THE SAfMA PROCESS

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Introduction

The Millennium Ecosystem Assessment (MA) is a global multi-scale study aimed at quantifying the relationship between ecosystem services and human well-being across the planet (Alcamo *et al*. 2003; Reid and Mace 2003) and, in particular, the current capacity and future potential of ecosystems to deliver services. The Southern African Millennium Ecosystem Assessment (SA*f*MA) is one of the sub-global assessments of the Millennium Ecosystem Assessment (MA), and assessed the services provided by ecosystems and their implications for human well being in southern Africa. SA*f*MA explored how local, regional as well as national informal and formal management systems could be combined to manage ecosystems in a way that ensures the continued provision of ecosystem services in the region.

SA*f*MA was initiated in 2000, following the MA call for assessments to be conducted at sub-global scales. Several scientists from the Southern African region responded independently, and the MA asked them to join forces and design a joint proposal for conducting a multi-scale sub-global assessment. The joint proposal development was followed by a period of assessment design, which involved consultation with experts and potential user groups from the region, including reviews by the MA itself and various experts and stakeholders from the region.

The assessment included an initial pilot assessment (Scholes *et al*. 2002) conducted from February 2002 to August 2002 followed by a full assessment until December 2003. The SA*f*MA pilot was useful for developing and testing ideas on how to conduct sub-global and multi-scale assessments. This pilot study also formed the foundation principles of an integrated design that allowed us to tie together the various components of the study. The fully nested design tested in the pilot was the design eventually implemented across the full assessment. At the global scale, the SA*f*MA pilot assessment helped to build understanding of the assessment process and support for it among stakeholders. The pilot assessment was also an important tool for building stakeholder awareness and involvement within the southern African region. The advantages gained by showcasing the pilot assessment at the World Summit on Sustainable Development cannot be over emphasised.

Purpose of the assessment

Ecosystems provide human beings with a range of services, ranging from direct benefits such as food or water to indirect benefits such as flood mitigation or climate regulation. In trying to implement policies or management interventions that aim to achieve some social objective, decision makers often face the challenge of having to make decisions about trade-offs among ecosystem services and among user groups from a basis where they do not have access to the best available information for deciding among the available policy responses.

SA*f*MA sought to address some of these challenges through the provision of the best available ecosystem service information to decision makers but also to try and inform the difficult trade-offs decisions that frequently have to be made.

Objectives

- To provide decision makers, academics, and civil society with reliable and useful information on the relationship between ecosystem services and human well-being in southern Africa;
- To provide this information at multiple and relevant scales ranging from local to regional levels;
- To enhance the capacity in the Southern African region to conduct integrated assessments;
- To positively influence sustainable development at local to regional scales through the development of answers to a range of questions on the relationships between human well-being and ecosystem services.

Components

The SA*f*MA assessment had three major components: a) an assessment of the current conditions and trends in the supply of and demand for ecosystem services. All SA*f*MA studies assessed three core variables (food, water, and biodiversity) as well as additional services requested by their particular stakeholders. Initially all these variables were treated as ecosystem services, however biodiversity was found not to fit the bill as an ecosystem service, and following the approach adopted by the MA, biodiversity was eventually treated as an indicator of the integrity of ecosystems which supports all other ecosystem services (Alcamo *et al.* 2003; Mace 2003); b) scenarios were developed for the region to depict plausible futures about the supply and demand for ecosystem services; 3) the assessment explored likely response options: (i) how people were likely to respond to future ecosystem service challenges and (ii) how people could respond, i.e. what types of responses were feasible in southern Africa and could be implemented proactively to improve ecosystem management and human well-being in the region.

Geographical scope and design

The SA*f*MA sub-global assessment was conducted at three scales in a fully nested design. The component assessments of SA*f*MA were a regional scale assessment, two basin scale

assessments and several community assessments. The regional assessment covered 19 countries in mainland Africa that lie south of the equator (Fig.1). Nested within the regional assessment were the basin scale assessments covering two major drainage basins: the Zambezi and Gariep. Within these basins several "community-based" assessments were conducted, which varied in scale from the scale of a village, city or even a broader eco-region. These local assessments incorporated conventional scientific data as well as well as informal local knowledge.

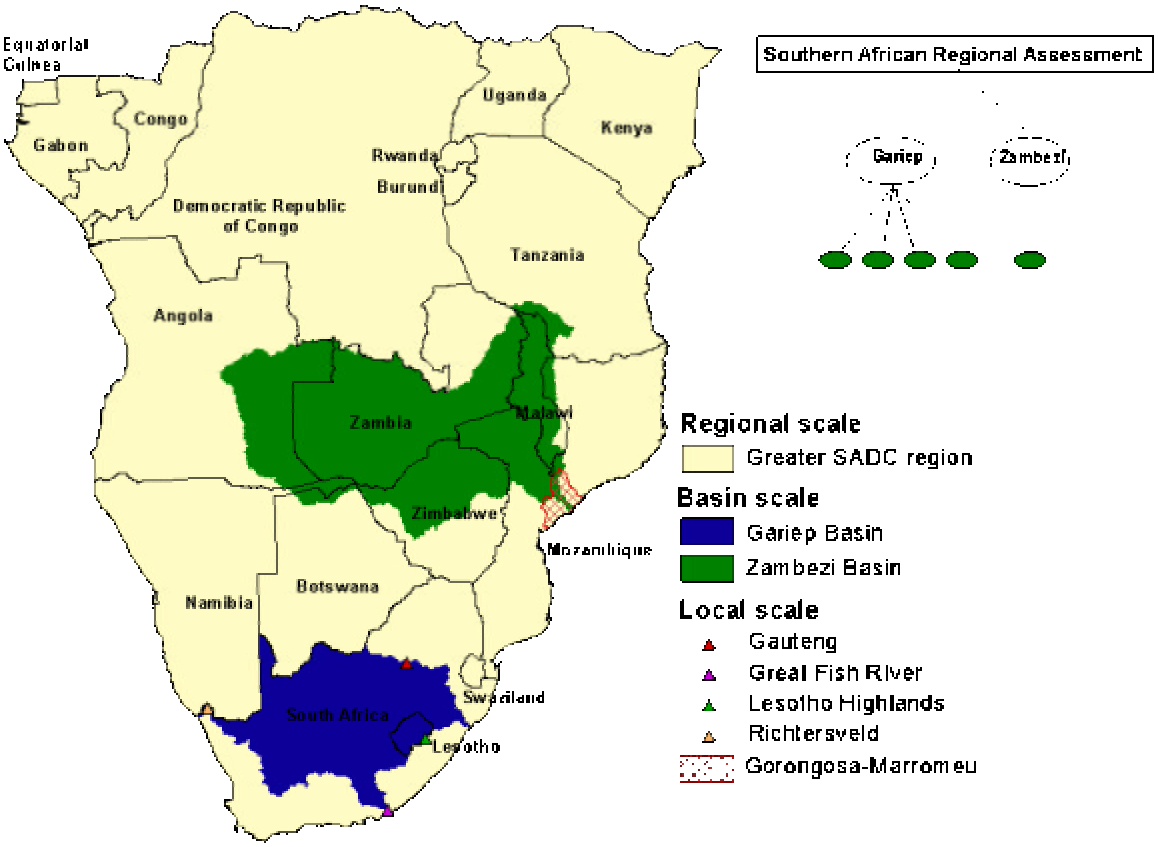

Figure 1. The location of assessment sites in the Southern African Millennium Ecosystem Assessment (SA*f*MA).

Why a multi scale approach?

SAfMA chose a multi-scale approach as this makes it possible to investigate processes at the scales at which they dominate (Holling 1992; Allen and Holling 2002). For example, water availability is influenced by community adaptation at the local scale, national water policy at the basin scale as well as climate patterns at the regional scale. A multi-scale approach can also take into account feedbacks between scales. For example, a local assessment of water supply in a downstream farming community would be incomplete without information about the upstream activities that impact on local water availability or regional precipitation patterns. Larger-scale assessments provide context for local-

scale studies and local assessments can ground-truth regional scale findings and provide an important reality check.

A multi-scale assessment is better placed to meet the needs of different users than a single-scale assessment. A regional scale assessment does not directly meet the needs of local communities, while local community assessments alone cannot meet the needs of regional bodies such SADC. Conducting a multi-scale assessment helps ensure that the perspectives at any given scale are reflected in the conclusions at the other scales. For example, a local community may have a very different perception of the costs and benefits of different ecosystem features to those advocated or held by national level decision makers. In addition, a multi-scale assessment can highlight where overall beneficial impacts of policy change at a national scale hides 'winners' and 'losers' at local scales (Fabricius book reference– Jennifer Jones).

Methods

Since a multi-scale assessment had never been conducted in the region, SA*f*MA adopted an experimental approach. The approach taken in SA*f*MA was to leave the choice of methodology open, but to decide on common variables and units of measurement in order to achieve integration. The assessments focused on three approaches: a) assessing condition and trend of ecosystem integrity, ecosystem services, and human well-being; b) scenario development, and c) assessing response options. These components mirror the three foci of the MA working groups of Condition and Trend, Scenarios and Responses. Initial work focused on the first component and consisted mostly of collating data and information. Much of the local assessment level data were collected using participatory research approaches and tapping into the knowledge and memories of local resource users while at the regional and basin scale much reliance was placed on existing and more conventional data and modeling techniques. Although similar ecosystem services were assessed (Table 1), the methodologies used varied from supply-demand calculations at broad scales to local livelihood approaches at local scales. It was found that while some methods are scalable, others were not, and each assessment adopted methods that were capable of answering the questions that were of relevance at its particular scale while trying to retain some measure of multi scale comparability.

Data on condition was often far easier to collate than trend information. The SA*f*MA team tried to standardize on a 10 year trend period. It was found that assessing ecological integrity of ecosystems was an integral part of the assessments and some innovative methods were developed e.g. measures of biodiversity intactness (Biggs *et al.*, in preparation) and conservation value (Pressey *et al.* 1999; Reyers, in press). Information on human well-being differed significantly between scales with more conventional data and indicators being used at the broad scale with more qualitative approaches at the local scale. The challenge with this kind of assessment is to take the data and information on each of the variables of ecosystems, services and human well-being and investigate the linkages and trade-offs. This proved to be one of the more challenging tasks.

Table 1. The various ecosystem services assessed in components of the SA*f*MA sub-global assessment.

Regional assessment	**Basin assessment(s)**	**Local assessment (s)**
Core variables	*Core variables*	*Core variables*
a. Food	a. Food	a. Food
b. Water	b. Water	b. Water
c. Biodiversity	c. Biodiversity	c. Biodiversity
Selected variables	*Selected variables*	*Selected variables*
d. Fuelwood	d. Grazing	d. Fuelwood
e. Grazing	e. Fisheries	e. Medicinal plants
f. Desertification	f. Energy/ fuelwood	
g. Air quality	g. Air quality	
h. Ecotourism	h. Cultural services	

The second component of scenario development proved to be more qualitative than quantitative with much reliance placed on the MA conceptual framework for investigating the impacts of various scenarios on ecosystems, services and human well being. The choice of scenarios was difficult with some scenarios not being appropriate at all scales. The decision was made to allow for independent scenario development within each of the assessments (Table 2). Interestingly enough at the end of the scenario development phase the types of scenarios developed at all scales were remarkably similar. These scenarios varied from market force driven scenarios to local governance ones. The final component of responses required the identification of responses possible in each assessment. These responses are discussed in more detail in Bohensky *et al*., in preparation). Here the project teams again made extensive use of the MA conceptual framework and investigated the implications of different responses within different scenarios on ecosystems, their services and the human well-being parameters.

Within each of these approaches the need to integrate between scales, components, and variables was of great importance as it is one of the important objectives of SA*f*MA. The fully nested design of SA*f*MA (region, basins, local assessments) provided a powerful test for assessing ecosystem services condition, scenarios and responses.

SA*f*MA users and stakeholders

SA*f*MA was designed and implemented in a way that allowed participation of stakeholders and users of the information generated. Due to the multi-scale nature of SA*f*MA, stakeholders are varied. At the regional level stakeholders include the Southern African Development Community (SADC) environment, water resources, agriculture/food security and development portfolios, national governments, the private sector, the media and the public. The two basin scale assessments (Gariep and Zambezi) contribute respectively to the needs of South Africa/ Lesotho and Zambia/Malawi/Mozambique/Angola/Tanzania and Zimbabwe governments, conservation and agricultural agencies as well as catchment management authorities. For

local assessments, the stakeholders and users are local communities, municipalities, common property associations, as well as local teachers and scholars.

Table 2. Classification of the MA global scenarios, the SADC region scenarios, the Gariep basin scenarios, and the Gariep local assessment scenarios into five scenario archetypes.

Scenario archetype		MA Global scenarios	SADC region Scenarios	Gariep basin scenarios	Gariep local assessment scenarios	Zambezi Basin scenarios	Gorongosa-Marromeu scenarios
Barbarisation	**Fortress World**	Order from Strength	African Patchwork	Fortress World	Stagnation	Climate Change Food security	Patronage
	Local Resources	Adapting Mosaic		Local Resources			
Conventional world	**Market Forces**	Global Orchestration, Technogarden	African Partnership	Market Forces	Green Engineering	Poverty HIV/AIDS Regional Integration	Devolution
	Policy Reform			Policy Reform	Betterment	National Politics	
Great transition	**Value change**	Rosy					

Users need information on the present condition, changes and trends in ecosystems in order to make environmentally sound management and policy decisions. Users expressed their needs in the various meetings and workshops SA*f*MA held with stakeholders. The need for information had also been stressed at numerous national workshops, in various State-of-Environment Reports, and in the SADC Policy and Strategy for Environment and Sustainable Development (SADC-ELMS, 1996). The needs were ascertained through direct consultation in workshops and meetings and through the participation of user groups in the reviewing of various reports and documents.

Individuals representing user groups were invited to contribute to SA*f*MA as members of User Advisory Groups (UAGs), one each for each of the various scales studied, as well as an Advisory Committee who guided the complete study. The different categories of SA*f*MA users were engaged in a variety of ways, ranging from their appointment on review panels to their involvement in intensive workshops at regional, basin and local scales in which issues of concern were identified and discussed.

SA*f*MA also engaged users through the 'SA*f*MA Fellowship Program' where individuals from stakeholder organizations were invited to become SA*f*MA Fellows. A SA*f*MA Fellowship entailed participation in SA*f*MA activities and reviewing of SA*f*MA documents and assisting with outreach and dissemination of SA*f*MA materials. SA*f*MA fellows also acted as bridges between SA*f*MA and other programs in the region and also took SA*f*MA messages to their organizations and countries. The pilot brochure released in August 2002 was designed as a user engagement tool and was distributed at the World Summit on Sustainable Development and elsewhere both within and outside the southern African region.

SA*f*MA governance

The Millennium Assessment process set out to be user driven. In SA*f*MA, stakeholders played an important role in the governance of the assessment. SA*f*MA had a two-structure governance system (Fig. 2) comprised of the Advisory Committee (AC) and the Technical Committee (TC). The ten member AC was comprised of representatives of stakeholders at regional level and was responsible for representing the interests of the different stakeholders, balancing the various interests within the region, creating a receptive policy environment for the work and outputs of SA*f*MA, endorsing the SA*f*MA

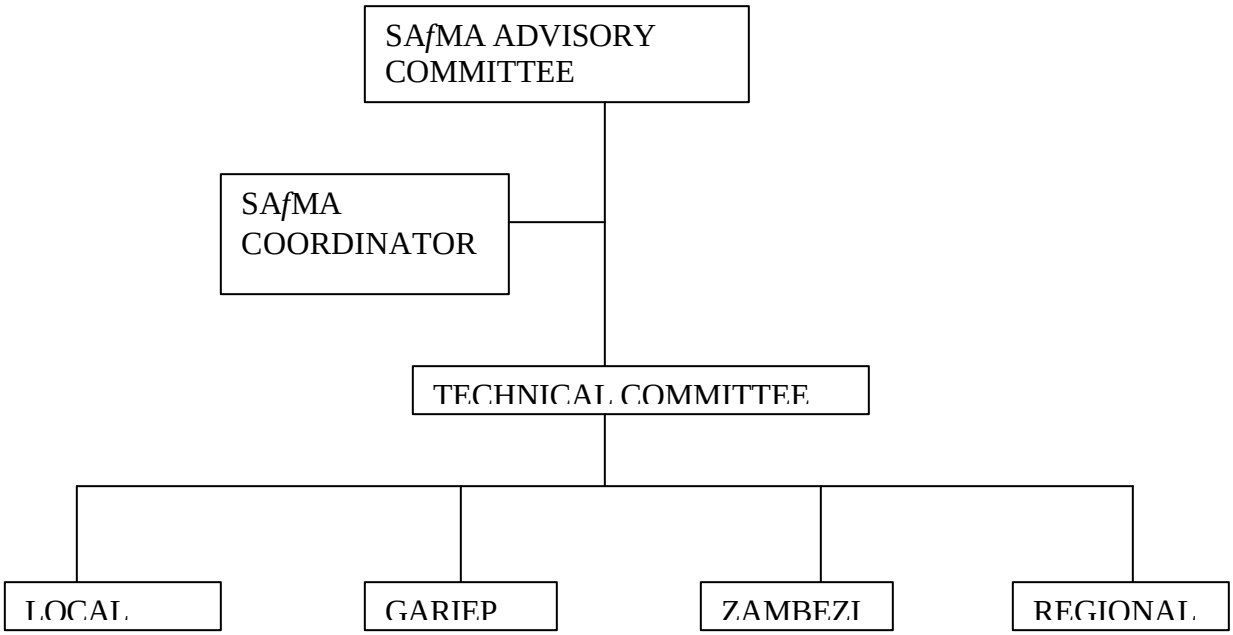

Figure 2. SA*f*MA governance structure.

outputs and directing the work of the technical team. The Technical committee comprised the principal investigators of the different component assessments of SA*f*MA and was responsible for designing the assessment, harmonizing the methods, communication between component assessments, monitoring progress, producing a multi-scale synthesis

report and final delivery. The coordinator was based at one of the stakeholder institutions in the region, had the role of linking the various SA*f*MA components and assisting the TC in the completion of its duties.

The coordinator also acted on behalf of the AC to oversee the implementation of approved plans. The AC interacted with and maintained dialogue with the technical experts, received regular feedback on how the assessment was progressing and in turn kept the technical committee informed of stakeholder expectations and perceptions.

The technical experts

The assessment was conducted by a multi-national and interdisciplinary team (Table 3). The technical work was conducted primarily by faculty and graduate students at academic institutions, and research or scientific staff from governmental or non-governmental organizations in the region (e.g. the Council for Scientific and Industrial Research (CSIR) in South Africa, Gorongosa National Park in Mozambique, the Zimbabwe Chapter of the Miombo Network, and many others). Most of the technical experts involved expressed their interest by responding to the MA call for participation in subglobal assessments. Others were invited to join in to provide certain skills in the different teams. The majority of the experts represent the natural sciences (ecology, conservation planning, forestry) with several social scientists and economists also on the roster. Most of the expertise that was used in SAfMA came from within the Southern African region.

Table 3 Institutions involved in the SAfMA

Assessment	**Lead Institution**	**Partner institutions**	**Principal Investigator**	**Other researchers**
Regional scale	Council for Scientific and Industrial Research (CSIR), South Africa		R.J. Scholes	O. Biggs J. Cooper G. Fleming T. Malungani A. Misselhorn
Gariep Basin	Stellenbosch University, South Africa	Lesotho partners?	A. van Jaarsveld	E. Bohensky B. Reyers L .Erasmus T. Knowles A. Ginsberg L..Nteletsane Lebesa M. van der Merwe
Gariep Local	Rhodes University, South Africa		C. Fabricius	C .Holgate C .Shackelton

				L .Zondo M .Pfab
Zambezi Basin	Miombo Network, Zimbabwe Chapter	Penn State University, USA	P. Desanker	D. Kwesha
Gorongosa Marromeu (Zambezi local)	Institute of Environmental Studies, University of Zimbabwe	Gorongosa National Park, Mozambique Eduardo Mondlane University, Mozambique, National Directorate of Conservation Areas (DNAC), Mozambique	T. Lynam	R. Zolho B. Reichelt A. Sitoe

Resources and Funding

Funding for SA*f*MA came *via* the MA from the government of Norway, with in-kind contributions from various agencies (governmental, non-governmental, academic, research bodies and private donors). Partnerships were formed with a range of different agencies in southern Africa and this facilitated the exchange of data, information and expertise.

Lessons learnt

Conduct a pilot assessment: The conducting of a pilot assessment was an important design principle that established the ground-rules and the basis for later integration. Integration would have been considerably more difficult if this initial pilot study was not conducted.

Multi-scale and nested design: SA*f*MA gained several advantages from its multi-scale design including the ability to conduct a reality check about ecosystem service conditions and trends emerging from various scales of analyses, the ability to ground-truth scenarios and to assess appropriate response options and policy interventions that can be used at different scales. An important finding was that at least one level of analyses should be inserted between global and local assessments and that the closer this level of analysis corresponded with administrative or socio-political decision making structures the better. This decision about the most appropriate intermediate scale of assessment is also influenced by the scales at which ecosystem service information is available for the region.

Early Integration: Integration is something that needs to be planned for from the outset of the assessment. Integration is very difficult to achieve afterwards and particularly in the absence of simplifying and unifying ground-rules and integration principles had not been informed. Some of the most important integration principles employed in SA*f*MA included: a fully nested design, the inclusion of core variables in each component of the study, the expression of ecosystem service variables in terms of supply : demand ratios and the use of comparable scenario archetypes.

Advisory Committee: The role played by the Advisory Committee in steering the project through difficult phases and providing leadership and guidance was of critical importance in delivering a better rounded and more useful final product.

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