was limited by availability of spatial data to describe constraints adequately at appropriate scales (see below).

Spatial impacts domains of interventions were analysed and described using two main approaches: mapping changes in ES provision, based primarily on changes in land cover (see Vrebos, 2013; Box 3.6); and hydrological modelling of impacts of interventions on erosion, water availability and water quality (see Section 3.4 below).

Box 3.3 Using local knowledge of SLM interventions - Inner Niger Delta

In the IND case study, a survey was conducted of 195 farmers, herders and fishers in three districts to provide an inventory of current practices for adapting to seasonal and year-to-year variability in water availability. Data were also collected on local knowledge relating to variability in the rainy season, traditional methods of seasonal and flood forecasting, and perceptions of the usefulness of flood prediction to local communities and producers. The data illustrate the range of different management practices currently in use, and the differences between districts. For details, see Zare 2013.



3.3.3 Combining local and scientific expertise

Approaches used by the case studies to identify relevant SLM interventions combined local and international expertise, using a mixture of participatory discussion and expert advice (Box 3.2). The three main inputs were local knowledge and experience; expert/ scientific inputs (based on international experience); and participatory brainstorming and exploration of options. These approaches were used in different ways and combinations in each case study, for example:

- **Local knowledge**: In the Inner Niger Delta, the identification of local strategies for restoration and adaptation was done through a series of focus group in 3 districts, with different occupational groups (farmers, fishers, herders). During the focus group discussions, stakeholders identified the problems encountered, the causes, restoration strategies, the application domain, results and technical implementation issues. Box 3.3. (See Zare, 2013 for a full description).
- **Historical experience**: In Oum Zessar, a program of land and water management has been underway since the 1980s, drawing on historical experience with traditional water

management methods (*jessour* and *tabia).* These structures, which retain water and sediment during storm events, have been rehabilitated and extended to new areas; and combined with new approaches using gabions and slotted pipes to enhance groundwater recharge (IRA/OSS 2013)

- **Expert analysis combined with participatory exploration**: In Fogera / Blue Nile, researchers identified a long list of 81 potential SLM practices to address the range of land degradation and production issue in the Blue Nile Basin. These were described and grouped in terms of their purpose (biophysical, hydrological and socio-economic), and the physical, socio-economic and institutional conditions needed for implementation, and screened using the PROCA tool (see below) to a short-list of 35 practices relevant for the region, which were explored in more detail with stakeholder groups (Pfeifer, 2011a).

The combination of local and scientific knowledge is a key component of the Afromaison approach. The role of local experts and stakeholders is to provide historical context and knowledge of previous management success and failures; insights in the dynamics of the system; assess local feasibility, acceptance and preferences; and highlight pressures and potential conflict. The role of scientific and technical inputs is to provide advice on technologies and approaches not currently used in the area; identify links and interdependencies that may not be obvious at local level; and provide predictive capacity based on experience in other areas.

3.3.4 Resources for identifying SLM Interventions

There is a very extensive literature on both research and implementation of interventions to improve land management and mitigate or prevent land degradation, particularly in Africa. A large number of studies, manuals, handbooks, guidelines and databases categorizing SLM practices, and describing case studies, are available. Of particular note are

- the WOCAT database (www.wocat.net), which focuses on technologies and approaches related to conservation agriculture;
- the AgWater Solutions database (http://awm-solutions.iwmi.org/), which focuses on small-scale agricultural water management;
- the 3R reports and manuals (www.bebuffered.org), which focuses on techniques to retain water in the landscape;
- African Development Bank Rainwater Harvesting Handbook (AfD, 2008);
- ICRAF publications on conservation agriculture and agroforestry (see for example Bayalaet *et al*, 2011);
- CIAT Tropical Soil Biology and Fertility Institute manual on integrated soil fertility management in Africa (Sangina and Woomer, 2009).

Available resources are reviewed in detail in Johnston (2012a).To expedite access to these resources for the case studies, and allow exploration of different options to address specific NRM issues, a search tool was constructed for Afromaison which groups SLM interventions into 11 major categories according to purpose, and uses a faceted search to explore over 400 case studies compiled from the literature (available at http://goo.gl/QQKM9F).

3.3.5 Description of technologies

An integral part of selection of practices is providing descriptions at appropriate level of detail to inform the discussion. A standardized format was developed for "practice cards" to summarise the key points for intervention types, to facilitate discussion in workshops (see Box 3.4). The format draws on outputs generated from the WOCAT database, but with the key difference that the cards describe a generic form of the technology, rather than a specific instance as is the case for the WOCAT and AgWater Solutions databases. Information fields were chosen to match the key criteria for selection of interventions in the case study. However, since the issues of concern differed, various versions of the practice cards were generated for each case study.

Due to the iterative nature of the selection process, increasingly more detailed information is required as the process progresses through initial identification of required intervention types (e.g. rainwater harvesting), selection of specific technologies (e.g. ponds, zai pits) to detailed design for the particular context, taking account of soil type, topography and available resources. (In general, detailed design is outside the scope of meso-scale projects such as Afromaison. It is, however, critical to the ultimate success of interventions that appropriate technical support is provided to communities at the stage of design and implementation). For example in the uThukela District, in the South African case study, three levels of description of SLM interventions were generated as the process progressed:

- Summary intervention cards describing the broad types of proposed interventions (see Box 3.4), used for initial identification and comparison of interventions
- A report providing details for 23 priority interventions, including information on variants of the technology, suitability in terms of land use, biophysical and social context, costs and benefits, and possible impacts (INR / IWMI, 2013)
- A training module for communities for implementing and monitoring erosion control structures in the Upper uThukela region (Everson, 2013).

3.3.6 Combining interventions

There is often not a simple one-to-one relationship between NRM problems and solutions. A single issue (such as erosion) may have multiple causes (overgrazing, track formation, vegetation clearing) and hence require a combination of interventions – we have termed this many-to-one relationship as ***stacking*** of interventions. Conversely, a single intervention may address a number of different NRM issues (for example, re-vegetation to address erosion, water retention, and provision of forage) – we have termed this one-to-many relationship as ***clustering*** of interventions.

SLM interventions are thus not selected and assessed in isolation, but as part of the overall INRM strategy. The iterative nature of the selection process is fundamental to this process, where interventions are identified and progressively refined as their relationship to other parts of the strategy become clearer. The main tools and approaches used in Afromaison to ensure that this happened include:

Box 3.4 Choosing interventions – practice cards: Fogera/Blue Nile

To facilitate comparison of different practices, interventions were described using a standard summary format known as "practice cards". Technologies were described using standard fields , with photos, and colour coded to group practices with similar purpose. The cards summarise technical and practical information relevant to implementing the technology, to help land managers assess the relative suitability of different technologies in different contexts. The cards were used in participatory discussion sessions with the Innovation Platforms, as an input to formulation of strategies at basin scale. (Pfeifer and Notenbaert 2011).

Level Fanya Juu (graded or level)

Hydrological purpose:	Soil and water conservation
Bio-physical purpose:	Erosion reduction
Socio-economic purpose	Increased crop yield
Suited to altitude?	Midland
Suited to slope?	3-15%, up to 5% for grassland
Suited to rainfall conditions?	900- 1400 mm >1400 if altitude 500 - 1000m <900mm if altitude >1500 (level) > 1400mm (graded)
Suited to soil conditions?	deep well drained soil not sandy not stony soils
Suited to degraded land?	no
Land needs	medium
Required level of labor input?	high
Required level of capital investment?	low
Generates additional fodder?	if combined with vegetation strip
Requires access to markets?	low
Required level of cooperation	high

Sand dam

Hydrological purpose:	use of river
Bio-physical purpose:	-
Socio-economic purpose	supplementary irrigation for cash crop
Suited to altitude?	lowland
Suited to slope?	-
Suited to rainfall conditions?	all proximity to the river
Suited to soil conditions?	sandy soils
Suited to degraded land?	no
Land needs	low
Required level of labor input?	high
Required level of capital investment?	high
Generates additional fodder?	no
Requires access to markets?	high
Required level of cooperation	high

Biological fertility management

(Legume, intercroping, crop rotation)

Hydrological purpose:	water recharge
Bio-physical purpose:	soil fertility
Socio-economic purpose	Fodder for livestock
Suited to altitude?	-
Suited to slope?	< 50%
Suited to rainfall conditions?	-
Suited to soil conditions?	-
Suited to degraded land?	no
Land needs	no
Required level of labor input?	medium
Required level of capital investment?	low
Generates additional fodder?	yes
Requires access to markets?	low
Required level of cooperation	low

- Analysis of cause – effect relationships and feedbacks, as part of the situation analysis / diagnostic. Conceptual mapping using CMap[5] was a particularly useful tool for identifying one-to-many and many-to-one relationships.
- Detailed description of selected interventions, including analysis of impacts, complementarities with other interventions, and what other measures are need to support or supplement the intervention (see for example INR / IWMI, 2013)
- Analysis of the spatial relationships between issues and interventions (including off-site impacts) - for example, using spatial mapping of issues and drivers (see Box 3.5); and analysis of interventions by management zone.
- In Fogera /Blue Nile, a participatory role play game (RPG), called Happy Strategies, was designed and used with stakeholders to explore combinations of SLM interventions in a landscape context (see Pfeifer and Habtermicheal, 2011)
- WAG is designed to simulate the links between different landscape zones and land uses. In playing the game, interactions and feedback between actions "played" by participants (interventions) become apparent.
- Review of the issues, drivers and proposed interventions in each designated zone, to identify overlaps, synergies and gaps, as part of the process to design economic instruments (see Section 4 below) and strategy formulation.

5 http://cmap.ihmc.us/

3.3.7 Tools for screening and suitability analysis

A range of decision tools for selecting SLM interventions were explored in Afromaison, including guided search tools (e.g. Schwilch *et al*, 2008), decision trees (e.g. African Development Bank, 2008); suitability mapping at a range of scales (Pfeifer, 2011; http://awm-solutions.iwmi.org/country-mapping.aspx; ;http://www.seimapping.org/tagmi/index.php); and GIS based tools for design and siting of rainwater harvesting (e.g. Barron and Noel, 2008). The range of available tools is described in detail in Johnston, 2012a.

In the case studies, a more limited set of tools were actually applied. These include:

- **PROCA** (Participatory Rapid Opportunities and Constraints Analysis - http://awm-solutions.iwmi.org/proca-and-gender.aspx) was used in Fogera / Blue Nile to screen 81 potential SLM interventions identified for the Blue Nile basin down to a portfolio of 35 technologies in 6 main groups. Screening was done using a combination of technical knowledge and consultation with local experts and farmers, through the Innovation Platforms. PROCA uses five "hurdles" which must be met for the technology or approach to be considered further: contribution to smallholders' livelihoods; gender and equity considerations; out-scalability; ease of implementation; and resource sustainability.
- **Guided interrogation of databases**: for example, at Oum Zessar, a methodology was developed under the DESIRE project for guided interrogation of the WOCAT database (Schwilch *et al,* 2008)
- **Suitability mapping** - a method for mapping suitability of proposed interventions in the Blue Nile basin was developed by Pfeifer (2011). Maps of biophysical suitability were generated using data on topography, soil type, land cover and climate. Socio-economic suitability was modelled by comparing known uptake of technologies (from household surveys) with variables of an economic production model (labour, capital, farm size and tenure, access to market). Relevant uptake data was not available for other case studies, and so the method was not readily transferable. An open-source tool was constructed for generating suitability maps for rainwater management strategies in the Ethiopian Blue Nile, and is available online at http://nilebdc.wikispaces.com/Nile+Goblet+tool+and+training .

The use of automated decision support tools, including suitability mapping, in selecting SLM interventions was explored in Afromaison but was found to be problematic. While these approaches are useful at regional scale, experience in Afromaison suggests that their applicability at meso-scale is currently limited, for a number of reasons. The first, and most obvious, is availability of relevant data on suitability constraints at suitable scales. Most existing tools for suitability mapping have been developed at regional to national scales (e.g. AgWater Solutions 2012; Kirby and Irvine 2012) and are too "broad brush" to be relevant at meso-scale. While the structure and logic of the tools are theoretically transferable across scales, detailed data on constraining factors are rarely available.

The second issue is the level of detail needed in describing interventions and constraining factors. Decision support systems need to be able to predict the appropriate social and ecological niche for interventions, and move away from blanket recommendations. However, while a technology group may be broadly suitable over a range of conditions, a particular instance or practice may be very tightly constrained. For example, contour bunds to reduce soil erosion are suitable in almost all conditions; but the exact form and layout of the bunds needs to be very specific to soil, slope and climate and may in fact vary within a single landscape.

Thirdly, at the meso-scale, the aim of suitability analysis is not to identify the “best” solution, but to identify a wide range of appropriate interventions from which land owners / managers can choose. The use of automated approaches may eliminate options that are of only moderate suitability in theoretical terms, but are a good fit to local preferences or to a broader catchment strategy.

3.4 Methods for ex-ante assessment of impacts

The impacts of SLM interventions should ultimately be evaluated in the context of the broader INRM strategies, and not in isolation, but evaluation of such broadly based strategies is a complex task (see Ducrot et al, in prep). A starting point is to build a picture of the likely impacts of the component interventions, before assessing interactions and feedbacks. Three approaches were used to assess ex-ante the likely impacts of SLM interventions: qualitative assessment; semi-quantitative analysis of changes in ES provision; and quantitative modelling. The same approaches were used for assessing individual interventions, and for exploring the bio-physical impacts of the overall strategies.

In the context of INRM, it is particularly important to capture off-site impacts, both to guard against unintended consequences, and to capitalize on potential synergies. In biophysical terms, the offsite impacts of SLM interventions are primarily related to changes in hydrology – that is, the quantity and quality (including sediment levels) of water available, and the way that water moves through the landscape (run-off rate, infiltration, groundwater recharge). Hydrological models thus formed an important component of the assessment. These models were also used to explore the vulnerability of the system to climate change by simulating the impacts of projected changes in rainfall and temperature based on a range of climate change scenarios (see Liersch and Reinhardt 2013).

Qualitative assessments of impacts were carried out as part of the detailed description of interventions described above. These assessments drew on previous experience, local knowledge and expert analysis to describe intended and unintended consequences of specific interventions. Examples are given in PAIP BVZ and in INR / IWMI, 2013. CMap (see above), undertaken as part of scenario analysis (under WP6 of Afromaison), was used to explore causal links and feedbacks in the system as part of assessing potential impacts.

Impacts of individual interventions and strategies were also assessed using Watagame. The game is structured to explore the links between management decision and outcomes in terms of livelihoods and environment. Critical environmental factors, causal links and impacts of different interventions and management decisions were defined within each case study as part of the process of customizing the game for local conditions, based on local knowledge and scientific input. Playing rounds of the game enabled participants to explore the cumulative consequences of decision making by different actors.

ES assessments: SLM interventions generally operate by modifying land cover (for example, conversion of agricultural land to agroforestry), land condition (for example, by reducing erosion), or both. Maps of ES provision can be generated and compared for conditions with and without interventions, using the ES mapping approach described by Vandenbroucke *et al* (2013) (where changes in land cover type are reflected in the Land Use and Land Cover (LULC) map; and changes in land condition are reflected in the provision of specific ES from the particular land cover, captured in the LULC – ES matrix). This approach was used in Rwenzori (Uganda) to analyse the potential impacts of converting steeply sloping agricultural lands to agroforestry and plantations, in terms of provision of ESs of erosion prevention and water quality regulation (see Box 3.6).

In uThukela District, a more integrated approach is being explored which aims to analyse the impacts of land management programs on ES provision, but capturing the feedbacks between land use and hydrological changes resulting from both planned interventions and external drivers. Major land use change drivers are identified, and spatially explicit land use models are developed to capture and represent the dynamics of land use change, encompassing socio-economic and biophysical variables, using the SITE model (Simulation of Terrestrial Environments[6]). The land use model is coupled with a hydrological model (SWIM) to simulate-feedbacks between LULC and hydrological change. For details see Van der Kwast *et al* (2013). Work is ongoing, but there are some issues both with availability of suitable land use data; and with validation of land use change trajectories, particularly in the context of post-apartheid South Africa, where the drivers of change are also changing. A similar approach has been used in studies under NBDC in the Jedeb catchment in the Blue Nile (close to Fogera) - see Yalew (2012).

Quantitative modelling of the impacts of SLM interventions focused mainly on hydrological modelling, since in biophysical terms, the offsite impacts of SLM interventions are primarily related to changes in hydrology – that is, the quantity and quality (including sediment levels) of water available, and the way that water moves through the landscape (run-off rate, infiltration, groundwater recharge). Hydrological models were also used to explore the vulnerability of the system to climate change by simulating the impacts of projected changes in rainfall and temperature based on a range of climate change scenarios (see Liersch and Reinhardt 2013).

- The SWIM (Soil Water Integrated Model[7]) hydrological model was used in Upper uThukela to simulate impacts of grazing management and veld burning on water availability, erosion, water quality and vegetation yields at basin scale (Pilz, 2013). SWIM was also used in Fogera to simulate the impacts of changes in land management (specifically, conversion of grassland pastures to cropping; and re-afforestation of the catchment).
- A similar model SWAT (Soil Water Assessment Tool[8]) was used in the Blue Nile at a range of scales: to simulate the impacts of climate change and conversion of woodland to agriculture in Ribb and Gumera catchments (Befekadu, 2013); and to investigate the hydrological impacts of landscape-wide interventions, including terraces and bunds, on soil and water conservation in the small (27km^2) Mizewa watershed, part of the Fogera case study (Schmidt and Zemadim, 2013).
- The InVEST[9] model (Integrated Valuation of Environmental Services and Tradeoffs) was explored in uThukela District and Fogera to assess the impact of SLM interventions on

[6] http://www.ufz.de/index.php?en=19080
[7] http://www.pik-potsdam.de/research/climate-impacts-and-vulnerabilities/models/swim
[8] http://swat.tamu.edu /
[9] http://www.naturalcapitalproject.org

individual ES – specifically water delivery and erosion prevention. InVEST uses a simplified hydrological model (for runoff) and a version of the USLE (Universal Soil Loss Equation) (for erosion / sediment yield) to generate quantitative estimates of changes in water and sediment yield under different land management scenarios (including implementation of SLM interventions).

- WaTEM/SEDEM10, a spatially distributed soil erosion and sediment delivery model, was used in Rwenzori to simulate the impact of changes in land cover (conversion of forest to agricultural land) on erosion.
- In Oum Zessar, where availability of water is constraining for development, WEAP (Water Evaluation and Planning[11]) tool was employed to assess water availability and the feasibility and outcomes of interventions relating to water allocation under a range of climate and economic development scenarios – see Box 3.7.
- In Fogera, use of a multi-criteria optimisation model ECOSAUT[12] was investigated as an input to selecting SLM technologies. The model uses farm level survey data to assess the social, economic, and environmental consequences of alternative land management strategies. The baseline model was set up for the Fogera catchment, but the model was found to be very data intensive, and no scenarios were simulated.

Although different approaches were used in each case study, three common issues emerged that limited the effectiveness of quantitative modelling for assessing impacts of interventions.

The first is the availability of data at adequate levels of detail, both as inputs to the model and to calibrate and validate outputs. Hydrological models are data intensive, requiring detailed spatial data on land cover, soils and land management; and time-series hydrology data to calibrate the models and validate results (see for example Van Griensven *et al* (2013) for a critique of the issues involved in validation of SWAT models in the Blue Nile). These data are notably lacking for most case studies.

The second issue has to do with the way in which the models simulate SLM interventions. All the hydrological models listed above simulate land management practices using a variant of USLE (Universal Soil Loss Equation) with empirical factors for cropping management (C) and conservation practices (P). Ideally these are obtained from experimental plot data under conditions similar to those being modelled, but more commonly they are estimated based on experience and literature values. SLM interventions are simulated by changing these factors, but there is little data on which to base estimates for new practices in the context of the case studies. The impact of interventions can thus be modelled only in broad terms, which means, for example, that it is very difficult to compare interventions which address the same issues (e.g. bunds vs vegetated strips). New approaches are being trialed in the Blue Nile, coupling SWAT (designed for catchment level studies) with APEX (Agricultural Policy / Environmental Extender), a modelling tool designed to simulate a wide array of land management strategies, at farm scales (Gassman *et al,* 2010).

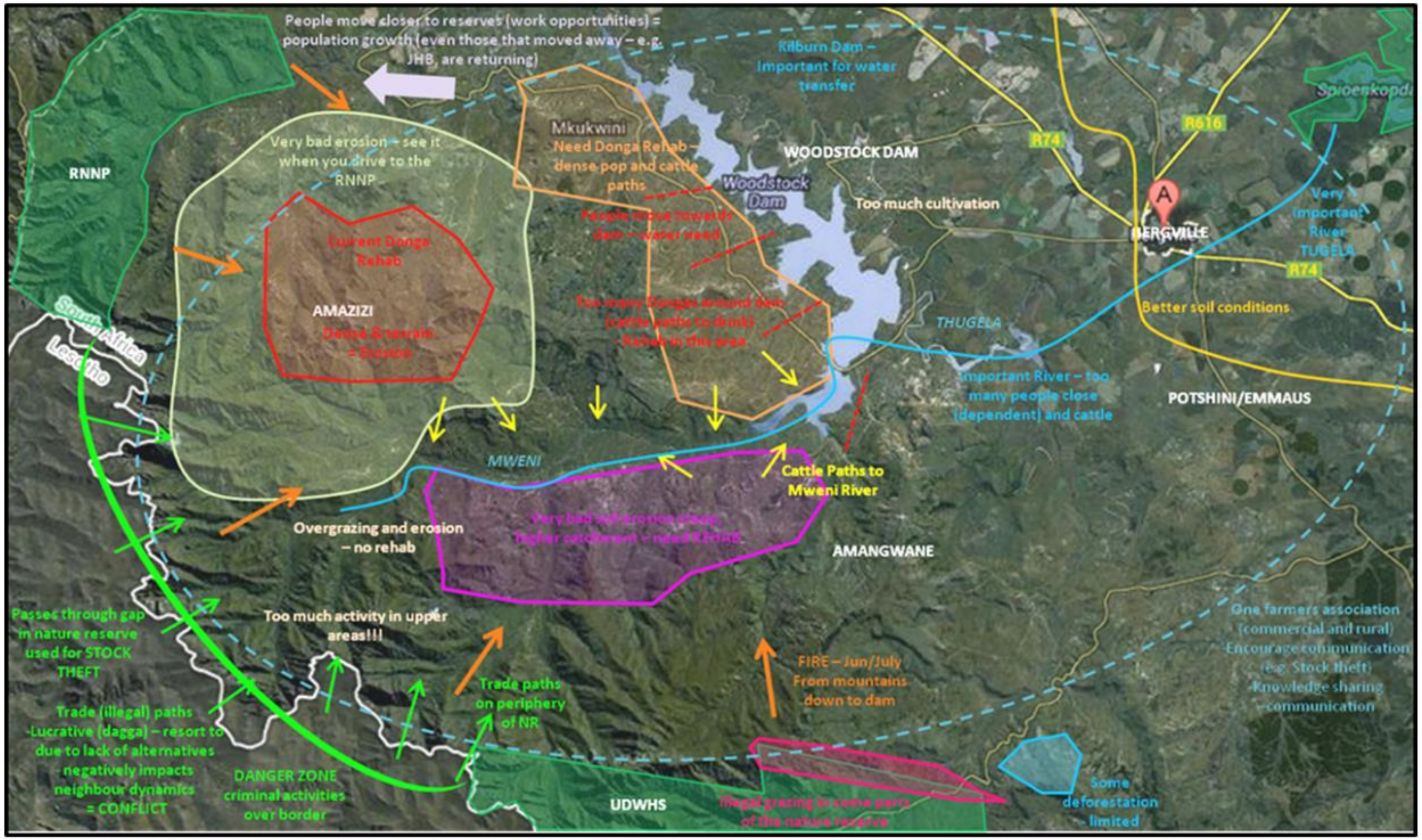
Thirdly, there is the problem of model complexity. Hydrological models are intrinsically specialist tools, requiring a significant degree of technical expertise. This expertise was not, on the whole,

10 http://www.kuleuven.be/geography/frg/modelling/erosion/watemsedemhome/
11 www.weap21.org
12 http://www.cipotato.org/publications/pdf/003640.pdf/view

available within the case study teams, but was provided by external partners from academic research institutions (PIK, UNESCO, IWMI). It is thus difficult to shift these tools into an operational space for planning and management within the case studies. In addition, the complex nature of the tools meant that considerable time is needed to develop, calibrate and validate the models and in several cases, modelling was not completed within the timeframe of the planning processes.

Box 3.5 Participatory mapping: uThukela District

Using a large aerial photo with basic landmarks (roads, rivers, settlements) as a base, meeting participants highlighted areas that face particular challenges - for example, areas where soil erosion is severe were demarcated, and the group discussed reasons and drivers. Participants also mapped out current work that is being done (for example erosion control programs, etc). This process is valuable because it gives a visual understanding of the area, and helps participants to make links between NRM problems and pressures / drivers

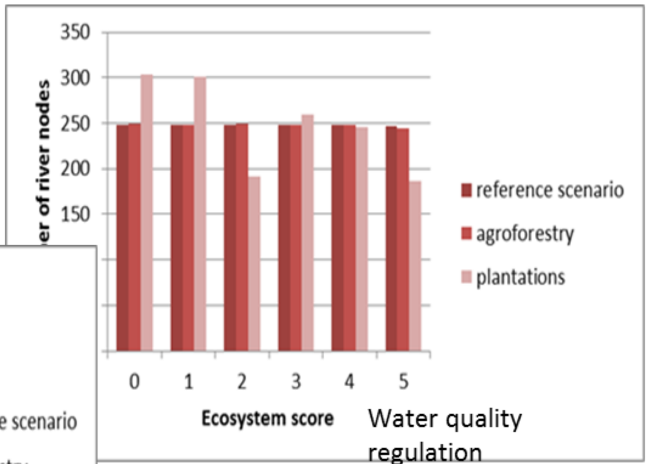


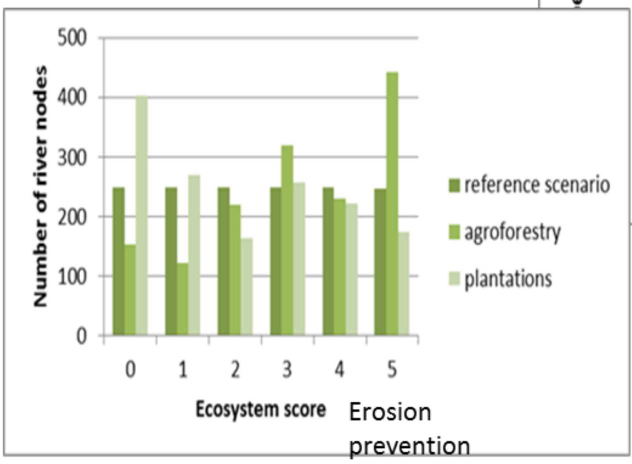
Box 3.6 Assessing impacts of interventions using ES assessments: Rwenzori

In Rwenzori, the potential impact of proposed SLM interventions across the catchment was evaluated by assessing the likely changes in delivery of ESs. The study assessed the impact of converting agricultural land in erosion prone areas to agroforestry and plantations. Theoretical land use change scenarios were developed, with areas for conversion selected based on population density and erosion vulnerability. Changes in supply and demand of specific ES under the new land use were modelled (using a combination of hydrological modelling and GIS analysis) and compared to the current situation.

The analysis gives an indication of how land use changes can result in changes of delivery for ecosystem services. The use of simple tools that can integrate flows between supply and demand allowed the evaluation of more complex ecosystem services. Incorporating population data under different land use scenarios can further improve the results.

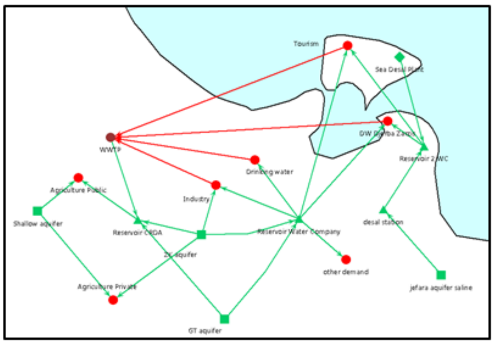
For details see Vrebos 2014





Box 3.7 Modelling impacts of interventions: WEAP in Oum Zessar

In Oum Zessar, groundwater is the main source of agricultural water. Recently a desalination plant was constructed, and an additional sea water desalination plant is planned from 2016 to supply water to urban areas and the tourism industry. With these developments, pressure on groundwater is diminishing and there are plans to develop additional irrigated areas using water from aquifers. The WEAP (Water Evaluation and Planning) hydrological modelling tool is being used to assess the extent to which agriculture can be scaled up, considering the available resources. The model will also elucidate the potential impacts of climate change on the groundwater resources in the Oum Zessar area. Results will be used to evaluate the potential benefits and impacts of different water management scenarios. (Mul et al 2014).



WEAP setup for Oum Zessar

3.5 Comparison of case studies

The approaches used to select and assess SLM in each case study are summarized and compared in Table 3.1. A range of different approaches and tools for selecting and assessing SLM interventions were employed in the case studies, and the process played out differently in each. No single "best" approach for identifying and assessing SLM interventions emerged, but a number of common factors and principles can be drawn out:

Participatory and technical inputs: The approaches used in each case study reflected differences in capacity and interests of stakeholders, as well as difference in available resources and information. The balance between participatory processes and technical inputs was to some extent reflective of the availability of local technical expertise – for example, in uThukela District and Oum Zessar, where local NRM research and management agencies are strong, there was a heavier reliance on technical inputs. However, it is clear that in all cases a strong participatory process was needed, both to capture local knowledge and to promote ownership and involvement.

Informal assessments: Although all case studies agreed to a structured assessment framework involving decision criteria and indicators, it quickly became apparent that in the context of participatory processes, suitability assessment and prioritization of interventions was not a linear, and indeed not always an explicit process. Identifying and assessing interventions as part of broader strategies was iterative, moving from individual interventions to integrated landscape-scale considerations and back again, with each step involving implicit assessments that resulted in inclusion or rejection of components. This emphasizes the importance of an agreed vision and values as a starting point for strategy formulation, since much of the assessment of suitability of interventions was made using implicit rather than explicit criteria and judgements.

Scale: In all case studies, there was an intuitive understanding of the meso-scale as a logical scale for planning and implementing SLM interventions. Meso-scale was defined more in terms of management level than physical size, as the scale at which operational (as opposed to policy) decisions are made, which bridges between farm-scale management and national policy, and where the cumulative impacts of farm-scale interventions are felt. In physical terms, it varied significantly between case studies; but in each instance there was an obvious link to the domain of local government agencies (district administration) with responsibility for implementing programs and interventions.

Zonation: Each case study used zonation within the meso-scale to delineate coherent management zones, where a common suite of SLM interventions are relevant. This zonation is usually related to topography as a primary determinant of management options, but the uThukela District also reflected tenure types, and in Oum Zessar and Mali, administrative regions.

Multiple interventions: All case studies identified a range of intervention types, with several proposed technologies for each, rather than specifying a single technology or technique. This is in line with the findings from earlier studies, where a diverse set of technologies for stakeholders to choose from was identified as a reason for successful adoption of SLM techniques (Barron *et al,* 2009; AgWater Solutions, 2013). All case studies prioritized interventions in the domain of small scale water management and rainwater harvesting; and agronomic approaches drawing on conservation agriculture techniques and agroforestry. Common themes across at least four of the case studies included grazing management; control and rehabilitation of erosion; and conservation and restoration of natural vegetation (wetlands, forests, riverbanks). There was a mix of farm-scale / individual actions, and interventions at community / landscape level; and recognition of areas where complementary measures are needed to ensure effective implementation (e.g. grazing management to protect re-vegetation or soil erosion control works). Finding approaches to support cooperative implementation of complementary interventions was addressed as part of the analysis of incentives (see Section 4 below).

Automated tools: There was limited enthusiasm in any of the case studies for adoption of computer-based decision support tools to identify and assess SLM interventions. One reason is the scale and detail of analysis required. This is best explained by the distinction between identifying generic interventions types; and designing a specific instance of the technology appropriate to local conditions. The meso-scale lies in the middle ground between these two, where local stakeholders are generally well aware of whether particular types of interventions are relevant (so generic tools are not useful), but the actual suitability and effectiveness of a technology depends on very localized conditions, and the details of design and implementation may vary from field to field. Most DSTs addressing biophysical suitability have been designed to assess generic intervention types at broad regional scales (e.g. Pfeifer, 2011; AgWater, 2012; Kirby and Irvine, 2012). Perhaps more importantly, it seems that the process of structuring and organizing information which underlies construction of DSTs is actually an essential part of the learning and exploration process for stakeholders in understanding the issues and priorities for their regions, and is difficult to shortcut. From a stakeholder perspective, it seems that the time required to set up a DST with appropriate detail for biophysical assessments can be better spent in understanding the local system. The exception was hydrological modelling tools, which were used as part of the assessment process in all case studies – but even in contexts (such as uThukela District and Oum Zessar) where local technical capacity was high, hydrological modelling was mostly conducted by external research partners with specialized expertise.

ES approach: in all case studies, assessment of ES was a starting point for discussion of landscape values, issues and interventions, but the concepts were applied differently in each case study. In the uThukela District, spatial patterns of supply and demand for ES were an important input to prioritizing areas for intervention. In the Inner Niger Delta and Oum Zessar, ES maps under different conditions of water availability (seasonal and inter-annual respectively) were used as a way to synthesize and summarize the range of management options available in response to variable climate and water availability. In Rwenzori, ES assessments were used primarily in analyzing the potential outcomes of different SLM interventions.

Table 3.3.71: Comparison of tools and approaches for selecting and assessing SLM interventions across the case study sites

	uThukela District South Africa	**Fogera / Blue Nile Ethiopia**	**Inner Niger Delta Mali**	**Oum Zessar Tunisia**	**Rwenzori Uganda**
Identifying and selecting interventions					
Technical tools and resources	ES assessments Practice cards / report	PROCA GOBLET tool (suitability)	TerrAfrica/WOCAT databases	WOCAT database Action sheets	Matrix of actions Practice cards
Expert knowledge	Consultation with local experts Existing programs (esp related to erosion management, weed control, wetlands)	List of potential technologies (>85 proposed)		5 technical working groups Existing programs for water harvesting	
Participatory	Existing interventions in communities	Wat-A-Game	Survey of agricultural producers Wat-A-Game	Community consultation meetings – 3 local groups	Wat-A-Game
Land and water management intervention domains					
	Agriculture; Grazing management Cross-slope barriers Gully reclamation Restoration / rehabilitation of natural vegetation	Soil management Water management and rainwater harvesting Agroforestry Livestock management / controlled grazing	Water infrastructure Agronomic techniques Fisheries management Grazing management	Water harvesting and groundwater recharge Groundwater irrigation Rangeland management Agricultural mgt Plantations	Water management On-farm techniques Land management Tree planting / agroforestry Restoration / protection of river banks and wetlands Land use planning / zoning
Combining interventions and formulating strategies					
Spatial disaggregation	Land tenure zones – World Heritage Area; Community Conservation Zone; buffer zone ; other (also distinguish communal and private lands)	3 topographic zones: upper – mid - lower	3 administrative areas	3 administrative districts representative of topographic zones: (upper – mid – lowe)r	3 topographic zones: upper – mid - lower
Scale	Combined – assign tasks to actors at different levels	Separate strategies for farmers, regional DM – merged for final strategy	Combined	Combined – assign tasks to actors at different levels	Strategies for different scales (household, village, community, region)

	uThukela District South Africa	Fogera / Blue Nile Ethiopia	Inner Niger Delta Mali	Oum Zessar Tunisia	Rwenzori Uganda
Technical tools and resources	ES maps for prioritisation	Suitability mapping (GOBLET)	OPIDIN	ES maps for prioritisation	ES maps and GIS analysis
Expert knowledge	Workshop combining outcomes of consultations	Expert inputs to Wat-A-Game	Input to strategy formulation workshops	Workshop combining outcomes of consultations	Expert inputs to Wat-A-Game
Participatory	Wat-A-Game sessions for different groups	Happy Strategies game Wat-A-Game	Wat-A-Game	Community consultation workshops - participatory collaborative approach involving GTT, the steering committee and local stakeholders and regional partners	Wat-A-Game
Assessing interventions and strategies					
ES approach	*SITE as input to ES*				GIS input to ES
Biophysical models	*SITE / SWIM*	SWAT ECOSAUT INVEST	SWIM Hydro-economic modelling (REF)	WEAP (IRA / OSS. 2013)	GIS models (Vrebos 2013)
Participatory assessment	Wat-A-Game	Wat-A-Game	Wat-A-Game Scenario assessment	Technical working groups and workshops	Wat-A-Game

PART 4: APPROACHES FOR ECONOMIC TOOLS AND INCENTIVES

4.1 Introduction

An economic instrument can generally be defined as a tool that aims to influence the way people use natural resources and manage the environment (Panayotou, 1998). This is achieved by changing the extent to which people feel or experience the cost associated with the use of resources, or the consequences of their decisions about how to manage or protect the environment (Anderson *et al*, 2001). An economic instrument, or combination of instruments, provides financial and other incentives so that users of natural resources pay for the social costs of that use, or benefit from the sustainable management of the resource and environment. Economic instruments therefore aim to provide incentives that will induce a change in the behaviour of people to improve the way they use and manage environment and natural resources.

Economic instruments designed to promote improved environmental management can range in definition from narrow to broad economic instruments (Anderson *et al,* 2001):

- Narrowly defined, economic instruments would include those that link direct and proportional benefits with performance objectives or targets for achieving the desired condition of the natural environment or specific natural resources. For example, price-based instruments, such as tax differentiation through rebates for landowners achieving certain biodiversity conservation objectives, could effect change by land owners as a result of changing the affordability or profitability of certain conservation focused land management practices.
- Broadly defined, economic instruments include instruments that have only economically uncertain or indirect links for the agent or institution whose resource or environmental management behaviour is to be altered. For example, an information based instrument (such as sustainability reporting) would not in itself increase the cost of pollution to a polluter, but could nevertheless encourage a reduction in discharge levels of pollutants levels due to social pressure associated with public opinion

Economic instruments can be clustered into three categories, and there are a range of instruments within each of these categories, for example:

- Rights based instruments
    - Ownership rights (e.g. strengthening ownership rights and use rights)
- Price based instruments
    - Market creation (e.g. tradable quotas, permits and shares)
    - Fiscal instruments (e.g. tax differentiation)
    - Charge systems (e.g. user charges, pollution charges)

  - Financial instruments (e.g. subsidies, payments for ecosystem services)
  - Environmental bonds and deposit refund systems (e.g. environmental performance)
- Legal, voluntary and information based instruments
  - Liability agreements (e.g. legal liability, non-compliance charges)
  - Voluntary instruments (e.g. voluntary environmental agreements, environmental certification)
  - Information based (e.g. labelling)

The suite of instruments considered in the Afromaison Project is not a complete inventory, but rather focusses on those that are likely to have the greatest relevance as incentives for INRM in the context of the Afromaison Project's objectives of INRM (see Appendix 1 for inventory of instruments considered in the Afromaison Project).

The effectiveness of economic instruments in providing incentives for improved resource use/ management is not only determined by the value of the benefit (or penalty), but also by a number of other factors such as:

- The instrument matches or complements the social, political and economic contexts.
- The instrument incentivises an intervention that corresponds with the environmental challenge.
- Incentive is recognised as meaningful or worthwhile by the target agents or institutions whose behaviour or management approach needs to change.

Furthermore, in developing countries in particular, where financial resources are typically scarce and where the institutional capacity may be limited, there are a number of other criteria that also impact on the effectiveness of economic instruments, including:

- Cost-effectiveness.
- Administrative feasibility.
- Equity.
- Consistency with other development objectives.
- Flexibility and transparency.

It is therefore important that a conscious and transparent selection process is undertaken to ensure that the economic instrument is a good fit to the context. Poor 'context-instrument' matching could result in the selection of an ineffective instrument that does not result in the desired behaviour/management change by the target agents or institutions, or may even act as a perverse incentive and result in a change contrary to the desired response.

Many resource managers and decision makers have limited knowledge of the range of economic instruments and their application potential, which limits their ability to undertake the context-instrument matching process. To assist in addressing this challenge, the Afromaison project developed a Decision Support Tool[13] (DST) that aims to support the selection of the economic instrument(s) that will have the greatest potential to provide effective incentives. Fourteen examples of economic instruments are included in this DST. While there are many other types of

[13] http://www.afromaison.net/eco_dss/index.html

Economic Instruments, the 14 included in this DST were selected on the basis of their relevance to the integrated natural resource management objectives of the Afromaison Project.

The Afromaison project also developed a Design Matrix (DeMax)[14]. The DeMax is applied to inform:

i. the assessment of the local potential to implement a selected economic instrument in a given context,
ii. key design considerations for the application of an economic instrument in a specific context,
iii. the evaluation of the likely impact and sustainability of the economic instrument in that context and,
iv. highlight potential flaws or barriers to the implementation of the selected economic instrument.

If a solution to potential fatal flaws or barriers cannot be found (for example a modification to aspects of the instrument, or an intervention in the local socio-political environment), then it is unlikely that the instrument will be effective. An alternative economic instrument (or an alternative mechanism to economic instruments) would then need to be explored.

The DST and DeMax tools were applied across the five Afromaison case studies as an approach to select and design economic instruments to create incentives for the sustainable land management restoration and adaptation interventions identified for priority environmental challenges (Figure 4.1). The outcomes of the DST and DeMax processes in each case study were analysed to assess the potential impact and sustainability of economic instruments in terms of realising the INRM objectives in the case studies (Table 4.1). From this analysis, conclusions were drawn on the potential contribution of economic tools and incentives to INRM strategies in developing countries.

4.2 Identifying and selecting economic instruments

4.2.1 Approach to selection

The DST uses four sets of criteria to explore and then highlight economic instruments that would likely provide the most meaningful incentives for implementation of management or rehabilitation actions/interventions in a particular context:

- Environmental
- Social
- Market
- Governance

The DST has four steps to help decision makers to 'walk through' the set of selection criteria' that will help to evaluate the relevance of the economic instruments in a local context:

[14] http://www.afromaison.net/eco_dss_2_0/index.html

- Step 1: Select the management or rehabilitation action requiring incentives to encourage implementation
  The environmental challenge and the associated restoration / adaptation interventions for which the incentive is required first needs to be identified. The stakeholders whose behaviour needs to be changed for the implementation of this intervention also need to be identified.

- Step 2: Apply evaluation criteria
  This DST applies a scoring and ranking process for assessing the suitability of economic instruments against a series of criteria. Four categories of criteria are applied for assessing the relevance of the economic instruments:

  i. ***Environmental*** – these criteria describe the objectives/priorities for the environmental interventions that are to be incentivised by the economic instrument. They also describe the context/conditions of the environment in which the management action or intervention is to be applied.
  ii. ***Social*** – These criteria refer to the social context, describing the socio-economic profile and characteristics of the communities and agents that would be involved in implementing the economic instrument.
  iii. ***Market*** – The market criteria relate to the market conditions in the environment within which the instrument will be applied. They also address the market for, or in which, environmental goods and services are traded.
  iv. ***Governance*** – These criteria relate to the institutional arrangement and structures, and their effectiveness in coordinating or controlling activity in society and in the environment.

- Step 3: Score instruments likely to offer most meaningful incentives
  The DST is programmed with points reflecting relative effectiveness of economic instruments under different conditions. The points have been set on the basis of a review of the application potential of the instrument internationally. The combination of responses by the user to the questions relating to the criteria (i.e. the yes/no answers to local objectives/conditions in the local context) determines the score calculated for each instrument. The score for each economic instrument is automatically calculated by the DST for each category, and then as a summary across all four categories. No weighting is applied in the calculations of the scores across the ecological, social, market and governance categories as the un-weighted score provides the user the opportunity to weight one or more of the categories more heavily than the others if needed for a specific context. The scoring system is designed so that instruments can be compared to each other, and the suitability of an instrument can be assessed relative to the scores of other instruments (Box 4.1).

- Step 4: Review information sheets to gain more information on how instruments work and cases where they have been applied
  Information sheets for all the instruments are included in the DST. The information sheets provide an overview of the instrument, as well as examples of case studies in which the instrument has been applied around the world. The user then completes the DST process by reviewing the information sheets for the instruments that scored highest and, on the basis of the review, decide whether to take the instrument forward into the design phase.

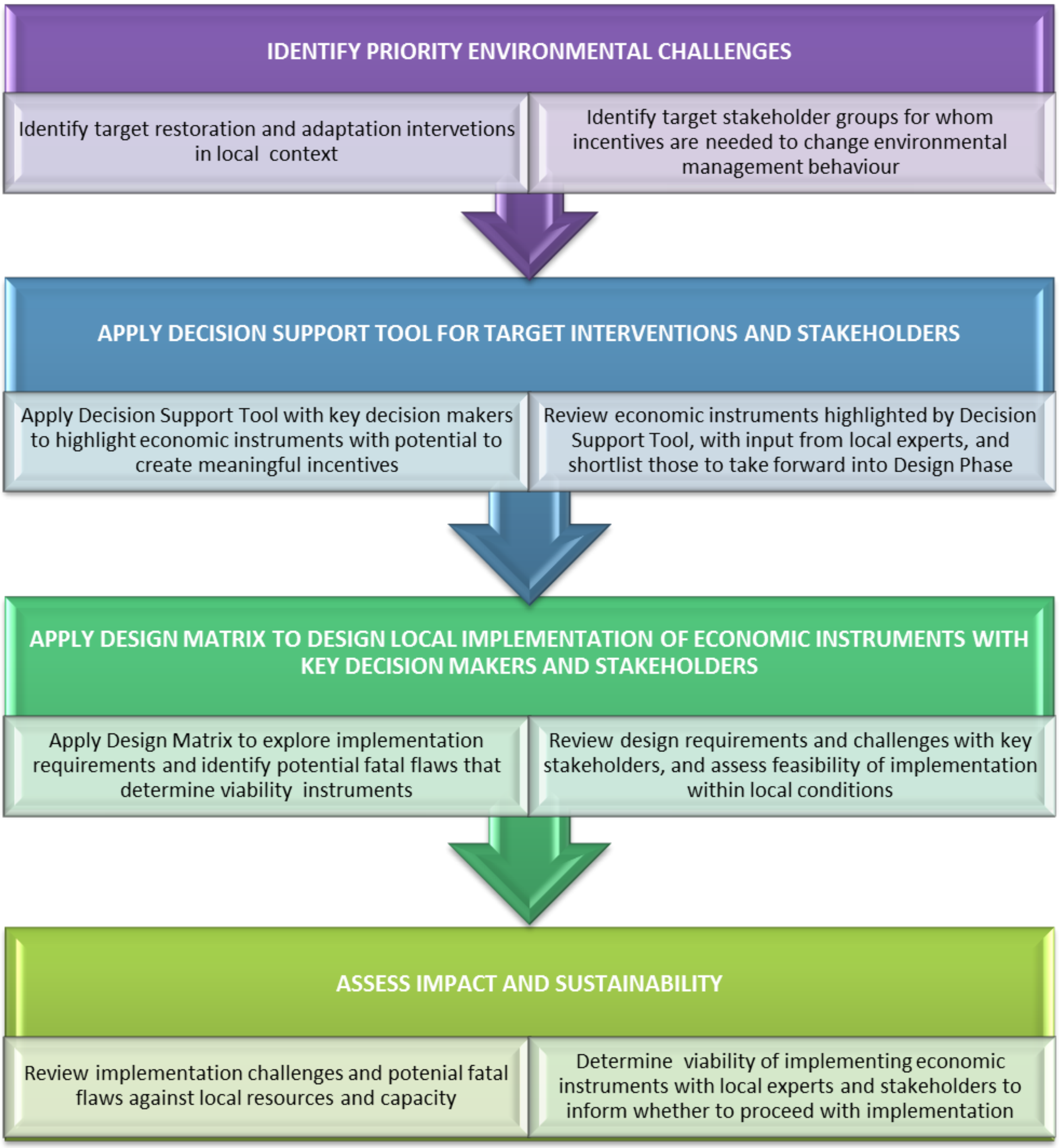
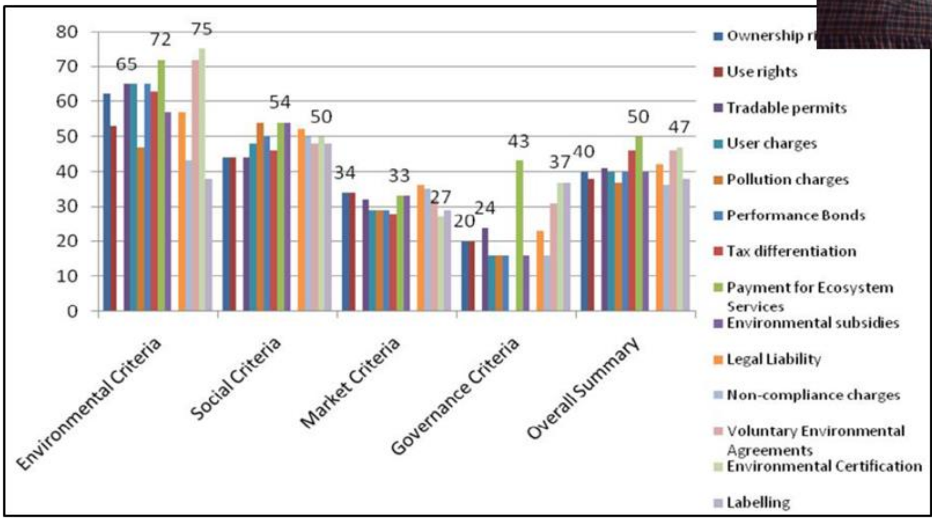


Figure 4.1: Overview of approach and tools for selecting economic instruments as incentives for improved natural resource management

Box 4.1. Application of the Decision Support Tool to assess the suitability of economic instruments according to criteria: Tunisia Case Study

The DST was tested during a stakeholders workshop organized at Regional Administration of Agriculture (CRDA) headquarter in Medenine, 17th July, 2012. The workshop was attended by a combined group of 17 stakeholders: internal (AFROMAISON Team, Case Study leaders, researchers, students) and external (Stakeholders within case study sites, steering technical committee members, technical authorities and policy makers, local administration).



The results of the application of DST in the Tunisia Case Study demonstrate that, according to the overall summary, "Payment for Ecosystem Services" came out with the highest score of 50. This is closely followed by "Environmental Certification" which scored 47.

Two main groups of economic instruments are already implemented in the case study of Oum Zessar watershed:

- Price based instrument, mainly financial instrument based on subsidies and loaning for investment and production input such as fuel, seeds, etc.)
- Property-rights based instruments, mainly Securing use rights applied to reduce overexploitation of water resources thought the protection of water table access.

In comparing the results of the DST with the instruments already in use in Oum Zessar, i.e. mainly "development and environmental subsidies" , the Oum Zessar case study team and local experts selected Environmental Subsidies as the instrument to take forward into the Design Phase. This instrument was selected because it was believed that it reflects the current regional and local context in Tunisia and is therefore suitable for testing the implementation of these instruments. Payment for Ecosystem Services was not taken into the design phase because, while initially preferred, it was recognised early in the process that there is currently no "willing buyer" to support the PES system.

Source: Oum Zessar Case Study, Tunisia, 2013 (OSS)

4.2.2 Outcomes of the selection approach applied by the case studies

- Of the 14 economic instruments included in the DST, 10 were highlighted by the case studies as having potential to create meaningful incentives to address priority interventions and challenges in the local context.
- In many cases, a single economic instrument could potentially address a range of challenges as a one-on-one relationship between economic instrument and intervention was not required. In this way a cluster of restoration and adaptation interventions could be incentivised through a single economic instrument.
- The socio-economic and cultural characteristics of a user group (whose behaviour is being targeted by the interventions) is a strong influence on the potential effectiveness of an economic instrument. Therefore, one economic instrument may provide a meaningful incentive for interventions for one group of stakeholders, but not for another group.

- While the DST has the potential to highlight economic instruments that theoretically have the potential to create local meaningful incentives, the process also requires the input of local stakeholders and experts who can evaluate and compare the instruments highlighted by the process, to decide which instruments to carry forward into the Design Phase. The fact that an instrument scores relatively well does not mean that it is locally suited to provide a meaningful incentive. This expert and local knowledge of stakeholders provides an 'informed filter' that can refine the list of economic instruments selected for the design phase.
- The DST helps to raise awareness about the range and types of economic instruments that do exist beyond the potentially limited knowledge of local resource users and managers, facilitates the selection of economic instruments that can implicitly contribute to a robust INRM strategy (Box 4.2).

4.3 Local design of economic instruments for implementation

4.3.1 Approaches for local design

The local implementation needs and opportunities of the economic instruments highlighted and selected during the selection phase were then explored by each of the case studies. A DeMax was developed through the Afromaison Project as an approach to support the design process for the local implementation of selected economic instruments. The DeMax comprises of a series of criteria that aim to inform:

- The assessment of the local potential to implement a selected economic instrument in a given context
- Key design considerations for the application of an economic instrument in a specific context
- Evaluation of the likely impact and sustainability of the economic instrument in that context
- Highlight potential flaws or barriers to the implementation of the selected economic instrument

The DeMax prompts users to analyse and determine if a series of condition criteria are likely to be met, and evaluate the relevance of the criteria to the context. These criteria address two aspects of implementation, namely (i) the potential impacts of the economic instrument on the local context, and (ii) the influence of the local context on the effectiveness of the economic instrument. The DeMax criteria are classified into four categories:

1. ***Social*** – Criteria relating to influence from and impacts to the socio-economy and culture of the target groups/community who would implement the management intervention, and who may derive benefit from the incentive. These criteria also consider secondary impacts to surrounding groups or communities.
2. ***Ecological*** – Criteria exploring direct and secondary impacts (positive or negative) accruing from the incentives generated by the economic instrument. It also addresses the potential for unintended impacts to other natural resources or interventions in the target area, or neighbouring areas.

3. ***Market*** – Criteria concerning the influence of and impacts to markets and economic opportunities, both locally and in the broader economy.
4. ***Governance*** – Criteria addressing policy and the influence of governance structures, institutional arrangements and capacity in supporting or hindering the implementation of the Instrument.

A fifth category of 'Other Issues' includes criteria that aim to encourage retrospective consideration of overarching issues that could inform the implementation of the instrument, but which do not affect the overall cumulative score or recommendation from the DeMax.

The user has the opportunity to weight the contribution of scores for each criterion to the overall score to reflect the local priorities and conditions. Once all the condition criteria have been rated, a cumulative score is calculated to provide a guide on whether or not the conditions for effectively implementing the incentive can be met in the local context. The results are classified into three categories of further action:

- Proceed with minor caution and attention to aspects of implementation design.
- Proceed with caution and attention to likely requirements for significant modification to instrument or receiving environment.
- Do not proceed as the instrument is unlikely to match context and create meaningful incentives.

Critical issues relating to the condition criteria raised by the stakeholders participating in the DeMax process are captured into the DeMax template. These critical issues may relate to anticipated problems that might limit local implementation of the instrument, or to conditions that might be required to create an enabling environment for effective implementation of the instrument. Issues that are considered critical or potential fatal flaws to the implementation of the instrument are flagged, and the summarised list of flagged issues can then be used to guide the revisions that would be required to effectively implement the incentive.

If a solution to these critical flagged issues and potential barriers cannot be found (for example, a modification to aspects of the instrument, or an intervention in the local socio-political environment), then it is unlikely that the instrument will be effective. An alternative economic instrument or mechanism would then need to be explored.

The outcome of the DeMax is therefore twofold as it provides:

- An approach to evaluate the potential effectiveness and sustainability of an economic instrument under specific local conditions.
- A process to highlight flaws or barriers to the implementation of the selected economic instrument in a specific local context that would need to be addressed in the design of the instrument, or the system to implement the instrument, if it is to be effective and sustainable.

Box 4.2: Summary of the DeMax applied for Environmental Certification in the Uganda Case Study

The DeMax highlighted that Certification does have implementation potential, but there are a number of critical issues that were flagged as potential fatal flaws that need to be addressed before implementation can be further considered. The final recommendation was therefore "Proceed with caution and attention to likely requirements for significant modification to instrument or receiving environment".

CRITERIA FOR LOCAL DESIGN OF IMPLEMENTATION OF ECONOMIC INSTRUMENT	CUMULATIVE SCORE		RECOMMENDATION FROM CUMULATIVE SCORE:	FLAG CRITICAL ISSUES
	66%		*Proceed with caution and attention to likely requirements for significant modification to instrument or receiving environment*	
1. SOCIAL CRITERIA	Occurrence of Condition *Select options from drop-down menus below*	Criteria Significance Weighting	Notes on critical issues to consider during design and implementation in local context	FLAG?
OVERALL WEIGHTING OF THE SOCIAL CRITERIA RELATIVE TO ECOLOGICAL, MARKET AND GOVERNANCE:		★★★★★	*Reasoning for this weighting:It requires compliance by all members of a particular community.*	
1.6. The instrument will help to build or maintain cohesiveness within and between resource / land users (i.e. little risk of increasing conflict/division among user groups)	*Likely*	*Above Average*	There is likely conflict between conventioal practioniers & thise that need certification. E.g commercial growersmay not desit the use of inorganic fertilisers. Also conflict may exist between upland and low land farmers	🚩
1.7. The instrument creates opportunities to benefit and uplift marginalised/vulnerable groups within the community (e.g. women/youth) or has no risk of increasing vulnerability in marginalised groups	*Likely*	*Above Average*	The marginalised groups may fail to follow up the application process for getting environmental certification. There is need for support from advocacy groups.	🚩
1.8. The instrument could also generate benefits (financial or non-financial) for neighbouring communities and can help to strengthen neighbour relations (no risk of creating tensions)	*Likely*	*Average*	This will occur only if the neigbours comply but they are unlikey if the certification does not extend to them	🚩
2. ECOLOGICAL CRITERIA	Occurrence of Condition *Select options from drop-down menus below*	Criteria Significance Weighting	Notes on critical issues to consider during design and implementation in local context	FLAG?
OVERALL WEIGHTING OF ECOLOGICAL CRITERIA RELATIVE TO SOCIAL, MARKET AND GOVERNANCE:		★★★★★	*Reasoning for this weighting:The overall purpose of certification is to increase/ enhance ecological health.*	
2.1. The instrument <u>will not</u> increase risk of creating new / compound environmental pressures on other resources or ecosystems (local or distant areas)	***Definitely will not increase***	*Above Average*		
2.2. The instrument will not create impacts that could compromise the integrity / effectiveness of other ecological management interventions (e.g. being implemented by other groups)	*Most Definitely*	*Above Average*		
3. MARKET CRITERIA	Occurrence of Condition *Select options from drop-down menus below*	Criteria Significance Weighting	Notes on critical issues to consider during design and implementation in local context	FLAG?
OVERALL WEIGHTING OF ECOLOGICAL CRITERIA RELATIVE TO SOCIAL, MARKET AND GOVERNANCE:		★★★★★	*Reasoning for this weighting:The incetive behing compliance to certification is to get premium pricess for the products*	
3.5. The scale of benefits and incentives are large enough to create meaningful incentives to change behaviour (i.e. either a single or multiple markets/investors that collectively will provide the meaningful incentives to change behaviour)	*Likely*	*Above Average*	Some of the benefits accruing from the intrument are not realised in the short term and change in behaviour might only be expected to occur in the long term after realising benefits in a sustainable manner.	🚩
3.6. The instrument can function in existing market structure and does not require new regulations, policies, or market dynamics (e.g. can function in informal markets)	***Unlikely***	*Above Average*	Corruption might affect the implemation. Also, the regulations currently in place might not enable smooth implemenation of the instrument	🚩
4. GOVERNANCE CRITERIA	Occurrence of Condition *Select options from drop-down menu below*	Criteria Significance Weighting	Notes on critical issues to consider during design and implementation in local context	FLAG?
OVERALL WEIGHTING OF ECOLOGICAL CRITERIA RELATIVE TO SOCIAL, MARKET AND GOVERNANCE:		★★★★	*Reasoning for this weighting:It is not important but not string enough compared to the other criteria*	
4.1. The intervention meets legal and policy requirements at all levels of government and does not conflict with existing legislation or regulations in the local context	*Likely*	*Above Average*	There are government policies and interventions such as those on the use of chemical such as DDT that the instrument is likely to conflict with.	🚩
4.2. There will not be opposition from other government agencies or stakeholders that would inhibit the implementation of the instrument and distribution of benefits (i.e. there are no groups with nested interests that would oppose the implementation of instrument)	***Likely will be opposition***	*Above Average*	some groups or individuals might oppose the intervention in favour of other interventions. E.g might support the implemention of GMOs	🚩

Source: Rwenzori Mountains Case Study, Uganda, 2013 (Mountains of the Moon University)

4.3.2 *Outcomes of the design approach applied in the case studies*

- Ten economic instruments were taken into the design phase across the five Afromaison case studies (see Table 4.1), and the results of the application of the DeMax indicate that the local design and implementation requirements for the economic instruments differ from case to case. There is no blue-print for applying economic instruments. Economic instruments require local context matching and adaptation to ensure ecological, socio-cultural and economic suitability. Economic instruments that are applied without adaptation to the local context may be ineffective or could even generate perverse incentives that further undermine the local INRM objectives. Local design and application of economic instruments benefits from input by local stakeholders and context specialists to calibrate them locally.

Box 4.3: Selection of Economic instruments for incentives in the Inner Niger Delta Case Study (Mali)

The selection and design of economic instruments took place at a stakeholder workshop held in Ouagadougou from 8 to 12 July 2013. Three strategies were developed (during a workshop held in Mopti from 22 to 24 May 2013) to meet the priority environmental objective of sustainable and integrated management of natural resources:

- ensure control of water in three IND municipalities with aim to develop agricultural, pastoral plains, pastoral, fisheries, and conservation of biodiversity by 2020;
- adopt mitigation options and adaptation to climate change in the IND
- strengthen the technical, organizational and financial capacity of 80% of players in 3 IND municipalities by 2020.

The DST and DeMax were applied to select and design economic instruments to create incentives for interventions in each of these strategies. The table below illustrates a potential example of the outcomes of the approach to select and design economic instruments for an intervention such as sustainable management of pastoral areas in the Inner Niger Delta:

Instruments	Score	Recommendations
Voluntary Environmental Agreements	62%	Proceed with caution and attention to likely requirements for significant modification to instrument or receiving environment
Users charges	56%	Proceed with caution and attention to likely requirements for significant modification to instrument or receiving environment
Use rights	81%	Proceed with minor caution to aspects of implementation design
Performance bonds	21%	Do not proceed as the instrument unlikely to match context and create meaningful incentives

Source: Inner Niger Delta Case Study, Mali, 2013 (2iE and Wetlands International)

- The effectiveness of economic instruments to create meaningful incentives is substantially enhanced by the adoption of a clustering and stacking approach:
    - **Clustering** involves grouping a range of restoration and adaptation interventions, and using a single or complementary set of economic instruments to collectively create the meaningful incentive required.
    - **Stacking** involves using a set of economic instruments to generate incentives that are adequate to bring about a change in management or use practices of the target resource managers and users. A number of instruments, each generating relatively small benefits, are stacked to collectively generate meaningful benefits that act as an effective incentive to trigger the change in management.

- The implementation of incentives for rehabilitation cannot be entirely isolated from the influence of other activities or drivers both within the meso-scale and beyond (i.e. regional or national). Externalities (e.g. associated with third party effects from the consumption of goods and services by illegal or non-rights holds groups who do not comply with local sanctions or incentives) can undermine the impacts and benefits generated through the economic instruments. The influence of outside markets can also create externalities that undermine or affect the significance of the incentives created locally. Implementing economic instruments therefore needs to be dynamic, rather than static, and ongoing adjustments may be required to ensure the relevance and meaningfulness of the incentive.

- Applying the DeMax was found to be time consuming by the stakeholders. However, the outcomes of the systematic design process highlight many critical design considerations and constraints at the local level. The DeMax process also helps to identify potential fatal flaws that could preclude the implementation an otherwise popular economic instrument. Examples of these fatal flaws include, for example, the lack of a willing buyer for the implementation of a Payment for Ecosystem Services (PES) instrument, or the creation of otherwise unidentified perverse incentives through Environmental Subsidies. Despite the time consuming nature of the DeMax, it also provides an opportunity to establish a platform for stakeholder consultation and interaction that can later be used to implement the economic instruments.

4.4 Conclusions and recommendations on economic instruments

- The design and potential implementation of 10 economic instruments were investigated across the five case studies (Table 4.1). Outcomes highlight the fact that governance systems, and the capacity of government in particular, will likely have the strongest influence on almost all instruments and are therefore a critically important consideration in the local design of an economic instrument. Access and sustainability of funding to generate and sustain incentives is a key limiting factor, while socio-economic, cultural and market contexts also have a significant influence the potential viability and local design of the instruments

Table 4.3.21: Investigation of economic indicators to create incentives across case studies

	Fogera/Blue Nile (Ethiopia)	Inner Niger Delta (Mali)	uThukela District (South Africa)	Oum Zessar Watershed (Tunisia)	Rwenzori Mountains (Uganda)
Environmental Certification	Address causes and symptoms of deforestation, erosion and grazing pressures but limited by lack of local of knowledge, expertise and market. Only in short to medium term.		Already applied in Timber industry (i.e. Forest Stewardship Council) but participation currently limited by requirements for absolute compliance with minimum standards. But may be possible to evolve into other systems with wider application potential.		Address causes of degradation (farming management) but limited by lack of local market, a need for training and possible abandonment in short term because of lack of short term benefits.
Environmental Subsides	Linked to causes of deforestation but does not address sustainable sources of income as funding from government or donors is unstable and therefore not sustainable.	Address cause by targeting provision of affordable firewood alternative and tree planting. Currently dependent on donors to ensure funding is sustainable but also driven by market activities (e.g. micro-finance programs).	Address a range of symptoms, particularly in poor rural communities. Long term impact limited as they do not address causes but rather symptoms of degradation, nor are they performance linked. Focus on poverty alleviation which is creating dependency. Government funding is unstable and therefore may be unsustainable in long term.	Use a combination of efficient water use subsides to address causes of water scarcity in the farming sector. Not limited as each subsidy is based on individual farmer and their achieving required performance targets.	
Strengthening Ownership Rights	Address drivers and symptoms of environmental degradation (communal graze lands and private crop lands). Government reflecting support for initiative to secure sustainability.		Widely proposed but few successful cases. Need strong local governance system to secure fair and equitable benefit distribution through rights based approach. Currently limited by weak governance systems and history of conflict.		Address causes of degradation through enhanced management and change of ownership. Limited by lack of regulatory governance system and corruption which may cause increase inequalities.
Payment for Ecosystem Service	Address issues of communal cohesion and environmental challenges but limited by lack of		Address social and ecological challenges but is rigorous process which requires a	No willing buyer resulting in government having to act as buyer to provide	Address degradation cause but may not be at a consistent scale, causing non-

	Fogera/Blue Nile (Ethiopia)	Inner Niger Delta (Mali)	uThukela District (South Africa)	Oum Zessar Watershed (Tunisia)	Rwenzori Mountains (Uganda)
	human capacity and the absence of a willing buyer.		substantial capacity and has high transaction costs. Sustainable if Could be sustainable in long term of willing buyer secured.	funds paid to farmers - as Environmental Subsides.	meaningful results. Limited by possible unstable social behavior, lack of government capacity and absence of willing buyer.
Performance Bonds		Address cause of ecological problem but only applicable for local not migrant fishermen - could result in social conflict. Possible through governance systems but limited by capacity.			
Tax Differentiation			Evident in existing Stewardship programs but benefits of conservation and stewardship not yet realized. Limited impact as costs of interventions likely outweigh benefits from tax differentiation. Closely linked to VEAs (*see below*).		
Tradable Permits and Quotas	Address driver of water shortages resulting in equitable distribution of resources and collective decision making. Need for commitment from various markets and governance levels.		Address ecological pressures without affecting socio-economic well-being of users. Need an authority to enforce system, equitable distribution of costs/benefits and availability of alternative opportunities. Implementation limited by weak governance system and history of conflict.		
Strengthening Use Rights		Address underlying causes, encourage long term management and create economic opportunities.	Address social and environmental challenges but few successful cases evident. Need to establish local system to		

	Fogera/Blue Nile (Ethiopia)	Inner Niger Delta (Mali)	uThukela District (South Africa)	Oum Zessar Watershed (Tunisia)	Rwenzori Mountains (Uganda)
		Implementation limited as may clash with existing hereditary resulting in conflict as well as the transfer of environmental pressure to other areas.	ensure equitable and fair distribution of benefits. Implementation limited by weak governance system and history of conflict (non-sustainable).		
User Charges		Address pressure on pastures but not incentive for rehabilitation. If not carefully regulated, could cause further degradation (sense of entitlement). May cause conflict with outside users or communities with existing rehab initiatives. Management of fee and affordability of charge will determine its success.	Address ecological and socio-economic challenges and would be relatively simply to implement in certain cases where conservation authorities or governance systems already in place to regulate and control access. Success and sustainability determined by price of user charge.		
Voluntary Environmental Agreements		Address causes of degradation, strengthen livelihood vulnerability, benefit social cohesion (joint decision making) and reestablish market activities but not likely to address poverty (only indirectly). Limited by possible lack of commitment by foreign operators/ outsiders.	VEAs are being implemented currently through stewardship agreements, but implementation of interventions through stewardship are not being secured through meaningful benefits resulting in costs of implementation outweighing benefits. Agreements currently limited to those who can afford to put land aside and who already have strong sense of environmental protection.		Address symptoms and underlying causes through various stakeholder and resource users' interactions. May enhance equity and reduce conflict but possible elimination of access/ rights may reduce well-being. Limited by government capacity and may restrict market opportunities.

- Rights based, price based, and legal, voluntary and information based instruments all have implementation potential in developing countries under certain conditions. However, the instrument-context matching process is critical to ensure the best instrument is selected to suit local conditions. Furthermore, there is no blue-print for implementation of economic instruments, and the implementation of economic instruments needs to be locally calibrated.

- The **impact and sustainability** of the incentives created through economic instruments is a function of a number of factors:
    - The extent to which the instrument-context matching has been effectively undertaken, both in terms of the selection as well as the design perspectives.
    - The capacity of the authorities mandated to regulate and control the resource use and management systems. The capacity, financial and logistical constraints of governments in developing countries typically means that local authorities are better positioned to undertake this responsibility if they are empowered through a process of devolution and decentralisation of power. Central government retains the complementary roles of monitoring, sanctions and policy, which are typically more effectively implemented from national level.
    - Externalities can undermine the sustainability of the economic instruments as a result of the local legitimate resource users no benefiting from the incentives equitably yet still bearing the costs. Implementation of incentives cannot take place entirely in isolation of other forces and influences. Therefore the impacts of externalities need to be managed and consideration of these impacts needs to be incorporated into the local design system for implementing the economic instruments.
    - Dependence on donors to fund incentives, in the absence of local markets, can undermine long term sustainability of an incentive. Local incentive schemes therefore need to include a plan to transfer capacity and responsibility to local governance systems in the medium to long term to insure the sustainability of the instruments and incentives beyond the life-cycle of the donor funding.

- Key lessons on **best practice** for the design and implementation of economic instruments include:
    - Economic instruments and the incentives need to be socially equitable and economically meaningful in the local context, need to reflect local market conditions and prices.
    - Monitoring and evaluation of the impacts and effectiveness of interventions need to be incorporated into the incentives system to ensure that the incentives are performance based. Evidence from the monitoring can then be used to motivate stakeholders / markets to invest and provide funding and benefits that can be used to generate the incentives for local resource users and managers to continue the interventions for improved NRM.
    - Economic instruments need to build or maintain social cohesion when introducing incentives for improved NRM, particularly within the realm of traditional cultures' resource use and management practices.

Box 4.4: Clustering and stacking on multiple interventions and economic instruments in the Blue Nile Case Study in Ethiopia

The Blue Nile Case Study, Ethiopia, identified and prioritized key ecological challenges and interventions through discussions with stakeholders and linked these to target interventions in the three ecological zones across the case study.

The table below illustrates some of the priority interventions identified in the Blue Nile case study, and the economic instruments selected through the DST and DeMax tools as having potential to create incentives for the uptake of these interventions. The table also highlights that PES and Strengthening Ownership Rights instruments were identified as instruments to create incentives for multiple interventions.

Intervention	Driver/s	Economic Incentive/s
Agroforestry	Deforestation, erosion	PES
Bunds	Deforestation, erosion	PES
Environmental Rehabilitation	Deforestation, erosion	Environmental Subsides, Ownership Rights
Forestry Plantation	Deforestation, erosion	PES
Grazing Management	Grazing mismanagement	PES, Ownership Rights
Irrigation water use	Water shortages	Tradable Permits and Quota's
Re-vegetation	Deforestation, erosion	PES

Key conclusions drawn by the case study included that:

- While different interventions may be addressed by a single economic instrument, a group of instruments may be needed to encourage a particular intervention
- Local possibilities for the design and implementation of economic instruments depend on opportunities and constraints at the local level.

Source: Blue Nile Case Study, Ethiopia 2013 (International Water Management Institute (IWMI))

- Economic instruments function as part of an INRM strategy rather than as a strategy on their own (see Box 4.5). An effective way of incorporating economic instruments and incentives into a strategy is through a process of clustering and stacking:
  - A range of restoration and adaptation interventions are **clustered** and incentives for their implementation are created through a single or complementary set of economic instruments.
  - A number of instruments each generating relatively small benefits, but when these are **stacked** they collectively generate meaningful incentives.

The impact and sustainability, transferability, and best practice of economic instruments are described in more detail under the outcomes and conclusions discussed in Section 5.2.3, and informed the recommendations outlined in Section 6.

Box 4.5: Incorporating economic Incentives into strategy development – Upper uThukela Case study (South Africa) This illustration demonstrates the process taken in integrating a number of components into the INRM strategy, indicating an example of how an economic incentive (e.g. Strengthening User Rights) was used within the strategy to create an incentive to address grazing management in the short term (0-5 years) in the World Heritage Site Zone of the case study.

INTERVENTION

GRAZING MANAGEMENT

Issue/ Problem	Drivers
Threats to biodiversity and ecosystem functioning (especially catchment and watershed functioning) Destruction of wetlands Soil erosion Bush encroachment Degradation of grasslands (increased erosion and declining biodiversity) - ***grazing management issues***	Overgrazing by livestock (cattle) entering from neighbouring areas Livestock movement Large herds for cultural / traditional reasons, "hiding" drug money Localised overgrazing - livestock kept close to homestead to avoid theft Inappropriate burning practice - winter burning by thieves / poachers to encourage livestock / game to graze distant areas for poaching or theft. Soil erosion due to overgrazing, inappropriate burning, sleds, mining

CHALLENGES

- *Too many cattle on legal grazing lands*
- *Illegal grazing!!! (SA and Lesotho)*
- *Intensive grazing (more than game)*
- *Where to get fodder???*

STAKEHOLDERS

- *Trad communities - Neighbours (tribal auth?? - inkosi)*
- *Prov gov: EKZNW*

SOLUTIONS

- *Mang legal agreements (User rights) - currently not strong enough (withdrawn if don't comply)*
- *Alter stock to achieve rotational grazing*

ACTIONS

ROTATIONAL GRAZING SYSTEMS

ALTERNATIVE FODDER SYSTEMS

REINSTATING HERDERS

ECONOMIC INCENTIVE

STRENGTHENING USER RIGHTS

Definition

Strengthening and formalising user rights of neighbouring resource users to resources within the WHS (such as licenses, access rights, usufruct certificates and concession bidding) helps to create a platform to regulate and control this use and create incentive for the resource users to take stronger ownership and management responsibility for the condition of the resource

Interventions

Protection of high value ES areas; Grazing management; Fire Management; Rehabilitation (erosion); Invasive Alien Plant Control

Zone

World Heritage Site

Stakeholders

EKZNW - livestock owners (communal tenure areas)

CHALLENGES

- Securing institutional buy-in and support from necessary departments for implementing a system of strengthening rights of non-state actors on state land
- Capacity and resources to implement and control use rights system

Source: Upper uThukela case Study, South Africa 2013 (Institute of Natural Resources, South Africa)

PART 5: OUTCOMES AND CONCLUSIONS

5.1 Contribution of integrated approaches and tools to INRM

Three central approaches to INRM include:

- Tools for spatial planning
- Approaches for restoration and adaptation
- Economic tools and incentives

Achieving an integrated strategy for NRM requires not only that these three approaches be included in the strategy, but that they are applied in an integrated way. While management strategies typically address the range of aspects of resource management in a linear or *silo* perspective, truly integrated management requires that not only the outputs integrated, but the development of the management strategy should also involve the integration of the various approaches from the start.

Achieving this integration requires an understanding of contributions of these key approaches to the strategy for INRM:

- Spatial planning processes and tools to give recommendations to better integrate NRM across scales and sectors, and to provide guidance for systematic and strategic assessment of cumulative and synergic impacts, caused by different sectors (beside agriculture, forestry, water resource management, tourism, urban and transport planning etc.) and from different developments.
- Interventions for improving livelihoods, cost-effectiveness, sustainability, cultural acceptance and overall landscape functioning in the context of current and future pressures on those resources, and to evaluate the impact of the tools and strategies on landscape functioning and livelihoods.
- Economic tools, appropriate to local social, institutional, political and environmental factors, which promote improved NRM by supporting the development of an appropriate incentive system.

The challenge is however to integrate these central approaches in the strategy development process. For example which approach is the starting point? And how are the tools and instruments from each of the approaches inter-related? (Figure 5.1)

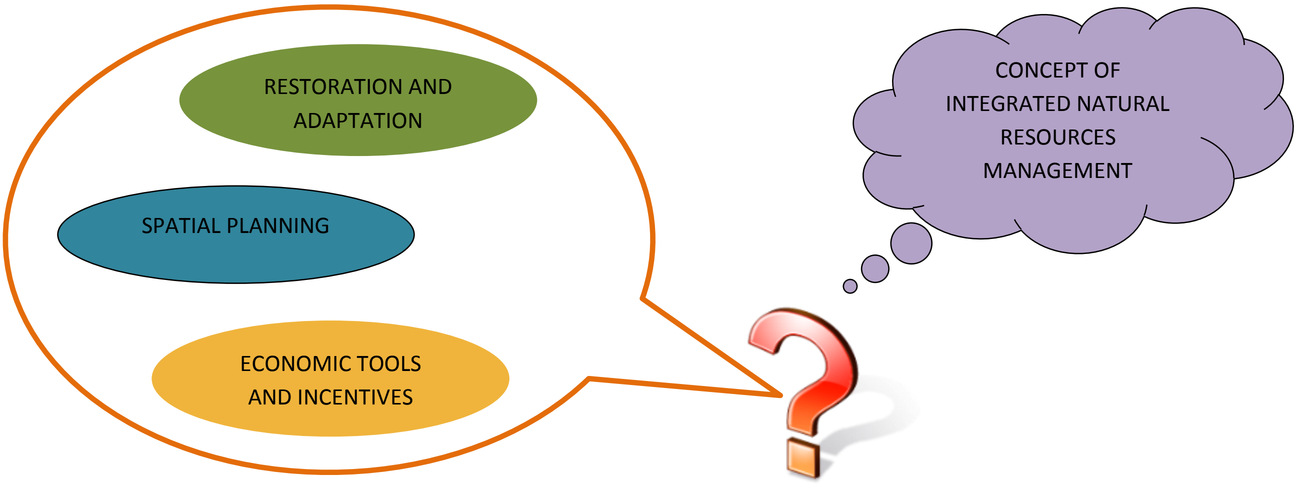


Figure 5.1: Integrating tools and approaches for INRM

- Spatial Planning is used to establish the spatial baseline across the meso-scale for which the INRM strategy is being developed, i.e. it is used to identify differentiation in the ecological, socio-economic and governance systems. This process involved the application of a range of spatial planning tools, selected according to the resources and capacity at the site. The outcome was a spatial framework reflecting the environmental challenges and management requirements across the meso-scale management area.
- Tools to identify Restoration and Adaptation interventions were then applied within the spatial framework developed through the spatial planning approach. Potential restoration, rehabilitation and adaptation interventions specific to the environmental challenges were identified and selected. The outcome of this process was an inventory of prioritised interventions to support ecological restoration and adaptation across the meso-scale target area.
- Economic tools and instruments were then applied to identify incentives for the uptake and implementation of the interventions for restoration and adaptation. A DST was applied to identify the economic instruments most likely to create meaningful incentives for the interventions within the local social, ecological, market and governance contexts of the meso-scale target area.

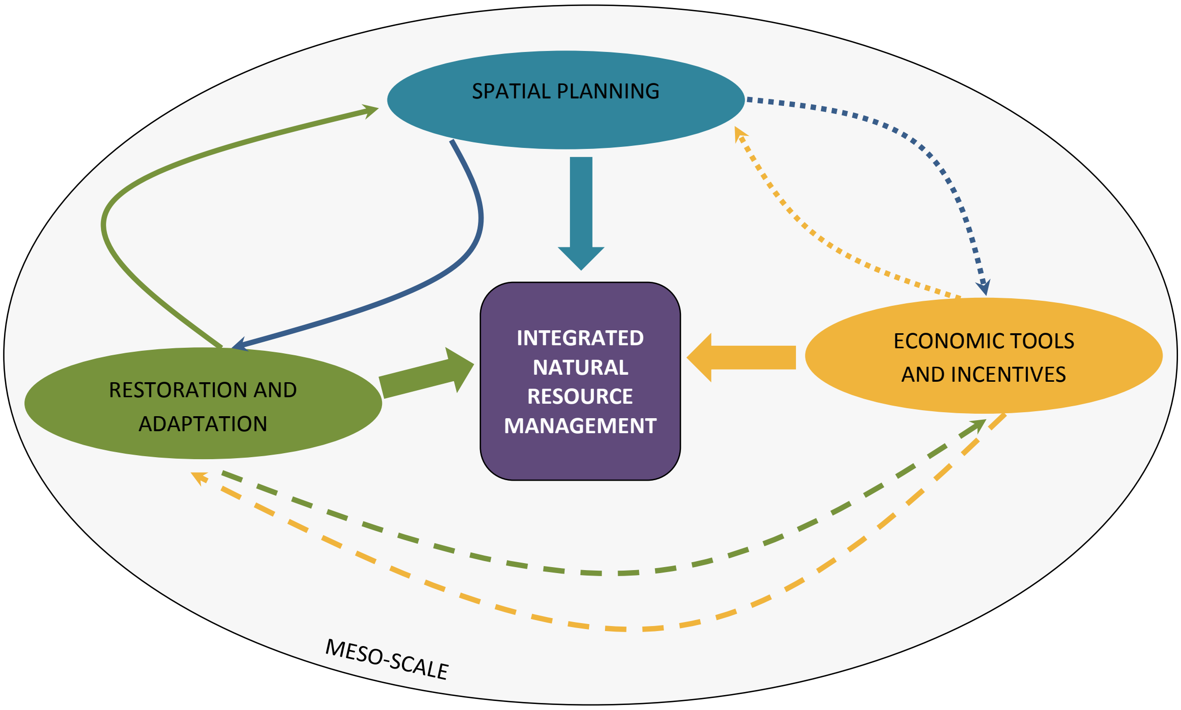


Figure 5.2: A process to integrate tools and approaches for spatial planning, restoration and adaptation and economic tools and incentives for INRM

Stakeholder participation was an integral part of the process of strategy formulation. Stakeholders were engaged using a mix of traditional modes of consultation, through formal meetings and surveys, and innovative approaches including participatory role play games (social simulation) and participatory video. In all case studies, a wide range of participants were consulted, including farmers and herders, village representatives, religious leaders, non-government organisations and local and district government representatives and decision makers.

An iterative process then followed this initial phase, during which the spatial planning, restoration and adaptation, and economic tools and incentives were revisited taking into consideration the influence each had on the other, for example:

- Inputs from the outcomes from various restoration and adaptation scenarios were incorporated into spatial planning models to identify the impacts of various management decisions across the meso-scale.
- The outcomes of the spatial planning models and simulations was used to assess impacts of restoration and adaptation interventions to landscape functioning in the context of current and future pressures on those ecosystems, and to inform selection and prioritisation of critical interventions.
- The design of economic instruments to incentivise the implementation of the prioritised interventions highlighted the opportunities to cluster the implementation of certain interventions according to stakeholder groups, scale and spatial distribution, and timeframes. This in turn was reiterated into the spatial planning approaches and evaluation

of the impact of the restoration and adaptation tools and strategies on landscape functioning and livelihoods.

It can be concluded from the Afromaison project that the three types of tools are inherently interdependent, if for instance spatial planning is applied to locate sustainable interventions and to optimize sustainable land and resource use, restoration and adaptation strategies are used to mitigate the deterioration of natural resources and the environment, and economic instruments are in place to determine the strategic allocation of investments. This integrated strategy dynamically changes with different drivers and causes for natural resource use and management decisions, at vertical and horizontal tiers, as well as with different actors involved.

Iterations of this process could be repeated as required, until an implementable INRM strategy is achieved. This iterative process of integrating the spatial planning, restoration and adaptation interventions, and economic tools and incentives approaches can subsequently also be applied to inform an adaptive management approach to implementing the INRM strategy.

5.2 Lessons learned on integrating approaches and tools

5.2.1 Spatial planning approaches

- **Inventory:** In general, the knowledge on spatial planning tools and their potential to support spatial planning process for the NRM is limited. The information on existing spatial planning tools used by different sectors and authorities engaged in NRM are not well communicated within case studies, it is therefore that a range of spatial planning tools from simple maps to complex integrated spatial decision support systems exists, but their use in formal planning process is still limited. Also, the combined application of Decision-aid Policy Tools (DPT), Analytical and Research Tools (ART), and Communication and Negotiation Tools (CNT) is crucial in Integrated Natural Resource planning, but the case study analysis reveals that even though all three categories of tools are available, these are not used in an integrated manner in the planning process. The approach applied here is the creating an inventory of all existing spatial planning tools used for natural resources management.

- **Gap Analysis:** Spatial planning process consists of various phases and activities, a number of spatial planning tools are used to support these phases and activities, such as for stakeholder engagement - participatory spatial planning tools are generally used. After creating the inventory, gap analysis of spatial planning tools in the planning process is carried out. The gap analysis indicated that there is lack of impact analysis and visioning tools in all the targeted case studies. The spatial planning tools applied in the case study aimed to address directly or indirectly these gaps, and recommended tools such as scenario technique, simulation game, causal networks, reframing, metaplan technique, impact matrix, checklists, and indicator systems to support the planning system.

- **Complex Spatial Planning Tools:** Considering the current situation (resources, capacity, stakeholder's interest and other contextual factors) less computer-based and sample spatial planning tools are preferred in many African countries. One of the main reasons why complex spatial planning tools are not preferred is because previously, many tools were introduced as part of donor funded projects, but are no more used due to lack of funding and local capacity. The aspect of the sustainability of tools is considered while introducing new spatial planning tools to the case studies, but the concern of local capacity to sustain such tools remain.

- **Assessment and Potential Transferability of Spatial Planning Tools:** In order to unearth best practice tools in all the case studies, all existing spatial planning tools were assessed using assessment criteria. The assessment of spatial planning tools indicates that similar tools used in different case studies are evaluated with different scores. For instance the WAG in Uganda and Ethiopia, where in Uganda it was evaluated as a best practice tool while in Ethiopia the same tool is evaluated with high potential for improvement. There is a clear need for best practice spatial planning tools to be transferred as there is an obvious gap of tools in the certain phases of the planning process. However, because of the importance of case specific contextual conditions for their uptake, well-functioning monitoring and evaluation systems must accompany any future transfer of tools. Also, the assessment indicates that Research and Communication tools are relatively easier to be transferred to other case studies with slight tailoring, but Policy tools need to be context specific and cannot be easily transferred.

5.2.2 Sustainable Land Management approaches

- **Flexibility of approach**: A range of different approaches and tools for selecting and assessing SLM interventions were employed in Afromaison, depending on the capacity and interests of stakeholders, as well as differences in available resources and information. The common threads were a strong participatory process; and active involvement of local government agencies (as likely implementing and coordinating agencies for the final INRM strategies). WAG provided the structure for stakeholder participation in four of the five case studies, but was modified and crafted for the different situations. Experience across the case studies emphasised the need for flexibility in adapting planning approaches to the context, rather than assuming that a common approach will suit all conditions.

- **Scale**: In all case studies, there was an intuitive understanding of the meso-scale as a logical scale for planning and implementing SLM interventions. Meso-scale was defined in management terms as the scale at which operational NRM decisions are made, which bridges between farm-scale management and national policy. As such, it differed in physical size, but sits squarely within the domain of local government, which will in many cases have primary responsibility for implementing programs and interventions.

- **Agreed values for assessment**: In the context of the participatory approach for strategy formulation used in Afromaison, selection and assessment of interventions was not a linear process, but was iterative and organic. Decisions as to the suitability of particular interventions were based on discussion of community preferences and values rather than explicit ranking or evaluation. Detailed schema of criteria and indicators, though favoured in theoretical terms, were not consistent with the actual processes of decision making; and could rarely be supported by available information. This emphasizes the importance of establishing an agreed vision and set of values as the basis for planning.

- **Diversity of options**: at the meso-scale, the aim of this not to identify a single “best” solution, but to identify a range of appropriate interventions from which land owners and managers can choose. Individual land managers have different capacities, resources and preferences, and a theoretical “best” option may not be appropriate for all. A diverse set of technologies for stakeholders to select from has been identified as a reason for successful adoption of SLM techniques in other studies (Barron *et al,* 2009; AgWater Solutions, 2013). The ultimate suitability of SLM intervention is determined by the details of design and implementation for the specific site, which varies between field and farm scale. At the meso-scale, it is possible to make broad recommendations about good practice, but not to prescribe design details

- **Innovation vs experience**: the SLM interventions identified in the case studies were mostly technologies that were already familiar in the context, rather than completely new innovations. To some extent, this can be attributed to the highly participatory nature of the process, where unfamiliar, and hence higher risk, technologies were not popular with stakeholders. It also reflects the fact that there is considerable understanding at the local level of the required management changes. The issue is in many cases is not the lack of knowledge about what to do, but how mechanisms and incentives can make change possible.

- **Combining interventions for maximum impact**: There is often not a simple one-to-one relationship between NRM problems and solutions. A single issue may have multiple causes and hence require a combination of interventions; and conversely, a single intervention may address a number of different NRM issues. It is essential that interventions address the underlying causes of degradation and mismanagement, not only the symptoms. Conceptual mapping is a very useful tool for unravelling chains of cause and effect.

- **Automated tools**: There was limited enthusiasm for adoption of computer-based decision support tools to identify and assess SLM interventions in the case studies. This can be attributed in part to the scale and detail of the analysis required for suitability and impact assessments at meso-scale, which it is difficult to capture in generic tools, and for which adequate data is not generally available. The effort required to customise tools for local use is significant, and often beyond the resources and capacity of local stakeholders. In addition, the process of structuring and organizing information which underlies construction of automated tools is actually an essential part of the learning and exploration process for stakeholders in understanding the issues and priorities for their regions, and is difficult to shortcut.

- **ES approach:** An ES approach provided a valuable framework for identifying and assessing interventions in three ways. i) Qualitative assessment of ES supply and demand based on stakeholder inputs is a useful way to capture the values attributed to landscape elements by different users, and the trade-offs between different land uses. ii) Mapping of the spatial patterns of supply and demand of ES can help to identify priority “hot spots” for conservation and restoration in areas where multiple ES are used or where supply cannot meet demand. iii) Simulation of changes in ES as a result of interventions, taking into consideration who benefits and where, provides an indication of both the effectiveness and the equity of proposed strategies. The use of ES concepts in Afromaison was characterised by emphasis on qualitative assessment of a wide range of ES, rather than on detailed economic valuation of individual ES, in line with broad INRM goals of the project. Tallis and Polasky (2009) make the point that valuation is not always important for ecosystem-based approaches to management: where there is broad agreement on management goals, simply knowing how ES will change in biophysical terms is the critical information.

5.2.3 Economic tools and incentives

a) <u>Impact and sustainability of economic tools and incentives</u>

- **Instrument-context matching** is critical for generating meaningful incentives for improved NRM through economic instruments. The effectiveness of an economic instrument in acting as an incentive for improved environmental management is not determined by the value of the benefit (incentive) alone. There are a range of factors that will influence the effectiveness of an instrument in a specific context, and key examples of these include, the extent to which:
    - The instrument matches or aligns with the social, political and economic contexts
    - The incentive relates to the nature of the environmental challenge and its causes
    - The instrument is perceived as an incentive by the target agents or institutions whose behaviour or management approach is being changed

  In addition, in developing countries in particular where financial resources are typically scarce and where limited institutional capacity typically exists, important criteria for selecting the best economic instruments also include:
    - Cost-effectiveness and administrative feasibility
    - Consistency with other development objectives
    - Equity, flexibility and transparency

  It is therefore important that a conscious selection process is undertaken to ensure that the economic instrument is a good fit to the context. Poor 'context-instrument' matching could result in the selection of an ineffective instrument that does not result in the desired behaviour/management change by the target agents or institutions, or may even act as a perverse incentive and result in a change contrary to the desired response

- **The impact and sustainability of the three categories of economic instruments varies** across developing countries, however, the following general conclusions can be made:
    - *Rights based instruments* typically have the greatest impact in areas with weak tenure or open access resources. However the impact and sustainability of these instruments is a direct function of the governance systems through which they are implemented. Weak institutional capacity means that the sanctions and controls needed to support the rights based instruments are absent or fragile which means they can be ignored or overridden by other forces. Furthermore, careful consideration needs to be paid to respecting and avoiding conflicts between traditional governance systems and the governance systems used to implement the economic instrument. Conflicts between these systems can

result in the erosion of social cohesion, which could ultimately undermine efforts to incentivise improved NRM.

- *Price based instruments* are relatively versatile and can be effective from less formal and weak economies through to formal and relatively affluent markets. The critical issue affecting impact and sustainability is the price / cost associated with the incentive needs to be meaningful within the local economy. The economic value of the incentive therefore needs to be locally calculated on a case by case basis and cannot be universally determined. In addition, price based instruments typically required effective governance systems to implement and enforce them effectively and equitably. Capacity and resource constraints of governance systems in developing countries can therefore be a key limiting factor to the impact and sustainability of price based instruments.

- *Legal, voluntary and information based instruments* are typically more effective in formal economies with the market limitations of less formal markets typically restricting the potential impact of these instruments. Weak governance also limits the impact of these instruments by being unable to support the legitimacy of the regulating systems established to implement the instrument. Nevertheless a strong platform of civic, NGO, or independent third party role-players can compensate for market limitations or weak governance systems, and can provide an enabling environment for meaningful impact and sustainability of these instruments.

- **Decentralisation and devolution of power** to local authorities and users are key criteria for effective economic instruments. While national / central governments typically hold *de jure* authority for environmental management, the reality of capacity, financial and logistical constraints of national government in developing countries typically means that local resource users effectively have *de facto* authority. Formally empowering the local authorities at the meso-level can help to provide on the on-the-ground legitimacy and control, which can then be used as the platform for management interventions and the implementation of local level tools and incentives. Central government does has an important role to play in INRM, particularly in providing support through monitoring, sanctions and policy, which is typically most effective if implemented at a national level.

- **Externalities** associated with "illegal or non-local users without local use rights" need to be addressed if the impact and sustainability of incentives are to be maintained. Externalities can be defined as third party effects arising from the consumption of goods and services for which no appropriate compensation is paid, or where consumers do not comply with sanctions or incentives established locally. These externalities can undermine the sustainability of the economic instruments as a result of the local legitimate resource users no benefiting from the incentives equitably yet still bearing the costs.

- The scarcity of local markets funding to generate meaningful benefits at the meso-scale in developing countries often results in a **dependence on donor driven processes**. Donor driven processes however need to include a plan to transfer capacity and responsibility to local governance systems in the medium to long term to insure the sustainability of the instruments and incentives beyond the life-cycle of the donor funding. This plan should include consideration of the potential roles and responsibilities of local government, Communities/private sector and NGO/support agencies.

b) <u>Best practice in implementing economic tools and incentives</u>

- Local fees, charges and penalties associated with economic instruments need to be calculated to **reflect local market conditions and prices**, so as to ensure that the incentives are socially equitable and economically meaningful in the local context. It is also important to protect the legitimate interests of local resource users by adequately considering local economic circumstances and avoiding the establishment of pricing schemes that reflect prices in external markets.

- **Monitoring and evaluation** of the impacts of SLM interventions from an early stage helps to demonstrate the need for, and value of, improved natural resource management. This evidence from the monitoring can then be used to motivate markets to invest in the implementation of economic instruments that can be used to generate the incentives for local resource users and managers sustain the SLM interventions.

- Economic instruments need to build or **maintain social cohesion** when introducing incentives for improved natural resource management, particularly within the realm of traditional cultures' resource use and management practices. Emphasis needs to be placed on creating awareness about the potential complementarity of the incentives with local rules and traditions, and on avoiding conflict. Economic instruments also need to take into consideration protecting the rights of traditional resource user groups, and not replacing these with opportunities for new user groups who are able to position themselves well within the incentive system, which might come at the expense of the traditional rights holders.

- The effectiveness of economic instruments varies at **different scales within and beyond the meso-level**. The absence of local markets may limit the effectiveness of economic instruments to generate meaningful incentives. Broader market opportunities beyond the meso-scale may need to be explored to support the creation of incentives. Economic instruments can harness regional, national or international markets to generate incentives. It is therefore important that the local design of economic instruments takes opportunities beyond the meso-scale into consideration for effective design and implementation.

- Economic instruments need to be **incorporated as part of a strategy** rather than seen as a strategy on their own. As part of an effective strategy, economic instruments need to function in relation with other tools and interventions, and there is seldom a simplistic one-on-one relationship between a single intervention and an economic instrument. This is because there are typically multiple drivers collectively resulting in environmental degradation, and also multiple interventions required to address these drivers of degradation. The most effective approach to implementing economic instruments is therefore usually through a clustering and stacking approach:

- **Clustering** a range of restoration and adaptation interventions, usually to be implemented by a similar group of stakeholders, through a single or complementary set of economic instruments to collectively create the meaningful incentive required.

- **Stacking** of a series of economic instruments may be needed to generate incentives that are adequate to bring about a meaningful change in management or use practices of the target resource managers and users. The benefits generated through a single instrument may not be adequate to generate a meaningful incentive. However, a number of instruments each generating relatively small benefits may be stacked to collectively generate meaningful benefits that act as an effective incentive to trigger the change in management.
  Instruments may also be stacked over time, for example an economic instrument that may not be sustainable in the long term (e.g. subsidies) and be used in the short term to generate incentives that induce implementation of restoration and rehabilitation. Monitoring and evaluation of the impacts of these interventions may be used to establish instruments (e.g. PES) that are more term sustainable in the long term.

Therefore, an approach of **clustering and stacking of economic instruments** across interventions and over time provides a mechanism of incorporating economic tools and incentives into an INRM strategy.

- There is **no blue-print** for applying economic tools and incentives for INRM at a meso-scale. Generic tools such as the DST and DeMax or instruments (e.g. PES or Environmental Subsidies) that have been developed internationally require local context matching and calibration to ensure ecological, socio-cultural and economic suitability.

- While tools such as the DST and DeMax have the potential to highlight economic instruments that have the potential to create local meaningful incentives, the process requires the input of local stakeholders and experts who can evaluate and compare the instruments highlighted by the process, to decide which instruments to carry forward. This expert and local knowledge of stakeholders provides an ‘informed filter’ that can refine the list of economic instruments and their local design for implementation.

PART 6: RECOMMENDATIONS ON APPROACHES AND TOOLS FOR INRM

1) Roles and contributions of stakeholder versus expert driven process in selecting and designing tools, interventions and strategies

The combination of local and scientific knowledge is a key component of the Afromaison approach. The case studies were chosen because of acknowledged challenges in terms of land degradation and water management, where current approaches are failing to provide solutions, and local authorities are seeking external expertise and assistance. The starting point for the project was the principle that INRM is intrinsically a local process, since the responsibility for day-to-day management of land and water resources lies primarily with landholders and local authorities. Afromaison was thus designed explicitly as a highly participatory process, using a mix of formal meetings and less traditional approaches. Two key aspects of the Afromaison approach were the use of participatory role play games (RPG) as a forum for mutual exchange of information and two-way learning; and close involvement of local government agencies, with the aim of forging direct links into their planning and management processes.

The role of communities and stakeholders is to provide local knowledge and insights into the system as it currently operates: the resource base, current land use, local practices and perceptions, pressures and potential conflicts. They are also able to provide historical context: understanding of the genesis and evolution of current problems; and knowledge of previous management success and failures. The role of scientific and technical experts is to provide advice on technologies and approaches not currently used in the area; identify links and interdependencies that may not be obvious at local level; and provide predictive capacity based on experience in other areas.

The advantages of a joint approach to INRM are obvious and important: capitalising on local knowledge and supplementing it with technical expertise that can provide fresh perspectives and approaches; two-way exchange of information, with deeper understanding of issues on both sides; capacity building within the community in terms of planning and management; local ownership of outcomes; more targeted solutions as scientists take on local concerns.

There are also, however, some risks involved, which need to be taken into account. Firstly, priorities and solutions identified through participatory processes are subjective, and may not always be representative of broader community concerns, or reflect issues deemed to be important from a more objective technical perspective. Desalgen (2013) points out that local power structures and political concerns may skew discussions, which are in any case strongly dependent on who has been consulted. There is a role for external technical experts to act as a "reality check" to ensure that long-term issues, or cryptic problems that may be masked by more obvious concerns, are not neglected. Secondly, participatory processes intrinsically seek consensus, which can result in "wish-lists" of solutions proposed without critical evaluation.

Technical inputs can help move beyond this by providing objective evaluation, but to achieve this, must be embedded in the participatory processes. This is not easy to achieve, and there is often a mismatch between stakeholder expectations and what research can realistically deliver, in terms of both timeframes and solutions. It was found in the project that technical processes often ran in parallel with, and to a different time frame than, the community consultation processes. Aligning these more closely remains a major challenge. The drive for consensus may also hamper decision making. This is where involvement of local government authorities is critical, as ultimately they are likely to be the agencies responsible for moving strategies to implementation.

2) Influence of drivers outside the meso-scale on local operations

While the meso-scale may be effective for the development of INRM strategies, it is important to consider the fact that circumstances and conditions in the locally defined meso-scale do not operate and exist in isolation. The meso-scale is not an insulated *bubble*, but rather a notional boundary to an area that is impacted on by externalities such as market forces, external users, climate change, etc., many of which the meso-scale actors have very little or no influence. Tools and approaches applied at the meso-scale to develop an INRM strategy may not be able to incorporate consideration of these externalities, and therefore the implementation of the INRM strategy needs to incorporate an adaptive management approach to take this into consideration and ensure the ongoing relevance of the strategy.

3) Clustering interventions and the approaches for spatial, restoration and adaptation, and economic incentives

The drivers and causes of land degradation and other NRM problems are a complex mix of biophysical, social and economic factors, and the solutions proposed must operate within the same complex space. For solutions to be sustainable, it is not sufficient to only treat the symptoms: underlying causes must also be addressed. Cause and effect domains can span multiple sectors and scales, with complex and sometimes unpredictable feedbacks. There is rarely a simple one-to-one relationship between NRM problems and solutions. A single issue may have multiple causes and hence require a combination of interventions; and conversely, a single intervention may address a number of different NRM issues. This is true not only in a biophysical context, but also of the social and economic systems. To remove barriers to implementation, it may be necessary to find different incentives for different actors; and combining incentives across interventions may enable actions which would not otherwise be feasible.

There are three components in dealing with this complexity: spatial analysis, to define which issues are co-located, and the domains of influence of both drivers and proposed solutions; cross-sectoral analysis, to identify synergies, interactions and feedbacks; and analysis of actors and stakeholders impacted by each set of issues. By combining this three-way analysis, issues and solutions which are common to different actors, sectors and locations can be aligned. SLM interventions are thus not selected and assessed in isolation, but as part of the overall INRM strategy. The iterative nature of the selection process is critical, where interventions are identified and progressively refined as their relationship to other parts of the strategy emerge.

4) Generic approaches and tools may require local calibration

There is no blue-print for applying tools and approaches for INRM at a meso-scale. Generic tools or approaches that have been developed internationally may require local context matching and adaptation to ensure ecological, socio-cultural and economic suitability. Without local fine-tuning, international approaches and tools may be unable to adequately support local objectives not because the tool or approach was inappropriate, but rather because it was not adapted to local conditions. Design of technologies are very specific for physical conditions in a specific context, and application of these technologies outside of the context for which they were originally designed could require fine-tuning to calibrate them for local conditions. Similarly, tools that have been established for broad international application may be too generic to be meaningful in a local context. However, application of these tools would benefit from input by local context specialists to calibrate them locally.

5) Building spatial planning, restoration and adaptation and economic instruments approaches into an integrated strategy

Spatial planning has the potential to promote integration across policy sectors and administrative boundaries. It therefore facilitates policy coherence and plays an important role in an integrated strategy, including restoration and adaptation, as well as economic instruments approaches. At the meso-scale spatial planning contributes to a reduction of conflicts between sectoral interests on larger territories (with a wider perspective than at local planning level), and therefore to the prevention of harm and damage of natural resources. A well-integrated strategy can be achieved, if:

- A common vision of INRM is approved;
- A shared platform exists for the coordination between different policy fields/sectors/ i.e. ministries of agriculture, forestry, water, nature conservation, urban and transport planning etc., for information exchange and for the alignment of policy objectives and activities relevant for NRM with the aim to achieve a common set of goals.
- Competencies of different actors in all three types of approaches and tools are clearly defined;
- Cooperation of all actors is promoted, and information, processes and decisions are made transparent;
- Procedures and methods are applied to achieve best practice integration,

In the Afromaison project, a common understanding of INRM was achieved but the common vision to bundle the different approaches could be made more visible. The project functions as a shared platform for thematic experts to work towards operationalization of INRM at meso-scale. The competencies to use and implement restoration and adaptation strategies, spatial planning tools, and economic instruments in the post project phase has to be ensured so that local partners inherit it. The participatory planning approach of Afromaison is maintained for information sharing, transparency and supporting NRM decisions. There is need for tools and methods for integration, such as steering committees in the South African case study.

6) Is the meso-scale the appropriate scale for generating strategies for INRM?

The meso-scale is defined differently in different case studies; it is, for instance, a province in Tunisia and a district municipality in South Africa. Therefore the meso-scale cannot be directly compared between case studies. However, in all case studies, it is the scale between national and local decision-making levels, where national policies are implemented and adapted, and participation of local stakeholders is integrated into the planning processes.

From the overall findings from the Afromaison project, it can be concluded that the meso-scale plays an important role in the implementation of strategies for sustainable resource management and integrates different sectoral plans. For example, the Environmental Management Framework for the district municipality in the South Africa case study. Several reasons of meso-scale importance were identified:

1. The meso-scale is intuitive and a useful scale for resource management, as it functions as a bridge between the local farm/community scale and the national scale;
2. At this scale a wider spatial and time perspective for decision-making is given, which includes longer-term strategies than at a community scale;
3. At the meso-scale cumulative impacts on natural resources of all sectoral decisions and on-farm decisions can be analysed, assessed and mitigated. For this aim, strategic environmental assessment plays an essential role as a decision-aiding process in spatial planning.
4. Meso-scale is as much about the management level than the physical scale as it is the scale at which most operational (as opposed to policy) decisions are made; and at which policy is translated into action - physically different in different areas
5. Level of application (meso to local) varies for different countries.

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APPENDIX 1: Inventory of economic instruments considered in the Afromaison Project

CATEGORY	TYPE	INSTRUMENT	EXAMPLE
RIGHTS BASED INSTRUMENTS	**Property rights** Definition: Rights based approaches aim to establish or strengthen a clear sense of ownership to reinforce private incentives for conservation and to underpin other market-based conservation tools. Exclusive and secure property rights make resource depletion internal to the owners/users. The consequence of this internalization is that the owner/s will not engage in resource extraction unless the price of the resource commodity covers not only the extraction cost but also the depletion or user cost, which is the foregone future benefit as a result of present use.	**Strengthening ownership rights** Instruments that define, adjust or create property rights to ameliorate environmental damage. They define the basic enforceable law for ownership and use of both tangible e.g. land and intangible permits such as property. This category largely applies to customary communal land rights systems, where land and resources are owned and managed communally.	• Awarding / strengthening land titles • Conservation easements
		Securing use rights This category largely applies to open access resources to common property resources under public or communal ownership.	• Awarding / strengthening resource use rights (e.g. licensing water, timber rights)
PRICE-BASED INSTRUMENTS	**Market creation** Definition: Instruments to strengthen the role of the market in guiding the allocation and use of resources, and providing economic incentives for conservation. Market creation uses economic instruments to nurture demand for, and provision of, new types of environmental goods and services or create new market value for existing goods and services.	**Tradable permits, quotas and shares** Marketable/tradable permit systems enable a government to issue a fixed number of permits or "rights" equal to the permissible or sustainable use levels, and distribute them among resource users. A market for permits is established and the permits are traded among users. Users requiring levels below their allotted permit can sell or lease their surplus allotments to other users.	• Catch/harvest quotas • Water shares • Resource shares (livestock and harvesting etc) • Tradable discharge permits
	Fiscal instruments Definition: Instruments used to discourage unsustainable production and consumption practices and raise public revenues. Fiscal instruments can be used to bridge the gap between private and social costs/benefits.	**Tax differentiation** Tax differentiation includes land and property taxes, where tax rates may differentiate between property classes with variable tax rates or tax relief provided for classes such as conservation. It can also relate to variations in indirect taxes, such as excise duties, sales taxes, or value added taxes for environmental ends. Goods and services that are associated with environmental impact or damage in production and consumption may be taxed more heavily.	• Differential property rates
		Input and output taxes	Not to be included in

CATEGORY	TYPE	INSTRUMENT	EXAMPLE
		Taxes on products related to the environmental impact of securing the raw material or the end product	AFROMAISON Decision Support Tool
		Pollution taxes Tax producers of on discharges or effluent to discourage indiscriminate pollution (i.e. encourage minimisation of pollution)	Not to be included in AFROMAISON Decision Support Tool
	Charge systems Definition: Payments for use of resources, infrastructure, and services and are similar to market prices for private goods. For example charges can be seen as "prices" for public goods or publicly provided private goods. They differ from market prices for private goods because they are not market determined but are administratively set by a government agency, a public utility, or other types of regulated natural monopoly. This contrasts them with taxes which are not payments for "services" but a means for raising fiscal revenue. Charge instruments are therefore used to align private and social incentives, promote environmentally sound behaviour, and raise funds for conservation efforts. Note: The difference between taxes (section above) and charge systems can be defined as: (a)environmental taxes are designed to change prices and thus the behaviour of producers and consumers, while also raising revenue (b) environmental charges are designed to partly of fully cover the costs of services and abatement measures such as water treatment or waste disposal	**User charges / fees** This is a charge/fee levied on the user of an environmental resource based on the costs of mitigating the impact (or treating emissions) that affect the resource.	• Water use charges used to improve water resource management e.g. catchment management activities such as alien plant clearing, water resource monitoring etc.
		Pollution charges These are usually effluent or emissions charges and are based on the actual amount of the pollutant discharged	• Water effluent charges • Waste charges • Air pollution charges • Noise charges
		Product charges or levies This is a mark-up on the price of a pollution-generating product that is based on the amount responsible for pollution. An example of a product charge is a carbon (fuel) tax.	Not to be included in AFROMAISON Decision Support Tool
		Betterment charges This is a fee levied for private properties benefiting from public projects.	Not to be included in AFROMAISON Decision Support Tool
		Impact fees A charge to help reduce the economic burden on local jurisdictions that are trying to deal with growth within the area	Not to be included in AFROMAISON Decision Support Tool
		Access fees Access fees for rights of access to an environment or a resource	Not to be included in AFROMAISON Decision Support Tool
		Administrative systems	Not to be included in

CATEGORY	TYPE	INSTRUMENT	EXAMPLE
		Service fee for implementing or monitoring regulation for the sustainable management of a resource	AFROMAISON Decision Support Tool
	Financial instruments Definition: Instruments designed to induce resource users to reduce or mitigate negative impacts to the environment by making control measures more affordable. Financial instruments are distinguished from fiscal instruments because they are often extra-budgetary and financed from foreign aid, external borrowing, debt for nature swaps, and the like. Often the motivation behind the creation of special funds for environmental protection or resource conservation is to avoid the scrutiny of the budgetary process.	**Financial subsidies** Incentives created through subsidies for example by offering grants, tax incentives, low interest loans, etc. Conversely, existing subsidies may offer perverse incentives resulting in environmental degradation (e.g. subsidising irrigation water could result in waste or water or salination of soils from waterlogging). The removal of such subsidies could be an effective instrument for improved resource management	• Soft loans • Grants • Location/relocation incentives • Revolving funds
		Payment for Ecosystem Services Payment for environmental service is a voluntary transaction in which a well-defined environmental service, or land use likely to secure that service, is being "bought" by a minimum of one service buyer who in return compensates a minimum of one service provider, if and only if the environmental service provider secures the quality and quantity of that environmental service. State schemes (where the Sate acts on behalf of the buyer) are technically not always true PES schemes as the 'payment' by the buyers may not be voluntary and may be raised by the State as a tax or levy	• Agro-environment schemes • Watershed protection • Carbon sequestration • Voluntary offsets for habitat/wildlife conservation • Bio-prospecting
	Environmental bonds and deposit refund systems Definition: Instruments that aim to shift responsibility for controlling environmental impacts, monitoring, and enforcement to individual producers and consumers who are charged in advance for the potential damage	**Environmental performance** Payments made to regulatory authorities before a potentially environmentally damaging activity is undertaken, and then returned when the environmental performance is proven to be acceptable.	• Performance bonds
		Land reclamation bonds Payments made prior to an environmentally damaging activity to secure resources for post operation rehabilitation	Not to be included in AFROMAISON Decision Support Tool
		Environmental accident bonds Deposits paid at the start of an environmentally high risk activity which could experience an event resulting in environmental damage, to ensure the resources are available for the necessary restoration operations	Not to be included in AFROMAISON Decision Support Tool
LEGAL, VOLUNTARY AND INFORMATION	**Liability instruments** Definition: Instruments that aim to induce socially responsible behaviour by establishing legal liability for (a) natural resource damage, (b) environmental	**Legal liability** Making an agent legally liable for damages associated with an accident or action that damages the natural environment. In cases where, two or more parties are liable in respect of the same liability, they may be jointly and/or	• A company may face remediation obligations due to contamination at a

CATEGORY	TYPE	INSTRUMENT	EXAMPLE
BASED INSTRUMENTS	damage, (c) non-compliance to environmental laws and regulations, and (d) non-payment of due taxes, fees or charges. In a sense, all these instruments have an enforcement incentive, namely the threat of legal action. Liability instruments differ from others in that they assess and recover damages ex post i.e. they are triggered when damages from the activity are realised.	severally liable.	site that they use or own.
		Non-compliance charges A fee imposed on an agent who does not comply with environmental requirements and regulations.	• A fine for poaching; overconsumption charges regarding water use
		Natural resource damage liability This liability generally relates to injury, destruction, loss, or loss of use of natural resources that do not constitute private property. Rather, the resources must belong to or be controlled by federal, state, local, foreign, or tribal governments. Such resources include flora, fauna, land, air, and water resources. The liability can arise from accidental releases (e.g., during transport) as well as lawful releases to air, water, and soil.	Not to be included in AFROMAISON Decision Support Tool
	Voluntary Instruments	**Voluntary environmental agreements** Formal negotiated agreements between groups / agents and the government to limit the over use or encourage sustainable management of natural resources	• Stewardship agreements
		Environmental certification Voluntary compliance with principles and standards recognised as being sustainable/ responsible environmental management. Compliance assessed by third party and incentives for certification largely market driven.	• Fixed system of certification within some predetermined bounds such as FSC, ISO 14000 or EMAS standards
	Information-based Instruments for informing the public about how eco-friendly a product or organisation is.	**Labelling** Branding and labelling of products with information on approaches to avoid or reduce environmental impact either in production process or in usage of product.	• Products are directly labelled as being environmentally friendly or meeting certain criteria
		Public disclosure May include sustainability reporting in annual reports or production agents or organisation to declare impacts to environment and initiatives and resources allocated to mitigate or reduce negative impacts while enhance positive impacts	Not to be included in AFROMAISON Decision Support Tool

APPENDIX 2: Environmental Management Framework process and available spatial planning tools (uThukela District Municipality, South Africa)

Phase	Activities	Stakeholder participation	Available Spatial Planning Tools			Outputs
			Decisions-aiding Policy Tools	Analytical & Research Tools	Communication and Negotiation Tools	
Inception	- Generic agreement on the EMF procedures - Project Management Team and steering committee	- Inception meeting - Kick off meeting and establishing steering committee		Scoping checklists to identify stakeholders, refine the scope of work, methodology (what tools will be used), time schedule, nature and format of the deliverables	- Stakeholder database	- Term of Reference - Management Team - Inception Report
Status Quo	- Preliminary study on the existing state of the natural resources - Detail data gathering and assigning specialists - Detail assessment and developing report - Review of status quo report	Ongoing development of stakeholders database. Public/open meetings advertised in press. One on one interviews/ meetings with key stakeholder groups. 3-4 Project steering committee meetings (PSC).	Systematic Conservation Planning Bioresource Programme	- Participatory GIS - Ecosystem Services M	- Ecosystem Services Mapping - Conceptual Map	- Final Status Quo Report
Desired State	- Assessing Opportunities and Constraints - Environmental constraint zones - Develop desired state report	- Stakeholder workshops - interview	- Trade-off Analysis - Strategic Environmental Assessment - Environmental Constraint	- Ecosystem Services Mapping - Scenarios - Sensitivity Analysis - GIS - Hydrological Model (SWIM)	- Ecosystem Services Mapping - Conceptual Map	- Desired State Report - Detail Maps of Management Zones

	- Review desired state report		Zones	- Land use model (SITE)		
Strategic Environmental Management Plan	- Assessing Opportunities and Constraints - Environmental constraint zones - Develop desired state report Review desired state report	- Stakeholder workshops - interview	- Trade-off Analysis - Strategic Environmental Assessment - Environmental Constraint Zones - Monitoring Indicators	- SWIM - SITE - GIS - Ecosystem Services Mapping	- Ecosystem Services Mapping - Conceptual Map	- Management Zones - Management Guidelines - Implementation Strategies - Strategic Environmental Management Plan