

Situation Analysis of Ecosystem Services and Poverty Alleviation in arid and semi-arid Africa

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**by the Consortium for Ecosystem Services and Poverty Alleviation in
arid and semi-arid Africa (CEPSA)**



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Executive summary

1. AIM AND OBJECTIVES

This report is a situation analysis of the links between ecosystem services and poverty alleviation in the arid and semi-arid lands of sub-Saharan Africa (SSA). It reviews the available evidence and focuses on the opportunities for poverty alleviation through the provision and management of ecosystem services. The study was undertaken between September 2007 and March 2008, and addressed five key questions:

1. Which ecosystems services are important, and in what way, for the well-being of the poor?
2. What are recent trends of changes in the supply of these ecosystems goods and services and what factors are driving such changes?
3. What capacity exists in the region to manage ecosystems to optimise benefits to the poor?
4. What knowledge gaps exist that limit the implementation of policies and practices to manage ecosystems better to contribute to human well-being, especially of the poor?
5. What success stories exist from the region where ecosystems have been managed with poverty alleviation as a key goal?

2. STUDY DOMAIN

The arid and semi-arid lands of sub-Saharan Africa constituted the study domain. These were defined as those countries for which at least 50% of their land area had a ratio of mean annual precipitation to potential evaporation of less than 0.5. Sixteen countries in the Sahel region, East Africa and southern Africa met these criteria, but not all of them were covered in equal detail due to time constraints and availability of information. Each sub-region had a dedicated research and consultation team assigned to it.

3. APPROACH

Due to time and budget constraints the focus was mainly on existing data and information, although primary data were collected through key informant interviews and workshops with decision makers and local communities. Untransformed and human-influenced landscapes and their associated processes were regarded as ecosystems. At least one ecosystem service was selected per category (provisioning, supporting, regulating or cultural) for detailed examination. This report focuses on:

- **Provisioning service:** water
- **Regulating services:** Soil fertility (and water)
- **Cultural services:** Cultural/spiritual values associated with nature, and tourism
- **Supporting services:** Biodiversity

Key literature and key informants who could identify less accessible literature and reports were identified early on, and consulted. Emphasis was placed on literature from the last ten years, although not exclusively so. We specifically sought data and information that provided *evidence* of the links between ecosystem services and the poor. The sub-regional teams also conducted two in-depth, location specific case studies with stakeholders that integrated several of the core aspects. Key experts and officials in several countries were identified early on and interviewed. A total of 85 face-to-face meetings and a number of workshops were held. These meetings also served to create awareness about the project. Our analysis focused on the 'bigger picture' and did not strive to analyse or assess biophysical or social processes in detail. We acknowledge that an in-depth understanding of such processes is essential for the sustainable management of ecosystem services for poverty alleviation.

4. METHODOLOGICAL CHALLENGES

Most work to date has been on provisioning services, and consequently information on the other services, with the possible exception of cultural services and tourism, is relatively sparse. The short time frame of the project restricted much of the literature search to readily available literature. In-country consultations with experts were done in parallel, and literature pointed out by them during the later consultations was difficult to access. The approach to link ecosystems and poverty is relatively new. Consequently, much of the exploring of relationships between the two spheres was done by the project team, and at times this was intuitive rather than evidence-based. The conceptual framework was more complex than initially realised.

5. PROVISIONING SERVICES

Provisioning services are critical in supporting the livelihoods of the ultra-poor. Any restrictions in the supply of these services will lead to increased vulnerability and deepening poverty. Provisioning services are part of a wide portfolio of livelihood strategies, both for home consumption and income generation. The safety net function of provisioning services is particularly crucial as a fall-back or insurance during times of unexpected shock or added stress to the usual livelihood activities. Degradation of local ecosystems undermines the crucial safety net function leaving poor households extremely vulnerable. Transformed ecosystems, if properly managed, can provide important provisioning and regulating ecosystem services. Agricultural products are a key provisioning service in sub-Saharan Africa, with much of it being imported from high production areas to low production areas. Water is one of the most important provisioning services, but per capita water availability has decreased since 1990. Factors causing water shortages are pollution, invasive plants, wetland degradation, and soil degradation. A combination of approaches that allow for diversification and increased food production is more likely to reduce the vulnerability of the rural poor than single strategies that e.g. promote trade in biodiversity products.

6. REGULATING SERVICES

Because the poor frequently reside in marginalised areas, both in rural and urban localities, they are most susceptible in situations where regulating services are diminished, for example flooding, drought, poor air quality, areas with higher disease incidence, and degraded or exhausted soils.

7. CULTURAL SERVICES

Many traditional norms, taboos and practices assist either directly or inadvertently in the management of ecosystems and specific species. Cultural services perform an important social function and can help to reduce vulnerability. This provides an entry point for biodiversity conservation as well as ecosystem management programmes that reduce poverty. Few poor households are beneficiaries of tourism developments that tap into cultural services, but the poor are indirect beneficiaries through revenue and tax flows via government.

8. SUPPORTING SERVICES

Soils are a key supporting service, and form the basis for many provisioning services, particularly via agricultural production. Loss of Nitrogen, Phosphates and Potassium from soils in many areas have led to lower crop yields, but there are notable exceptions where soil moisture and fertility are being actively managed e.g. using manure and water retention structures. Biodiversity is a key supporting service and plays a role in the livelihoods of rural communities. Biodiversity loss is taking place through land transformation, consumptive use and invasive plants. Traditional crops and traditional livestock breeds broaden the genetic diversity underpinning agricultural production. The effectiveness of protected areas as a response to conserving biodiversity and promoting human well-being is being questioned, and approaches that involve local communities in biodiversity conservation are being spearheaded in sub-Saharan Africa, albeit with varying success. Biodiversity loss will even further restrict the options available to the rural poor. There is little information about the biophysical processes that need to be maintained to conserve biodiversity as a supporting service. Such information is crucial for the development of management strategies.

9. DRIVERS OF ECOSYSTEM CHANGE

Understanding drivers is complex because of the differing spatial and temporal scales, as well as the blurred interface between drivers and reactive policies. Many drivers are locally specific both in history, nature and/or magnitude. Consequently, any proposed interventions to address negative drivers will need to be based on local contexts. Global markets, particularly in agriculture, are an ultimate driver of change in ecosystem services, leading to proximate drivers such as land transformation. Population and demographic increase is another ultimate driver, as is rainfall and climate change. A third ultimate driver is governance. The more proximate drivers across most sites and scales included:

- Land transformation
- HIV/AIDS
- Over-use of resources (harvesting, grazing, abstraction)

- Urbanisation and expansion in peri-urban areas and
- Trends in tourism markets.

The impacts of these drivers vary according to local and national contexts, and drivers that have negative impacts under certain conditions can have positive impacts when contexts such as policies, infrastructure and markets change.

10. MANAGEMENT INTERVENTIONS

Poverty alleviation programmes very rarely have any consideration of their environmental impacts (either positive or negative) and the monitoring of the impacts (either poverty or ecosystem attributes) of interventions was particularly weak. This hinders any meaningful evaluation of their relative strengths and weaknesses to help design future interventions. A core aspect of management interventions is dealing with trade-offs, which frequently have neither been recognized nor dealt with. There is a dire need for appropriate tools, that are usable at all levels of decision-making, to help identify trade-offs and then make defensible decisions with that knowledge. Barriers to interventions include:

- Policies linking poverty and ecosystem services are the responsibility of single government departments, thereby limiting their impacts.
- Ecosystem services are undervalued or not valued at all, which leads to them being overlooked or taken for granted.
- Low policy coherence and lack of coordination between different multilateral environmental agreements.
- Problems in moving from policy to practice.
- Scaling up from a few localised projects or initiatives.
- Poor monitoring and a lack of timely and accurate information and data.
- Scale mismatches between the biophysical units of ecosystem management and the corresponding governance units.
- Poor management of common pool resources.
- Local knowledge and local social networks are the keys to local interventions that work, but the political will to hand over power to local people is often lacking.
- National interventions include devolution, which can be fraught with problems when local capacity is low; land reform to broaden access to resources; public works programmes; and programmes to promote commercialisation of resources.
- Payments for ecosystem services is a promising emerging innovation which requires major policy adaptations in order to work.

11. CAPACITY GAPS

Capacity gaps exist in all countries at different levels. A lack of critical mass in human resources capacity is evident throughout the region. This is especially problematic regarding monitoring of ecosystem services and of specific programmes. Several themes under capacity gaps are discussed, including:

- improving policy and institutional environment
- limitations of the skills base

- capacity at district and local level
- lack of integrated planning and management
- capacity in civil society
- capacity for monitoring
- lack of action on climate change
- capacity to manage selected ecosystem services for poverty alleviation.

One of the major capacity gaps identified in this analysis is the paucity of scholarly networks to promote and conduct good social and ecological science, and develop ways to integrate science into policy making. This will require excellent project management and facilitation skills.

12. RESEARCH GAPS AND PRIORITIES

Any situation analysis covering several questions, six countries and multiple ecosystem services will be able to identify numerous research needs and implementation gaps. However, this report focused on those relating to the interface between poverty alleviation and ecosystem services. The point is made that the (re)packaging existing knowledge into the ESPA paradigm should not be taken lightly. Four types of research gaps were identified:

- a. The need for empirical data, and methods to collect them;
- b. The need to understand social-ecological processes;
- c. The need to promote knowledge development and knowledge sharing;
- d. The need for monitoring, to enable adaptive management.

13. COMMUNICATION AND OUTREACH STRATEGIES

If research is to be effective it needs to be translated into appropriate policy and management knowledge, which then needs to be communicated (in appropriate form) to the relevant stakeholders so that the necessary actions can be taken. Key ingredients of a communication strategy include:

- A 'political' champion
- A long-term vision
- A dedicated communication strategy and budget
- Repeated messages
- Ownership and a sense of pride in the project by local people and officials.
- Participatory research
- Significant scale
- Cross-disciplinary communication
- Make ideas real
- Understand the context
- Local language
- Clear messages to land managers and planners.

14. CONCLUDING STATEMENTS

The report concludes with general conclusions and lessons learned both with respect to the ESPA programme and regarding the execution of this situation analysis. The most significant of these conclusions are first, that investments in managing and securing ecosystem services alone will not eradicate poverty. It needs to be a significant part of broader poverty alleviation initiatives; second, that there is inadequate consideration of poverty alleviation issues by ecosystem management agencies, and there is practically no consideration of ecosystem resources and impacts by social welfare or economic development agencies (other than tourism projects); third, that provisioning services are a significant component of diversified livelihood portfolios, both for home consumption and income generation. Poverty alleviation initiatives need to build on the inherent diversity of rural livelihoods rather than constrain it, through promoting a diversity of options, of which provisioning services should be seen as only one component of a suite of options and fourth, that support and management for delivery of ecosystem services will benefit all inhabitants of the region, including the poor. Since the poor are more directly reliant on ecosystem services for a larger share of their livelihoods, an investment in securing ecosystem services will be of greater benefit to them than other sectors.

List of Acronyms

AIDS	Acquired Immunodeficiency Syndrome
ASAL	Arid and semi-arid Africa
CAMPFIRE	Communal Areas Management Programme for Indigenous Resources
CBD	UN Convention on Biodiversity
CBNRM	Community-based natural resource management
CCAA	Climate Change Adaptation in Africa
CEPSA	Consortium on Ecosystems and Poverty in Sub-Saharan Africa
CRES	Compensation and rewards for ecosystem services
CRIAA	Centre for Research Information Action in Africa
DFID	UK Department for International Development
DWAF	Department of Water Affairs and Forestry (in South Africa)
EA	Eastern Africa
EIA	Environmental impact assessment
EPWP	Extended Public Works Programme
ES	Ecosystem Services
ESPA	Ecosystem Services and Poverty Allevation programme
ESRC	UK Economic and Social Research Council
EU	European Union
FANRPAN	Food, Agriculture and Natural Resources Policy Advisory Network
GDP	Gross Domestic Product
ha	hectares
HIV	Human Immuno-deficiency Virus
IPCC	Inter-Governmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
MA	Millennium Ecosystem Assessment
MAR	mean annual rainfall
MDGs	Millennium Development Goals
NERC	UK Natural Environment Research Council
NRM	Natural resource management
NTFPs	Non-timber forest products
PES	Payments for ecosystem services
PRSP	Poverty Reduction Strategic Papers/Plans
RPRP	Rural Poverty Reduction Programme
SADC	Southern African Development Community
SAfMA	Southern African Millennium Ecosystem Assessment
SANParks	South African National Parks
SnAfr	Southern Africa
SSA	Sub-Saharan Africa
TFCAs	Transfrontier conservation areas
UN	United Nations
UNCCD UN	Convention to Combat Desertification
UNEP	UN Environmental Programme
UNFCCC	UN Framework Convention on Climate Change
WA	West Africa/Sahel
WRI	World Resources Institute
WfW	Working for Water programme
WWF	World Wildlife Fund

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Chapter One: Introduction

1. BACKGROUND

Human beings have always depended on ecosystems for a range of services critical to their well-being. The dynamics of this relationship are characterised by a worldwide increase in urbanisation, rapid technological advances, population increase and ever-increasing global interconnectedness, along with the ascendance of the market as the dominant global economic system. These developments are accompanied by significant environmental costs, rendering ecosystems that are increasingly transformed and often mismanaged and degraded. Billions of people, many of whom may have a keen appreciation of the importance of ecosystem services in their everyday lives, are engaged in a daily struggle for survival. Their struggles routinely involve making short-term trade-offs between the environment and securing their next meal.

The Millennium Ecosystem Assessment (MA) made a significant contribution in documenting, communicating and developing an understanding of the importance of ecosystem services to human well-being (MA 2005a). The MA spanned a range of ecosystem services, in multiple regions, and at different scales. It communicated authoritative findings on the state of the world's ecosystems to policy-makers and international agencies. It also identified gaps in understanding that need to be addressed. By emphasising that humans are an integral part of ecosystems and by placing human well-being as the central focus for assessment, the MA established sound conceptual, scientific and political bases for the actions needed to enhance the conservation and sustainable use of ecosystems. The MA argued cogently that,

“Current estimates of 3 billion more people and a quadrupling of the world economy by 2050 imply a formidable increase in demand for and consumption of biological and physical resources, as well as escalating impacts on ecosystems and the services they provide.” (MA 2003a: 17).

Whilst the MA was highly influential as a landmark international effort in reminding researchers and decision-makers of the links between ecosystem services and human well-being, the future well-being of humankind requires that the links between ecosystem services and the well-being of people are ever better understood, the messages communicated are more coherent and mainstreamed into decision-making, and that the required policies and actions are implemented more soundly, especially with respect to alleviating poverty in developing countries.

Unequivocal evidence now exists which shows that the world's poor have a disproportionately greater *direct* reliance on ecosystem services. They also have greatly reduced capacity to compensate when ecosystems services are impaired and are therefore most vulnerable and in shorter time-scales to ecosystem degradation (WRI 2005).

The developed world has recommitted itself to fighting global poverty, a commitment most frequently articulated by the Millennium Development Goals (MDGs). Governments and multi-lateral agencies across the world have renewed their efforts to eradicate global

poverty. Thus far, relatively few of these interventions explicitly acknowledge the linkages between human well-being and ecosystem services, much less prioritise these in their policies and programmes. Nevertheless, it is amply clear that the achievement of the Millennium Development Goals, i.e. to reduce and ultimately eradicate global poverty, depends upon environmental sustainability and the adoption of long-term strategies to assure the supply of ecosystem services. To this end, the UK's Department for International Development (DFID), the Natural Environment Research Council (NERC) and the Economic and Social Research Council (ESRC) declared their intention in 2007 to launch a five-year, multi-disciplinary research programme ('ESPA') aimed at achieving sustainably managed ecosystems and contributing towards poverty alleviation in developing countries.

The first phase of the programme involves the execution of situation analyses by different research teams in four geographical regions and two cross-cutting assessments on rural/urban interactions and marine ecosystems. It is envisaged that the outcomes of the situation analyses will inform the design of the five-year ESPA programme which, if approved, will be launched during the course of 2008.

Arid and semi-arid lands of sub-Saharan Africa (hereafter referred to as ASAL) were prioritised because of this region's particularly high susceptibility to environmental degradation, climate change and persistently high levels of poverty. This report presents the findings of the situation analysis which was conducted between August 2007 and March 2008 by the *Consortium for Ecosystems and Poverty Alleviation in Semi-arid Africa* (CEPSA).

2. INTRODUCTION

The literature emphasises the point that environmental transformation can and often does devastate the lives and livelihoods of the poorest. Declining ecosystem services often (i) lead to a steady erosion of livelihood assets, (ii) increase vulnerability by making people less able to withstand external shocks, (iii) increase the risk of widespread disaster and (iv) exacerbate existing conflicts and give rise to new conflicts over access to ecosystem services.

The literature also points to the specific characteristics of the 'dryland' (i.e. arid and semi-arid) regions of sub-Saharan Africa which exacerbate the feedbacks between poverty, environmental decline and long-term vulnerability. The most significant among these characteristics are the close dependence of household-level livelihoods and national economies on the utilisation of natural resources, the number and strengths of drivers of change in ecosystems, the extent and depth of poverty, relatively weak governance regimes, and the severity of adverse impacts due to climate change projections.

To facilitate the study, the region under scrutiny was divided into three sub-regions, viz. west, east and southern Africa. Sub-regional reports were generated for each of these sub-regions which provides finer-grained analysis than is possible here (see Annex 2 to 5).

The specific requirements set out for the research team conducting the ASAL regional study were to:

- provide evidence of the importance of ecosystem services for human well-being, especially in terms of poverty alleviation, and beyond just provisioning services. If available, such evidence will provide a solid platform to argue that investments in ecosystem management could be viewed as the same as – or a component of – implementing a poverty alleviation programme;

- explore the *linkages* between ecosystem services and poverty (including vulnerability) and the factors (such as drivers of ecosystem change and trade-offs) that influence these linkages;
- identify *knowledge gaps* that would need to be filled through a longer term research and advocacy programme, so that appropriate policy and management interventions could be implemented to prevent and reverse poverty through sound ecosystem management; and
- identify strengths and weaknesses in *management capacity* for ecosystems and their services.

3. ARID AND SEMI-ARID LANDS OF SUB-SAHARAN AFRICA

Sub-Saharan Africa comprises 40 mainland countries (covering 24.3 million km²), and is home to approximately 770 million people. It has been estimated that upwards of 268 million people live in Africa's arid and semi-arid areas ('drylands'), which comprise 43% of the continent's surface area (Anderson *et al.* 2004). Of these 268 million people resident in African 'drylands', 75% are rural dwellers whose livelihoods exhibit a strong reliance of ecosystems services.

For the purposes of this situation analysis, the arid and semi-arid lands of sub-Saharan Africa were defined as those sub-Saharan countries for which at least 50% of their land area had a ratio of mean annual precipitation to potential evaporation of less than 0.5 (UNEP 1991), resulting in a list of 18 core countries (Table 1.1). Information from countries with less than 50% of their area falling into this definition of drylands, for example, Tanzania or Nigeria was not ignored, but no consultations were held in those countries, nor were specific literature searches conducted for these countries.

Table 1.1: Sub-Saharan African countries classified as semi-arid or drier

Country	% hyper-arid	% arid	% semi-arid	Total % with a MAP/PE ratio of <0.5
Botswana	0	19.3	80.7	100.0
Djibouti	22.4	77.6	0	100.0
Eritrea	0	57.8	42.2	100.0
Mauritania	59.5	37.9	2.6	100.0
Namibia	9.3	44.1	46.6	100.0
Niger	53.1	43.3	3.6	100.0
Somalia	13.7	66.7	19.6	100.0
Mali	46.1	26.9	18.4	91.4
Sudan	29.2	31.8	26.8	87.8
Chad	42.8	23.6	20.8	87.2
Zimbabwe	0	0	82.7	82.7
Swaziland	0	0	81.2	81.2
Burkina Faso	0	12.1	67.0	77.1
Kenya	0	34.5	41.8	76.3
South Africa	0.9	29.8	44.4	75.1
Mozambique	0	0	64.1	64.1
Senegal	0	10.4	52.0	62.4
Ethiopia	0	34.3	24.0	58.3

3.1. Characteristics of arid and semi-arid lands

Maintaining a livelihood in 'drylands' anywhere in the world is a daily struggle because of a number of inherent abiotic and biotic features that challenge human ingenuity and adaptability. In the African context, the struggle is compounded by poorly developed infrastructure, weak governance and variable economic situations. Whilst noting localised exceptions, overall the drylands of SSA (Deng 2000) are characterised by:

- Low rainfall which limits primary productivity;
- Highly variable inter-annual rainfall which requires highly adaptable livelihoods;
- Strong seasonality in delivery of the low rainfall, which is typically concentrated into only a few months. This means human activities and livelihoods have to be compatible with long dry periods without or with very little rainfall;
- Highly variable supply of many provisioning services due to fluctuations in rainfall;
- Soils of low fertility (either inherently or because low soil moisture constrains uptake of soil nutrients)
- Soils with low organic matter due to limited biomass and slow decomposition rates
- Generally low or sparse vegetation cover, except along water courses or in regions of relatively higher rainfall (above 400 mm p.a.)
- A disproportionate reliance on key resource areas in the landscape, such as inland lakes, wetlands, springs, oases and river systems
- High ecological resilience but at low levels of productivity
- high species endemism
- projections that indicate that the already high aridity will increase under climate change, which will stress the adaptive and coping strategies that local inhabitants have developed over decades and centuries. No other system is likely to be affected to a similar extent (IPCC 2007a, MA 2005a)

Taken together, these attributes place limits on the nature of possible livelihood strategies and activities in drylands. At the arid end of the spectrum, extensive pastoralism is the norm. As mean annual rainfall (MAR) increases, with a concomitant decline in variability, the levels and reliability of herbaceous and agricultural production improve, as does the extent of woody plant cover and the services it provides. Consequently, there is increasing sedentarisation of human populations with increasing MAR, and pastoralist livelihoods give way to agro-pastoralist ones, and at approximately 450 – 600 mm MAR, to mainly agricultural ones. In all instances, most households engage in multiple livelihood activities, of which agriculture (pastoralism and/or arable farming) is only one dimension. Others include migrant labour, petty trade, consumption of wild resources, fisheries, welfare transfers and in a few countries, state-provided grants. However, the large distances from services and markets and relative isolation from central government agencies and other, more productive regions mean that dryland areas of SSA typically have:

- Low human population densities relative to moister regions
- Few social services (especially health and educational services)
- Limited road infrastructure and thus restricted access to services and markets
- Low human development profiles
- Populations with limited education levels and thus also limited skilled human resources
- Low levels of financial capital
- Low bargaining power and participation in central government political processes
- A high reliance on ecosystem services for daily livelihoods, with this reliance increasing through commercialization/trade in natural resources,

- High levels of indigenous knowledge concerning local systems, plant and animal species
- A significant contribution to national economies and to the livelihoods of people, but which are often not adequately acknowledged in national GDP accounts (IUCN 2008)

The combination of high variability in the natural environment, limited infrastructure and relatively low skills base means that neglect of drylands areas and the consequent incidence of poverty in drylands are both usually high. This is the case in SSA, where poverty levels are amongst the highest in the world, and are the most persistent.

The significant, although not exclusive, reliance of inhabitants of drylands on local ecosystems for their livelihoods has resulted in a decline in the supply of ecosystem services in many situations. However, whilst ecosystem services may best be provided by relatively intact systems, it is important to appreciate that human activities can impact ecosystem services in many ways, that these impacts are not always negative, and that even when negative, the degree and nature of impacts can vary enormously. For example, urban habitats are highly modified relative to the previous state, and despite many negative attributes, impacts and large ecological footprint, they may still contain much indigenous biodiversity, produce some food and forage via urban agriculture, receive rainfall and contribute to the recharge of aquifers, maintain and even enhance areas of high aesthetic appeal. Although the total yield of all ecosystem services is lower than that of less modified ecosystems, the services provided in urban areas undoubtedly require consideration and management. This is especially the case because of the rapid growth in urbanisation in the region.

3.2 Historical access to resources and systems of resource tenure

Across Africa, a history of land alienation and European settlement, followed by growing economic inequalities, competition for land, and rapid urbanization, have created a complex political economy in which landscape transformation reflects many influences besides those of ecological determinants.

Systems of resource tenure are integral to the distribution of rights of access and benefits. Access to ecosystem services thus often replicates power structures in the local society, especially when economic or policy-driven dynamics, including the intervention of the state in land allocation, result in relatively rapid change. Such changes are particularly critical for pastoralists whose grazing rights are seldom adequately protected (McCarthy *et al.* 2000).

The dilution of the influence and power of customary institutions such as chiefs, headmen and spirit mediums impacts negatively on cultural values and respect for sacred sites (Byers *et al.* 2001). Loss of knowledge and the erosion of customary institutions lead to encroachment into historically protected and sacred sites, such as in Mozambique (Virtanen 2002), which can have an impact on ecosystem integrity.

4. METHODS AND DATA SOURCES

4.1 General approach

A number of different methods were employed to locate, summarise and synthesise the data and information for this situation analysis, and also to raise awareness in several countries in each of the three sub-regions:

- Desktop synthesis of existing information and data. This was the main approach taken across the three sub-regions, although the East and West African sub-regional teams placed more emphasis on consultations with local specialists and engaged more selectively with the published literature than the southern African sub-regional team. Ongoing web searches were conducted to identify, access and review all relevant literature. Area/subject specialists who could point to less accessible literature and grey reports were identified and consulted. Preference was shown to literature published in the last ten years, although literature that predated this period was not ignored.
- The emphasis was on locating *evidence* of the links between ecosystem services and the poor. In a conscious attempt to move beyond the anecdotal information and generalisations in this broad field of enquiry, the team consistently privileged reliable sources of 'hard' data.
- Drivers of change and their relative magnitude were derived from the project team's interpretation of existing information and case studies, verified by expert opinion wherever possible.
- Consultations with subject experts were a feature of this analysis. Key experts in 13 countries were identified and engaged either by e-mail, telephone and face-to-face interview, or through regional or country workshops. Village-level workshops were held in Kenya.
- Consultations/information gathering meetings were held with officials in several countries. These meetings were held to inform in-country officials about the ESPA project; to gain access to any additional grey literature and other unpublished data and to canvass their opinions and explore their understanding of the conceptual and practical linkages between ecosystem services and poverty. Such consultations also provided insights into local understandings and interpretations of the drivers of change in the fields of interest, and provided opportunities to learn about any projects linking ecosystems and poverty alleviation that were underway in the respective countries. Lastly, these consultations served to widen the regional network that could facilitate future communications in the post-situation analysis phase of the ESPA programme.
- Our analysis focused on the 'bigger picture' and did not attempt to analyse or assess the complex biophysical or social processes in detail. We acknowledge that an in-depth understanding of these processes is essential for the sustainable management of ecosystem services for poverty alleviation, but this falls outside the scope of our analysis.

In making the conceptual link between ecosystem services and poverty alleviation, it is clear that to date comparatively more research has been done on provisioning services than any of the other categories. This is no doubt because provisioning services are most visible in helping poor people meet their immediate need for food, energy, shelter and income. It is not surprising then that the role of provisioning services was most readily acknowledged during the in-country consultations conducted during the course of this study. Regulating, supporting and cultural services, on the other hand, are more indirect in their benefits and consequently have rarely been valued in terms of their contribution to poverty alleviation. Cultural services in particular are seldom considered, and indeed

were rarely mentioned during the in-country consultations. The exception was nature and cultural tourism.

4.2 The interface between ecosystem services, drivers of change and poverty alleviation

Drivers of ecosystem change are natural or human-induced factors that directly or indirectly cause a change in an ecosystem (see Chapter 3), and thus affect its capacity to deliver services. Drivers of change in ecosystems thus affect the people who use or depend on ecosystem services.

The interface between ecosystem services, drivers of change and poverty alleviation is depicted conceptually in Figure 1.1 (for a more detailed discussion of the conceptual framework used in this study, see Annex 1).

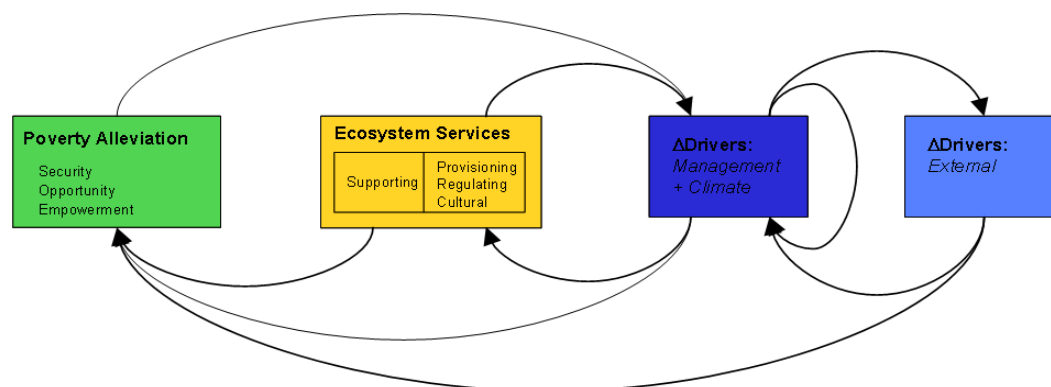


Figure 1.1 A conceptual model showing relationships between drivers of change in ecosystems and effects on ecosystem services and poverty alleviation. (Arrows indicate influences between components, including interactions and feedback loops among drivers).

Trade-offs between ecosystem services are common and must be addressed systematically when analysing the links between services and poverty alleviation. For example, the conversion of natural vegetation to arable land to expand food production, often one of the most immediate needs of poor people, may result in the loss or decline in a number of other ecosystem services related to biodiversity and land cover. It has been argued that we have not yet begun to fully understand the implications of these trade-offs, in particular their impacts on regulating and supporting services and how these changes might impact on poverty (UNEP-WCMC 2007). Because issues of both political influence and economic power are implicated in processes and decisions that involve trade-offs, the poor are most often 'losers', because they lack the power and 'voice' to oppose the trade-offs that are inimical to their well-being (UNEP/ISSD 2004). While trade-offs need not always have negative consequences for the poor, the implications require recognition, appraisal and management to enhance the positive dimensions and limit the negative ones.

5. METHODOLOGICAL CHALLENGES

The process of conducting this situation analysis threw up a number of methodological issues:

- The professional expertise of the project team as constituted at the outset and approved by NERC/DFID/ESRC, was weighted significantly towards expertise in the natural/environmental sciences, with comparatively fewer specialists with experience in livelihood/poverty fields of analysis. As a result, there was a perceptible bias in the consortium towards the ecosystem/natural environment side of the 'ecosystem services and poverty alleviation' nexus.
- The project brief required that at least one ecosystem service be selected per category of service, i.e. provisioning, supporting, regulating and cultural. However, as noted above, most research to date in the arid and semi-arid drylands of sub-Saharan Africa has been on provisioning services, and consequently there is a wealth of literature on these services while data on the other ecosystem services, especially as they relate to poverty and well-being, are relatively sparse.
- It must be appreciated that sub-Saharan Africa is a vast area, spanning 40 mainland countries, many with insufficiently developed research skills and capacities and generally weak ecosystem and poverty monitoring infrastructure. In consequence, we are unable to present evidence from each and every 'arid and semi-arid' SSA country. Key messages or conclusions are illustrated where relevant by pertinent, graphic examples. However, the examples presented should not be over-generalised, and counter-examples may well exist in other areas, situations or contexts. But the existence of counter-examples does not negate the argument or evidence that is presented. Rather it simply shows that Africa-wide generalisations are problematic, and that the extent of the condition we point to may be highly significant but in area or context-specific ways.
- It was often difficult to differentiate between drivers, trends and interventions. For example, often the driver of change in an ecosystem service is a specific policy or intervention (e.g. land reform, electrification). Many trends such as increasing variability in rainfall or increasing commercialisation of natural products can also be thought of as drivers. Often all three interact to produce a particular result.
- A detailed analysis of the biophysical and social *processes* underpinning the links between ecosystem services and poverty alleviation was not possible due to time and space constraints. This important facet requires further in-depth assessment.

6. FORMAT OF THE REPORT

Chapter Two focuses on unpacking the importance of ecosystem services to the well-being of the poor. In **Chapter Three**, the drivers of ecosystem change are examined and prioritised. In **Chapter Four**, the ecosystem management strategies and interventions that are regarded as successful or less so, are reviewed. **Chapter Five** sets out the research gaps and priority areas for future programmes of research funding. It also turns attention to the knowledge and capacity gaps and shortcomings that have emerged through a review of the literature and of best practice across the study area. Following this, **Chapter Six** discusses communication and outreach strategies that would be an integral part of any future programme. **Chapter Seven** documents some of the lessons learnt by the team that conducted this situation analysis.

Chapter Two:

The importance of ecosystem services to the well-being of the poor

1. INTRODUCTION

The livelihoods of the vast majority of the 268 million people - or 40% of the total population of Africa - who live in arid and semi-arid areas, depend on transforming multiple ecosystem services into economic and socio-cultural goods and services that support their livelihoods. Biophysical limits, primarily the low and highly variable rainfall and nutrient-deficient soils (Mortimore 1998), are instrumental in defining the options and the opportunities for poor people, particularly in rural areas. The spatial as well as long, medium and short-term variability in rainfall mean that livelihood strategies are both diverse and dynamic and that alleviating risk is a major livelihood objective. In consequence, the livelihoods of the poor in arid and semi-arid SSA are highly vulnerable, not least because they face an extremely wide array of risks and insecurities while characteristically exhibiting low adaptive capacity, i.e. they lack the assets, savings, insurance, alternative options/choices and access to technologies that would enable them to deal with periodic shocks and crises and indeed to recover from them. Other reasons include the disease burden carried by the poor and the weak infrastructure in many areas which increases the cost of integration into the world economy (N. Adger pers. comm.).

This chapter focuses on the nature of the fragile livelihoods and pervasive poverty that are the daily fare of the majority of people who reside in this region. It makes explicit the linkages between these livelihoods and a suite of ecosystem services that are regarded as critical to the poor.

2. ECOSYSTEM SERVICES AND LIVELIHOOD STRATEGIES

To secure their livelihoods in marginal environments characterised by high levels of variability, the poor adopt livelihood strategies that are integrally linked to the full range of ecosystem services, i.e. provisioning, regulating, supporting and cultural services. Their dependence upon and hence the importance of ecosystem services is frequently most apparent in poor rural communities who rely on small-scale farming and livestock production, extensive pastoralism, fishing and forest-based activities for their livelihoods (Scholes & Biggs 2004, WRI 2005). Table 2.1, which is based on participatory data obtained in Niger and Nigeria, indicates that every livelihood strategy except migrant labour is associated with a provisioning services which is underpinned by a supporting or regulating service (West Africa report).

The ease of access to the trade in many non-timber forest products means that this livelihood strategy provides an important option for poor and marginalised households who would have difficulty accessing other employment opportunities, or who are less able to cope with risk than better-off households (Cavendish 2000; Neumann & Hirsch 2000, Shackleton & Shackleton 2006). Women in particular benefit widely from the use and

sale of provisioning services, as do older and less educated people who cannot compete effectively in the formal job market (Kaimowitz 2003).

Table 2.1 Livelihood strategies and associated ecosystem services in Nigeria and Niger (West Africa sub-regional report). (P=Provisioning; S=Supporting; R=Regulating; C=Cultural)

Livelihood strategy	Ecosystem Service	Type of Service
Rainfed farming	Cultivable land, soil fertility	S
Wetland farming	Wetlands (where available)	R
Pastoral (mobile) livestock production Sedentary livestock production	Rangeland, fallows	P; S
Sale of water	Sub-surface water	P; S
Collection and/or transformation of wild foods/NTFPs	Woodland, rangeland, farm trees	P; C
Woodcutting and charcoal production (more important in Sudan)	Woodland, farm trees	S; P
Sale of hay and other fodder (Niger, Nigeria, Senegal)	Fallows, crop residues	P
Herding contracts (Niger, Nigeria)	Rangeland, fallows	P;S
Fishing	Surface water	P;S
Hunting	Woodland, rangeland	P; S; C
Petty trade including house trade	Ecosystem, agricultural, livestock products	P; S
Casual labour	Farmland, woodland, rangeland	S
Seasonal work outside the area (Niger, Nigeria, Senegal)	Not applicable	

The collective use of these provisioning resources is an activity that is accessible to all households, but is more likely to be exploited by poorer households with limited land resources and other assets, minimal education and skills, and few other income sources, thereby contributing a greater proportion of total income to these households (Arnold 2002, Fisher 2004, Shackleton *et al.* 2001). Wild foods in particular are extremely important for the nutrition and food security of children, especially those from poor and HIV/AIDS-affected households (Kaschula in Shackleton 2006).

Given that **regulating services** are not consumed directly nor can they be sold to generate income, their role in supporting livelihoods and buffering against poverty is less easily demonstrated than for provisioning or supporting services, which may be very important to the poor. Poor people living in marginal areas are generally very susceptible to flooding, drought, poor air quality, disease, and soil degradation. Proper ecosystem management to ensure adequate regulating services does not directly lift the poorest households out of poverty, but it reduces the frequency and severity of shocks to which they are subjected, thereby contributing to a reduction of their vulnerability, and allowing them to invest their meagre resources into other livelihood activities.

The role of **cultural and spiritual services** in relation to livelihoods and thus to poverty alleviation is not well articulated in the literature. There is a growing body of qualitative, ethnographic literature which documents local people's rituals and respect for the

environment, and their concerns and fears of the consequences when such services are diminished or lost (Cocks & Dold 2006, Bernard 2003, Fox 2001). Many traditional norms, taboos and practices assist either directly or indirectly in the management of ecosystems and specific species (Madzwamuse *et al.* 2007). Sacred sites, e.g. forests that harbour spirits, sites for ritual ceremonies and offerings, burial sites where the ancestors reside, imposing trees and natural features such as pools, springs, mountains and caves, can all assist with the protection of habitats and biodiversity.

Research conducted in the Eastern Cape of South Africa has shown that the amount of plant material harvested per household annually for cultural uses (2016 kg) exceeds that for utilitarian purposes (1754 kg) (Cocks 2006). These products may be used as traditional gifts (e.g. mats and brooms), as cultural symbols (e.g. woodpiles amongst the *amaXhosa* in South Africa), in rituals (e.g. particular species of firewood, alcoholic brews, medicines), as charms and talismans against external agents like witches, as 'protectors' against events such as lightning strikes (e.g. grass brooms), and to build friendships and reciprocity. The latter is particularly important in assisting households cope with vulnerability. For example, the sharing of marula (*Sclerocarya birrea*) beer (a widespread savanna ecoregion product) plays a key role in building and maintaining vital social support systems, allowing people to draw on these networks in times of need (Shackleton & Shackleton 2005). In two sites in Zimbabwe, Campbell *et al.* (1997) reported that the cultural value of the environment accounted for 29% and 16% of the value of goods appropriated from the environment. Such sacred places play a prominent part in the religions of many rural communities in the region representing 'hidden forces' upon which people draw to make sense of their environment and their predicament (Murombedzi 2003). Cultural landscapes can also provide refugia for particular species, deliver regulating services and contribute to landscape diversity. This may represent an 'entry point' for policy directed towards enhancing the value and usefulness of ES for poverty alleviation.

2.1 The role of specific ecosystem services in livelihoods

a. Transformed vs. untransformed ecosystems

All parts of the globe are ecosystems, regardless of how they are used. This is true of a natural rainforest, irrigated rice field or dense urban areas. Indeed, very little of the Earth's surface is really natural and ecosystem services are provided by all ecosystems. These services change, however, as ecosystems are altered by humans. In many cases, as the ecosystem is changed or transformed, many services are lost. Nevertheless, managed or transformed ecosystems provide improved services when management is aimed at augmenting ecosystem processes. For example, dams can significantly alter the river flow regime downstream and lead to loss of ecosystem services, such as flood recession agriculture, groundwater recharge, fisheries and provision of grazing land. However, if the dam is operated appropriately, these ecosystem services can be maintained or enhanced. In northern Cameroon, releases of water from Maga dam have restored ecosystem services to the Waza-Logone floodplain and made them more reliable, removing many natural hydrological extreme, such as floods and droughts (M. Acreman, pers. comm.). The optimal total benefit is at a context-specific threshold level of transformation which needs to be determined for individual social-ecological systems (Fig. 2.1) (M. Acreman, pers. comm.).

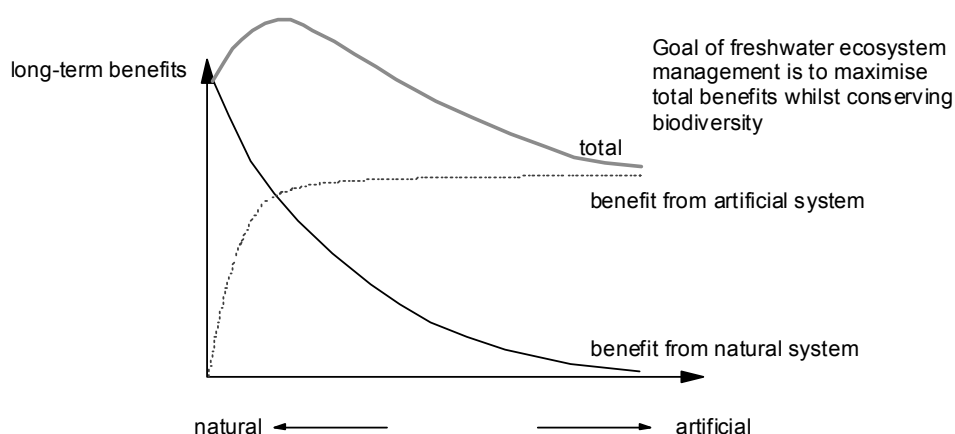
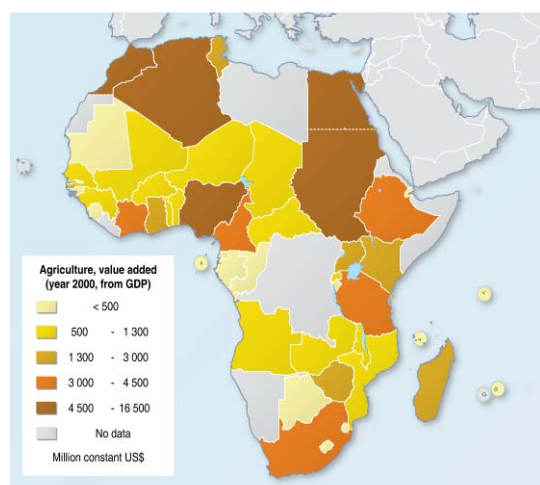


Figure 2.1 Conceptual model of the trade-offs involved when natural systems are transformed to maximize total benefits to humans. The optimal level of transformation, where maximum total benefits are provided without loss of supporting services is where total benefit 'peaks' (M. Acreman, pers. com.)

b. Agriculture

Agriculture is the main, but rarely the only, source of household income across the region and contributes substantially to GDP in the region (Fig 2.2). Highly dependent on a range of ecosystem services, agricultural production systems range from nomadic pastoralism over vast areas of the Sahel and East Africa to sedentary forms of agro-pastoral production. The expansion of markets and the cash economy mean that relatively few households can now genuinely be considered as subsistence farmers isolated from market economies. Consequently crop and horticultural production, as well as livestock, good and services and a wide range of natural products in both raw and processed form, enter the market, albeit at highly variable rates over time.



Source: World Bank, World Development Indicators, through UNEP DEWA/Geneva Data Portal <http://geodata.grid.unep.ch/> Accessed January 2006

Figure 2.2 Contribution of agriculture to GDP in Africa (source: <http://maps.grida.no/go/collection/african-environment-collection>). Agriculture represents 20-40% of GDP in sub-Saharan Africa, excluding subsistence agriculture

Agricultural products are locally consumed but not necessarily locally produced. In arid, densely populated parts of Kenya and Eritrea, for example, net primary production attributed to human appropriation (agriculture) can be more than 1000% of locally produced production, due to imports (Fig. 2.3) (Source: Imhoff et al. 2004).

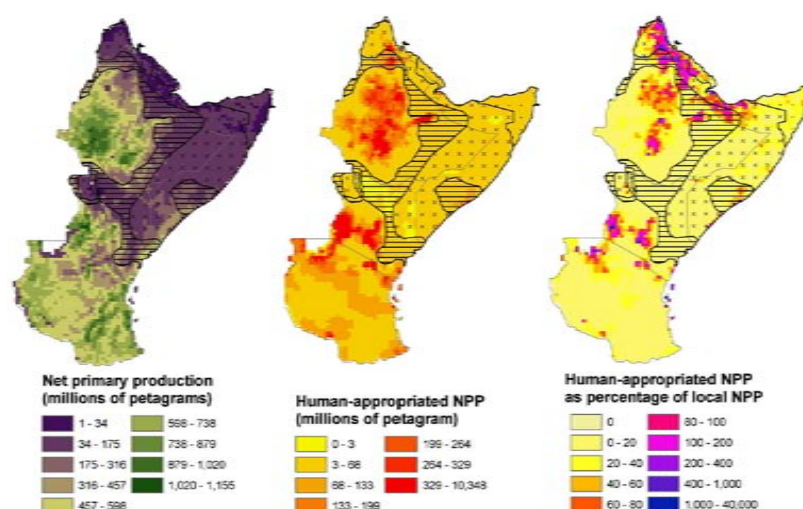


Figure 2.3 Human appropriation of net primary production in East Africa (source: Imhoff et al. 2004)

Agricultural production is closely linked to human well-being. It influences human health, infant mortality rates (see 3.2). There are complex links and feedbacks between hunger, conflict, peace and stability (Figure 2.4). Many researchers point out that such relationships are more nuanced than depicted and require a more research in specific contexts (J.J. Swift, pers. comm.; N. Adger pers. comm.).

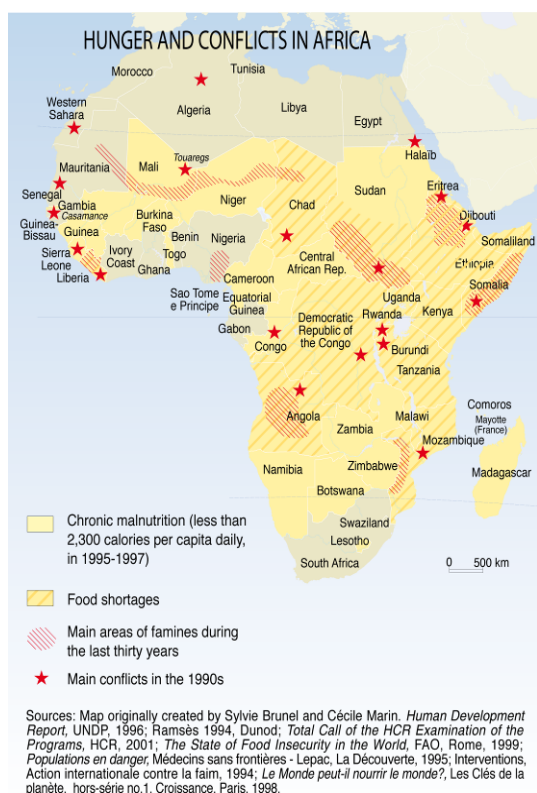


Figure 2.4 Locations of areas in Africa which face chronic malnutrition (less than 2300 calories per day and per capita, 1995-1997), areas which are affected by food shortages, the main areas that have experienced famines during the last thirty years (approximately 1966 to 1996) and the locations of the main conflicts that occurred in Africa in the 1990s <http://www.grida.no/climate/vitalafrica/english/27.htm>. The causal factors of conflict are complex (J.J. Swift, pers. comm.).

The growth of urban centres is an important feature of the region. Currently, only 40% of sub-Saharan people live in urban areas, but urbanisation, and cyclical rural-urban migration, is increasing dramatically. It is estimated that urban populations will account for more than 50% of the total population within 25 years (UN 2004) and this is already the case in countries such as South Africa. Urban agriculture is gaining in importance, particularly in East and West Africa (Flynn 2005).

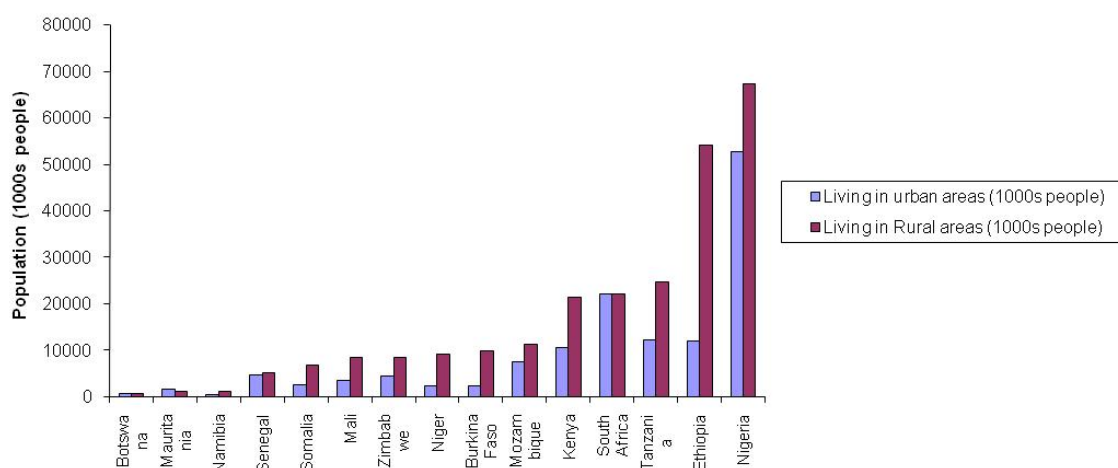


Figure 2.5 People living in urban and rural areas in sub-Saharan Africa

2.2 Vulnerability and Livelihood Diversification

Loss of ecosystem services influences the poor in multiple ways. In West Africa, for example, child mortality is highest in the most degraded areas (Fig 2.6).

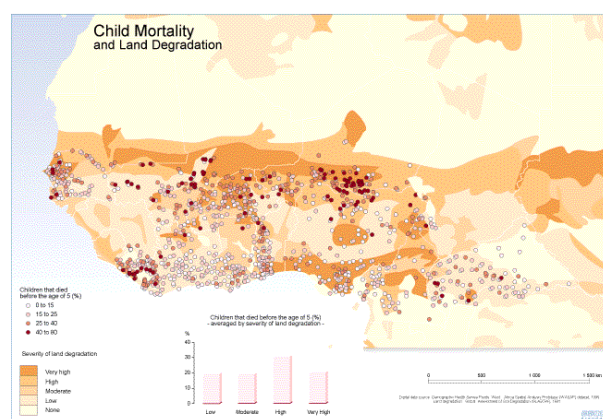


Figure 2.6 Child mortality and land degradation in West Africa (source: www.povertymap.net)

The relationship between poverty and degradation is also complex. Many regions with high incidences of poverty are also high in biodiversity. Areas with high incidences of underweight children often coincide with places where species richness of amphibians and bird endemism is high (see Fig

2.7). The correlation is probably spurious and raises new questions regarding the assumed correlation between poverty and degradation (N. Adger pers. comm.).

The literature demonstrates clearly that in the study area livelihood diversification is the strategy of choice to reduce human vulnerability (Ellis 2000, Bryceson 2002, Campbell *et al.* 2002). Other sources of livelihood, such as income from jobs, remittances, and welfare grants and transfers are often critical components of people's livelihood strategies. For many households in arid and semi-arid SSA, arable cultivation or livestock production forms the primary livelihood activity, whilst for others it may be a strategy for diversifying household income, as is illustrated for Botswana (Madzwamuse *et al.* 2007). In the arid Namaqualand region of South Africa, small stock farming has shifted from being a core economic activity to primarily an insurance against unemployment, with pastoralism being seen as a way to build resilience through the diversification of household economic activities. In the savannas of Zimbabwe, dryland arable agriculture is practised by most households, but on average contributes less than a quarter (22%) of total household income, and only 10% of all cash income (Campbell *et al.* 2002). Its role in food security, however, is critical. Other important sources of ecosystem service based

income included livestock production (21% of total income), use and sale of savanna resources (15%) and cultivation of gardens (8%).

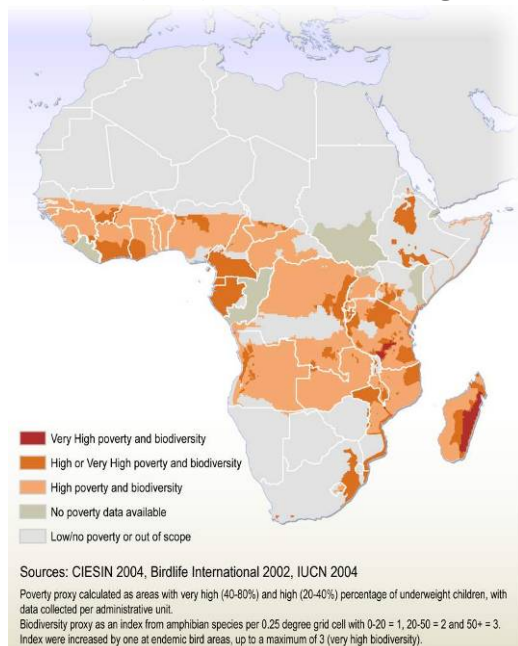


Figure 2.7 Areas where biodiversity is threatened in relation to poverty on a continental scale. Areas where high percentage of underweight children - used as a proxy for poverty - coincide with a high occurrence of amphibian species and endemic bird areas - a proxy for biodiversity (www.poverty.net)

Cavendish (2000) found that 'environmental income' (including forage for livestock production) formed some 40% of total income for the poorest households relative to 29% for better off households. Women in particular are dependent on a wide range of wild harvested products, from fruits to craft materials, as a source of cash income, with a high proportion of female-headed and elderly households trading in these goods (Madzwamuse *et al.* 2007, Shackleton & Campbell 2007, Shackleton *et al.* 2008). In

Botswana, for example, basketry (from palm fronds) forms a crucial source of income for thousands of poor women, while the trade in mopane worms in the same country employed as many as 10 000 local people (Styles 1995). Increasing commoditisation of biodiversity as a general trend across the region does, however, have repercussions for resource access by vulnerable households, governance, management and sustainability.

Similarly, because of their limited resources, poor people bear much of the burden associated with the degradation of ecosystem services. They tend to be more susceptible to extreme natural events like floods. Often they do not have the resources to build appropriate shelters or they may occupy environmentally unsafe areas. The poor are also more affected by diseases linked to deteriorating ecosystem services. For example, in Malawi the costs of malaria consume some 33% of household income amongst the poor compared to 4.2% for the rich (UNEP/IISD 2004). The largest part of sub-Saharan Africa is regarded as a malaria transmission area (Fig 2.8).

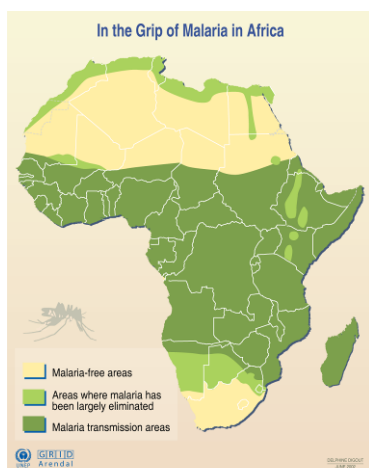


Figure 2.7 locations of malaria-free areas, malaria transmission areas and the areas in which malaria has largely been eliminated in Africa, 2002

<http://www.grida.no/climate/vitalafrica/english/18.htm>

2.3 The need for basic biophysical science

Basic understanding of ecosystem processes and how these relate to functions and services needs to be improved. It is necessary to understand what key elements are required to maintain ecosystems in particular contexts, what the critical levels are for nutrients or moisture levels, the thresholds for change in key processes, and consequences for ecosystems when the thresholds are crossed and/or key species are lost. Such information is essential to sound management.

Scientific institutions, such as Research Councils need to be strengthened in developing countries, to create a basis for the exchange of research ideas and thinking. Such institutions need to support learned societies that promote excellence in science which underpins the applied research delivered to agencies, authorities, governments and NGOs (M. Acreman pers. com.)

3. WATER: A CRITICAL PROVISIONING (AND REGULATING) ECOSYSTEM SERVICE

Because water is essential for life, the ecosystems associated with rivers and wetlands acquire special significance in dryland areas, being green corridors in an otherwise arid landscape. Within the drylands of arid and semi-arid Africa, water ecosystems supply a range of services that are of value to people. Masundire & Mackay (2002) and Turpie & van Zyl (2002) list these services as:

- Water supply for household use, agriculture, industry and power generation;
- Dilution, transport and purification of biodegradable wastes;
- Harvesting of wild plants and wild animals including fish;
- Transport routes;
- Aesthetics, leisure and tourism;
- Cultural customs and spiritual values;
- Flood attenuation;
- Moderation of microclimate;
- Maintaining terrestrial ecosystems through groundwater recharge.

Fresh water is the most important provisioning service provided by rivers and wetlands. Water is essential for domestic purposes (drinking, cooking and personal hygiene) and for watering crops and livestock, as well as a range of other productive activities. Water is thus important for maintaining health and for supporting livelihoods. When water supply and sanitation are improved, there is a direct reduction in susceptibility to the severity of HIV/AIDS and other major diseases. The ephemeral water systems (*oshanas*) of the North-Central region of Namibia, which is home to 40% of the country's population, are focal points for livelihoods and the groundwater found here adds almost 150 mm/annum to MAR.

Table 2.2 Linkages between water, environment and poverty (Source: Hirji & Molapo 2002)

Dimensions of poverty	Examples of water and environmental linkages
Income and consumption	Access to water for productive use. Access to natural resources, sustainable growth
Inequality, equity and empowerment	Secure tenure and access to natural resources, water rights and entitlements. Right and responsibilities to water users, community groups, basin organisations, local governments
Sustainable livelihoods	Sustainable land and water practices
Health	Water quality, safe drinking water and sanitation. Protection against water borne disease
Security and vulnerability	Improved disaster preparedness and response, water harvesting and conservation

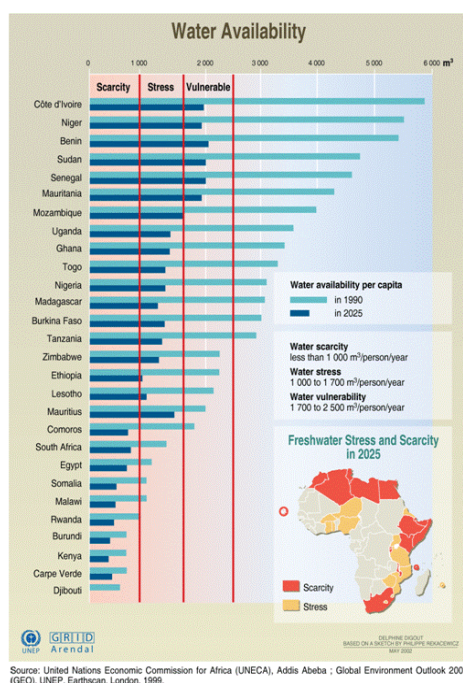


Figure 2.8 Water availability in Africa

Per capita water availability in Africa has drastically decreased since 1990 (UNEP-GRID). Five countries experienced water scarcity (<1000 m³/capita/annum) in 1990, whereas 11 countries are predicted to be in the same position in 2025. Nine countries experienced water stress (1000-17000 m³/ capita/ annum), while 14 countries will be in the same position by 2025 (Fig. 2.9) (UNEP-GRID 2007).

While surface water provides the bulk of water related ecosystem goods and services, groundwater is widely used throughout the region for domestic water supply and livestock watering, and provides a buffer against drought in many areas. Groundwater which is closely linked to surface systems, is vulnerable to over-abstraction and pollution. For example, in Zimbabwe, the contribution of groundwater to surface water is 31%, and groundwater seepage maintains the high water levels of *dambos* – which are important areas of cropping in headwater areas.

The poor depend more directly on the natural water sources for domestic water supply, flood irrigation and other productive uses. The quality and quantity of natural water is therefore of great importance for the well-being of poor communities. For example, 76% of rural dwellers in Mozambique rely on unimproved water supplies, with the attendant health risks due to pollution and water-borne diseases. In the Sahel, where domestic water is derived from common wells drawing on sub-surface aquifers, 'water poverty' is most noticeable where labour is scarce and water has to be purchased from carriers. Irrigation water, in rare streams and wetlands, is controlled by powerful members of the community.

Factors that lead to water shortages, thereby exacerbating poverty, include **pollution** (Masundire & MacKay 2002) including agricultural use of fertilisers and pesticides can have serious direct impacts on wetland and riverine biota. Human settlements on or close to floodplains are often associated with **poor sanitation** leading to increased nutrient inputs into the water. **Transformation** of wetland areas for 'productive' landuse is a major threat to wetland ecosystems. The most common landuse change is to irrigated cropping and rangeland degradation. **Aquatic weed infestations** are a major problem in many of the dams in southern Africa. Kariba weed (*Salvinia molesta*) originated in South America and became a major problem in Lake Kariba after the Zambezi River was dammed in the 1960s. It is also present in East Caprivi and is widespread in inland dams in Zimbabwe where it causes problems for irrigation, domestic and livestock water supply, fisheries and the environment in general (Chikwenhere & Keswani 1997). Water hyacinth (*Eichhornia crassipes*) is another invader from South America which in the 1990s supplanted Kariba weed as the principal aquatic weed infestation in Lake Kariba (Chenge 2000). In South Africa **invasive woody species** have been identified as a threat to water resources through increased consumptive use of water relative to natural vegetation. Among the main species listed are *Acacia mearnsii* (black wattle) *Acacia longifolia* (long-leaved wattle) and *Eucalyptus longifolia* (blue gum), all Australian imports. Versveld *et al.* (1998) estimate that invasive alien species deplete the national mean annual runoff by 7%. In the arid Northern Cape this value is as high as 16.7%. **Land degradation** leads to other critical factors: higher runoff and lower infiltration, and thus less groundwater recharge and lower dry season flows; over-abstraction of groundwater leading to drying up of wells; and reduced flows downstream from dams at certain times of year (M. Smith pers. com.).

Box 2.1: HIV/AIDS and household water use in Ngamiland, Botswana

The majority of households (73 %) in Ngamiland have access to piped water from community standpipes. However, water supply can be erratic. Reasons include breakdown of the pump, as well as “high absenteeism from work by the water officials due to HIV/AIDS related illnesses and attendance at funerals”. The two most common coping strategies to deal with interrupted waters supplies are to (i) use less water and (ii) collect water from nearby dams or streams. The unreliability of supply compromises local livelihoods – 66 % of households complained of the inconvenience. This unreliability has other impacts, especially in view of the high incidence of HIV/AIDS in the region (+35% of pregnant females presenting at clinics are HIV+; overall prevalence in the adult population is +15%). Mean daily consumption rates of water are 30 l person. However, in households with AIDS sufferers, the amount of water required increases by 67–165%. Consequently, households with AIDS sufferers experience severe and potentially life-threatening difficulties when the water supply is interrupted. In the first instance, the use of polluted water makes the AIDS patient more vulnerable to opportunistic infections derived from water-borne micro-organisms. Secondly, the inability to bath increases patients’ discomfort. Thirdly, the inability to wash soiled clothes presents unhygienic conditions in the household. Fourthly, family care givers face social sanction and exclusion for not looking after patients properly when they fail to bath them regularly or wash their clothes. The majority (96%) of care givers stated that the unreliability of water supply increased the burden of caring for AIDS sufferers.

Ref: Ngwenya & Kgathi 2006

4. SOIL FERTILITY: A CRITICAL SUPPORTING SERVICE FOR THE POOR

Within southern Africa over 90% of rural inhabitants till the soil to grow some or all of their food requirements, and any surplus is sold to generate income. Such producers are typically termed subsistence, smallholder or small-scale, farmers, and agriculture represents a significant component (22-70%) of their livelihood portfolio (Dovie 2001, Shackleton *et al.* 2001, Campbell *et al.* 2002). It is within the rural areas that formal poverty measures are most extreme.

At the regional level, the soils of much of southern African are typically low in nitrogen and frequently deficient in phosphorus too (Scholes 1993). Nutrient balance studies of small-holding cropping systems across Africa typically show that there are insufficient nutrient inputs from fertiliser or manure (e.g. Scoones 2001, Dougill *et al.* 2002). Based on data for 1982-84, Stoorvogel *et al.* (1993) estimate annual nutrient losses in sub-Saharan Africa at rates of 22 kg N, 2.5 kg P, and 15 kg K/ha/yr. Another study claimed that 86% of sub-Saharan African countries are losing combined NPK at rates of 60-100 kg/ha/yr (Henao & Bannante 1999). The World Bank estimated that all but three African countries were losing >30 kg/ha/yr of NPK.

There are many exceptions, and short-term nutrient balance studies can be misleading (Scoones 2001), but overall such studies usually indicate a negative balance for nitrogen and also frequently insufficient phosphorus, which therefore may potentially reduce crop yields over time (Chibudu *et al.* 2001, Dougill *et al.* 2002).

Poorer families have a greater proportion of their livelihoods derived from cropping, but have fewer resources to provide inputs. This is demonstrated in the frequently reported higher soil nutrient levels in homegardens and village perimeter fields relative to distant fields, because the cropped areas closest to the home receive most of the organic manure from the kraals (Chibudu *et al.* 2001). For example, Zingore *et al.* (2007)

reported that soil carbon levels in home fields were generally double that of outfields on different soils in Zimbabwe. The difference in nitrogen was between 33% and 900% higher.

Box 2.2: Impacts of declining soil fertility on poor farmers

- Declining crop yields resulting in increased food insecurity, under- and malnutrition which have further ramifications such as:
 - Reduced health and hence increased susceptibility to disease
 - Reduced dietary diversity
 - Reduced productivity of household labour, further eroding agricultural productivity (especially relevant in communities with high HIV/AIDS prevalence rates)
 - Straining of social networks due to reliance on others for food handouts
 - Possible disintegration of the family resulting in migrancy.
- Reduced crop surplus for sale, thereby eliminating a source of much-needed cash resources.
- Diversion of scarce cash resources from e.g. education, health to purchase food and/or fertilizers.
- Clearance of natural lands for new fields (Dahlberg 2000, Chibudu *et al.* 2001). This requires significant labour, and new fields may also be situated far from the homestead.
- Reduced plant cover associated with low crop yields increases the possibility of soil and wind erosion, providing further negative feedbacks on soil fertility (Folmer *et al.* 1998).
- Reduced land values.

5. BIODIVERSITY: A CRITICAL SUPPORTING SERVICE IN ARID AND SEMI-ARID RANGELANDS

Biodiversity is necessary for the delivery of many ecosystem services and underpins the very functioning of ecosystems. It forms the basis for nature-based tourism and provides all the important products needed to meet a range of livelihood needs, including spiritual and emotional fulfilment. Biodiversity also underlies important supporting and regulating services such as nutrient cycling and soil fertility, pollination, and carbon sequestration. It includes diversity at the genetic level, at species level and of ecosystems and habitats, and involves variety (species richness, genetic variability), abundance (numbers of individuals or populations in a location), levels of organisation, and biological interactions (e.g. predators and prey relations) (UNEP-WCMC 2007).

Box 2.3: Number of species used

A complete inventory of species used would be impossible. However, there are some illustrative numbers from southern Africa:

► 94% of canopy and 77% of sub-canopy forest species in South Africa have at least one recorded use (Geldenhuys 1999).

► Dovie (2006) recorded use of woody plants at ten different villages and found a mean of 90 % of all woody plants were used for one or more purpose.

► Communities typically use several hundred species, and individual households dozens to meet their energy, nutritional, medicinal and construction needs (Shackleton & Shackleton 2004a).

► Hundreds of different medicinal plant species are traded daily in each of the markets of major cities (Mander 1998, Williams 2004, Cocks 2006).

(source: southern African report)

Local communities use a wide range of species to improve their livelihoods (Box 2.3). In many instances the environment is manipulated to provide particular services. There is evidence that people have introduced useful wild species to areas where these were uncommon, as is the case with marula (*Sclerocarya birrea*) in parts of Namibia. These diverse landscapes are key for local livelihoods as illustrated in the Mozambican case study by Mapaure *et al.* (Southern African sub-regional report, Case study 2): “Landscapes are important for the bundles of ecosystem goods and services that local communities derive from each location in the landscape”. Landscape units such as thickets and forests had the highest local livelihood importance scores. However, several

recent trends including the expansion of settlement areas, are leading to greater homogenisation of these landscapes (Giannecchini *et al.* 2007) and cropland (Campbell *et al.* 2002). Aerial photographic analysis by Giannecchini *et al.* (2007) in Limpopo Province, South Africa indicated a general decline in the patchiness of the landscape over the period 1974-1997 with an associated decrease in habitat diversity.

The aggregate annual value of selected regulating services provided by biodiversity in the Kgalagadi South subdistrict of Botswana (southern Africa report; Madzwamuse *et al.* 2007) is:

- Carbon sequestration – US\$111 300
- Protection from wind erosion – US\$68 400
- Wildlife refuge value – US\$15 000
- Value of groundwater recharge was estimated as negligible.

In eThekweni Municipality in Durban (South Africa), the replacement value of the ecosystem services supplied by 63 000 ha of open space was valued at R3.1 billion per year and tourism linked to these areas at about US\$ 400 million in 2001 (DEAT 2007). The value of pollination services to crop production in South Africa was estimated as about US\$ 390 million in 1998 (Allsopp 2004).

Land transformation is one of the greatest causes of biodiversity loss. At a regional scale, less than 20% of the arid ecoregion has been transformed, whereas between 20% and 80% of the semi-arid savanna ecoregion has been transformed, with higher rates occurring in the moister east (Burgess *et al.* 2004). In general, fresh water species are under greater threat than terrestrial taxa, and savanna ecoregion species more so than those in the arid regions (UNEP 2007). Species losses within southern Africa are relatively small, with about 99% of the number of wild organisms present 300 years ago still persisting (van Jaarsveld *et al.* 2005). More important than species extinction for poor people dependent on biodiversity is a declining abundance of useful species, reduced size classes (such as for carving woods, shellfish, medicinal plants), species composition changes (such as from perennial to more drought sensitive annual grasses in rangelands), local species losses and altered distribution ranges of particular species. A number of useful and commercially harvested species especially those used for medicines (e.g. bulbs), horticulture (e.g. desert succulents, cycads) and harvestable sizes of species used for woodcarvings (e.g. *Dalbergia melanoxylon*) are regarded as being threatened.

The genetic diversity of crops and livestock is key to sustainable agriculture and livestock production especially in risky dryland environments (Wollny 2003, Eyzaguirre & Dennis 2007). Genetic variation is evident in the cultivars and landrace varieties that farmers use, in the wild relatives of domesticated species, in useful indigenous species that may be cultivated, and in local breeds of livestock. Namibia, for instance, is the centre of origin for *Citrullus* (water melon) where these and other cucurbits are an extremely important food source for humans and animals (Maggs *et al.* 1998).

Southern Africa has several local breeds of small ruminant that are ideally adapted to the harsh climates characteristic of the arid rangelands of the region (Lebbie & Ramsay 1999). In Namibia, in the wetter and fairly isolated northern regions, considerable geographic and phenotypic variation has been found amongst traditional crops such as pearl millet, sorghum, cowpeas and groundnuts giving rise to a variety of local landraces (Maggs *et al.* 1998, Madzwamuse *et al.* 2007). Different landraces are often used to match the microhabitat conditions in cultivated areas, to spread risk and labour

requirements, and in some areas because no modern varieties have been developed (UNEP-WCMC 2007). Local farmer selection of wild marula has resulted on larger fruits in trees in homesteads and fields (Leakey *et al.* 2005).

A key response to ensuring biodiversity conservation has been and still is the designation of protected areas (Table 2.3). Increasingly, conservation approaches that recognise the needs and rights of local people are gaining support within sub-Saharan Africa. There are now a number of examples where people continue to live in parks such as for some of the new Transfrontier Parks and in the Richtersveld National Park in South Africa. These new approaches have helped to reduce the trade-offs between biodiversity conservation and the well-being of the poor.

Table 1.3 Number of protected areas, their surface areas and percentages of countries' area protected (World Conservation Monitoring Centre, 2007)

Country	No. of protected areas	Area in Km ²	% of country's surface area protected
Angola	16	154580	12.06%
Botswana	71	175650	30.19%
Chad	32	119773	9.33%
Eritrea	3	5006	3.19%
Ethiopia	42	187623	16.99%
Kenya	348	75237	12.69%
Lesotho	1	68	0.22%
Malawi	130	19405	16.38%
Mozambique	47	65260	7.48%
Namibia	173	123563	14.42%
Niger	6	84141	6.64%
Nigeria	997	61115	6.48%
Senegal	14	22422	10.77%
South Africa	558	79359	6.13%
Sudan	26	119842	4.72%
Swaziland	8	601	3.46%
Tanzania	810	376606	38.36%
Uganda	747	63368	26.29%
Zambia	683	312002	41.46%
Zimbabwe	249	57525	14.72%

Conservation outside of protected areas, particularly in conservancies (several hundred in each of Namibia, Botswana and South Africa) and biosphere reserves, is increasingly seen as a vehicle for merging development and social issues with biodiversity conservation (DEAT 2007, see below). In terms of genetic diversity there are trade-offs between productivity and resilience. Frequently, the desire to sustain and utilise traditional breeds and landraces conflicts with the need to promote economic development through improved crop varieties and breeds based on a reduced genetic range (Lebbie & Ramsay 1999). There are trade-offs between intensified, more productive and market orientated systems which tend to result in the homogenisation of genotypes and the need to maintain adaptability (e.g. adaptive fitness in animals) as a risk aversion strategy in harsh environments. Ex-situ conservation has been the dominant

intervention for plant genetic resources, but is of limited practical relevance for animal genetic resources (Wollny 2003). New approaches to popularising local breeds and supporting breeding programmes are required as well as the promotion of these in the market place, which could include the use of economic instruments such as certification and labelling (Lebbie & Ramsay 1999, Anderson & Centonze 2007).

5.1 Consequences of biodiversity loss to the poor

Biodiversity loss severely affects the ultra-poor, who have a disproportional reliance on ecosystem services. Particular impacts of biodiversity loss on the poor include:

Loss of ecosystem/habitat diversity

- Loss of water regulation and other key regulating services like pollination.
- Loss of traditional knowledge and cultural sites.
- Loss of inputs into agriculture and increased costs.
- Increased environmental risk and decreased resilience.
- Slower post-drought recovery.
- Loss of key resources areas for grazing – e.g. flood plains.
- Changes in disease patterns - some ecosystem changes, particularly in wetland and river systems can create new habitat niches for disease vectors such as malaria.
- Loss of potential alternative land use options and economic diversification opportunities such as tourism.

Species composition change and local loss of species

- Loss of traditionally available resources and potentially useful species.
- Decreased options for income generation.
- Loss of inputs into agriculture.
- Need to buy in substitutes (feed, building materials, energy) and impacts on cash flow (cost of substitutes in degraded rural areas was estimated to be about 25% of income in Namibia)
- Reduced productivity of rangelands and forage shortages during dry years.
- Increased food insecurity.

Genetic erosion

- Increased drought vulnerability.
- Loss of crop diversity.
- Loss of traditional knowledge and cultural traditions.
- Increased food insecurity.
- Loss of local adaptive options and future societal options (option values)
- Reduction in the range of biophysical environments that can be utilised.
- Increased vulnerability to disease and livestock population crashes.

While much still remains to be understood about the relationship between biodiversity and regulating services, it is clear that if biodiversity is not managed effectively, future options will become ever more restricted (UNEP 2007) and the resilience of these complex socio-ecological systems to disturbance and shocks compromised (Madzwamuse *et al.* 2007). It is critical that decisions mainstream the full values of ecosystem goods and services provided by biodiversity and that given the gaps in our understanding a precautionary approach is taken. As a supporting service, there are constant tradeoffs involved in any decision pertaining to land use and biodiversity. Sometimes the trade-off results are negative for biodiversity as land is transformed to

high impact areas such as mines, cities, dams, and infrastructure. These trade-offs are made daily and at every scale from a single household to a community, to development planners and government departments.

Despite the links between ecosystem services and poverty in arid and semi-arid SSA that have been explored here, the reliance of the poor on ecosystem services has rarely been measured and is still typically overlooked in national statistics, poverty assessments, and land-use and natural resource management decisions. In particular, the trade-offs and the patterns of winners and losers associated with ecosystem change, and their impact on the chronically poor, the very young and the elderly and on women in particular, has been given little consideration. Such inattention can result in inappropriate strategies that ignore the role of environment in poverty reduction, possibly leading to further marginalisation of the poorest sectors of society and increased pressure on ecosystems.

However, there is also a need for realism and to avoid overstating the potential of ecosystem services to provide, on their own, pathways out of poverty. For example, natural products taken as provisioning services, should rather be seen as one component of a multi-sectoral approach for tackling rural poverty. Thus, natural product trading alone is not the answer, but nor is arable production, livestock rearing, migrancy, or state welfare grants. It is only through the careful integration of these livelihood sectors that there will be any lasting positive impact on the welfare of the rural poor (Shackleton *et al.* 2008). Ultimately, the rural economy needs to be seen as a whole (N. Adger pers. com.). The challenge is to optimise the trade-offs between human-managed and natural landscapes, which requires empirical research and complex systems models.

Chapter Three:

Drivers of change in ecosystem services in the arid and semi-arid regions of Sub-Saharan Africa

1. BACKGROUND

This chapter considers the proximate and ultimate causes of ecosystem change in the arid and semi-arid regions of sub-Saharan Africa. In light of the strong links between ecosystem state and human well-being, any positive or negative change in ecosystem state will have concomitant positive or negative changes in the supply of ecosystem goods and services and ultimately human well-being. Consequently, it is essential to build a clearer understanding of the drivers of ecosystem change in the region, as both (i) indicators of possible current and future trends and (ii) entry points for intervention.

This chapter discusses the challenges of identifying and understanding the provenance and impacts of drivers - which in itself can be a politically loaded exercise. It then illustrates the linkages with selected examples of governance, HIV/AIDS, rainfall, population growth and climate change as drivers of ecosystem change, and analyses situations where drivers act in a cascading manner, where one driver catalyses changes in secondary drivers which then act synergistically on ecosystem change (see Annex 1 for a more theoretical discussion and definitions of drivers).

1.1 Considerations of scale

Drivers of change in ecosystems operate at all levels, from global to national, to local and household. Similarly, the effects of different drivers are also felt at different spatial scales and appear over different lengths of time. There are important differences among drivers, therefore, in the spatial and temporal scales at which they operate. Thus, what appear to be the most significant drivers at one level, may not be the most significant at larger or smaller regions or time scales (MA, 2005). It is also the case that drivers can operate at all scales from local to global depending upon how widespread they are and at what level they can be addressed (Table 3.1).

Table 3.1: Scale of driver relative to how common/widespread it is and the ability of local communities to address it

		Ability of local communities to intervene	
		Low	High
Global pervasiveness of the driver	Low	Regional driver (e.g. HIV/AIDS in southern Africa, bilateral or regional trade policies, bush encroachment)	Local driver (e.g. specific local level initiatives or disturbances such as a construction of a dam, loss of land to some development; introduction of aliens)
	High	Pervasive driver (e.g. climate change, globalisation, urbanisation, rainfall variability)	Global driver (e.g. over-harvesting, over-grazing, governance changes)

(adapted from Shackleton *et al.* 2008 - the southern African CEPISA report)

2. EXAMPLES OF SIGNIFICANT DRIVERS OF ECOSYSTEM CHANGE IN THE ARID AND SEMI-ARID REGIONS OF SUB-SAHARAN AFRICA

As indicated, drivers operate at different scales, and the effects of any specific driver is also dependent upon the context in which it is felt and the suite of other drivers operating at the same time or immediately prior to. Consequently, it is conceptually and methodologically challenging to generalise from continental to national to local situations within the drylands of SSA. The three sub-regional reports provide multiple examples of drivers for specific ecosystem services in specific localities. Some were common across West, East and southern Africa (e.g. rainfall variability, growth of markets, urbanisation), yet their effects differ from place to place. The following examples serve to demonstrate a range of drivers and their effects. This treatment is by no means exhaustive, but is sufficient to demonstrate the importance of understanding drivers of ecosystem change and the implications thereof for poverty alleviation.

2.1 Highly variable rainfall

It bears repeating that rainfall is the primary limiting factor of ecosystem productivity and human activities dependent on ecosystem services in the arid and semi-arid lands of SSA. It is not only that rainfall is low however, but also the highly variable timing of rainfall, both within seasons and between years. Consequently, permanent residents need to evolve multiple knowledge systems and coping strategies to deal with erratic, and at times, prolonged shortages of rainfall, which constitute a major source of livelihood vulnerability.

Short-term variability or shortage of rainfall can affect cropping and livestock husbandry activities, either through reduced productivity or complete loss of the harvest or depletion of people's herds and flocks with potentially dire consequences for well-being. Local populations react in multiple ways, such as temporary migration to other areas, planting different crops, herding their animals further afield, increasing their reliance on wild species, temporarily diversifying their livelihoods, liquidating their household assets to tide them over until the next rains, and so on. Assuming the next rains do arrive within the expected window period, then these strategies may be sufficient. However, if rainfall is below average or delayed over a number of successive seasons (such as in the Sahel where a 35% decrease in rainfall was experienced between the 1960s and 1990s; the landmark drought in southern Africa in 1991-1993) then human well-being may be

seriously affected as assets are lost, and the ability to rebuild agricultural infrastructure or herds is eroded.

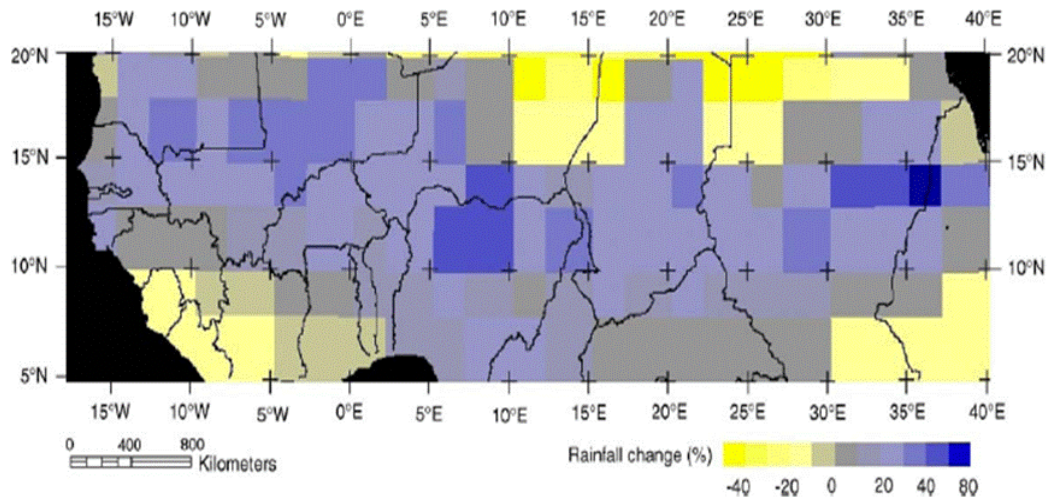


Figure 3.1: Rainfall change across the Sahel, 1980-2003 (Hermann *et al.* 2005)

Often seen as a positive driver, the provision of secure water supplies can reduce the vulnerability of dryland inhabitants. Such provision is usually done by drawing from ground water supplies. However, there is some debate that this undermines ecological resilience as artificial water supplies permit the maintenance of higher stocking rates and cropping activities than would naturally be the case. Thus, grazing resources have less chance to recover in the post-drought period (Kerven 1992). The same can be argued for drought policies that subsidise re-stocking (Danckwerts & Stuart-Hill 1988).

2.2 Climate Change

The climate change scenarios for sub-Saharan Africa are spatially variable, with some regions predicted to become moister (for example in East Africa) and others drier, such as Namibia (see Cooper *et al.* 2008). However, at a sub-continental scale, the arid and semi-arid lands are anticipated to become drier due to increasing mean temperatures, and are likely to experience more erratic rainfall. Thus, the well-known negative effects of previous droughts on ecosystems and livelihoods will be magnified. Notable exceptions exist, e.g. the Sahel where opposite trends have been recorded and where certain scenarios suggests it will see a considerably wetter (although still variable) regime in the rest of this century (J.J. Swift pers. com.; cf. Fig. 3.1).

Whether or not the age-old coping strategies of dryland communities will be adequate to deal with these changes remains to be seen, but some observers have suggested that current high urbanisation rates are already a reflection of the effects of climate change (Barrios *et al.* 2006). There is little doubt that climate change will strain the capacities of the most vulnerable regions, communities and households. Respondents in all three sub-regions of this study were of the opinion that changes in rainfall patterns were already evident. Both local people who participated in workshops in East Africa, and government and NGO officials in southern Africa perceive that rainy seasons are increasingly becoming shorter and more variable, and that this is associated with changes in

rangeland and agricultural productivity. This is validated by empirical research in southern Africa (Thomas *et al.* 2007).

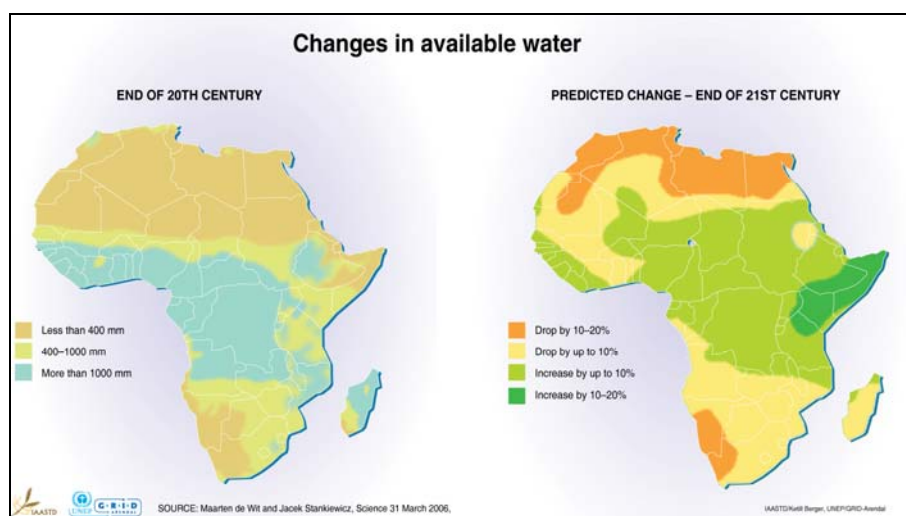


Figure 3.2: Changes in available water in Africa (www.agassessment.org)

Climate change will have multiple effects, each becoming a driver in its own right, such as changes in the growing conditions for crops, the spatial distribution and productivity of wild species, the distribution and availability of water resources, the distribution and incidence of diseases, and altered fire regimes. With respect to fire regimes, the perception that an increasing incidence of fire is driving ecosystem change was articulated by a number of different participants in the southern Africa sub-regional consultations. They ascribe this phenomenon to climate change which results in more extreme weather, greater drying and high winds towards the end of the dry season.

The effects of climate change will be felt most by the poor and those in arid and semi-arid lands, essentially because of their dependence on natural resources and their limited capacity to adapt (WRI 2005; Huq *et al.* 2005; Mortimore & Manvell 2005; Thomas *et al.* 2007). It is predicted that changing rainfall and temperature patterns will increase water scarcity and could have severe impacts on rainfed agricultural production. Both the area of land suitable for cropping and crop yields are expected to decrease (FAO 2005). In the arid regions of Namibia and Botswana even a slight increase in temperature or change in precipitation could produce a striking change in vegetation which would exacerbate impacts of trends in degradation in the arid rangelands (Mizuno & Yamagata 2005). This change becomes a positive feedback loop, and the effects continue to increase (Mizuno & Yamagata 2005, Mortimore, 2005).

Feedback interactions between climate change-related trends and those of other drivers are becoming increasingly significant. For example, overgrazing and clearing of land increases the natural vulnerability of semi-arid regions to changes in rainfall, as changes in vegetation decrease the capacity of ecosystems to store and regulate water flows. Thus, human modification of dryland areas is increasing vulnerability, leading to further modification, and loss of resilience to externally driven changes such as climate change or the spread of invasive species.

2.3 Global markets and the commoditisation of ecosystem services

Through, for example, changes in prices and subsidies, market forces are drivers of change that have an impact on resource management and extraction decisions from local to global levels. Globalisation has expanded demand for sub-Saharan African natural resources in countries like China, thereby stimulating new demand for harvesting from ecosystems at local levels. National-level trade policies operate similarly, for example in Botswana, where export policies for beef are linked to changes in rangeland condition. Lambin (2001) has argued that globally agricultural and trade policies have the greatest significance on land cover change.

There are, however, divergent views about the influences of market development on ecosystem management, as either (i) improved market access can result in the overexploitation of ecosystem services, or (ii) market chains can lead to ecosystem improvement through increased investment. Nevertheless, there is evidence that the changes associated with globalisation tend to “reduce the capacity of the local area to meet the needs of the local population, increasing dependency on the vagaries of markets” (UNEP-WCMC 2007). Moreover, the ‘double exposure’ of people who are already vulnerable because of economic globalisation to ecosystem and climate change is having profound impacts on their vulnerability (O’Brien 2006).

2.4 Governance

In many areas the effectiveness of managing and regulating the use of ecosystem services is being reduced, especially in situations where there is a transition from traditional authorities and institutions to more ‘modern’ ones (Fabricius *et al.* 2004, Lawes *et al.* 2004, Mortimore 2005). Nonetheless, where examples of improved governance exist these are often associated with a devolution of decision-making and management with subsequent benefits for ecosystem services (e.g. biodiversity in conservancies of Namibia). There is however mixed evidence regarding the effectiveness of devolution. It often places additional risks and responsibilities on the poor which they are not equipped to deal with (N. Adger pers. com.).

Governance drivers themselves are differentiated by scale. Multilateral environmental agreements, such as the UNCCD, apply at the global level, but they are negotiated over periods of years and then further time is taken for national governments to translate their content into legislation and policies, while implementation programmes can take years longer (Lankford *et al.* 2007). The norm is that changes in ecosystems arising from global environmental governance thus occur very slowly and indirectly. Moreover, local governance arrangements are necessary to cross scales and link policies from higher levels to local action on management drivers. In some contexts, local governance is capable of promoting rapid impacts, such as in Machakos in Kenya (Tiffen *et al.* 1994).

Weaknesses in the governance of water resources demonstrate how impacts on ecosystem services drive changes in livelihoods and vulnerability. One example is the widely used mechanism for regulating the use of water: a water use permit for abstracting or impounding surface water or groundwater. However, water can easily be over-allocated if controls on the distribution of permits are lax, if enforcement is weak or absent or where actual quantities of water available are not known, typically because there is a lack of capacity to collect reliable data. In the case of the Pangani basin in Tanzania, for example, water users are required to have permits, but in the absence of reliable hydrological data, too many permits have been issued. As a result, formerly perennial streams are now dry for parts of the year. This causes conflict among water users and

reduces water availability for domestic and productive use, with negative impacts on income and health. To overcome this, the Pangani Basin Water Board, with support from IUCN and other partners, has completed an integrated flow assessment for the river, to provide the data needed for better allocation decisions, including an allocation to the environment needed to sustain ecosystem services. This has been allied to reform of water governance under the Tanzania National Water Policy (2002) (see Lankford *et al.* 2007).

Corruption can have major impacts on water delivery, as a recent study by Transparency International indicates (Shordt *et al.* 2006). It was estimated that nearly two-thirds of the operating losses of 21 African water utility companies studied were due to corruption. Shordt *et al.* (2006: 7) argue that “good governance and transparency could free up most of the resources needed to achieve the Millennium Development Goals” and that a reduction in corruption could free up much-needed revenues to fund the attainment of the MDGs.

2.5 Land transformation

Land transformation was mentioned as a major driver by multiple stakeholders across the different countries. It is manifest as a change of land use or vegetation cover from reasonably extensive with high levels of cover, to significantly modified systems with reduced or no cover, such as land given over to housing, roads and fields. Conversion of largely natural lands or extensive rangelands to agricultural fields or plantations is the most widespread cause. This typically has negative impacts on the provision of most ecosystem services such as water quality, flood regulation, biodiversity, cultural services and the like. It represents a common trade-off occurring across the globe, where services are foregone in order to improve the reliability of food production. The 2005 Global Forest Resource Assessment indicates that the rate of deforestation of forests and wooded lands is significant even in dryland countries. For example Malawi, Niger, Nigeria and Zimbabwe are all losing naturally wooded lands at greater than 1.5% p.a (Table 3.2). However, it should also be acknowledged that certain types of land transformation can in some cases benefit ecosystem services and poverty alleviation, for example when dams and human-influenced wetlands are properly managed (MA 2005).

Table 3.2: Average annual rates of deforestation (%) in selected sub-Saharan Africa dryland countries (source: FAO 2005)

Country	%	Country	%	Country	%
Botswana	-0.9	Mali	-0.9	Senegal	-0.7
Chad	-0.6	Mozambique	-0.2	South Africa	-0.1
Ethiopia	-0.8	Namibia	-0.9	Sudan	-1.4
Kenya	-0.5	Niger	-3.7	Swaziland	-1.2
Malawi	-2.4	Nigeria	-2.6	Zimbabwe	-1.5

Transformation is probably most severe in the rivers and wetlands ecoregions. At the local scale small wetlands and seep lines are ploughed up by both subsistence farmers as well as large commercial enterprises, often irreversibly so. They are drained and canalised, built up, covered over, and invaded by alien species. This impacts water quality and flow regimes, as well the supply of key resources such as weaving reeds, and biodiversity. At a larger-scale streams and rivers are impounded (e.g. Kariba Dam in Zimbabwe; Cahora-Bassa Dam in Mozambique), a move which alters flow regimes, floods cultural sites, homesteads and grazing lands, and negatively impacts on biodiversity and local livelihoods. The costs and disruptions are borne by local communities, who typically receive comparatively few of the benefits (Mwangi 2007).

2.6 Demographic shifts

Both the growth in human populations and high and increasing concentrations of human settlement are consistently linked in the mainstream literature to land transformation and over-harvesting of natural resources for both subsistence and commercial uses (see all three sub-regional reports). Population growth at larger scales is linked to ecosystem changes at smaller scales, for example because of increased land clearing for agriculture and harvesting of fuelwood and medicinal plants. Projections of population figures across several sub-Saharan Africa counties show that many face the prospect of a doubling of their populations between 2002 and 2025. On the one hand, the two most populated countries (Nigeria and Ethiopia, each with significant areas of drylands) will contribute disproportionately to population growth in sub-Saharan Africa. On the other hand, HIV is a major factor in the relatively low increases projected for populations of southern African countries.

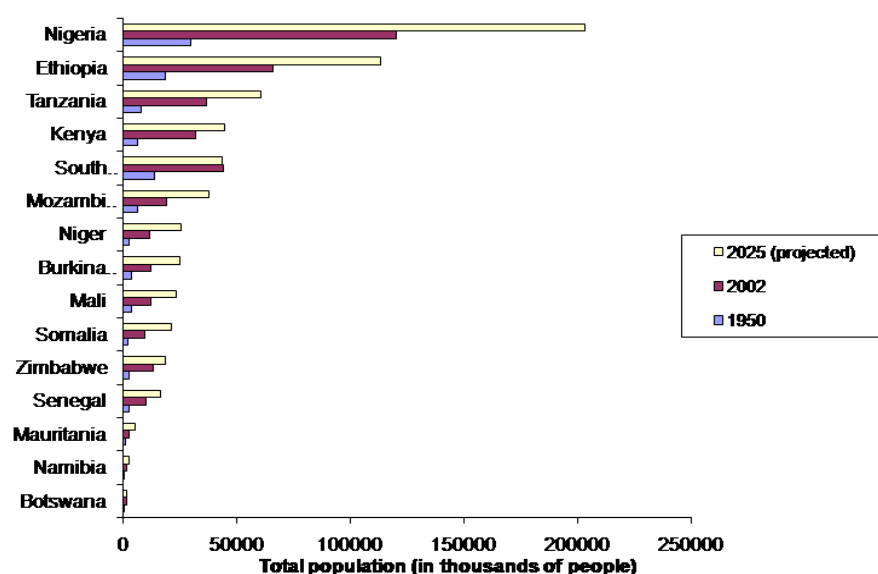


Figure 3.3 : Projections of population change, 1950-2025

Even though 'dryland' cultures, for example pastoralism, remain robust in many countries, for some the advances of globalisation and communication technologies mean that younger generations prefer to seek alternative livelihood options in towns and cities. Consequently, the population growth rates in arid and semi-arid sub-regions taken as part of national states are expected to be lower than portrayed in aggregate, national-scale statistics and models. Nonetheless, increasing populations utilise greater proportions of ecosystem services and require that more areas are subjected to intensified management. For example, in Kenya the rural population doubled to 3.5 million between 1973 and 1992. The average farm size was reduced to just 1.6 ha, and irrigated agriculture expanded by 2,850% between 1973 and 2000. Government encouraged intensification of agriculture. Population increases can however be beneficial to ecosystem services under appropriate policy conditions. For example, in Machakos (Kenya), rural families made investments in field terracing, field drains and water diversion channels. Trees were protected and planted on farmlands and in woodlots. Surface water was stored behind large numbers of small dams. The value of agricultural and livestock production per sq km and per capita increased by factors of >10 and >5 respectively, notwithstanding an increase in the district's population from 0.25 to 1.5 million (in the period 1932-1989) (Tiffen *et al.* 1994).

Urbanisation continues at a rapid pace in the surveyed countries, but all still retain a significant rural populations. Urbanisation has wide-ranging effects, both in the rural areas as well as the urban and peri-urban ones. In short, urbanisation patterns affect rural areas by typically removing those with better education and marketable skills. In some instances, the land may be reallocated to those remaining behind, but there may be strong cultural links to the birthplace, and so many urban households maintain their ties and claims to land in the rural areas (Hebinck & Lent 2007). There is often a steady erosion of local knowledge as the next generation grows up in the urban areas. In the growing towns and cities, the pace of urbanisation is frequently too rapid for authorities to keep up with service provision. Hence there are burgeoning shanty towns in many areas, inadequately serviced with water, sanitation or refuse collection. Contamination of water supplies from growing urban and peri-urban populations where water and sanitation systems may be badly sited and are not adequately managed is a threat to the ecosystem service of water provisioning and is an emerging regional theme as urbanisation increases (for example in Maputo, Mozambique). Urbanising populations are also consumers of many resources, including charcoal, fuelwood, medicinal plants, water and food, many of which are especially harvested and transported many kilometres for sale in regional and national centres. Conversely, if properly managed and with appropriate policies, urbanisation can revitalise rural economies (J.J. Swift pers. com.).

2.7 HIV and AIDS

Although HIV and AIDS is an important driver of change in natural resource use, its impact in this regard has received relatively little attention to date. Its impacts on ecosystem services and poverty are propagated through both management and external drivers of change. Sub-Saharan Africa accounts for close to 70% of the world's cases of HIV infection and the high infection rates in a number of sub-Saharan countries (southern Africa, Nigeria and Kenya in particular), are a great cause for concern (Table 3.3). The well-being of 4-5 other people, mostly but not exclusively in the same household, is negatively affected for every individual infected by the virus. Evidence from southern Africa shows that agricultural labour and cash shortages amongst HIV/AIDS affected households has led to the reversion to and increased consumption of wild plant foods and protein sources such as bushmeat and insects (UNAIDS 1999, Kengni *et al.* 2004, Hunter *et al.* 2007, McGarry 2008). A strong link has been reported between the increase in the AIDS pandemic and the over-use of traditional medicines (Maundu *et al.* 2005; Barany *et al.* 2005, Mander & le Breton 2006), and reliance on fuelwood as household cash flows decline (Hunter *et al.* 2007). Ngwenya & Kgathi (2006) describe the impacts of HIV/AIDS on the need for and supply of water in Ngamiland, Botswana. Water supply has been compromised due to lack of diesel fuel for borehole engines or lack of infrastructure maintenance due to "high absenteeism from work by the water officials due to HIV/AIDS related illnesses and attendance at funerals".

Table 3.3: HIV prevalence (%) in selected sub-Saharan Africa dryland countries (source: UNAIDS 2007)

Country	%	Country	%	Country	%
Botswana	25.2	Mali	1.3	Swaziland	25.9
Chad	3.3	Niger	0.7	Uganda	7.1
Ethiopia	1.4	Senegal	0.7	Tanzania	7.0
Kenya	6.7	South Africa	16.2	Zimbabwe	18.1

HIV/AIDS is a particularly strong driver in southern Africa, the epicentre of the pandemic, moderately strong in East Africa and less significant in the Sahel region of West Africa. The HIV/AIDS pandemic results in increased reliance on a number of natural products. Other livelihood assets including financial, social and human capital are eroded. The

pandemic is having negative impacts on agricultural productivity and on the long-term chronic food security situation in the region. It is predicted that several countries will experience a decline in human population over the next few decades, including Botswana and Swaziland, further stressing the relatively low skills base of these countries. HIV/AIDS has a number of significant impacts in countries that already have limited formal capacity to manage ecosystem services for poverty alleviation (Gelman *et al.* 2005, Erskine 2005), including:

- Significant loss of education and training investment
- opportunity cost of considerable public resources having to be diverted to tackling the pandemic
- diversion of household financial resources that might have been invested in education, etc.
- loss of experience
- loss of institutional memory
- loss of networks and partnerships
- loss of worker productivity through heightened morbidity and absenteeism
- increased financial burden as a result of the above losses.

These impacts are exacerbated by the increased reliance of communities and households on ecosystem services as they experience the effects of HIV/AIDS. Thus, there is greater demand on ecosystems but reduced capacity to respond. For example: the provincial conservation authority in KwaZulu-Natal province in South Africa has lost 9% of its 3,000 staff to AIDS; “a national fire awareness programme in South Africa lost 10 of its 12 extensionists, and the Wildlife & Environment Society in Malawi has lost 14% of its 60 staff to AIDS” (Gelman *et al.* 2005). Thirteen environmental managers working in and around Saadani National Park in Tanzania died of AIDS-related illnesses in a five-year period (Torell *et al.* 2006).

2.8 Tourism

Globally, tourism activity has increased dramatically in scope and scale in recent decades, in direct response to increased affluence (particularly in Northern countries) and easier global connectivity (Williams 1998). The World Travel and Tourism Organisation estimated a tripling in the number of international travellers to 1.6 billion by the year 2020. Within this context, tourism has come to be seen by many developing countries as an ideal development approach (Reid 2003), since it (i) attracts external capital, (ii) generates new sources of economic activity, (iii) may stimulate development in rural and often neglected areas, and (iv) can be directly linked to ecosystem integrity. A significant sub-sector of the growing tourism industry is ecotourism which depends entirely on relatively intact natural and cultural environments. Thus, tourism can be a direct driver for sound ecosystem management for a range of goods and services, as well as the restoration of previously degraded landscapes. Given that the natural attractions and biodiversity of sub-Saharan African drylands feature prominently on the international tourism agenda, there is considerable scope to link tourism development to sustainable environmental management and poverty alleviation, through revenue injections into the poorer parts of developing countries (Wahab & Pigram 1997, Mowforth & Munt 1998). In many sub-Saharan countries tourism is one of the fastest growing sectors (Table 3.4). For example, in Botswana tourism provides 4.5% of all employment making it the second highest employment sector after agriculture, and the second biggest contributor to the GDP after mining (Mbaiwa 2005). Sub-Saharan Africa had the highest growth rates in tourism (10.4%) of any region of the world in the two years 2004-2005.

Table 3.4: Contribution of tourism to national GDP in 2003/04 (note all values are rough estimates). (Source: www.tourism2006.com)

Country	Contribution (%)	Number of visitors	Country	Contribution (%)	Number of visitors
Botswana	10.3	975 000	Namibia	11.0	695 000
Ethiopia	5.5	210 000	Nigeria	6.6	920 000
Ghana	no info	440 000	South Africa	7.4	6 700 000
Malawi	3.0	480 000	Swaziland	6.6	220 000
Mali	2.6	135 000	Uganda	4.6	510 000
Mozambique	1.0	900 000	Zimbabwe	3.3	1 850 000

Ecotourism activities frequently occur within the living environments of rural communities. Consequently, maintenance of the tourism attractions of ecosystems and landscapes can potentially benefit the poor, and weak management of such attractions can undermine the value of the tourism receipts and consequently opportunities for poverty alleviation. For example, tourism in the Okavango Delta (Botswana) generates more than the direct-use value of resources (Mmopelwa & Blignaut 2006). Tourism has added a new strategy to local livelihoods, promoting diversification and reduced reliance on any single sector. Maintenance of ecosystems for ecotourism ventures also supplies other ecosystem services such as water regulation, carbon sequestration, pollination, etc. to surrounding communities and downstream users. However, it is not all beneficial, as there is evidence that the poor capture only a small proportion of the broader benefits from ecotourism initiatives, and in some instances their livelihoods are negatively affected through restrictions on land use options and access to resources (Kiss 2004).

3. CONCLUSION

This chapter has highlighted the complexity involved in the analysis of drivers, which operate at different spatial and temporal scales and intensities. The chapter has broadly outlined a number of the key drivers of ecosystem change in large areas of sub-Saharan Africa. It was pointed out that the interactions between drivers are complex, often hard to predict and frequently difficult to manage. The timing, duration and intensity of drivers taken in isolation and in combination all promote different responses in time and space. Yet, understanding the causes of ecosystem change presents an important opportunity for developing interventions that will alleviate poverty and human vulnerability, while developing capacity at all levels to manage ecosystem services effectively.

An improved understanding of ecosystem trends, and human responses to them, is undoubtedly predicated on a better understanding of drivers. The uncertainties that surround trends for drivers, that result from a virtual absence of comprehensive and continuous monitoring, hampers our ability to determine, understand and predict the longer-term trajectories of change. Indeed, it is a common limitation throughout Sub-Saharan Africa that research and information systems are not backed by the comprehensive and sustained data collection that is needed to monitor trends and impacts. Better long-term data sets for major trends in human well-being and ecosystem change would allow for the examination of correlations of presumed drivers and their relative role, magnitude and importance in relation to specific trends. This improved understanding can then translate into programmes aimed at enhancing intervention on both fronts.

Chapter Four:

Management strategies and possible

ESPA interventions

1. INTRODUCTION

This chapter highlights current management strategies and practices in the arid and semi-arid regions of Sub-Saharan Africa that aim to both enhance the capacities of ecosystems to provide services on an ecologically sustainable basis and to alleviate poverty. It provides examples of good practice, highlights innovative approaches that seek to simultaneously address sustainable management of ecosystem services and poverty alleviation, and discusses the nature, extent and significance of trade-offs made in policy decisions and interventions.

The primary theme of this situation analysis is that of the significant **variability or heterogeneity** across arid and semi-arid sub-Saharan Africa. The nature of poverty and people's experience of it is extremely varied over space and time, with differential dependencies on the range of ecosystem services.

While the notion of trade-offs feature prominently in the analysis of predictably messy, complex and even contradictory 'development' interventions, we are able to identify good practices in the context of ecosystem management and poverty reduction. In this we are guided by the definition of good practices as *"a method, process or approach that has resulted in a breakthrough and that has a lasting effect in the area of poverty reduction and sustainable ecosystem management"* (IUCN-NL et al. 2007, p.12). Four key qualities of good practices can be summarised as innovation, effectiveness, sustainability and replicability (Box 4.1), although we have used these somewhat loosely as a rigorous application would have excluded a number of promising initiatives.

2. SCALES OF INTERVENTIONS IN COMPLEX SOCIO-ECOLOGICAL CONTEXTS

Interventions include policies that create the enabling conditions for integrated responses and successful implementation, strategies, programmes, projects, planning frameworks and 'tools' for intervention. They may also comprise processes such as multi-stakeholder decision-making, local innovations and adaptations at community and household level. Responses and actions that improve the capacity of ecosystems to continue to deliver services crucial to poor people can be found at any level from local to international. They may operate at different spatial scales (from landscape to species or community to household), and may be led by different actors in society (e.g. international agencies, national

governments, local governments, civil society organisations, private sector or business interests, local people or combinations of these).

Policy and institutional factors are central. They determine firstly which practices and interventions are recognised and gain support at the various levels, and secondly how likely they are to be implemented and upscaled. In our conceptual model (Annex 1), policies and institutions mitigate the intensity of interactions between the drivers, ecosystem services and human well-being. They are strongly influenced by a range of factors, including prices and incentives, legal and regulatory systems (including resource tenure regimes), management institutions, and knowledge systems in the broadest sense. It is beyond the scope of our synthesis to compile a detailed analysis of policy relating to ecosystem management and/or poverty alleviation.

Box 4.1: Key qualities of good practices

An analysis of 14 case studies concluded that 'good practice' in the area of poverty reduction and sustainable ecosystem management varies according to the local and national context, and that an adaptive approach is therefore essential. Four key qualities of good practices are highlighted:

1. **Innovative** – showing new and creative solutions to problems of poverty and environmental decline
2. **Effective** – having a lasting positive impact on the quality of life and the environment of the people concerned
3. **Sustainable** – capable of being continued once external support from donors or development organisations is discontinued
4. **Replicable** – can be used as a model for policies or adopted and replicated elsewhere by other organisations or communities

ref: IUCN-NL et al. 2007

3. UNDERSTANDING TRADE-OFFS

A principal challenge in managing ecosystem services is that many are interdependent and attempts to capitalise on one service (through human actions such as dam building for water provision) often leads to reductions or losses of other services (e.g. less 'visible' regulating services). In reality, these other services are traded-off, sometimes unintentionally (MA 2005c; Rodriguez et al. 2006).

3.1 Trade-offs between biodiversity conservation and agriculture

Cultivation leads to the loss of some ecosystem services, but also the ability to access a new set of services that was previously unavailable, through intensification of production. This increases food security but also brings new threats such as accelerated erosion, biodiversity loss, nutrient depletion and problem animals/pests which damage cultivated crops. Norton-Griffiths & Southey (1995) estimated that Maasai landowners forego about US\$26 million in potential earnings each year by not fully developing their land for agricultural purposes. This presents a huge incentive to develop the land and thus a threat to wildlife conservation. The threat will become even more acute if the marginal value of land increases, e.g. because of rising food prices. They estimated that without conservation, Kenya's GDP would be 3% higher, i.e. conservation is costing the Kenyan economy 3% of its GDP.

In Namibia, wildlife conservation and the associated crop damage has lead to a decrease in crop production as the following quote illustrates:

“In Namibia, conservancies are almost taking over the whole country. This is good but it has its own consequences. Wildlife has increased, tourism has increased a bit. But if you look at the benefits, they are maybe not tangible enough. People in Caprivi and Kavango were dependent on crop production. But now with the increase in elephants, this is suffering. They need to see an increase in benefits. In some conservancies, they get Namibian \$2000 annually – in a community of 3000. The international community also needs to compensate them – for example if they are conserving forests very well.” *NRM expert, regional organisation, southern Africa*

The construction of large dams, particularly if poorly planned, can have major negative trade-offs for human well-being and biodiversity. The construction of dams on the rivers that feed Lake Chad has lead to its contraction from a water body with a surface area of 25,000 km² in late 1960's to a one which is barely 500 km² in area now. These changes have had a severe impact on the livelihoods of an estimated 9 million farmers, fisherman and livestock herders (Fig 4.1) (<http://www.unep.org/dewa/assessments/ecosystems/water/vitalwater/27.htm>).

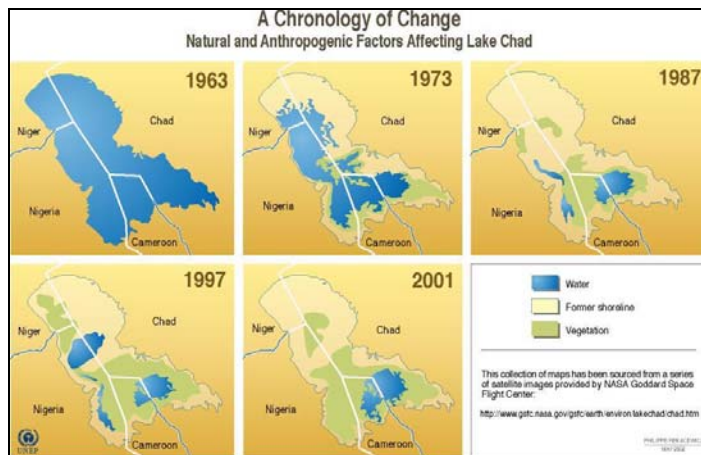


Figure 4.1 Changes to the surface area of Lake Chad and surrounding vegetation from 1963-2001 due to the construction of large dams in its catchment and climate change (<http://www.unep.org/dewa/assessments/ecosystems/water/vitalwater/27.htm>)

3.2 Barriers to intervention

Despite considerable progress in recent years in recognising the importance of environment and ecosystems services for the poor in the region, there are still numerous barriers to making a real difference on the ground (DEAT 2006). Some of these are listed below.

- Policies linking poverty and ecosystem services rarely extend to other departments whose mandates are social welfare, health, land affairs, energy, economic development, rural development, etc.
- The exclusion of the environment from national accounts undervalues and takes ecosystem services for granted (DEAT 2006).
- Low policy coherence and lack of coordination between different multilateral environmental agreements.
- Problems in moving from policy to practice.
- Scaling up from a few localised projects or initiatives.

- Poor monitoring and a lack of timely and accurate information and data (Adeel *et al.* 2007).
- Scale mismatches between the biophysical units of ecosystem management and the corresponding social and administrative units affecting successful implementation (Frost *et al.* 2007).
- Poor management of common pool resources, especially in communal areas (Frost *et al.* 2007).

3.3 Traditional knowledge and customary practices

Traditional knowledge and local customs may represent important components of good resource management practices at the 'grassroots' level, although caution should be exercised as traditional management practices are not always appropriate (Chalmers & Fabricius 2007). Many traditional resource management systems and everyday uses of resources fall under this sphere of customary governance.

Local knowledge about ecosystem processes, such as the effects of fire, has enabled communities to manage rangelands in the more mesic parts of sub-Saharan Africa, with local pastoralists keenly aware of the benefits of different forage species and of tools such as fire for forage management (Kepe & Scoones 1999, Kassahun 2008, Solomon 2007). Traditional farming systems in the desert-prone drylands are often characterised by a rich diversity of traditional crop varieties, which increases the adaptive capacity of people farming in arid areas.

3.4 The value of social networks and social capital

Ideally, social institutions and networks that are organised around the use and management of ecosystem services bring people together and encourage them to find common solutions to resource management problems. In these networks, people share traditional and ecological knowledge and common cultural rituals and practices which are critical in building social cohesion and "a sense of community".

Collective action in Machakos (Kenya) by the traditional institution of the *mwethya* or mutual assistance groups is an example of a long tradition of ecosystem management in Kenya. Farm-level investments include terracing, pasture development, tree planting, use of exotic breeds of livestock and hybrid forms of fruits such as oranges, avocados and mangoes. Many farmers report that they learn about new ideas about farming from the other *mwethya* group members or through resource persons such as agricultural extension officers, in a process facilitated by, Excellent Development, an NGO in Kenya. Machakos shows how the importance of creating arenas for collaborative learning. It also highlights the fact that social networks help create linkages across scales in ecosystem management and enhance the capacity to deal with change and uncertainty. Trust is another important component, with the *mwethya* groups relying heavily on trust as the basis for social cohesion. Local social organisation builds the capacity to self-organise, which leads to greater confidence, while social learning stimulates communication and knowledge sharing and improves resilience. Social networks create the nodes for interpersonal interaction and ties, bolstered by good leadership, which can establish functional links within and between organisational levels in times of need.

However, drawing on research conducted in the Usanga basin in rural Tanzania, Cleaver (2005) warns of the dangers of over-romanticising the intrinsic poverty alleviation possibilities that many now associate with social capital. She points out that "the poorest [people] experience clusters of interlocking disadvantage that make it highly unlikely that they can draw on social capital to ameliorate their poverty, or that increased association and

participation at community level is necessarily beneficial to them” (Cleaver 2005: 893, Ainslie 1999, Molyneux 2002). Similar reservations exist about the nature of “community” where culturally embedded discrimination against ethnic minorities, certain social groups and women is the reality in many “communities” in rural sub-Saharan Africa. Barrett *et al.* 2005 stress that “[p]retending social harmony exists where there is none may not only fail to ensure the success of community-based approaches to conservation or development, but may also impede efforts to develop adaptive approaches to integrating informal community groups, local governments, national governments, private businesses and nongovernmental organizations according to organizational comparative advantage.”

4. INTERVENTIONS AT THE LOCAL LEVEL

4.1 Community-based natural resource management

In southern Africa, community-based natural resource management (CBNRM) is regarded as a major innovation in the conservation and management of natural resources (Fabricius 2004, Turner 2004). CBNRM Programmes in southern and East Africa attracted substantial donor investment in the late 1980s and early 1990s. A leading example of a CBNRM programme is the legally formulated conservancies of Namibia, discussed in Box 4.2.

Box 4.2: CBNRM in Namibia

Namibia has gained prominence as a ‘good practice’ example of success in CBNRM programmes. Here, legally formulated wildlife conservancies are run by elected committees with technical support from government and NGOs. Income from hunting, tourism, jobs, craft markets, and game meat has improved livelihoods, along with infrastructure, empowerment, and new skills. It is estimated that 120 000 km² of land is now managed by conservancies. One in eight Namibians (or 220 000 people) is a member of a conservancy and the gross revenue earned by conservancies is over US\$2 million per annum

Ref: NACSO 2006

CBNRM has had positive impacts in several spheres including:

- the development of new policy and legislation that provides communities with more secure rights and benefits over natural resources,
- empowerment of disenfranchised groups,
- improved organisational capacity at the local level and better, more democratic, local governance,
- financial benefits at community and household level,
- livelihood diversification and reduced vulnerability,
- employment, and
- improvements in biodiversity and the resource base, breaking the downward spiral of poverty, resource dependence and degradation.

One of the recent innovations of CBNRM programmes is the move in the direction of ecosystem management as opposed to management to maximise financial returns to wildlife. Finding long-term solutions to financial and institutional management disputes remains a challenge.

The overall experience with CBNRM has important implications for interventions in the management of semi-arid and arid land in sub-Saharan Africa. These include:

- Incentives for management: Incentive-led approaches such as CBNRM have generally replaced the legislative approach to management. However generating sufficient incentives to achieve change, even with high value wildlife resources is challenging.
- There are deeply embedded and often conflicting traditional and political power structures in rural Africa that limit the potential for changes in management.
- Policy changes that allow for the devolution of control over natural resources are sporadic and often not part of a regular policy cycle. Devolution of resource management has generally been incomplete and seldom includes control over the central asset – land.
- The political will to hand over power to local communities is often lacking.

4.2 Pastoralism as an adaptive response

Mobile pastoralism (i.e. nomadic or transhumant pastoralism) is a well-adapted form of land use in the context of biophysical conditions in Africa's challenging arid and semi-arid regions, and has co-evolved with local social and ecological systems (see Box 4.3). The 1970s witnessed the spectacular failures of externally-imposed projects that tried to impose both a sedentary lifestyle and range management techniques developed on the prairies of North America. More recently, mobile pastoralism is increasingly recognised as a sophisticated technique that makes good use of the ecological variability found in arid and semi-arid SSA (UNDP 2003). Sedentarisation has on the whole been resisted by herders whose animals need to be moved around the landscape in search of water and forage. A new generation of pastoral projects (UNDP 2003) is said to exhibit more enlightened qualities, including:

- Respect for mobile pastoral strategies
- Respect for herders' indigenous knowledge and technical understanding
- A concern with risk and variability
- Priority given to institutional development
- And priority given to the systematic participation of pastoralists themselves in project identification and management.

(see also Thomas and Twyman 2005).

Box 4.3: Pastoralists and benefits to crop farmers

In Sahelian West Africa, an important but often underrated contribution of pastoralist livestock to the national economy is their role in fertilising farmers' fields. Where chemical fertilisers are too expensive, or simply not available in remote markets, animal manure is a critical crop input. Elaborate arrangements are made between herders and farmers. The primary exchange is usually for farmers to provide water and allow herders to graze their animals on stubble after the harvest. In return, the animals are stabled on the fields at night and fertilize them with the manure. Dryland millet yields in Senegal and Mali are reported to double or quadruple as a result. A range of additional relationships between farmers and herders develop around this primary exchange, including barter of milk for grain and a variety of social events. In recent years such arrangements are in decline, as farmers sell or use crop residues themselves, and accumulate cattle of their own.

Ref: UNDP 2003 (source: Africa Regional Resource Paper (see www.undp.org/drylands go to drylands policy/challenge papers)

Pastoral governance is a critical issue that concerns the relationship between formal institutions of the state and the traditional/informal rules and social structures of pastoralist groups (see UNDP 2003: 16-17). The marginal environments inhabited by pastoralists mean that the risks they face are high. Climate change-related fluctuations in rainfall and possible temperature increases could have very harmful effects on pastoralist economies with negative consequences for poverty alleviation objectives. Given the responsiveness of local people to changes in their environment, it is critical that external interventions build on what they are already doing for themselves. This has been identified as a key success factor in much of the literature.

4.3 Agro-ecological approaches

A number of approaches are being implemented in the region that promote a more ecologically sound form of agriculture. These agro-ecological approaches provide opportunities to mitigate the negative impacts of landuse change on key regulating services such as soil fertility and biodiversity, where trade-offs for provisioning services are inevitable. Illustrative examples include conservation farming, ecoagriculture, organic farming, integrated pest management, participatory sustainable land management approaches and agroforestry. In most of southern Africa, such approaches have received relatively little attention, although Namibia has a programme exploring conservation tillage in the North-Central region in recognition of the need to build up soil structure and fertility and the area under conservation tillage in South Africa has increased from 500 000 ha in 1975 to 1.5 million ha in 2005.

In the Central Plateau and Eastern Region of Burkina Faso, in the period 1980-2000, the Mossi people have increased their crop yields, the numbers of on-farm trees, the numbers of livestock – and amount of manure – and fodder production. With the assistance of international donors and NGOs, and with the involvement of government departments, they implemented soil and water conservation measures on a large scale. Yield improvements without soil degradation were achieved and household food security improved which saw out-migration being slowed (Anderson *et al.* 2004, Reij & Steeds 2003).

Under semi-arid conditions with variable rainfall regime and high and growing population densities, successful interventions have the following key elements:

- Effective adaptation of initially inappropriate external knowledge in soil and water conservation;
- Adaptation of indigenous self-help institutions to harness labour and capital;
- Valorisation of a growing rural population in labour-intensive terrace farming, with integrated livestock production, manuring, and animal traction;
- Access to produce markets and to urban markets for both educated and unskilled labour;
- Secure resource tenure for men, though not always for women, and strong social attachment to family land.

4.4 Environmental Flows

'Environmental flows' is an approach to mitigate the downstream impacts of dams and water abstraction on ecosystems and livelihoods, through negotiation of the quantities and timing of flow releases. It is being piloted in a number of basins in southern and eastern Africa. It is based in part on ensuring that ecosystems are included in water allocations, as a means of ensuring that ecosystem services are maintained, or at least that trade-offs are explicit and negotiated (M. Smith, pers. com.).

5. NATIONAL POLICIES AND PROGRAMMES

5.1 Decentralisation

There is now considerable experience of decentralisation in the field of natural resource management, with much work done all over Africa, but perhaps especially in West Africa (Dalal-Clayton *et al.* 2003, Vorley 2002, Ribot 1995). Lessons include:

- Subsidiarity, i.e. the devolution of powers to the most local level of government that can effectively discharge these powers, can be interpreted and play out in various ways. Decentralisation may lead to greater inequities (and inefficiencies) between social groups if accountability and representation mechanisms are weak or non-existent. Thus, without building political and negotiating skills, decentralisation may simply decentralise conflict and rent seeking;
- Decentralisation means more than de-concentration: placing subordinates at remote outposts while retaining most decision-making power at the centre does not improve governance;
- The importance of decentralising budgets in parallel with decision-making powers;
- Decentralising natural resource management powers, including in some cases power to allocate land to private ownership, brings into prominence a new category of players – elected regional authorities. Guarantees of minority interests previously assured by central government may not be as effective at the regional or district level;
- Linkages between different administrative levels and linking communities with the lowest administrative levels remain two key areas for attention. A primary outcome of these linkages needs to be coordination of decision making among levels. For example, at basin level decisions may relate to amounts of flow needed from particular sub-basins, while at community and/or sub-basin level, decisions need to then ensure that water is allocated among various uses in ways that work within the flow requirement for discharge from the basin.

A challenge for many interventions seeking to link poverty alleviation with sustainable management of ecosystems is the incomplete process of decentralisation throughout much of the region. Examples of superficial decentralisation in parts of West Africa have led to more, not fewer, barriers to mobility and have thus presented additional constraints on the adaptive livelihood strategy of mobile pastoralists (UNDP 2003). Barrett *et al.* (2005) point out that “privatisation has become as much a mantra as decentralisation. Moreover, the two are often closely intertwined where authority and responsibility for activities devolve to community-based groups without effective capacity to set, monitor and enforce rules, without the range of skills and resources to remain flexible, to adapt designs to local conditions and to liaise effectively with actors at other scales and in other sectors.”

5.2 Land reform

There is widespread insecurity of land tenure in the drylands of Sub-Saharan Africa, arising from past policies which did not accord indigenous and customary occupancy the same status as private property tenure. Land and resources owned in common have been most affected, the more valuable areas frequently having been withdrawn from local custodianship or reallocated to outsiders and investors, thereby depriving millions of poor people of protection against the negative effects of social transformation and the commoditisation of land (Wily, 2006). While land reform processes have been initiated in many of the dryland countries of Sub-Saharan Africa to redress inequalities with respect to access to land, there has been limited progress to date in dealing with the inherent challenges of customary tenure (Cousins 2007, Campbell *et al.* 2003, Lahiff 2003). With highly complex land tenure and resource tenure arrangements that vary significantly over

short spatial distances and between social groups, there is every reason to proceed with caution.

5.3 Public works programmes that address ecosystem rehabilitation and poverty alleviation

The South African government's **Working for Water** programme has gained international recognition for its innovative and sustained approach to both ecosystem management and poverty alleviation (Turpie *et al.* 2008). The programme has three main objectives: (i) conserving ecosystem services by eradicating alien vegetation; (ii) poverty alleviation through job creation as part of South Africa's Public Works Programme, and through establishing small and micro enterprise and; (iii) raising public awareness about the importance of and threats to water resources. Working for Water also funds applied research into the economics, ecology and sociology of alien plant eradication. Its key ingredients are a major awareness-creating and marketing drive, coupled with a strong focus on ecosystem service objectives. There is significant scientific support for the methods adopted, with strong political support at the highest level and thus financial support and backing over the medium term, directly linked to a poverty reduction and skills improvement imperative. Given the success of the model, Working for Water has spawned additional programmes founded on similar principles, e.g. Working for Wetlands, Working for Woodlands (which includes a successful restoration project in heavily degraded Sekhukuneland in the north of the country), Working on Fire, and Working for the Coast. These South African examples offer lessons for other countries with high unemployment rates and ecosystem management challenges.

6. EMERGING INNOVATIONS

6.1 Support for commercialisation of natural products

Natural product commercialisation is seen as a way to link sustainable natural resource management and livelihood improvement, and often forms part of larger CBNRM programmes. Throughout the region rural people, and women in particular, have for decades traded in a wide range of natural products, primarily for sale in local markets. Specific strategies are now being developed by the development community to provide alternative sources of income to rural households.

There are both positive and negative elements to the process of commoditisation of ecosystem services both in terms of their management and the livelihoods of rural people. New markets, specifically those with external linkages, such as tourism or the export of medicinals, create new income opportunities. However, where there is uncertain or weak tenure over resources, commoditisation can lead to unsustainable harvesting. However, markets also create incentives for production and management – one of the factors that has driven farmers in west Africa to plant and manage trees over which they also have secure tenure.

6.2 Payments for Ecosystem Services

Payments for Ecosystem Services (PES) schemes reward people through subsidies or market payments derived from other people who benefit from the services such as water quality, carbon sequestration, biodiversity and flood control by wetlands. Payments for ecosystem services generally seek to create incentives for land managers rather than to criminalise their behaviour through legislation. The key innovation that distinguishes PES from other incentive-based approaches is that there is a contract between the user (buyer) of the ecosystem service and the supplier of that service.

A global review of payments for ecosystem services concluded they should be considered with cautious optimism. The review highlighted the potential for PES mechanisms to marginalise some categories of landholders and the need to better understand the trade-offs associated with some land use changes. Currently in Africa there are very few projects and very limited understanding of the PES mechanisms (Grieg-Gran & Porras 2007). Indeed, there are several proposals currently being developed for PES approaches and projects in South Africa. Among these is an initiative being driven by the national Working for Water programme, a PES project that is being developed for the Maluti-Drakensberg TransFrontier Conservation Area, and a carbon sequestration project is reportedly being developed in Gorongosa in Mozambique. Except for South Africa, the options for PES mechanisms in dryland sub-Saharan African countries appear limited. Due to the arid and semi-arid environment in these countries, the investment from the carbon market is likely to be small.

The benefits, or potential benefits, of PES schemes for specifically improving the well-being of the poor is a much debated area with some commentators being quite optimistic, while others less so. There are also questions regarding whether, and under what circumstances, PES will be able to compensate fully for foregone alternative land uses. Moreover, PES tends to benefit those who have degraded their ecosystem services rather than rewarding those who have protected these.

6.3 Pilot climate change adaptation projects

Given the dire predictions regarding the impacts of climate change on the livelihoods of people living in arid and semi-arid lands (IPCC 2007a, MA 2005a), emerging local-level initiatives for adaptation to climate change are important interventions to consider. Currently, work on adaptation at national, provincial and municipal levels is at best focused on developing frameworks and has not yet progressed to the stage of developing strategies and actual tools for supporting the thinly-spread pilot adaptation projects that do exist. Support to these community-based projects is currently largely restricted to pioneering work by NGOs. Analysis of early case studies in South Africa indicates that an action learning approach that promotes synergies between local knowledge and experiences and scientific knowledge is a vital component to facilitate the development of effective and locally-owned adaptation strategies (Urquhart 2007).

DFID and the Canadian International Development Research Center are supporting the Climate Change Adaptation in Africa (CCAA) programme. This programme was set up to improve research on climate change adaptation in a range of African settings. A number of action research projects have been funded and more are under consideration. CCAA aims to facilitate interactions between African scientists, researchers and policy-makers around climate change issues.

7. CONCLUSION: A NEW APPROACH TO DEFINING AND MEASURING 'SUCCESS'

Conventionally, interventions aimed at improving ecosystem services while alleviating poverty are designed by outsiders to benefit the poor. Most interventions suffer from a focus on projects, funding and technological fixes, they are output-directed, and define success as a utopian steady state. Achievements for the poor are typically measured in financial terms, and improvements to ecosystem services are rarely monitored, and where they are, a species-focused approach instead of a systems approach is often used. The outcome of this is often that adaptability is reduced. Such approaches are particularly problematic in Africa where capacity across all levels is low, governance in several places leave a lot to be desired,

and local powers are limited. By definition, one-size-fits-all approaches disregard the variability of local social-ecological contexts (cf. Scoones 2004).

‘Success’ in the present context is defined as the observable/measurable impact of an intervention that benefits the well-being of ‘targeted’ poor people while leaving intact the sustainable provision of a given ecosystem service; or conversely, that safeguards the provision of an ecosystem service while not reducing the well-being of those who use it. Complete transformation in development approaches is seldom possible and positive ‘tipping points’ are rare. Instead we propose an alternative approach that monitors tendencies and ‘directions of movement’, acknowledging that change is gradual and that historical factors mitigate against fast progress.

Chapter Five

Research and capacity gaps for the sustainable management of ecosystems to maximise poverty alleviation

1. INTRODUCTION

Interventions to support the poor through ecosystem management need to be informed by relevant research and the capacity of institutions. An important result of this situation analysis is the identification of key research gaps that need to be filled to allow policy and management agencies to reduce poverty through judicious management of ecosystems and use of the services they provide. Leading from this is the need for an assessment of the capacity of local, national and regional institutions to manage ecosystems for poverty alleviation based on current or future research findings. The term 'capacity' is here used to denote more than just the availability and abundance of the quality and quantity of human resources but also the existence of the necessary skills, knowledge, awareness and motivation as well as logistical support to allow the skilled people to do their job. These are referred to as **technical** capacity, which is characterised by supply-side concerns that historically have dominated donor agencies' interventions. **Institutional** capacity, by contrast, encompasses a demand-side perspective, which emphasises the ability of a country or organisation to make optimal use of the existing technical capacity and resources, with the focus on capacity utilisation and absorptive capacity (Dalal-Clayton *et al.* 2003).

2. RESEARCH GAPS

It is noteworthy that a considerable body of research relevant to the ESPA agenda already exists throughout SSA. While a great deal of this research output is not framed in the language and methods of ecosystem services, much of it is highly relevant to the new discourse. Any new research programme developed by the NERC/DFID/ERSC consortium should avoid duplicating previous work even if initiated from a different perspective or theoretical framework. Ideally any new research programme should seek to complement existing work, with a strong focus on the vulnerability, risks and uncertainties faced by households and institutions in the region, along with development of mechanisms to ensure that research is used. Stakeholders consulted during the course of this situation analysis repeatedly requested that existing and new research be collated and distributed to all stakeholders at multiple levels (from grassroots to policy).

2.1 Assembling and repackaging existing knowledge

Given the existence of relevant and valid research, albeit within different frameworks, the initial priority should be an exhaustive process of assembling and collating the existing research, and packaging it in appropriate formats for different stakeholders, such as policy briefs, information brochures and curriculum notes, amongst others. Particular areas where significant impacts could probably be made based on existing research knowledge include:

- information to decision-makers on the importance of ecosystem services to livelihoods and poverty.
- water resource management at catchment, interbasin and inter-country levels;
- new technical possibilities for utilising ecosystem services (e.g. new crops, crop intensification, value addition, market development);
- people's rights regarding access to ecosystem services for basic needs (e.g. water, fuelwood, land for production);
- supportive legislation underpinning the good governance and management of ecosystem services for poverty alleviation;

2.2 New research

New research needs to address the superficial nature of much of the existing data and generate knowledge that adequately addresses issues of variability so that vulnerability, risk, thresholds and tradeoffs can be better understood in relation to ecosystem services and poverty alleviation. Particular areas requiring attention, identified through in-country consultations and literature review were grouped into five themes which are outlined below. These are not evidence based from published works, but are founded on in-country consultations and summary contained in the three sub-regional reports.

2.2.1 Empirical data needs and research methods

- Long term data are needed on trends in ecological and social attributes in more regions.
- For many ecosystem services there is limited information on their magnitude, trends, drivers, or quantification of value to human well-being, especially for regulating, cultural and supporting services. This applies internationally (e.g. Kremen 2005).
- There is no study in SSA where all ecosystem services have been quantified, valued and related to human well-being. The more numerous single service studies preclude assessment of trade-offs. The same scarcity applies at an international level (Turner *et al.* 2003).
- Better understanding and models are needed on how to scale up and adapt successful interventions to locally specific circumstances and opportunities.
- There is considerable urgency to explore valuation methodologies and refine the mechanisms by which these valuations can enter decision-making frameworks. The construction of approximately 1,500 large dams in Africa that assumed the opportunity cost of water to be zero is evidence of the importance that needs to be given to valuation methodologies and their use by policy makers.
- Payment for ecosystem services has the potential to drive environmentally appropriate practices based on the supply of ecosystem services, and thus needs testing in multiple contexts.
- The management of water at all scales is key element in reducing the risk faced by farmers in arid and semi-arid lands, and thus the trade-offs involved in water management (especially the effects of dams on downstream users) require further research.
- The bulk of available information pertains to rural environments. There is a significant dearth of information on environmental services generated in urban environments and consumed by urban residents.
- Most work on the value and contribution of ecosystem services to livelihoods and poverty alleviation does not contextualise the contribution of ecosystem services relative to other livelihood sectors and opportunities available to the poor. This gap should be addressed.
- Research dissemination and uptake of results is an important gap. Understanding the political or other constraints to research uptake, and findings ways to overcome these, is necessary for greater effectiveness.

- Development of measurement and monitoring tools for regulating services, and their inclusion in project impact assessments.

2.2.2 Understanding social-ecological processes

- The probable impacts of climate change on human well-being and poverty dynamics.
- In relation to soils as a supporting ecosystem services, key questions relate to what are critical soil condition limits, particularly with regard to soil organic matter content, for maintaining specific ecosystem services? And what is the importance of below-ground biodiversity in maintaining soil ecosystem services?
- Many interventions, either for poverty alleviation or ecosystem health, are inadequately monitored and hence it is often difficult to assess their impacts. Easy and robust monitoring tools and protocols need to be developed.
- A clearer understanding is needed of the feedbacks between drivers operating at international and national levels on local social-ecological processes.
- The general trend in most countries has been a decline in traditional and local government capabilities and authority concerning ecosystem and resource management. The reasons for this and approaches to reverse it need to be understood.
- A better understanding is required of social exclusion/privilege and equity in relation to access to and use of ecosystem services, as these norms may alleviate or exacerbate poverty.
- A deeper understanding is needed of the place of ecosystem services in diversified livelihoods, their dynamics in response to prevailing drivers, their variability and the trade-offs between livelihood streams.
- The costs of adverse trade-offs are rarely considered, especially (although not exclusively) with respect to agricultural policies and projects. Consequently, there is a need for a thorough examination of such policies and communication of where they can be justified in terms of environmental sustainability and economically.
- The commoditisation of ecosystem services is a key linkage between natural and social systems that can impact poverty status and/or ecosystem health. Context relevant predictive models are required.
- What are the barriers to larger uptake to ecologically friendly production systems (e.g. approaches that rely on reduced quantities of herbicides and pesticides)?
- Research into the linkages between ecosystems and poverty must recognise (and address) the importance of tenure as a driver of the vulnerability of the poor in drylands.
- Other than for vertebrates and plants, little is known about the trends in species diversity even though biodiversity is the major supporting service which underpins nearly all others. Consequently inventory and monitoring of all major taxonomic groups are required.
- In relation to soils as a supporting ecosystem services, key research questions revolve around what soil ecosystem services are impaired and where, and through which practices? What is the importance of below-ground biodiversity in maintaining soil ecosystem services?

2.2.3 Knowledge systems

- A mechanism is required to capture and mobilise local knowledge on ecosystem management, and integrate it with other knowledge systems.
- Research is needed on gauging the awareness of decision-makers of the links between ecosystem services and poverty alleviation, the levels of misunderstanding and apathy that exist and investigating strategies for overcoming this.
- The impact of HIV/AIDS on knowledge systems and research development.

2.2.4 Monitoring and adaptive management

- Indicators need to be developed and data collected on particularly slow variables, including soil nutrient loss, trends in critical natural capital, land use change, and trends in human vulnerability linked to ecosystem services.
- Measuring and interpreting long-term trends are essential, to prevent reactive management that responds to short-term fluctuations;
- Before this can be done, the thresholds of acceptable change in ecosystems need to be researched and documented, to enable decision makers to apply adaptive management principles.

3. CAPACITY GAPS

It is noteworthy that there is relatively little ‘hard’ information that deals specifically with capacity, other than sectoral government reports. Few explore the capacity of local, national or regional agencies to develop and implement ecosystem-based policies and programmes for poverty alleviation. Our sub-regional teams all reported that the awareness, understanding and commitment to ecologically sustainable development amongst high-level decision-makers still need to be improved. However, even where awareness and understanding are strong, there are relatively few decision-makers who make explicit links between the state and functioning of ecosystems and local poverty, other than by relying on the land degradation rhetoric. At a generic level, oft-stated challenges pertaining to capacity levels in SSA include: its supply-driven nature, skills limitations, inadequate local financial management systems, inappropriate administrative procedures and a lack of effective coordination (Ministry of Local Government, 2005; ILO, n.d.).

Reasonable knowledge regarding poverty and ecosystem services exists in many countries and regions of SSA (Chapter 2), but the skills base is extremely narrow in many countries. This is compounded by the large size of many African countries and large distances officials need to travel. Several respondents noted that HIV/AIDS was devastating the already small pool of skilled professionals. This drains the training budgets of departments, and results in a lack of continuity in planning processes and interactions with communities on the ground. High mobility of skilled people has a similar effect.

Table 5.1: Different elements of human resource capacity (adapted from the UN 1995)

Capacity	Attributes
Knowledge of the subject	adequate basic knowledge of the subject area; integrate different knowledge systems; eagerness to continually learn; apply critical thinking to new knowledge
Appreciation of the bigger picture	understand and learn from historical processes; adopt a systems approach; rationally prioritise critical choices
Plan proactively for the medium & Long term	question, innovative, and design better options; project planning and monitoring of outcomes; undertake future planning
Respond to pressing and overarching inequities	have concern for resources; adopt moral reasoning; adopt societal related thinking
Reaction to change and Uncertainty	proactively plan for unexpected changes; implement short-term crisis management

The key challenges in respect of the objectives of ESPA are to enhance the capacity of organisations and individuals to:

- manage the capacity of ecosystems to deliver key services, especially those used by the poor.
- build the adaptive capacity of people to cope with the projected impacts of climate change.
- make appropriate and informed trade-offs between meeting short-term needs and long term goals in the management of ecosystem services for human well-being;
- implement policies aimed at regulating the use of ecosystem services and build capabilities to monitor and govern such use.

Concomitantly, there is a need for researchers and research institutions to develop their own capacities to:

- speak to and engage across disciplines, both conceptually and empirically, in ways that are much more effective in delivering greater understanding of underlying processes, drivers and trends. This understanding must then be translated into development outcomes.
- to engage in co-learning and action research methodologies that build effective partnerships with local people (*including* the poorest), and other local and national stakeholders.
- acquire the skills (including negotiation/conflict resolution skills) and the motivation to penetrate the structures of the policy process at the appropriate levels, which may be community, local government, province, national or regional levels.

3.1 Cross-scale capacity gaps

The key cross-scale challenges relating to capacity to design and implement appropriate policies and interventions as identified by in-country consultations include:

- capacity to develop vertical alignment between strategies, policies and institutional structures at regional, national and local levels. This relates to communication strategies, decision making structures and capability for implementation.

- capacity to manage cross-border ecosystem services such as air quality, water bodies, migratory wildlife through institutions that facilitate regional co-operation.
- sustained capacity to raise awareness about the links between ecosystem services and poverty amongst decision makers at all levels.

In some cases, awareness may be high but the political will to legislate, pay for ecosystem services and take unpopular decisions, such as acting against over-use of resources, is low. Governments are quick to react on fast-changing factors such as floods and fires, but reluctant to act on slow changing variables such as gradual ecosystem degradation.

3.2 Capacity issues at the national level

One of the major challenges is to design interventions that address the *drivers* of poverty and ecosystem degradation, rather than just the symptoms. A thorough understanding of the mechanisms by which drivers influence ecosystem services and poverty, and the interactions between drivers, is therefore necessary. This does not always require more research, but rather improvements in the way research findings are applied. Improvements in services such as clean water, electricity, telephone connections, access to electronic media, and improvements in transport networks will make a huge difference to the capacity of local communities, industry, and government to manage ecosystem services for the benefit of the poor. It is necessary to map out intersecting and cascading drivers, and plan interventions accordingly. This necessitates implementation of inter-disciplinary research, models that provide essential simplicity, and intersectoral planning and implementation. Most sub-Saharan African countries currently lack widespread capacity for development planning and implementation. Capacity building is therefore a critical pre-requisite in most countries.

During the in-country consultation component of this situation analysis, a number of capacity related themes were identified in different countries, including:

- line ministries still typically work in silos with limited integration between different levels and ministries of government.
- integration between extension structures and services remains severely limited.
- national monitoring systems are weak, both in relation to poverty indices and trends in ecosystem services. Improving monitoring will require additional skilled human resources, monitoring protocols, equipment, vehicles and fuel, and updated computer hardware and software.
- ecosystem services and the environment do not receive high priority in national plans and budgets, which cascades down at all levels in terms of restricted capacity, both human resources and support infrastructure and equipment.

3.3 Capacity gaps at the local level

At local level capacity gaps identified vary according to local context and stakeholder groups consulted. Key themes to emerge were that:

- Training is required at all levels on a better understanding of the environment, integrated natural resource use, pro-poor development and conflict management.
- Local communities must be provided with basic services, access to information, and training, to enable them to deal with the complex institutional challenges of managing ecosystem services.
- There is a need to promote community resilience and build the confidence of communities in themselves and their capacity to act.
- Collaborative decision-making between local, national and international actors is essential.
- Throughout SSA, traditional leadership institutions have played a strong role in the past. However, in many regions, traditional institutions may no longer be appropriate to deal with

the multi-scale drivers of ecosystem change. Since degradation is often directly related to the lack of clear authority and the breakdown of the traditional sanctions system, one area for capacity building with respect to local-level natural resource management is to bridge the gap between 'democratic' political and traditional institutions (Ntsebeza 2003, von Maltitz & Shackleton 2004).

- The capability to initiate and manage needs to be developed to reduce dependence on external funders and consultants.

4. CONCLUSIONS

Capacity, monitoring and research constraints are a recurrent theme in the overall governance of African countries, their people and their resource endowments, with obvious implications for the poor. This reality is both a consequence and a cause of the economic, technological and institutional marginalisation of SSA. The diversity, magnitude and impact of pressures on ecosystems and the livelihoods dependent upon them in sub-Saharan Africa, demands that the means and mechanisms are sought and found to urgently address these challenges. National, regional and international research and development consortia have a role to play in this regard, through meaningful and equal regional and North-South partnerships, to actively pursue programmes for poverty alleviation that genuinely privilege the poorest.

Chapter Six:

Communication & outreach strategies for implementing an ESPA research programme

1. INTRODUCTION: CHALLENGES TO CONVENTIONAL RESEARCH APPROACHES

Numerous evaluations of development programmes and projects attest to outcomes below expectations, as well as the difficulties in achieving uptake of research carried out in conventional 'top-down' processes. Many in-country respondents in this study corroborated this, by voicing scepticism about the effectiveness of past donor-funded interventions. They also expressed concern about external agencies and research institutions operating in their countries with limited regard to local capacity development, little evidence of alignment with national and regional priorities, and/or superficial partnerships with local institutions. To avoid these common shortcomings, a future NERC/DFID/ESRC research programme must adopt an innovative, and carefully designed and principled strategy. This strategy will guide programme actions to form partnerships and to use methodologies that will deliver real benefits for poverty alleviation. The key to meeting this challenge lies in bridging the gap which currently exists between the production of scientifically rigorous knowledge on the one hand and its uptake and application using effective processes for ensuring relevance to felt needs on the other (Barnard *et al.* 2007).

Responding to this demand calls for a redefinition of what should constitute "excellent" research. This new research agenda needs to link action with research in a way that has a tangible impact on poverty and ecosystems, through institutional linkages at different levels.

2. DEFINING A NEW RESEARCH AGENDA

Defining a new and more effective agenda for research means re-casting the historical dichotomy between scientific research and local development processes. This will reflect the more complex relationships between these two processes, promote cross-fertilisation of scientific and local knowledge, and take into account the different time frames that apply. In general, scientific processes occur over longer time frames, driven by the need to produce rigorous, defensible, credible and scientifically relevant knowledge. Following longer time frames, development processes are based on meeting immediate needs, and are thus driven by a need for relevant, practical and demand-driven knowledge. This is particularly the case in the arid and semi-arid lands of sub-Saharan Africa, where climate change is exacerbating high levels of poverty and changing ecosystem services in unpredictable ways.

The proposed model for the new research programme builds on accepted good practice by adding a stronger focus on outcomes rather than inputs, and proposes methodologies for a more effective development process that combines research with clear impacts on poverty. This model provides a mechanism to harness scientific rigour with development processes in mutually beneficial ways while recognising the complexity of local livelihoods.

2.1 What is new?

The key feature of the new research approach is its requirement for implementation and impact. This is in contrast to the more traditional ‘dissemination strategy’ and ‘strategy for putting findings into use’, and must include a set of mechanisms to achieve this. There has to be a strong link to the institutional frameworks and organisational structures of development processes at different levels, to promote mainstreaming. It also relies on building partnerships that are impact-orientated.

While participatory action research methodologies have been effective in dealing with empowerment and demand-led processes, many of them have not attained the desired level of impact on the ground or in scientific circles. Lessons from case studies indicate that this relates to the failure to make meaningful linkages with development processes at larger scales for leveraging in additional resources to promote upscaling. Local knowledge, which forms the basis for participatory research, is frequently inadequate for detecting changes in very slow variables, e.g. change over several generations. The multi-scale nature of processes that drive ecosystem change and human well-being necessitates that research must incorporate different sources of knowledge, with varying levels of technicality and varying in scale from local to global.

2.2 Mechanisms and processes in the new model

The proposed new model centres around demonstration projects in which the impact of research can be clearly shown. These demonstration projects consist of a research project and an accompanying implementation project where learning takes place through adaptive management. It is based on strong partnerships between Northern and Southern hemisphere institutions, with links to policy makers and practitioners as part of the network (Figure 6. 1).

The guiding principle behind the proposed research strategy is to plan and execute research around “demonstrations”. These are long-term processes that lie outside the remit of the research programme and are funded through for example GEF, governmental development strategies, NGO-led community development or policy work and donor projects. They might be small or large, but are characterised by having a primary focus on action and implementation of change processes in development. “Demonstrations” is used loosely here to cover a spectrum of action from community development to national and international policy processes. The research strategy would deliver into these demonstrations, as a vehicle for achieving impacts.

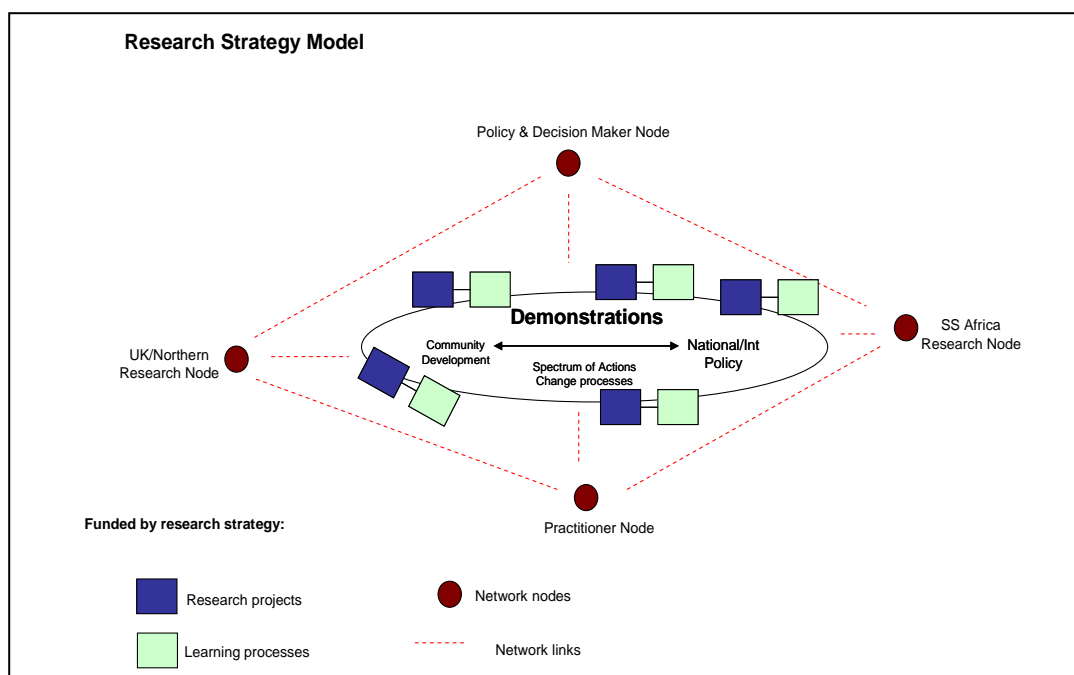


Figure 6.1 Components of a new research framework

A mechanism is required to enable effective linkages to be made between research and demonstration projects. This would be achieved by facilitating the formation and operation of networks that integrate the scientific and development communities. The networks are thus institutional linkages designed to support and facilitate research and impacts on development processes. There is an absolute requirement for these networks to be goal driven and accountable for deliverables, which is linked to the urgency for action in the sub-Saharan context.

2.3 Participants and functions

The key stakeholder categories that need to be part of such networks, include scientists from both the North and the South, development practitioners, grassroots stakeholders and policy makers, from both government and donor agencies. These networks should be an integral component of the proposed research programme, with funding allocated for their formation and management, but accountable against specified deliverables. They need to be longer term and build on existing processes at multiple scales. The networks need to be driven by goals and deliverables, and not simply be 'talkshops'.

The purpose of these networks would be to:

- Mobilise demand articulation
- Form research consortia and formulate research proposals
- Mobilise and convene action learning
- Strengthen learning and capacity
- Advance dissemination and communications
- Facilitate scaling-up, to move beyond pilots
- Develop institutional linkages
- Develop opportunities for political engagement.

Research projects would be designed to interface with demonstration projects and the enabling network. Projects would be developed by consortia mobilised through the network, with objectives developed according to local priorities in demonstrations. Learning processes would

be directly linked to research projects and delivered into the demonstrations, but would reach a broader set of users through the network. The interface of research, networks and demonstration would create multi-directional flows of knowledge, creativity, learning and change between scientific knowledge and development practice.

In this way, research projects are able to overlap with demonstration processes, but are not completely driven by them. Alongside research projects are learning processes that draw on the research projects and feed into and interact with the demonstration processes. These then build wider capacity necessary for the scaling up of demonstration processes, through interaction at different institutional levels.

In such processes, the role of the scientist is not to run demonstration, communication or dissemination processes. Scientists need to interface with these processes (demonstration and learning), which should be run by their own facilitators, who manage networks and demonstration processes. Such facilitators need to be wary of taking too much control in driving processes, and must recognise their role as being one of creating spaces in which dialogue and action can take place. A further guiding principle is to ensure that space is retained for scientific dialogue, creativity and delivery of scientific outputs. This structure would fit professional scientists and scientific institutions into more effective impact pathways, rather than the model that makes dissemination an addendum to research projects.

This model is arguably better adapted to work with the specific knowledge and development requirements of complex adaptive systems models, which are central to ecosystem – poverty linkages.

3. COMMUNICATION AND OUTREACH

3.1 Context of the research policy nexus in sub-Saharan Africa

Governments in SSA (and elsewhere) frequently have policy cycles that are disjointed and often not linear. Consequently, arena to influence policy cannot be pinpointed accurately and engagements with policy-makers are often haphazard and opportunistic. In fact, because there are multiple policy processes on the go at any one time (e.g. MDGs, PSRPs, National sectoral policies on land, services, conservation, desertification, etc.), and poverty is a focus of many sectoral policies, there are multiple policy windows at any given moment. Researchers need to recognise that policy is not just the domain of governments and bureaucracies, but that donors, NGOs, multilateral agencies and civil society (researchers, NGOs and communities), also have critical roles to play.

Structural adjustment and devolution have often been accompanied by loss or undermining of institutions for Research and Development, especially those that used to be sponsored by central governments. High turnover of government officials and of community members results in (i) research often not being processed by the officials who commissioned it, or not communicated to others, and (ii) loss of institutional memory. Archiving of information remains a problem in many countries, especially at the local level, which often leads to reinventing the wheel with each successive research project. This understandably leads to research fatigue and frustration on the part of the people subjected to the same probing questions time and again by different research teams.

Donor support should include making scientific knowledge far more accessible in SSA, for instance by ensuring that scientific journals and publications are readily accessible and affordable to African academic institutions and researchers. Moves are afoot to ensure that this

happens, but the practice should be a fundamental component of research partnerships and projects. Similarly, exchange programmes that encourage researchers to spend 3-6 months in the countries and institutions of their respective partners to become immersed in the research and academic culture of another institution or country, can be a highly beneficial investment of research funding and should become a standard part of research collaborations.

3.2 Good practice

If research is to be effective it needs to be translated into appropriate policy and management knowledge, which must be communicated (in appropriate form) to the relevant stakeholders so that the necessary applications can be effected. Much of the academic and grey literature has no impact on changing knowledge, actions and practices for the better or otherwise. Communication of research should be an iterative, interactive and multi-directional process that involves a wide range of stakeholders from planning, through to design, implementation and monitoring and evaluation (Barnard *et al.* 2007).

What follows are some of the features that have brought influential research projects into the public eye and kept them there. These projects are characterised by:

- **Demand-led research.** The demand needs to be articulated clearly by broadly representative constituencies from communities up to national governments.
- **A 'political' champion.** For communication to be effective and to ensure that it reaches to the very top, successful programmes have at least one political champion who sets out a vision for the programme, who lobbies for support, and who acts as a conduit for dissemination of results into government policy-making forums and think-tanks.
- **A long-term vision.** It takes time to change knowledge, practices and attitudes. Short-term programmes of less than 10 years have less impact on ecosystem management and on poverty than do longer term ones. They also have less internal flexibility to react and change as new understandings develop (Sayer & Campbell 2004).
- **A dedicated communication strategy and budget.** Many projects have inadequate budgets for the communication of research and development findings. This is particularly true of short-term projects. Successful ones, spanning many years, have either (i) media and communication specialists ("knowledge intermediaries") on the project team, or (ii) adequate budget to consult specialists at regular intervals. Successful communication takes time, money and the correct skills.
- **Clear (but not simplistic) messages repeated consistently.** Irrespective of the stakeholders to whom the message is being targeted, repetition of the message is essential. Communication can take diverse forms, but it must be regular and have a consistent message. Because tapping into different media is essential, the distribution of a glossy annual report is insufficient.
- **Communication in the vernacular.** Local language communication is important for reaching and influencing community stakeholders. Budget allocations need to make adequate provision for translation costs where necessary.
- **The project-inspired 'story' must be perpetuated.** Residents and officials in the project-affected areas must receive exposure to the project, both its activities and its findings, on a regular and ongoing basis;
- **Ownership and a sense of pride in the research and overall project by local people and officials.** This in itself has a number of requirements over and above a successful communication strategy, but a good communication strategy helps to foster ownership and pride, provided there is regular media exposure of participants and people whose lives are improved by the outcomes of the initiative.

- **Participatory research.** Stakeholder support and buy-in is also engendered by commitments to participatory research methodologies, which also shorten the gap between research outcomes and implementation on the ground, and start the process of communication from the outset.
- **Significant scale.** Reception of the results communicated to officials, donors and policy stakeholders is enhanced if the project has multiple sites or covers a reasonably large geographic area. Small projects are important, and can lead the way with innovation and local impact, but they are constrained by their specific contexts and the personalities of the particular, situated role-players. Larger projects facilitate comparative analysis and reflection of why some approaches work in some areas but not in others, and can foster internal innovation and reflection by virtue of having a greater critical mass.
- **Cross-disciplinary communication.** Communication of messages must be both disciplinary based and cross-disciplinary. The linkages between the different core components, i.e. ecosystems *and* poverty alleviation need to be established and constantly reinforced.
- **Make ideas real.** Concepts need to be translated into real tangible projects which can be profiled, highlighted and visited.
- **Understand the context.** Whilst it is important to communicate the success (and failures) of approaches and projects so that they can be replicated elsewhere, it is important that the context of each success is also fully understood and communicated – one size does not fit all.
- **Clear messages to land managers and planners.** Managers and local officials who make decisions about land use and zonation constitute a particularly important stakeholder group. They need to be targeted with clear messages and materials that cover the relevant legislation and responsibilities around ecosystem management, and highlight the ways and means of alleviating poverty.

4. CONCLUSIONS

A great deal of work has been done recently on getting research into use. DFID is at the forefront of these developments and generates a considerable amount of goodwill by making a raft of reports and policy briefs, etc. freely available online and in hard copy. Other funders have similar 'open access' policies to the outputs of development interventions that could be examined to learn valuable lessons (Ainslie & Hassan 2007, Barnard *et al.* 2007). The differential but generally limited access to the electronic media on the part of millions of people in SSA is likely to remain a reality for years to come. This calls for innovative thinking around delivery of research communication strategies. However, the rapid spread of mobile telephone usage and access to relatively inexpensive satellite technology across much of Africa opens up exciting new possibilities for research interventions and opportunities for information sharing.

In conclusion, it is worth noting that the scientific and development research "community" is by no means homogeneous and the particular needs, theoretical orientations and professional interests of younger/junior vs. more established researchers, as well as female vs. male scientists, expatriate vs. national, locally-trained vs. internationally-trained researchers, and academically-inclined vs. more applied researchers, all need to be disaggregated and understood. While there is no doubting the essential future role of rigorous scientific research that can stand up to peer review, the days of a major, multi-year research project proposal having under the "Communication and Dissemination" section only the objective to 'publish at least two papers per year over four years in appropriate international journals' are well and truly over.

Chapter Seven:

Lessons learnt by the CEPESA team in conducting this situation analysis

1. CONTENT-SPECIFIC LESSONS

- Investments in managing and securing ecosystem services alone will not eradicate poverty. Such investments need to be a significant and conscious part of broader poverty alleviation initiatives.
- There is inadequate consideration of poverty alleviation issues by ecosystem management agencies, and there is practically no consideration of ecosystem resources and impacts by social or economic development agencies (other than tourism projects). Participatory Poverty Assessments as well as national Poverty Reduction Strategy Papers need to explicitly include environmental components. In-country experts reported that poverty alleviation programmes or projects rarely consider environmental dimensions. The importance and value of ecosystem services needs to be mainstreamed into planning and decision-making processes from local to international levels. This disconnect is where donor agencies can make a significant contribution.
- Provisioning services are a significant component of diversified livelihood portfolios, both for home consumption and income generation. Poverty alleviation initiatives need to recognise and build on the inherent diversity of rural livelihoods, by promoting a diversity of options, of which provisioning services should be seen as only one of a suite of options.
- Unlike most poverty programmes and interventions, ecosystem services are pervasive at all spatial and temporal scales. Consequently, support and management for delivery of ecosystem services will benefit all inhabitants of the region, including the poor. However, as the poor are more directly reliant on ecosystem services for a larger share of their livelihoods, carefully targeted investments in securing ecosystem services will be of greater benefit to them than other sectors.
- There is growing evidence in the region that land use practices which promote multiple use and sustainable use of resources usually have an equivalent or greater return than converted landscapes when all costs and benefits are accounted for. Thus, unsustainable uses, or intensive production of single resources without quantifying the trade-offs in respect of other services, frequently cannot be defended in economic terms.
- As human well-being diminishes there tends to be a concomitant increase in immediate dependence on ecosystem services. This increased pressure often has a negative feedback on the capacity of the ecosystems to deliver services which can create a downward spiral of increasing poverty and ecosystem degradation. There is growing evidence that the HIV/AIDS pandemic may be driving such a situation in many parts of SSA.
- The analyses of the drivers of change in ecosystem state are complex because of the temporal and spatial variation, as well as in relation to the scale of analysis. Nonetheless, in most instances there have been large changes, with the net direction of change being negative (other than for tourism). In other words, ecosystem services are being compromised on a wide scale and to a significant extent.

- Local projects to secure ecosystem services can certainly be useful (e.g. the Working for Water programme, some CBNRM programmes), but the functional scale of ecosystems and their drivers is typically at larger spatial and temporal scales than at which such projects operate. Consequently, better management and appreciation of ecosystem services and their role in alleviating poverty might be best achieved by interventions at the policy level. An important objective should be to change the understanding, attitudes and attitudes that policy-makers, planners and land managers have towards ecosystem services.
- The poor are confronted by many external drivers and trends against which they are relatively powerless to act, including those impacting on the delivery of ecosystem services. Policies and interventions need to support and strengthen the capacity of the poor to adapt, create and build their own opportunities, rather than impose external prescriptions or unidimensional development opportunities.
- HIV/AIDS is a major scourge that is devastating the region especially in the way it drains household assets and resources, and consequently deepens poverty. It is also undermining ecosystem management through the permanent loss of skilled people and managers, and increasing the short-term exploitation of especially provisioning services. The effects will be felt for many decades to come. Robust, comprehensive and extensive interventions based on shared knowledge and practice from the successful programmes in parts of Africa and globally are required immediately throughout the region.
- Whilst all ecosystem services are important, water is a particularly important ecosystem service in arid and semi-arid areas. Yet projections indicate that several districts and countries in the region will be severely water stressed within two to three decades. The poor are already at the forefront, having least access to bulk water supplies, and are most susceptible to water-borne diseases. Dams and the redistribution of water from areas of higher rainfall serve to delay the onset of local shortages, but not without impacts on other ecosystem services. Consequently, there is an immediate and pressing need for comprehensive and extensive interventions to increase water use efficiencies, water recycling and rainwater harvesting to reduce absolute demands per capita and per unit of production.
- The bulk of available information and literature pertains to rural environments. There is a significant dearth of information on ecosystem services generated in urban environments and consumed by urban residents. This presents a potentially dangerous misconception that urban communities can exist relatively independent of ecosystem services other than water and those services necessary to produce food in the surrounding rural areas.
- Trade-offs are inevitable in all decisions, at all scales, pertaining to land use, development and ecosystem services. Future programmes need to arm decision-makers (at all levels) with the information, knowledge and skills to make informed decisions based on an awareness and a thorough analysis of the relevant trade-offs.
- The capacity to manage ecosystem services varies from country to country, region to region, and for specific services. However, other than for water as a provisioning service, there is a perception in most countries that national budgets should focus on infrastructure development and social services. The share of national budgets allocated to ecosystem management functions is pitifully small because national decision-makers have not been made aware of the value of ecosystem services (in both financial and non-financial terms) in supporting all human endeavours and in supporting the poor. Consequently, as a very generalised assessment, insufficient budget is available for capacity development and maintenance of that capacity.
- There is an inadequate understanding and appreciation of the importance and value of ecosystem services, even provisioning ones, on the part of planners, bureaucrats and policy makers, resulting in many avoidable negative trade-offs. Consequently, there is an urgent need for better research and communication of that research to these agencies.

2. GENERAL LESSONS REGARDING THE ESPA PROCESS

- The CEPESA team underestimated the logistical implications of the brief (“arid and semi-arid sub-Saharan Africa”) which called for the team to both identify, access and digest the considerable published literature and the often relatively inaccessible grey literature and adequately engage with and canvas the input of a broad cross-section of stakeholders in the three subregions.
- The overall ESPA project has adopted a relatively new theoretical approach – taken largely from the Millennium Ecosystem Assessment (with its emphasis on “ecosystem services”) - and one that gives due acknowledgement of DFID’s specific concerns around poverty alleviation. NERC, DFID and ESRC might have tried to find more common ground – prior to rolling out the situation analysis phase - between their respective conceptual and practical commitments to and expectations of the ESPA programme.
- African government departments and agencies are not yet structured to deal with ecosystem services and human well-being in an integrated manner. Consequently they do not collect and store data that integrate the two. A few conservation and environmental departments do recognise and operate in a poverty alleviation paradigm, but practically no social development agencies make conceptual or operational links to ecosystems.
- The burgeoning literature on livelihoods and poverty exhibits varied conceptualisations of poverty. This complicates the interpretation, comparability and ultimately the use of the literature and its associated data-sets. It also means that margins for error exist in the interpretations of the more specific linkages between poverty alleviation and ecosystem services programmes.
- The request to integrate the views and concerns of key stakeholders into the situation analysis was compromised by the limited time available to allocate to this activity. Similarly, while significant consultation and awareness raising was undertaken during the course of the project, the project was not able to achieve real buy-in, much less integration of its concepts and ideas into government/stakeholder policy forums or programmes.
- Despite efforts to locate it, some countries have a serious dearth of literature on the key ESPA topics – e.g. Swaziland. There was also limited literature dealing with the situation in Mozambique. This may be in part due to language barriers, in that some literature in Portuguese was not accessible to the English-speaking research team. In fact, the issue of language is likely to recur, and ESPA must take cognisance of the significant differences in intellectual traditions across Franco-, Anglo- and Lusophone Africa.
- To the extent that stakeholder views were to be solicited, the methodology to achieve this and to adequately reflect and integrate these views into this report, although discussed and planned for, were not sufficiently articulated, conceptualised and implemented. No sharp distinction was made between (i) qualitatively canvassing the views of a convenient sample of specialist stakeholders by means of one-on-one interviews, (ii) viewing the stakeholder consultations primarily as an opportunity to raise awareness about the likely future ESPA programme and its conceptualisation of the key issues and (iii) systematically surveying the state-of-the-art current knowledge bases of a cross-section of purposefully identified stakeholders.

3. LESSONS LEARNT SPECIFIC TO THE CEPESA TEAM

- Given the complexity and variability along a number of indices and gradients across the West, Eastern and Southern African countries included in the CEPESA study, more attention to the development of the conceptual frameworks and plans of action, and to internalise

common understandings of what the assessment entailed on the part of both the sub-regional research teams in the CEPISA consortium and of the stakeholders consulted.

- Something which was identified at our Project Inception Workshop was the critical need to ensure that the conceptual model, the methodology and the methods used by each sub-regional research team were both sensitive to sub-regional specificities and would still be sufficiently standardised across the ASAL region to meet the need to make ASAL-wide statements, conclusions and recommendations. This proved to be much more of a challenge than was anticipated.
- Although it was also identified as a potential problem early on, the issue of integrating and synthesising the highly variable, even disparate data, evidence and narratives, as well as data collected at different scales from the three sub-regions was nevertheless underestimated. Moreover, the extent of the challenge in this regard only emerged rather late in the project cycle, i.e. at the final synthesis writing workshop at the end of January 2008. What emerged here was that, despite the very clear *Table of Contents* for the final report, which was circulated in good time and discussed in detail with each of three sub-regional teams, the three reports produced by the three constituent sub-regional studies and their respective research teams differed quite substantially.
- The realisation only really sunk in then that the final report, comprising a synthesis and integration of the three sub-regional reports, would in fact have to be far more than the sum of these three somewhat disparate parts. This has required significant additional work to tap into data sources that provided ASAL-wide perspectives.
- The vastness of arid and semi-arid Africa is daunting. This report has consistently pointed to the enormous heterogeneity of sub-Saharan Africa. Encouraging the consortia in the ESPA fold to conduct situation analyses at such vast scales was positive in that it forced research team leaders to assemble expert teams from the 'four corners' of the continent and beyond. This has the stimulating effect of bringing together regional expertise that might not otherwise have found sufficient cause to collaborate. The scale at which many ecosystem services have effect also warrants a coarse-scale perspective in the first instance. The trade-off is of course, foregoing the generating of finely-tuned understandings of the intricate nature of the ecosystem services – human well-being linkages in specific localities.

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Annex 1: CEPsA conceptual framework and definitions

1. Conceptual framework

To facilitate integration of the different components of the study and the work of the three sub-regional teams, the design of the project and interpretation of the literature was guided by (i) a conceptual framework of the links between ecosystems and poverty (see Fig. 1), and (ii) a number of central and integrative themes. The conceptual framework was informed by the Drylands Development Paradigm (Reynolds & Stafford-Smith 2001), the Ecosystems and Human Well-being framework of the Ecosystem Millennium Assessment (MA 2003), and the Sustainable Livelihoods Framework (Carney 1998; Garnett *et al.* 2007).

The conceptual framework adopted here views ecosystem services and human well-being as integrated, and part of a single, complex human-ecological system (Figure 1). Drawing on current state-of-the-art thinking, it focuses on the feedbacks between drivers of change, ecosystem services, and human well-being, and assesses how externalities, interventions and mitigating factors affect these relationships (Nelson *et al.* 2007; Walker & Meyers 2004; Holling 2004; Millennium Ecosystem Assessment 2005; Reynolds & Stafford Smith 2001; Folke *et al.* 2005).

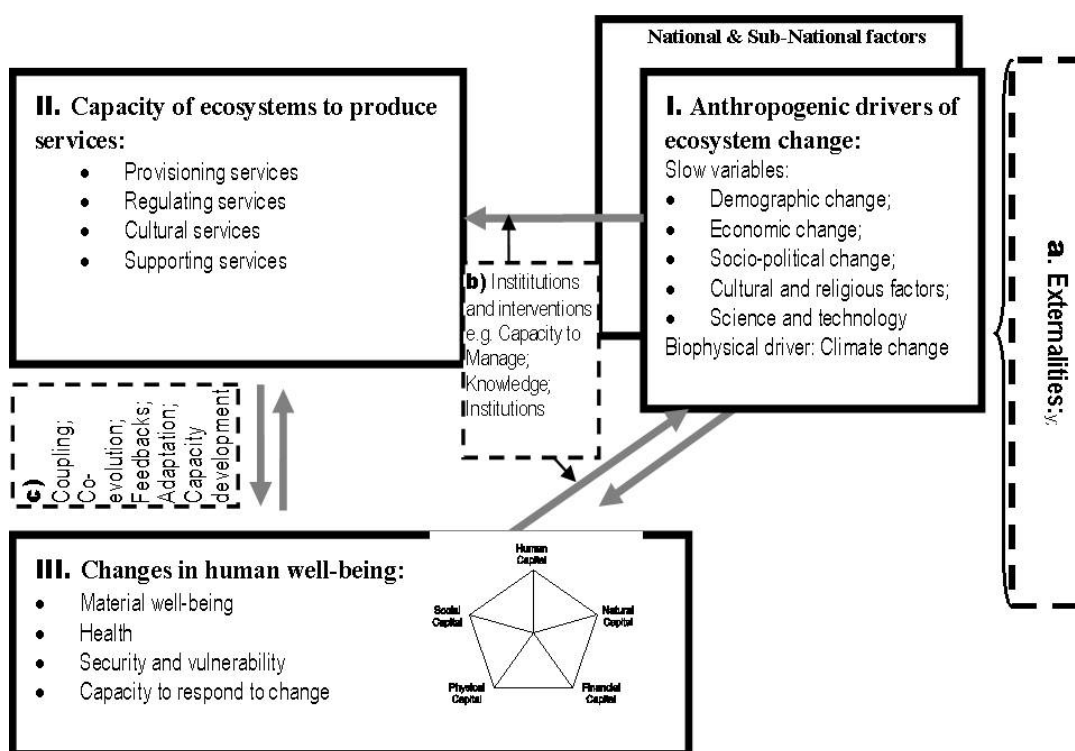


Figure 1: Overall conceptual framework for CEPsA team

The environmental externalities component (Box a) assesses the external factors such as mean annual rainfall and variability; evapotranspiration; available nutrients from the underlying substrate; physical geography such as coastlines, lakes and rivers, and topography; and land availability.

The anthropogenic drivers (Box I) represent the underlying causes of ecosystem change, i.e. demographic factors; macro-economic issues; social and political interventions; land and resource access issues; cultural factors; and the application of science and technology. These are mostly 'slow variables' which cause gradual changes to the system until a threshold is reached, where the system changes to a different stable state which can be either more or less productive. It is postulated that resilient systems take a longer time to reach a threshold than systems with low resilience. Not only do these drivers operate at several spatial scales, from local (at the level of household or a village) to national and global levels, but they also influence the capacity of ecosystems to produce services (Box II).

Ecosystem services and human well-being (Box III) are coupled through feedbacks and have co-evolved through mutual adaptations. The constituents of human well-being are material well-being, health, security and freedom, and the *capacity* to respond to change, shocks and surprise. They also include access to natural, physical, human, financial and social capital, depicted as an 'asset pentagon' in Box III.

Policy and institutional factors (Boxes b and c) mitigate the intensity of interactions between the drivers, ecosystem services and human well-being. They are strongly influenced by prices and incentives, legal and regulatory systems (including resource tenure regimes), management institutions, and knowledge systems.

The framework focuses on management strategies and practices that aim to enhance the capacities of ecosystems to provide services on an ecologically and economically sustainable basis. These may operate at the international or national levels (conventions, policies, laws and regulations), the community level (common pool resources management, by-laws, customary grazing rights, etc.), or the household level (strategies to manage soil fertility, livestock management practices, water harvesting, etc.).

The integrative themes of this framework include:

- The vulnerability of the poor to changes in the availability of essential ecosystem services
- The inevitability of trade-offs in policy and management options that affect the supply of different ecosystem services relative to one another.
- The complexity of the relationship(s) between people and ecosystems, and the fact that these relationships are dynamic.
- Factors, at multiple scales, in isolation and in synergy, that are driving changes in the capacity of ecosystems to deliver services.
- Evidence of thresholds having been crossed in the capacity of ecosystems to deliver specified services.

2. Typology of ecosystem services

For the purposes of this study we adopted the MA (2005a) typology of ecosystem services, which includes:

Table 2: Classification of ecosystems services

TYPE OF SERVICE	DESCRIPTION	EXAMPLES
Provisioning	Products or goods obtained from ecosystems	Water Protein and starch Fodder Fuelwood

		Medicinal plants
Regulating	benefits obtained from regulation of ecosystem processes/ buffering capacity of ecosystem services	Water regulation & flood control Drought mitigation Disease regulation
Supporting	services necessary for the production and delivery of other ecosystem services	Biodiversity Maintenance of soil fertility
Cultural	non-material and enriching benefits	Spiritual and social Educational Recreation & tourism

Some services, such as biodiversity, can fit into more than one category. Biodiversity is a necessary condition for ecosystems to function and thus can be classified as a *supporting* service (UNEP-WCMC 2007). However, in many instances, biodiversity is also listed as a *provisioning* service, since the diversity of species that make up 'biodiversity' supply a wide range of important natural products (crops, wild foods, building materials, etc.) and genetic resources (land races, varieties, etc.), while the maintenance of biodiversity, particularly at a landscape level, can be thought of as a *regulating* service. Biodiversity is also often classified as a *cultural* service because of its importance for nature-based tourism, and its significance to traditional cultural beliefs.

Many services across categories are also closely linked and interdependent, for example the provision of clean water may depend on the water purification service provided by wetlands. Indeed, many provisioning services are highly influenced by the state of regulating services. The reverse is also true, in that overexploitation of ecosystem goods (provisioning services) can have negative impacts on the regulating services that maintain water, soil and air quality. This makes it difficult to discuss and assess the importance of any single service in isolation from others. Furthermore, because of the links that exist between services, actions directed at improving one service often have synergistic effects on other services, e.g. the protection of natural forests for biodiversity can also reduce carbon emissions and regulate water supply (MA 2005a).

3 Poverty and human well-being

Based on the multi-dimensional nature of poverty, poverty alleviation is framed as an increase in *security*, *opportunity* and *empowerment*, which conversely are lost when poverty deepens (DFID, 2002). Each contributes to the alleviation of poverty because:

- *security* enables poor people to withstand shocks and stresses that may otherwise lead to loss of life, well-being or livelihoods;
- *opportunity* provides the means to overcome deprivation, through income generation, use of technology or access to services or resources;
- *empowerment* gives poor people the ability to influence and take control of decisions that affect them.

The *capacity to adapt* to change is an underlying factor which determines people's ability to respond to change, as well as the ability of the ecosystem to self-organise.

Poverty, in its broadest sense, may be defined as:

The pronounced deprivation of well-being related to a lack of material income or consumption (the conventional measures of poverty), low levels of education and health, poor nutrition and low food security, high levels of vulnerability and exposure to risk, and a profound lack of opportunity to be heard (Chambers 1988, World Bank 2000, Sunderlin *et al.* 2004).

This definition of poverty recognises that poor people's concerns go beyond just adequate income to include aspects of security, capability, independence, choice, health and well-being, social and economic inclusion and the ability to devise appropriate coping strategies when faced with shocks and crises. Recognising that simplistic econometric measures of poverty are insufficient, the MA noted that the ways in which poverty is experienced and expressed depends on specific contexts and situations, and reflects "local physical, social, and personal factors such as geography, environment, age, gender, and culture" (MA 2003a: 22). Going further, it is also clear that narrow economic conceptions of poverty – and even the MA's explication – ultimately place an inordinate proportion of the burden of poverty on the fragile shoulders of poor individuals and households themselves, thereby directing attention away from rights-based approaches that stress political activism and collective organisation around poverty eradication. These last-mentioned approaches lay greater emphasis on the multifarious roles of local institutions, national governments, international agencies and the weight of the market economy in the production and reproduction of poverty at all scales (see Hickey & Bracking 2005).

A closely related concept, vulnerability is both a condition and determinant of poverty (IUCN *et al.* 2003). Vulnerability encompasses aspects of both exposure to risk (harmful livelihood impacts) and the lack of capacity or capability to respond to its consequences (Wieggers *et al.* 2006). The high rates of HIV/AIDS infection in one part of the study area, namely southern Africa, add considerably to the vulnerability context with which poor people have to contend. Living with risk is a part of daily life for poor people. However, a shock can send the very poor on a downward spiral into deeper poverty from which it becomes increasingly difficult to escape (Baulch & Hoddinott 2000). This is in contrast to more resilient individuals and households which have the ability to either avoid adverse impacts on their well-being or to recover more quickly from shocks.

Recent studies designed specifically to explore the links between ecosystems and the welfare of the poor have favoured a focus on various constituents or determinants of human well-being, which as a concept is taken as broader than poverty (Table 3). These studies show a large degree of *complementarity* between all the constituents listed. For example, access to clean water contributes to the ability to remain free from disease. Thus addressing one constituent is likely to provide synergies for achieving others (UNEP/IISD 2004).

Table 3: Concepts and constituents of human well-being (conversely poverty can be defined as a lack of adequate access to these constituents)

Instrumental freedoms of Sen's capabilities approach (Sen 1999)	Millennium Ecosystem Assessment (MA 2005a)	Human well-being, poverty and ecosystem services: Exploring the links (UNEP/IISD 2004)
<ul style="list-style-type: none"> ▶ Participative freedom - ability to participate in decisions through such institutions as free speech and democratic elections ▶ Protective security - safety nets against adverse effects of disasters ▶ Economic facilities - ability to participate in trade and production ▶ Social opportunities - 	<ul style="list-style-type: none"> ▶ Material minimum for a good life (adequate livelihoods, sufficient food, shelter, access to goods) ▶ Health (strength, feeling well, access to clean air and water) ▶ Good social relations (social cohesion, mutual respect, ability to help others) ▶ Security (personal safety, secure resource) 	<ul style="list-style-type: none"> ▶ Ability to be nourished ▶ Ability to be free from avoidable disease ▶ Ability to make a livelihood ▶ Ability to live in an environmentally safe shelter ▶ Ability to access adequate clean water ▶ Ability to have clean air ▶ Ability to have energy to keep warm and cook ▶ Ability to use traditional medicine

<p>ability to access education and health services</p> <p>► Transparency guarantees - culture of openness and trust</p>	<p>access, security from disasters)</p> <p>► Freedom and choice (opportunity to be able to achieve what an individual values doing and being)</p>	<p>► Ability to continue using natural elements found in ecosystems for traditional spiritual and cultural purposes</p> <p>► Ability to cope with extreme natural events</p> <p>► Ability to make sustainable management decisions that respect natural resources and enable the achievement of a sustainable income stream</p>
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We recognise that complex power and political economic considerations are implicated in the global configuration, distribution and, indeed, in the conceptualisation of poverty (Hickey & Bracking 2005). We also recognise that while poverty is always and universally debilitating and an affront to our common humanity, it is also multi-dimensional in its constituents and is experienced differently by differently-situated peoples (Hulme & Shepherd 2003). While acknowledging these realities, we have retained the focus on the linkages between poverty and ecosystem services in our analysis. This does not mean that we are deaf to the criticisms voiced by some interviewees (during the in-country consultations conducted as part of this situation analysis) regarding the fundamental, structural inequalities that are continuously recreated – many would argue produced - by the workings of present world order (as represented by *inter alia* studies of this nature). Rather, as researchers and knowledge managers, we feel that we are best placed to make our modest contribution to reversing both the state of ecosystem decline and the alleviation of poverty through knowledge generation, sharing and dissemination concerning the linkages between these two major contemporary issues.