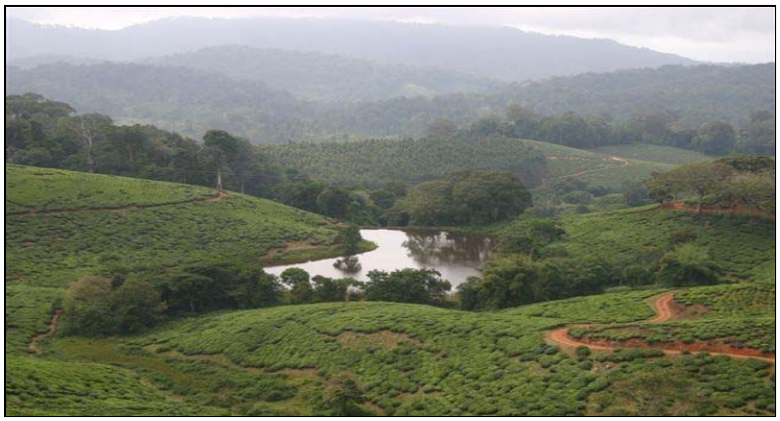

INTEGRATED ECOSYSTEMS ASSESSMENT IN TANZANIA:
Experiences in Ecosystems Management

NATIONAL ENVIRONMENT MANAGEMENT COUNCIL
(NEMC)

Disclaimer

The views presented in this report are those of authors of the papers and workshop participants and in no way should they be construed as views of the National Environment Management Council (NEMC)

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PREFACE

The five days Workshop on Ecosystems Assessment was organised by the National Environment Management Council (NEMC), with the support of the UNDP-funded Poverty-Environment Management programme and United Nations Environment Programme (UNEP) through Poverty-Environment Initiatives (PEI) programme. The objective of the workshop was to raise awareness on the concept of integrated ecosystems approach, using the Millennium Ecosystem Assessment (MA) and Southern African Millennium Ecosystem Assessment (SAfMA) methodological approach. It also aimed at exchange of information and experience from different ecosystems in Tanzania through presentations made by commissioned experts.

The workshop drew participants from stakeholder institutions that are actively involved in the conservation of some of the key ecosystems in the country. The first three days covered the key findings from the MA and SAfMA, the link between these, the Environmental Management Act (EMA) No. 20 of 2004 and the National Strategy for Growth and Reduction of Poverty (NSGRP or *MKUKUTA*). Papers that were presented highlighted the status and experiences gained from conservation activities carried out in various ecosystems such as mountains coastal, wetlands, marine, drylands and shared/transboundary ecosystems. Presentations also provided an opportunity for participants to learn about ecosystem characteristics, functioning, values and existing opportunities for livelihoods, threats and restoration approaches.

The last two days were devoted to a field visit to Amani Nature Reserve, which is part of the Eastern Usambara Mountains Forest Ecosystem. Participants had a chance to get a practical understanding of the integrated ecosystem approach. For example, they had an opportunity to see the Derema wildlife corridor, which is currently managed by the Amani Nature Reserve Authorities, butterfly farming, a tea estate, privately and community managed forests within the reserve. Participants also visited Sakale village to see the environmental impact of artisanal gold mining and discussed with the villagers on their role in the conservation of the reserve.

Workshop participants charted the way forward and identified some of the criteria that will be used for assessing ecosystems. Decided that the criteria be discussed by a panel of experts for further analysis. The highest priority was accorded to the Mountain Ecosystems, as highlighted in the EMA No. 20 of 2004.

This report provides only a summary of the papers and issues raised during the discussions as well as the proposed way forward in ecosystems management in Tanzania. Readers are advised to access the full proceedings that will include the peer reviewed papers in a publication that will be issued as a NEMC Technical Report.

ABBREVIATIONS AND ACRONYMS

ACWM	African College of Wildlife Management
AIDS	Acquired Immunity Deficiency Syndrome
ALEF	African Lakes Environmental Facility
CBD	Convention on Biological Diversity
CBO	Community Based Organisation
DFID	Department for International Development
EAC	East African Community
EAMs	Eastern Arc Mountains
EC	Electrical Conductivity
EMA	Environmental Management Act (No 20 of 2004)
EUTCO	East Usambara Tea Company
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GIS	Geographical Information Systems
HASHI	Hifadhi Ardhi Shinyanga
HIV	Human Immunal-Deficiency Virus
JECA	Jozani Environmental Conservation Association
LTBP	Lake Tanganyika Biodiversity Project
LTMPP	Lake Tanganyika Management Planning Project
LVEMP	Lake Victoria Environmental Management Project
MA	Millennium Ecosystem Assessment
MBCA	Menai Bay Conservation Area
MDGs	Millennium Development Goals
MEAs	Multilateral Environmental Agreements
MKUKUTA	Mkakati wa Kukuza Uchumi na Kuondoa Umaskini Tanzania
NAFCO	National Agriculture and Food Corporation
NAFRAC	National Forestry Research and Agroforestry Centre
NBI	Nile Basin Initiatives
NEMA	National Environment Management Authority
NGO	Non Governmental Organisation
NEMC	National Environment Management Council
NSGRP	National Strategy for Growth and Reduction of Poverty
PEAP	Poverty Eradication Action Plan
RIDEP	Regional Development Programme
SADC	Southern African Development Community
SAfMA	Southern African Millennium Ecosystem Assessment
SWAP	Sector Wide Approach
TANESCO	Tanzania Electrical Supply Company
TPRI	Tropical Pestcides Research Institute
UN	United Nations
UNDP	United Nations Development Programme
VCC	Village Conservation Committee
WCPA	World Commission on Protected Areas
WCST	Wildlife Conservation Society of Tanzania
WWF	World Wide Fund for Nature

1. INTRODUCTION

Tanzania is endowed with a number of biological and other natural resources, which among others; include forests, water, minerals, fish, wildlife and soils. Such resources are of paramount importance to the existence of ecosystems that range from wetlands, marine to highlands or mountain ecosystems. These ecosystems support the livelihoods of a majority of Tanzanians and the country's economy in general. They provide goods and services which include food, water, medicine, biological diversity as well as raw materials to industries. Indeed, they are very vital for socio-economic development.

Utilisation of the ecosystems' goods and services has been steadily increasing due to population growth as demand exceeds ecosystems' capacity to supply them, which has created much pressure on the ecosystems and hence, threats on their existence. Since ecosystems are cross sectoral in nature, there is a need for effective management strategies so as to enhance their sustainability. A holistic approach is therefore needed to identify the values, needs and threats, and to suggest appropriate and effective management interventions.

In the initiatives to conserve the environment and also implement her responsibilities as per the Environmental Management Act, No. 20 of 2004, the National Environment Management Council (NEMC) organised a workshop (June 27th – July 01st, 2005) on Integrated Ecosystems Assessment in Tanga. This workshop was supported by UNDP through Poverty-Environment Management Programme and UNEP through her Poverty-Environment Initiatives programme. Specifically, the workshop objectives included the following: (i) To learn from Millennium Ecosystem Assessment findings (ii) To agree on criteria for identifying critical ecosystems (iii) To agree on methodology for ecosystem assessment (iv) To formulate strategies for improving livelihoods of communities adjacent to critical ecosystems.

This report highlights the key findings that emanated from discussions that took place during the workshop. The information provided is based on the papers presented and issues raised by the workshop participants. A way forward on what should be done next was also agreed upon.

2. PARTICIPATION

Participation in the workshop was by invitation, and almost all that were invited attended the workshop. Workshop participants included experts from the University of Dar es Salaam, Sokoine University of Agriculture, Division of Environment and Poverty Eradication in the Vice President's Office, Ministry of Natural Resources and Tourism, African College of Wildlife Management Mweka (ACWM), World Wide Fund for Nature (WWF), Tropical Pestcides Research Institute (TPRI), Zanzibar Departments of Fisheries and Forestry, Wildlife Conservation Society of Tanzania (WCST), National Environment Management Council (NEMC), National Forestry Research and Agroforestry Centre (NAFRAC), and National Environmental Management Authority (NEMA) and Minstry of Finance of Uganda. A resource person was invited from the University of Pretoria in South Africa to

make presentations on the Southern Africa Millennium Ecosystem Assessment (SAfMA) which was part of the global Millennium Ecosystem Assessment (MA) (see appendix 2).

SECTION 1

3. OPENING REMARKS

A representative of the National Environment Management Council (NEMC), the host institution welcomed the participants to the workshop and to Tanga region which is endowed with abundant natural resources, ranging from marine to forest resources, found in the cool mountains of Usambara which forms part of the Eastern Arc Mountains. He particularly thanked the Senior Permanent Secretary for coming to Tanga to officiate at the workshop, which shows the high importance he attaches to environmental matters especially issues of ecosystem assessment and/or management.

He informed the participants that the workshop is intended to raise awareness on the importance of having an integrated approach in ecosystems assessment, management, as well as acquainting ourselves with the requirements of the recently passed National Environmental Management Act No 20 of 2004. As stipulated in the Act, NEMC has been assigned a very significant role of planning for and management of environmental protected areas, many of which would be critical ecosystems. It is therefore pertinent that the Council collaborates with other stakeholders who are involved in the science of conservation and management of ecosystems at the local, national and global levels to be able to implement the provisions of the Act.

One of the workshop presentations will be the highlights of the Millennium Ecosystem Assessment, focusing on the Southern African Region. This will be presented by a representative of the Southern African Millennium Ecosystem Assessment (SAfMA) who has been invited from South Africa, Ms. Erin Bohensky. He recognised the presence of Prof. Maro who apart from being the Facilitator of this workshop also contributed in the preparation of the Millennium Ecosystem Assessment report; as well as Prof. Misana who is the President of the African Mountains Association, a professional body that takes high interest in the state of mountain ecosystems.

He further informed that there will also be other presentations from participants representing key ecosystems of our country, which include among others, the Eastern Arc Mountains, the Lake Tanganyika ecosystem, which is shared by four countries, marine ecosystems and dryland ecosystems that have been restored. Presentations will focus on the characteristics and values of these representative ecosystems, threats, restoration approaches and how communities interact, benefit from and participate in their conservation. Participants will also get first hand experience of how different components of the ecosystem function by visiting the Amani Nature/Biosphere Reserve, which is part of the Eastern Arc Mountains. They will see phenomenal aspects of ecosystem fragmentation, impacts of artisanal mining within the reserve, community participation in conservation issues, water sources as well as butterfly farming as a strategy to reduce poverty.

The host later introduced the representatives from Uganda who had come to share experience with us as neighbours, considering that we have a vested interest to manage and sustain the shared ecosystems of Lake Victoria and the Minziro-Sango Bay Ground Water Forest Ecosystems. NEMC board members and representatives from Zanzibar were also introduced. The Senior Permanent Secretary was then invited to open the workshop

4. OPENING SPEECH

The Senior Permanent Secretary in the Vice President's Office, Mr. Raphael Mollel opened the workshop.

Mr. Mollel stated that Tanzania is endowed with great richness of biological and physical resources that support the livelihoods of the majority of her citizens and that the resources are managed by a variety of stakeholders, particularly local communities. The country's wildlife resources are among the richest in the world, and the protected areas network covers more than 35% of the total land area. There are also a significant number of fauna and flora species that are endemic to Tanzania.

Earnings from tourism which is mainly wildlife and mountain ecosystem dependent accounts for 6% of GDP, and when the direct and indirect benefits were combined, the sector's contribution was 12.4% in 1999. Sound management of such ecosystems is therefore of paramount importance for economic growth and improvement of the livelihoods of the surrounding communities.

There are also a variety of wetlands and mountain ecosystems which support livelihoods of a significant number of people in both rural and urban settings through provision of food, building materials, medicines and income. Furthermore, some of these ecosystems play a significant role in mitigating the impacts of climate change and pollution buffering processes. They are therefore important for economic growth and reducing income and non-income poverty in the country as stipulated in the **National Strategy for Growth and Reduction of Poverty,** popularly known in Kiswahili as **MKUKUTA.**

Many of these ecosystems are managed as national parks, forest conservation areas, nature and biosphere reserves, game reserves and marine reserves. However, there are others that are not under any form of protection.

This workshop aims at raising awareness on the integrated approach of assessing ecosystems and sharing knowledge and experience with the view of coming up with sound management plans that will contribute to attaining sustainable ecosystems management in the country. Tanzania being a mega biodiverse country, is obviously anxious to know the place it occupies in the Millennium Ecosystem Assessment Report. The information to be shared from this global project should help us to understand better our own ecosystems, threats, values and their general scientific assessment approaches.

He expected that one of the outputs of this workshop was to come up with sound criteria that will be used to identify critical ecosystems for the development of management plans for their sustainability. This is extremely important as it will help the country achieve one of the Millennium Development Goals of environmental sustainability; as well as achieving a major legal requirement under the Environmental Management Act No. 20 of 2004 on the need to identify, plan for and manage environmental protected areas, many of which may fall within the purview of critical ecosystems or environmental sensitive areas.

Ecosystems in the country have been subjected to various forms of destruction, many of which are anthropogenically induced, consequently establishing non-sustainable trends. Among these are: unsustainable and/or over utilization patterns, littering, illegal artisanal mining, infrastructure development and agricultural expansion into protected areas.

These trends are attributed to various reasons, among which are pressure from demographic changes, inadequate management capacity, inadequate institutional coordination, inadequate participation of key stakeholders and low level of awareness on the importance of some ecosystems such as wetland systems found in urban areas.

Mr. Mollel pointed out that the Government has however undertaken a number of initiatives to address the situation. These include developing sectoral policies and legislations, action plans and strategies that are conservation oriented. These policies aim at among other things, to conserve and enhance our natural heritage, so as to meet the needs of the communities whose livelihood is directly linked with the ecosystems and resource use.

It is in this context that the Government initiated participatory frameworks in fisheries, forestry and wildlife sectors, that is, Collaborative Fisheries Management Areas; Joint Forestry Management and Wildlife Management Areas, respectively. Similar approaches are also promoted by the Water Sector, i.e. Water Users Associations.

Among the key policies is the National Environmental Policy of 1997, which provides a framework for mainstreaming environmental issues in the decision making process at all levels of society. The overall objective of the policy is to prevent and control degradation of land, water, renewable biotic resources, and air as well as promoting sustainable use. The policy has identified six major environmental problems that need urgent attention. These include land degradation, deforestation, deterioration of aquatic systems, lack of accessible good quality water, loss of wildlife habitats and biodiversity, and environmental pollution, all of which have relevance to the context and scope of integrated ecosystems assessment.

The National Environmental Management Act No. 20 of 2004 provides a legal and institutional framework necessary for coordinating environmental activities across sectors taking into cosideration accountability and the role of individual citizens.

The Act provides an opportunity for establishing environmental protected areas out of critically sensitive habitats that are not under any form of protection; and to develop management and monitoring plans for such areas once declared so. The areas include threatened mountains, coastal habitats, riverbanks and indigenous forests. Furthermore, threatened wetlands as well as areas condemned to environmental abuse could as well be recategorized as areas in need of special protection. It is in this context that the workshop is expected to come up with criteria that can be used in the country to identify critically sensitive areas for better management including rational utilization of existing resources as well as restoration plans for those in degraded state. This will also help to meet the challenge of making an inventory of ecosystems that are under threat, especially mountain ecosystems, which is now a legal requirement under the law.

To achieve the intended goal of ecosystems sustainability, reseach plays a key role. Mr Mollel wished to underscore one of the MKUKUTA goals that emphasizes on the importance of social well being and quality of life. This goal targets the conservation of natural resources and ecosystems that people depend upon for their livelihoods, reduction of loss of biodiversity and reduced vulnerability to environmental disasters. The implication of this is that, interventions will definitely require building capacity at different levels including research to achieve such a goal. Hence, a workshop of this nature should definitely help to determine the necessary ingredients for achieving this MKUKUTA goal.

He also wished to restate the importance of the workshop in overall implementation of the national environmental policies and their enabling legislations. His advice was that the Tanga workshop should not be the only time when ecosystem issues are discussed in such a forum. The expectation is to see that the intended outputs help to refocus our conservation approach in the field, especially where we also want to ensure ecosystems contribute to growth and reduction of poverty for the communities which have inextricably existed with them.

Mr. Mollel thanked UNDP for the financial support for the workshop, UNEP and SafMA for their technical support, and Uganda for sending two participants to the workshop, and declared the workshop officially opened.

5. MKUKUTA AND ECOSYSTEMS MANAGEMENT

The National Strategy for Growth and Reduction of Poverty (NSGRP), in Kiswahili Mkakati wa Kukuza Uchumi na Kuondoa Umaskini Tanzania (MKUKUTA), which was prepared after extensive consultations, with a name change reflecting national ownership, direction and focus, is a five year framework successor to the Poverty Reduction Strategy (PRS). MKUKUTA focuses on growth and governance, mainstreams cross-cutting issues, demands cross-sectoral collaboration, its outcomes focus and integrates the MDGs, and has a very strong link to the budget process.

MKUKUTA's aim is to stimulate growth and reduce poverty and its framework has three clusters: growth and reduction of income poverty, whose broad outcome is that broad based and equitable growth is achieved and sustained; quality of life and social well-being, with the broad outcomes

that the quality of life and social well-being of the poorest and most vulnerable groups is improved, and inequalities in outcomes across geographic and social economic groups is reduced; and Governance and accountability, whose broad outcomes include peace, political stability, national unity and social cohesion, democracy and political and social tolerance, good governance and the rule of law, and accountability of leaders and public servants. Under each cluster there is a set of goals and under each goal there are targets, interventions to achieve the targets and identification of actors.

- The goals of the cluster on growth and reduction of income poverty include: ensuring sound economic management; improving food availability, accessibility and nutrition at household level, with focus on food security needs of children and women, in urban and rural areas; reducing income poverty of both men and women in urban and rural areas; and provision of reliable and affordable energy to consumers.

- Under the cluster on improvement of quality of life and social well being, the goals of MKUKUTA are: equitable access for boys and girls to primary and secondary education, universal literacy among men and women, and expansion of higher, technical and vocational education; improved health and well being of all children, women, especially vulnerable groups by reducing infant, child and maternal mortality and malnutrition, and increased HIV/AIDS prevention/treatment; all men, women and children have access to affordable and safe water, sanitation, decent shelter, and a safe and sustainable environment, and reduced vulnerability from environmental risk; social protection and delivery of rights to the most vulnerable and needy groups with basic needs and services; and effective systems for universal access to quality and affordable public services.

- Governance and accountability goals of MKUKUTA are: improving personal security and absence of crime; reducing political/social exclusion and intolerance; representative, accountable and inclusive systems of democratic governance and rule of law; protecting and promoting rights of the poor and excluded in the justice system; ensuring equitable allocation of public resources and effective control of corruption; and ensuring effective public service framework to improve service delivery.

Out of the total number of 108 MKUKUTA targets, 15 are direct and another 5 are indirect environmental targets. Examples of environmental targets include: reduced negative impacts on environment and peoples' livelihoods; increased contributions to rural incomes from wildlife, forestry, and fisheries, reduction in land degradation and biodiversity loss; natural resources and ecosystems that people depend upon for production and reproduction conserved; reduction in harmful industrial and agricultural effluents; 95% of people access to basic sanitation by 2010; and reduced vulnerability to environmental disasters.

Some examples of environmentally related interventions under environment and non-environment targets follow. Goal 2 is sustainable and broad based growth promoted, and under the target of reduced negative impacts on environment and peoples' livelihood, the interventions are to

promote actions that incorporate environmental protection measures in plans and strategies, and to develop action plans for implementation of Environmental Management Act No. 20 of 2004. The second target under this goal is to increase growth rate for livestock sub sector from 2.7% in 2000/01 to 9% by 2010. Interventions include promotion of efficient utilization of rangelands and empower pastoral institutions, for improved livestock productivity. The second intervention is to promote pastoralism as a sustainable livelihood system. Goal number 4 in Cluster 1 is to substantially reduce rural income poverty of both men and women. The target is increased contributions from wildlife, forestry, and fisheries, to incomes of rural communities. The interventions include: develop programmes for increased local control/earnings in wildlife management areas, establish locally managed natural resources funds, using traditional knowledge; scale up participatory forest management in all districts, as a mechanism for increasing income of rural communities from natural resources; and harmonize natural resources sector policies and strategies, remove conflicts in laws and regulations, and implement community based natural resources management programmes.

Under Cluster II, goal 3 is on increased access to clean, affordable and safe water, sanitation, decent shelter, and a safe and sustainable environment, and thereby, reduced vulnerability from environmental risk. The target is reduced water pollution levels from 20% in 2003 to 10% in 2010, and all schools to have adequate sanitary facilities by 2010. The interventions include implementation of pollution control, occupational health and safety standards and environmental management as specified under sectoral guidelines and the Environmental Management Act; implementation of national environmental education strategy with focus to increase awareness on issues of health and environmental risks; and ensure adequate sanitation facilities at all public institutions –schools, health centres, markets and public places, including access for the disabled.

Other targets in goal 3 under Cluster II are: reduced vulnerability to environmental disasters; natural resources and ecosystems that people depend upon for production and reproduction conserved; reduction in land degradation and loss of biodiversity. Interventions to achieve the targets include improved land management and adoption of water conservation technologies and implementation of national plans under Multilateral Environmental agreements (MEAs) to halt desertification and land degradation, and restore degraded lands; build capacity of local government authorities and NEMC to manage natural ecosystems and protect resources from undue negative impacts through the implementation of natural resources plans; implementation of mechanisms and policies to mitigate against environmental disasters such as flooding, drought and refugee influx, and put in place post disaster actions.

Another example is goal 3 in Cluster III, which is to ensure that structures and systems of governance as well as the rule of law are democratic, participatory, representative, accountable and inclusive. The target is to ensure representative, inclusive (poor and vulnerable groups) and accountable governance institutions are operating at all levels. Interventions include enforcing and harmonizing policies and laws relevant to land and natural resources utilization and management, and surveying all village and urban lands and issuing them with certificates; strengthening security of tenure of demarcated village lands held communally or individually, and

removing conflicting provisions in laws that manage sectors such as mining, pastoral activities and wildlife.

There is direct relationship between MKUKUTA and ecosystems as economic growth and peoples' livelihoods depend on ecosystems, for example, direct use of ecosystems in agriculture and fisheries or indirect use as in tourism, provision of energy and water, and the negative impacts of pollution increase, loss of biodiversity and land degradation. The relationship is experienced in health and vulnerability, i.e., clean water, access to traditional herbs and medicines, maintenance of ecosystems to reduce environmental risks, implementation actions under MEAs including Convention on Biological Diversity (CBD), Convention to Combat Desertification (CCD) and Framework Convention on Climate Change (UNFCCC). The relationship is also seen in governance, particularly community access and control, secure tenure, participation in decision making, and tackling corruption. In mainstreaming, the relationship between MKUKUTA and ecosystems is also demonstrated when integrating environment into plans and budgets, link to strategic environmental assessment, and in preparing district and sector plans.

What criteria should be used to identify a critical ecosystem and from whose perspective? The criteria may include the biodiversity/economic values, threatened species/livelihoods, services such as water and energy and spiritual and cultural values. An ecosystem can be critical from the perspectives of the local community, the scientist, politician, economist, international NGO and the public servant.

Environment therefore has been integrated as a cross-cutting issue in the MKUKUTA and this provides an opportunity to move towards sustainable development.

6. THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT No. 20 (2004) AND ECOSYSTEMS MANAGEMENT IN TANZANIA

Tanzania has a variety of ecosystems of economic, ecological, social, scientific and aesthetic importance. Many of the ecosystems are cross-sectoral, for example wetland ecosystems which fall under the sectors of water, agriculture, forestry, wildlife and fisheries. The sectors involved have to work together, and interventions have to follow an ecosystem approach to maintain integrity. Other ecosystems such as mountains, lakes, rivers and national parks traverse across national boundaries and therefore need regional cooperation in their management. The different ecosystems have been subjected to a variety of human destructive activities including heavy pressure from agricultural expansion, overgrazing, settlements especially in the wildlife corridors, wildfires and overexploitation. The result is declining soil fertility, reduced water flow and loss of biological diversity, all of which have impacts on poverty.

In response to the problems facing the ecosystems, government has taken initiatives and measures aimed at conserving and protecting the ecosystems, including formulating policies, action plans and legislations that are conservation oriented. Examples of such initiatives include the National Environmental Policy, Forestry Policy, Wildlife Policy, National Forest Programme, Integrated

Coastal Zone Management Strategy, Agricultural Sector Development Strategy, Forestry Management Act (2002), and the Environmental Management Act (2004).

Ecosystem management has faced problems of degradation and over utilization; for instance, mountain ecosystems that have high endemism and catchment value but are not protected under the law; inadequate technical capacity to undertake effective integrated pollution prevention and control; lack of institutional mechanisms for collection, analysis and dissemination of data and information for management. However, environmental research has not been given priority as a source of data and information; and there has therefore been little understanding of the state of the environment and ecosystems.

The National Environmental Management Act (EMA) No. 20 of 2004 seeks to provide for legal and institutional framework for sustainable management of the environment, prevention and control of pollution, environmental quality standards, public participation and a basis for the implementation of international instruments on the environment. The Act gives due recognition to ecosystem issues and management in the following sections selected as examples. Section 18 of the Act gives NEMC the mandate of carrying out survey which will assist in the proper management and conservation of the environment, to undertake and coordinate research, investigation and survey in the field of environment, collect and disseminate information about the findings of such research, investigation or survey and publish and disseminate manuals, codes, guidelines relating to environmental management and prevention or abatement of environmental degradation.

Section 47 of the Act gives power to the minister responsible for environment the mandate to declare any area of land that is ecologically fragile or sensitive as an environmental protected area. Section 48 gives the mandate of facilitating the carrying out of scientific research to developing environmental protection and ecosystem management plan for environmental protected areas. Section 55 provides the mandate of issuing guidelines and prescribing measures for the protection of riverbanks, rivers, lakes and lake shores. Section 58 gives the mandate to identify and protect mountains, hills and landscapes which are at risk from environmental degradation. Section 177 of the Act gives the mandate to conduct surveys on the state of the environment and to research and make forecast on the environmental changes and other studies that may contribute to the formulation of policies and preparation of action plans and strategies with regard to environmental conservation and management.

EMA (2004) is in line with the East African Cooperation (EAC) Treaty on the Environment and Natural Resources. The EAC Treaty among other things gives due recognition of ecosystems and the importance of research in environmental management. Section (2) of Article 112 of the Treaty calls for the partner states to adopt environmentally sound management techniques to the control of land degradation, such as soil erosion, desertification and forest encroachment, all of which have direct relevance to the maintenance of ecosystems.

The criteria for identifying and declaring environmental protected areas include:

- High endemism - ecosystems with a good number of endemic species
- Level or status of degradation – ecosystems which are highly degraded, heavily polluted or heavily harvested need to be protected to allow speedy recovery
- Level of community dependency – most ecosystems support communities, providing them not only with wood and non wood products, but they are also important watershed systems. Therefore, protecting these systems will help to maintain the supply of goods and services.

It is clear that there is lack of information about the existing ecosystems. This information gap can easily be solved by undertaking more studies and research to produce reliable information for decision making and to facilitate in the development of sound conservation plans and programmes. Since most of the ecosystems are either cross-sectoral and or trans-boundary, there is a need to strengthen institutional collaboration and international partnership taking into account both ecological and economic relationships at both national and global scales.

There is a need therefore to define specific criteria for prioritizing areas to qualify as environmental protected areas and methodology for preparing their inventory.

SECTION 2: MILLENNIUM ECOSYSTEM ASSESSMENT

7. THE MILLENNIUM ECOSYSTEM ASSESSMENT: OVERVIEW AND RELEVANCE TO TANZANIA

Human demand for ecosystem services is growing very quickly around the world, and despite the knowledge of the increasing demand and diminishing or endangered supply, science is not being effectively brought to bear on these challenges. Existing mechanisms for linking science and policy are highly sectoral while the major problems today are increasingly multi-sectoral; significant issues identified by scientists are not on policy agendas; and new data sources, methodologies and models are underutilized in many countries.

In the integrated ecosystem approach, people are integral part of ecosystems. The approach provides a strategy for integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way. The ecosystem approach focuses on the functional relationships and processes within ecosystems, distribution of benefits that flow from ecosystem services, use of adaptive management practices, the need to carry out management actions at multiple scales, and inter-sectoral cooperation. The ecosystem approach provides a framework for designing and implementing a range of responses: those directly addressing needs, protection and sustainable use of ecosystem services; and those needed to address indirect and direct drivers.

The Millennium Ecosystem Assessment (MA) was an international four-year (2001-2005) effort, the largest assessment of he health of Earth's ecosystems called for by the UN and authorised by governments through the Convention on Biological Diversity, the Convention to Combat Desertification, the Ramsar Convention on Wetlands and the Convention on Migratory Species. The assessment involved many disciplines and partnership of UN agencies, conventions, business and non-governmental organizations, and had a multi-stakeholder board of directors. It was prepared by 1,360 experts from 95 countries, 80- person independent board of review editors, and received comments from 850 experts and governments. The Millennium Ecosystem Assessment assessed existing knowledge on ecosystem services and human well being at multiple scales, from global to local.

The defining features of the MA include: it is demand driven, providing information required by government, business and civil society; it is an assessment of the current state of knowledge, a critical evaluation of information concerning the consequences of ecosystem changes for human well-being, and intended to be used to guide decisions on complex public issues; the authoritative information clarifies where there is broad consensus within the scientific community and where issues remain unresolved. MA is policy relevant, not policy prescriptive. It includes integrated assessment that considers multiple benefits and trade-offs between sectors; multi-scale assessment where findings at any scale will be improved by information and perspectives from other scales; four assessment components and corresponding working groups, i.e., conditions and trends, scenarios, responses, and sub-global assessment.

The benefits people obtain from ecosystem services include provisioning, for example food; regulating (e.g. game and flood regulation); supporting; and cultural services. The focus of the MA was on the consequences of ecosystem change on human well-being. The conceptual framework of MA included human well-being and poverty reduction (basic material for a good life, health, good social relations, security and freedom of choice and action); direct drivers of change (changes in land use, species introduction or removal, technology adoption and use, external inputs, resource consumption, climate change, and natural physical and biological drivers); and indirect drivers of change (demographic, economic, sociopolitical, cultural and religious, and science and technology). The MA conceptual framework captures links between ecosystem services and constituents of well-being, allows explicit analysis of trade-offs among ecosystem services and constituents of well-being, allows explicit analysis of trade-offs among ecosystem services, and analysis of trade-offs among the various constituents of well-being.

MA Findings

The MA findings included the following:

- Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demand for food, fresh water, timber, fiber and fuel. This has resulted in a substantial and largely irreversible loss in life on Earth.

- The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development. But these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people. Unless addressed, this will substantially diminish the benefits that future generations obtain from ecosystems. Degradation of ecosystem services often causes significant harm to human well-being, and represents loss of capital asset. Unfortunately, the loss of wealth due to ecosystem degradation is not reflected in economic accounts. Also the pattern of winners and losers has not been taken into account in management decisions, for example, some of the people affected by changes in ecosystem services are highly vulnerable, and the reliance of the rural poor on ecosystem services is rarely measured and thus typically overlooked in national statistics and poverty measurements.

- The degradation of ecosystem services could grow significantly worse during the first half of this century and is a significant barrier to achieving the Millennium Development Goals. Many of the regions facing the greatest challenges in achieving the 2015 targets coincide with regions facing the greatest problems of ecosystem degradation. Although socioeconomic factors will play a primary role in achieving many of the MDGs, targets are unlikely to be met without improvement in ecosystem management for goals such as poverty reduction, hunger, child mortality, disease, and environmental sustainability including access to water.

- The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services can be partly met under some scenarios that the MA considered but these involve significant changes in politics, institutions and practices that are not currently under way. Many options exist to enhance specific ecosystem services in ways that reduce negative trade-offs or that provide positive synergies with other ecosystem services. Ecosystem degradation can rarely be reversed without actions that address one or more indirect drivers of change: population change (including growth and migration); change in economic activity (including economic growth, disparities in wealth, and trade patterns); sociopolitical factors (ranging from the presence of conflict to public participation in decision making); cultural factors; and technological changes. Collectively these factors influence the level of production and consumption of ecosystem services and the sustainability of production.

The MA findings can be used in different ways:

a) Decision-making and management

- The framework used, particularly the focus on ecosystem services, helps in incorporating the environmental dimensions into sustainable development policy and planning;
- Provides planning and management tools;
- Serves as a benchmark;
- Provides foresight concerning consequences of decisions affecting ecosystems;
- Identifies response options;
- Identifies priorities.

b) Assessment, capacity and research

- Provides a framework and tools for assessment;
- Helps build capacity;
- Guides future research.

The relevance of MA to Tanzania lies in the challenges of mainstreaming environment into the poverty reduction objectives of MKUKUTA, the implementation of the Environmental Management Act No. 20 of 2004, and in the synergistic achievement of environmental management and growth.

MA reports already available include: Human Health Synthesis, Synthesis for the Convention on Biological Diversity, Business and Industry Synthesis, Synthesis for the Convention to Combat Desertification, and Synthesis for the Ramsar Wetlands Convention. Visit the MA website: www.MAweb.org

8. THE SOUTHERN AFRICAN MILLENNIUM ECOSYSTEM ASSESSMENT (SAfMA): OVERVIEW OF METHODOLOGY AND FINDINGS

The Southern African Millennium Ecosystem Assessment (SAfMA) is one of 33 sub-global assessments conducted across the globe using the Millennium Ecosystem Assessment (MA) framework. It aimed to assess the services provided by ecosystems in southern Africa and their

impacts on the lives of people. SAfMA was undertaken at three spatial scales, regional assessment, basin assessment and local assessment. The regional assessment covered Africa south of the Equator, the basin assessment included Gariep and Zambezi basins and the local assessments included Gauteng, Great Fish River, Lesotho Highlands, Richtersveld, and Gorongosa-Marromeu. The SAfMA component studies assessed three core ecosystem services, i.e, food, water and biodiversity as well as additional topics of interest to the stakeholders of each particular study such as wood fuel and cultural services.

Assessment steps included identifying and categorizing ecosystems and ecosystem services; identifying links between ecosystem services and human well being; identifying direct and indirect drivers of change; and selecting indicators. This led to the assessment of current and historical trends of ecosystems, services and drivers, and evaluation of impact on human well being. The final step was to develop scenarios, evaluate response options and analyse and communicate uncertainty. Ecosystem services selected at regional, basin and local levels were water, food, energy, biodiversity, and livestock; while cultural services were selected at regional and local levels and medicinal plants and building materials at local level. Data collected included national databases on land cover/use, water, forestry, biodiversity, agriculture, industry and population. Data on indigenous knowledge was collected at local scale.

Under 'conditions and trends' component of MA, SAfMA assessed freshwater availability and quality, food security, biodiversity intactness, cultural and spiritual services, and nature-based tourism. Intangible services are highly valued by all people, of all income levels and all sectors of society. Sacred sites are protected by traditional customs and practices. Nature-based tourism, including game viewing, hiking, river rafting, and beach holidays, contributes 9% of SADC's GDP and is growing at 15% per annum. It is overtaking traditional harvest-based sectors, and has a large potential remaining.

Scenarios are possible visions of the future, they are not predictions. They are intended to improve understanding of links between ecosystems and human well being and how these may change over time. For example, Gariep Basin scenarios under market forces approach would have strong economy facilitated by national governance framework, but poor wealth distribution, weak local governance, and weak social and environmental policies. Under policy reform approach there would be effective democratic governance, strong, globally-linked economy in a balanced trade regime, significant poverty reduction and substantial investments in health, education and technology sectors. Under the fortress world approach there would be weak and ineffective governance, weak civil society, economic collapse and increasing gap between wealthy and poor, who live, respectively inside and outside the 'fortress'. Under the local resources approach there would be weak national governance, weak economy, strong civil society, community driven resource management and strong reliance on informal sector. The process of developing scenarios is a powerful vehicle for communicating assessment findings and a tool for exploring how people respond to ecological and social change.

Responses are human actions, including policies, strategies and interventions, to address specific issues, needs or problems in different domains. The ways of dealing with problems related to ecosystem services may be technological, institutional/policy-oriented, economic, behavioural or cognitive. We assess responses as part of complex social-ecological systems where response is ongoing across services, sectors and scales; and we assess responses because we need evaluation of successfulness of the responses and what could be done better. SAfMA evaluated responses by reviewing past and current mostly technical and policy measures (Regional and Gariep basin); exploring the future by using scenarios to elicit likely responses (Gorongosa-Marromeu); participatory assessment (Local livelihoods) by identifying coping strategies across three sites; and developed a new framework based on impact, awareness and power.

An example is changing responses in the water sector in South Africa, where past 'command and control' responses favoured farms and industry and not communities or ecosystems. The South African Water act of 1998 emphasizes equity, sustainability and efficiency. It protects minimum needs of the people and of ecosystems, and applies market based allocation. The national legislation is not adequate for ecosystem processes; hence there is devolution to catchments and local levels. Most river basins are shared, so trans-boundary basin authorities are also involved in their management.

Integrated responses are beginning to replace sector-based approaches; they enable a single, coordinated response to satisfy multiple objectives. For example the Multi-agency Working for Water Programme in South Africa creates a synergy between social and environmental goals. This model is being extended to the management of fire and coastal management. Local perspectives are important. Cultural practices represent an important long-term adaptive response to uncertainty at the local level, by regulating the use of the landscape and its resources. Adaptive management, long practiced by local communities, is now being incorporated into formal institutional policies and governance arrangements.

Responses are experiments and provide opportunities to learn and show the need to look at longer temporal scales. Choosing any one response may mean that alternatives are foregone. SAfMA has also shown that there are limited tools and approaches to assess responses.

The SAfMA findings have been disseminated in five reports, TV, radio, magazine and newspaper reports, scientific papers and training materials and courses. The findings also feed into the MA global process.

SECTION 3: CASE STUDIES

9. ASSESSMENT OF FOREST CONDITIONS IN THE EASTERN ARC MOUNTAINS OF TANZANIA

Sustainable forest ecosystem management in Tanzania has become a major concern. As one of the important forest ecosystems in Tanzania, the Eastern Arc Mountain (EAMs) forests are undergoing an accelerated rate of human induced impacts and destruction. There is a need for monitoring changes for effective management. In order to measure changes in the condition of the forest ecosystem, a number of baseline surveys must be established that can be repeated either as a whole or in part. A linked chain of issues forms one of the fundamental parts of this baseline is that of assessing forest disturbance, threats facing the forest, and effectiveness of management of the forest ecosystems. The objective of the study was to assess the condition of the forests of the EAMs as a basis for future management practices. The specific objectives included: assessment of levels of disturbance, identifying types and intensity of threats, and determine the management effectiveness of representative forest reserves.

The Eastern Arc Mountains consist of a chain of ancient crystalline mountains near the Indian Ocean Coast, running from Taita Hills in South-East Kenya to Makambako Gap just to the South-West of the Udzungwa Mountains in Tanzania. There are a series of isolated mountains separated by lowlands. The study sites included twenty five forest reserves and two forests in each of the districts of Mufindi, Kilolo, Ulanga, Kilombero, Kilosa, Mpwapwa, Muheza, Kilindi, Korogwe, Lushoto, Same, Mwanga, and one from Mvomearo district. The EAMs are important for their environmental and ecological values, their life support materials and for hydrology.

Their environmental and ecological values include the fact that they are one of 25 global biodiversity "Hot Spots"; 25% of the EAMs plant species are endemic, i.e. about 60% of all endemic species of Tanzania; the flora is much richer in terms of number of endemics and number of species than equivalent areas of forests outside them from the Horn of Africa to the Cape; carbon storage and emission mitigation is over 500 tonnes per hectare. The EAMs spread over 14 districts mainly in 5 regions of Tanzania. Their biodiversity is therefore of great value to the people living adjacent to them. About 40% of the total household consumption of forest and woodland products such as firewood, building materials, medicinal herbs, wild fruits and other food materials are derived from the forests. The forests of the EAMs are major catchment areas providing water to over 3 million

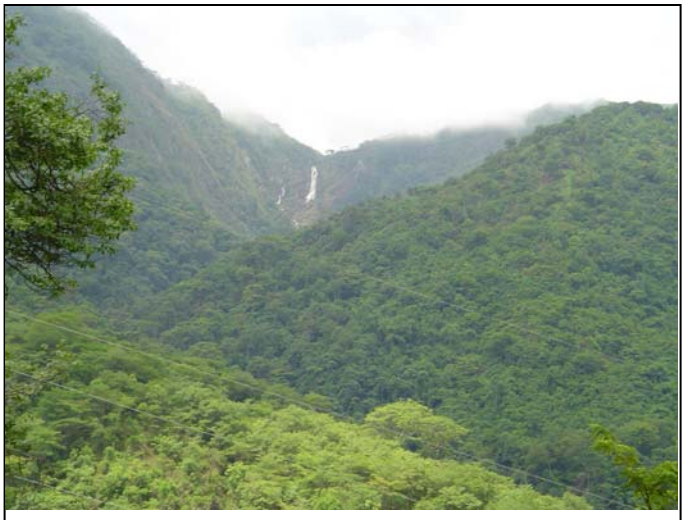

Figure 1: Part of the Udzungwa landscapes within the EAMs

people and to several industries. 70% of Tanzania's electricity is generated from hydropower sources derived from the EAM forests (e.g. Kidatu and Kihansi dams).

Forest disturbance was assessed through determination of dead, old cut and new cut trees and poles in a series of plots along transect lines; forest threats were categorised into forest edge and forest interior, and were assessed either along the disturbance transects, random walks in the forests, or existing paths in the forest; TRA index was determined; management effectiveness assessment used the World Commission on Protected Areas (WCPA) management effectiveness tracking tool; assessment was done in collaboration with district professionals and local communities.

The findings or results of the study showed that there is evidence of decline in forest disturbance with low percentage of new cuts for both trees and poles, possibly as a result of earlier conservation initiatives. A total of 10 main threats were identified in all the forests, fire and pole cutting being the most dominant threat followed by grazing. All were both forest edge and forest interior threats. Other threats included bamboo and *cusssonia* extraction, honey collection, trailing, stone extraction and grass cutting. Overall TRA index ranged from 26.3% to 71.4%. TRA for most forests (14) ranged between 30% and 39%; five forests were in a range between 40% and 50%; four had below 30% and only two above 50%. Privately owned reserves had the highest TRA %. Management effectiveness for most of the forests (18) was between 31% and 45%, meaning inadequate conservation efforts. Privately owned reserves were well managed with management effectiveness of over 50%. Out of the thirty main issues used to evaluate the management effectiveness the following are key in the management of the EAM forests: legal status; management planning; regularity of work plans; staff numbers and training; budgeting and finances; education and awareness; participation and input by local communities to the planning process; access to the forest by adjacent communities; and monitoring and evaluation. Future management should concentrate on these key issues in the management of the ecosystem.

10. MOUNTAIN ECOSYSTEMS: THE CASE OF MOUNT KILIMANJARO

Mount Kilimanjaro, located 300 km south of the Equator in Tanzania, is 5,895 metres above sea level (m.a.s.l), and covers an area of 388,500 ha. It depicts all major climates of the world, the highest mountain in Africa, and the highest free standing mountain in the world. It is a massive volcanic mountain surrounded by the Maasai steppes ecosystem complex. Mount Kilimanjaro is recognised as an essential life-line support ecosystem because it is the primary source of water, food, fuel, non timber forest products and building materials for the people of northern Tanzania.

Mount Kilimanjaro has a rich diversity of ecosystems that are a result of a large range of altitude (700 – 5,895 m.a.s.l) and reliable high rainfall. The mountain is particularly rich on vegetation types: the cultivated areas found all round the mountain at altitudinal range between 700 and 1600 m.a.s.l made of savannah bush land, grassland, pastureland and cropland, mainly maize and wheat and on the south and eastern parts (1000 -1700 m.a.s.l) agroforestry systems dominated by coffee and banana crops; indigenous forest found all round the mountain at an altitude range of

1600 – 2800 m.a.s.l; and an alpine zone found between 2800 and 3500 m.a.s.l. The mountain ecosystem is rich in fauna: 140 species of mammals of which 87 were forest species; 405 bird species; and 140 species of grasshoppers and locusts which contribute 32% of the species found in the world.

Services provided by Mount Kilimanjaro ecosystem include purifying the air, cleaning the water, production of biomass, hold the soil, provide minerals, recharge water, provide shelter and trap heat. The major value of this ecosystem is to provide ecological services which in turn provide life line support to the people living contiguous and far from the mountain. Specific values include rich natural resource base in terms of relief and drainage, climate, soils and vegetation, which jointly provide the following benefits: water catchment which provides water for agriculture, hydropower and other water based utilities; medicinal and cultural benefits; bee keeping; fertile soils for agriculture; tourism; and World Natural Heritage Site.

Figure 2: Mount Kilimanjaro ecosystem is threatened by increasing population pressure

The viability of Mount Kilimanjaro is threatened by several factors, mainly rapid population increase which has been influenced by reliable and abundant precipitation, fertile soils, moderate weather and communication infrastructure. The population of the four districts, Moshi Rural, Moshi Urban, Hai and Rombo, has increased fourfold between 1948 when it was about a quarter of a million to over a million in 2002. The rapid increase in population and inadequate environment management system contribute to the deterioration and depletion of the natural resources of the mountain ecosystem. The increasing demand on the ecosystem goods and services from the increasing human population has resulted in deforestation, overgrazing, soil erosion, siltation, flooding, species extinction and entry into the poverty trap.

In the case of Mount Kilimanjaro ecosystem, the following inadequately controlled and managed anthropogenic activities threaten the ecosystem:

- Encroachment into the forest reserve and national park for settlements by forest plantation quarters for forest reserve and national officials; crop cultivation; grazing in the forest reserve; and quarries developed in the forest reserve for supplying road surfacing material.
- Illegal harvesting of timber and non timber forest products – logging of indigenous tress in the forest reserve, particularly camphor and cedar; honey collection; charcoal burning and poaching using traps and snares.

- Vegetation disturbances mainly by fires caused by honey collection, clearing farms, charcoal burning, poachers, pit sawyers, tourists and lightning.
- Geographic and climatic factors: soil types, slope, temperature and intensity and duration of rainfall together with land use practices increase ecosystem stressor threats; many of the threats are centred within the lowland ecological zone; where soils are fragile and vegetation is sparse due to arid climatic conditions the threat is greater; the lowlands are prone to pollution from agricultural practices on the upper zone from coffee farming.
- Mount Kilimanjaro has been ecologically isolated from the Maasai steppe ecosystem complex due to settlements and crop cultivation, and this has led to local species extinction and blocking of wildlife corridors.

Natural resources utilization and management factors have included the establishment of the forest reserve, the half mile strip forest, forest plantations, national park, coffee and sugar estates, wheat farms and cattle ranches which interfered and disrupted traditional and indigenous natural resource management systems and caused inequality in access to land to the majority of the local communities.

It is suggested that the ecosystem stakeholders supported by lead institutions should undertake the restoration of the damaged ecosystem. The lead institutions are Forest and Beekeeping Division, Tanzania National Parks (Kilimanjaro National Park) and the four district councils. Restoration approaches include the identification of stakeholders and ecosystems threat survey. Primary stakeholders are communities of people who depend on the ecosystem resources for their livelihood support. A failure in the ecosystem functioning will directly affect the lives of stakeholders. Secondary stakeholders are institutions, organisations, individuals and societies that have a close interest in the ecosystem resource. These interests may include national resources and environmental conservation, resource utilisation (tourism and harvesting of timber and non timber products), spiritual and cultural linkages. A failure in the ecosystem will not directly affect the lives of the individuals in this category.

Tertiary stakeholders are institutions, organisations, individuals and societies that have interest to ensure the viability of the ecosystem by supporting and facilitating the conservation and management of the ecosystem but hey are not interested in the utilisation of the resources. They include non-governmental organisations (NGOs), community based organisations (CBOs), civil society organisations and international development partners.

Several stakeholders have been identified in the Mount Kilimanjaro ecosystem but at project level interest. No ecosystem level identification of stakeholders has been conducted.

A survey of threats to Mount Kilimanjaro Forests was conducted in 2000 but there are indications that it was preceded by a survey of stakeholders. The survey identified the following threats: logging of indigenous trees, mainly camphor and cedar; burnt forest areas for charcoal production; forest villages; crop cultivation; livestock grazing; land slides due to intensity of logging on steep slopes with heavy precipitation; quarries for road surfacing material. These threats are common in

the forest reserve and Kilimanjaro National Park. Other threats found outside the two protected areas include decline in water availability for irrigated farming due to reduced discharges from the catchment area and soil fertility due to intensive cultivation.

The following ecosystem restoration interventions have been applied to Mount Kilimanjaro ecosystem: community based interventions; half mile strip community forest plantation running from east to south west and supplied wood and wood products for the local communities. It also buffers the forest reserve.

Community manages the protected areas through a conservation project; (COMPACT) funded by UNDP and United Nations Foundation, that support small sized community focused projects that enhance the capacity of local communities, increases local community awareness of and concern for the protection of the ecosystem, and promotes and support communication and cooperation between local communities and park management. Kilimanjaro National Park under its outreach department supports and facilitates communities to develop and implement small sized projects which are intended to enlist conservation support from local communities and address poverty alleviation.

In order to enhance the conservation and management of the forest reserve and the national park the following interventions have been implemented: secured the Kitendeni wildlife corridor that links Kilimanjaro National Park in Tanzania and Amboseli National Park in Kenya which is important for elephant migration between the two parks; banned harvesting of timber and non timber products in the forest reserve; and processes are underway to annex the forest reserve to Kilimanjaro National Park.

There is need to develop an integrated conservation and management plan for the Mount Kilimanjaro ecosystem; enhance the afforestation programme for wood and wood products; rehabilitate the half mile strip community plantation; and re-establish some of the blocked wildlife corridors by replanting them with indigenous trees.

11. MANGROVE ECOSYSTEM OF THE JOZANI CHWAKA BAY NATIONAL PARK: COMPOSITION AND ECOLOGICAL FUNCTIONS

Jozani Chwaka Bay National Park is the largest single most important site for the conservation of Zanzibar's globally significant biodiversity. It is the first national park of its kind in Eastern Africa containing swamp forest, coral rag forest, mangrove forest, salt mash and sea grass bed. Jozani Chwaka Bay conservation area was created in1995 for purposes of fostering the long-term survival of the area and its surrounding habitats that host natural ecosystems with various flora and fauna species including indigenous endemic and endangered species. It was declared a national park in 2005, and covers an area of 5,000 hectares.

Chwaka Bay mangroves cover an area of 2,394 ha in two blocks, Kinani and Mapopwe, and are a government-reserved forest gazetted in 1965. The park mangrove covers an area of 1,828 ha.

There are four management units of Charawe, Mapopwe, Michamvi and Ukongoroni. For conservation purposes, Chwaka bay mangrove is sub-divided into three zones, which are: I, II and III whereby zone I is strictly for protection while the others are alternative working circle and harvesting units. There are ten mangrove species distributed in the four management units, plus seventy plant species belonging to ten main vegetation types. The ten mangrove species include *Rhizophora mucronata, Bruguiera gymnorrhiza, Ceriops tagal, Xylocarpus granatum, X. molucensis, Hiritiera littoralis, Avicenia marina, Pemphis acidula, Lumnitzera racemosa and Sonneratia alba.*

Figure 3: Part of Chwaka Bay mangrove ecosystem

Chwaka bay mangroves fulfil many important functions such as nursery grounds for fish breeding; protection of the coastlines against tidal waves and storms; maintaining an ecological balance in Mapopwe and Kinani creeks; preventing siltation of coral reefs by trapping sediments; builds land through accumulation of silt and detritus; preserves purity of the coastal water by absorbing pollutants; acts as wind breaks for agricultural farms surrounding Jozani-Chwaka Bay National Park; provides opportunities for education, scientific research, recreation as well as ecotourism in the park; and is utilised for various purposes as fisheries, wax and honey production, shells collection, boats making, household items, fuel wood and medicines.

Mangrove forests are described as productive ecological assets and as an economic resource. Chwaka bay dwellers have for generations depended on the mangrove forests directly or indirectly for their livelihoods and income generation. The forests provide a unique and valuable range of resources and services, making them far more valuable than the sum of the products generated. Ecologically the forests support a diverse range of organisms. Chwaka bay communities have always depended on the mangrove ecosystem: 75% of the households depend upon forestry for their livelihoods; and mangrove contribution to fisheries in Chwaka bay area is 49%

Threats to mangrove resources are mainly from human overexploitation due to increasing population that aggravates the demand for forest resources; lack of alternative livelihood systems for the people; and deprived role and right of communities on protecting and benefiting from the resources. Other forms of land use such as hotel development refuge damps, sewage from hotels and households, and pollution, also threaten the ecosystem.

From early 1980s, the extraction and transportation of mangroves as a source of income around Chwaka Bay took a new turn as a result of politics. Immature Kinani closed forest was opened for exploitation and since then the government has not been able to effectively control indiscriminate exploitation and transportation of wood from the mangrove forests. 73% of Chwaka Bay population engage themselves in cutting mangroves for fuel wood, wood plunks and building poles. 53% of Chwaka Bay population extract mangroves from Kinani closed forest knowing that it is illegal, but encouraged by the fact that wood stock from Kinani is larger in size compared to that from Mapopwe open forest.

Mangrove resources have been overexploited and as a result there are conflicts for the scramble for the resource. A total of 9,032 people from the six villages of Bwejuu, Charawe, Cheju, Chwaka, Michamvi and Ukongoroni are the major mangrove users. Their economic activities include fishing, seaweed farming, shifting cultivation, beekeeping, exploitation of coral rag and exploitation of mangrove resources for burning of lime and charcoal and cutting poles and fuel wood. Around Chwaka bay agriculture and fishing related activities are equally important as wood cutting and wood trading as the main sources of income. However, 25% and 8% depend on wood cutting and wood trading as their main source of income respectively. Most of the wood is mangrove in the form of building poles, firewood, charcoal and lime making.

Each village has its own conservation committee (VCC) responsible for: sustainable management and conservation of the park; supervising the utilisation of the resources according to set regulations; preparing village local management plans/agreements; collecting revenues from natural resources harvests; spending money on social development of the village; and preparing by-laws to control the utilization of the resources. At higher community level, the village conservation committees have been jointly coordinated into one powerful organization, the Jozani Environmental Conservation Association (JECA) responsible for provision of advice to Chwaka Bay Mangrove management and VCCs; establishing strong relationship with community committees; and creating harmonious situation in the implementation of the conservation activities by resolving resource use conflicts.

Mangrove restoration efforts started in the early 1990s and involve planting mangroves in highly degraded areas done jointly by village conservation committees and village schools as an educational approach. Planting is sustained by committee efforts, but there is little information available on mangrove planting.

12. MARINE ECOSYSTEMS: THE CASE OF MENAI BAY CONSERVATION AREA, ZANZIBAR

Menai Bay Conservation Area (MBCA) is situated in the southwest coast of Unguja Island, Zanzibar and has an area of 470 km2. There are 19 villages along the coast of MBCA with a population of 27,502 people.

The main goal of MBCA is to conserve the biological diversity, ecological processes and productivity of the area and associated ecosystems to ensure that resources are sufficient for local

people to maintain their livelihoods. MBCA was set up in 1988 and officially gazetted as a conservation area in 1997. The objectives of MBCA include: to establish a multi-user marine conservation area; to maintain and /or improve ecosystems and resource yields within MBCA through effective management systems which include active local community participation; to make local communities participate fully in the planning, implementation and monitoring of the natural resources of Menai bay; to ensure that local communities attain greater awareness of conservation and sustainable resource use through educational and public awareness programmes; and make biological and socioeconomic research and monitoring to provide a basis for management of the MBCA.

Ten mangrove species have been identified in Menai Bay. The functions of mangroves are the production of litter and detritus exported to lagoons and the near shore coastal environment; and they also provide feeding, breeding and nursery areas for prawns, shellfish and many other commercial fish species. Mangroves are valuable as sources of firewood, charcoal, medicines and building materials for houses and boats. They are a source of income for many people engaged in selling mangrove forest products.

Very few studies have been conducted to assess sea grasses at Menai Bay. However, the following genera have been found: *Halodule, Cymodocea, Thalassia, Syringodium,* and *Thelasodendron.* Sea grasses serve as breeding, nursery and feeding areas for many invertebrates and vertebrate species; they are a source of food for herbivorous invertebrates, fish and turtles; they trap and bind sediments thereby reducing particulate pollutants over coral reefs; and they provide protection to shorelines by dissipating wave energy. No direct use of sea grasses has been recorded so far in Menai Bay.

The most dominant coral reef genera are *Acropora, Montipora, Porites, Millepora, Lobophyilla, Echinopora* and *Favia.* Good coral reefs in the area are found adjacent to the islets and sand banks. Coral reefs support food webs, life cycles and productivity of the adjacent shallow water fisheries; contribute to off-shore fisheries beyond the islets; and serve as natural protective barrier, deterring beech erosion, retarding storm waves and allowing mangroves to prosper. Coral reefs attract tourist who go to Menai for snorkelling.

Six species of cetaceans have been recorded: Indo-Pacific bottlenose dolphins, Indo-Pacific humpback dolphins, spinner dolphins, risso's dolphins and humpback whales. Humpback whales migrate seasonally from temperate waters where they eat to warm tropical waters where they breed and calve. They come to Menai Bay from July to November. Cetaceans' meat is used as food for human beings. Cetaceans are also a tourist attraction. Sea turtles occurring in Menai Bay include Green turtle, Hawksbill, loggerhead, Olive Ridley and Leatherback. Turtle meat is used for food and carapace for decoration.

Fishing is still artisanal, using traditional crafts and simple fishing gear, the locally made outrigger (ngalawa) and line, traps and nets. Two species of sea weeds are cultivated, *Euchema spinosum* and *Euchema cottonii.* A variety of mollusks are found in Menai Bay. They are collected mainly by

women. Tourism is associated with coral reefs and sand banks in Fumba, and dolphins and whales in Kizimkazi. The threats facing the ecosystems are: destruction of coral reefs by fishing and tourist activities; uncontrolled cutting of mangroves and bycatch of dolphins and turtles in gillnet fishing.

Figure 4. Dolphins as part of tourist attraction in Menai Bay

Restoration approaches include: raising awareness of local communities on environmental education, regeneration/ restoration of mangroves and management of sea turtles and of dolphin tourism.

The MBCA has facilitated the formation of village conservation committees; it has reinforced surveillance system which entails patrolling, arresting and taking offenders to the police. The project has performed well in implementing education and public awareness programmes. Local fishermen are being involved in collecting information on fish caught and monitoring programmes at fish landing sites.

13. THE MALAGARASI WETLAND ECOSYSTEM: AN INTEGRATED STUDY

The study was carried out on the Malagarasi wetland around Lake Nyamagoma in the north and Lake Sagara in the south, by scientists from the University of Dar es Salaam. The general objective of the study was to establish conservation measures for the Malagarasi wetland ecosystem for sustainable development. The specific objectives were to assess biodiversity within the wetland; to study hydrodynamics and chemical conditions that influence the functioning of the wetland ecosystem; to study the socioeconomic activities and their impacts on the wetland ecosystem; and to evaluate environmental health benefits and risks to the people surrounding the wetland. The research questions were what are the driving forces causing the degradation and or productivity of the wetland ecosystem? What are the environmental pressures currently facing the wetland ecosystem? What is the present state of the environment and its impact on the wetland ecosystem?

Field work activities included measuring the depth of Lake Sagara, water and zooplankton sampling, sediment sampling using a grab sampler for microbe and mineralogical determination, fishing at 2 metres depth to determine fish characteristics, physico-chemical measurements for EC, Oxygen, temperature, pH, turbidity and transparency. Socioeconomic aspects included conducting interviews to establish the sources of drinking water, energy sources, agricultural activities, mining activities, health aspects, fishing efforts and demography.

Laboratory work included geochemical work to find out heavy metals and major cations and heating clay fraction for XRD analysis; zoological work involving extraction of invertebrate from sediments and sorting them into major taxa; botanical work of identifying plants to species using published keys and matching with specimens in the herbarium; phytochemical work involving the extraction of plant materials and phytochemical investigations.

The results of the study show that the processes influencing chemical data include: mixing, dilution, cation exchange, oxidation-reduction, diffusion, adsorption and denitrification; sediment sinks of nutrients; brine inflow from springs; high mercury levels noted at Lake Sagara; and seasonal effects on nutrient levels were noted. Silica concentration was high in the dry season and low in the wet season, due to dilution effect. Chloride concentration was high at Lake Nyamagoma, attributed to brine springs along river Malagarasi and those at Muyovosi river head waters. Dissolved Oxygen decreases with depth in both lakes and is absent at the bottom of lake Nyamagoma, but some oxygen is present at the bottom of Lake Sagara. SiO2 is high at the surface in the afternoon and vice versa in the morning. There are induced wind currents, sediment-water interface, bioturbation, and gas ebullition, all of which disturb SiO2 gradient and promote diffusion. Turbidity is highest in the morning and more or less uniform at depth in the afternoon, due to wind induced mixing. Clay minerals from XRD show that kaolinite smectite dominate.

Eight different fish species were caught. The catch was high at 1 metre depth and low at the bottom. Meiofauna is more abundant at Lake Sagara than at Lake Nyamagoma and invertebrates are more abundant during the dry season than the wet season at Lake Sagara. Lake Sagara has more invertebrate than Lake Nyamagoma. The most frequent botanical species from both lakes were recorded and grass and sedge species dominated. *Aeschynomene pfundiiTaub* dominated Lake Sagara periphery but was absent at Lake Nyamagoma, while *Eleocharia dulcis* (Burm.f) Trin. was common at Lake Nyamagoma but absent at Lake Sagara. The wetland ecology was stable.
Fish resources on Lake Sagara included *Hetrobranchus longifilis,* cat fish, and high catch of *Protopterus aethiopicus* caught by fisherman using gill nets and long lines. Energy resources were biomass at Nyamagoma, which is an excellent binder for coal use in domestic applications.

Threats to the wetland include: excessive sedimentation from fire outbreaks, logging, overgrazing and poor farming practices; over fishing from too many dug-out canoes, more juvenile fish caught than adult fish, bad fishing methods of water splashing, poisoning and use of small mesh size nets; pollution from domestic waste, mining, agrochemicals and oil spills; habitat destruction The uncontrolled fishing has resulted in fish catch declines that are affecting the economy and human health. The pollution is resulting in eutrophication and declining lake productivity, human health is at risk, water quality is deteriorating and the habitat is impaired. The impact of fire outbreaks is eutrophication, shallowing up of the lake and biodiversity decline. Overgrazing within Lake Nyamagoma area is promoting soil erosion and excessive sedimentation and habitat changes. The findings of the study were presented to and discussed by the Ward Council.

The study showed that the driving forces are farming and fishing which are the major economic activities, common bush fires and overgrazing activities, bad fishing methods are used, artisanal gold mining activities, and induced wind mixing process in both lakes. The pressures include high PO4, NO3 levels at Lake Sagara than Nyamagoma; increased domestic effluents; increased sedimentation; overfishing in Lake Sagara; high Hg levels at Lake Sagara; reduced light penetration due to high turbidity; and oil spillage and sewage. The current state shows that both lakes are polluted; Lake Sagara is more eutrophic and productive than Lake Nyamagoma; Lake Nyamagoma is more saline than Lake Sagara; Lake Sagara produces more greenhouse gasses than Lake Nyamagoma; and that the ecology is still stable. The impacts identified are: water quality is deteriorating; there is loss of biodiversity; both lakes are shallowing up; decreased fish resources; and human health is at risk.

Figure 5. Overgrazing within Lake Nyamagona area, Malagarasi

Recommendations for future work: identify sources of nutrients along with their mode of transport; study hydrological influences on the functioning of the wetland; quantify current sedimentation rates; evaluate the contribution of greenhouse gasses to climate change by these tropical wetlands; assess current fish stocks in both lakes; study alternative sustainable livelihood systems; and conduct long-term monitoring on the wetland ecology. The main lesson learnt is that local people should be involved in such studies.

14. FROM THE SMALLER HIGHLANDS TO THE INDIAN OCEAN: ISSUES SURROUNDING THE GREAT RUAHA RIVER ECOSYSTEM

The Great Ruaha River (Kilombero and Luwega rivers) form the Rufiji River, 177,000 km2. It headwaters in the Kipengere Mountains northeast of Lake Nyasa, descends to the Usangu plains to Ruaha National Park, Mtera, Kidatu, Kilombero, Selous Great Ruaha, to the Rufiji Delta and RUMAKI seascspe. The Great Ruaha catchment area covers 83,970 km2 or 47% of the Rufiji basin. In 1988 the population (Dodoma, Singida, Iringa, and Mbeya) was 4.7 million with a growth rate of 2.8% per year, and in 2000 the population was estimated at 6.3 million. Agriculture contributes 90% of the livelihoods: 35,000ha of irrigated paddy producing 19.5 billion shillings worth of rice; 65,000ha area of rainfed cultivated maize producing maize worth 8.8 billion shillings; 300,000 head of livestock; and 700 tonnes of fish per year.

The biodiversity includes miombo and acacia woodlands, several thousands of elephants, hippopotamus, giraffe, buffalo, kudu, and Roan and Sable antelopes, wild dogs, and lions in the Ruaha National Park. Usangu plains are an important bird area with 450 species including species and large aggregations of migratory wetland birds. The montane woodlands of the Kipengere and Livingstone mountains contain several endemic or altitudinally localized plant and animal species.

The main issues in the Great Ruaha river ecosystem include: competition for water use by six clusters of users, i.e. irrigation, domestic, livestock, fisheries, wildlife/environment, and hydroelectric power generation; prolonged dry period of the river in the dry season; contested stakeholder perspectives on causes of drying up of Ruaha river; conflicting and uncertain policy objectives, strategies, and criteria to manage water; and increasing demand for water from immigrants into the area.

The reasons for the drying up of the river are believed to be: extension of water abstraction for rice; dry season use of surface water to meet domestic needs; large and small scale dry season crop irrigation influence; possible changes to Usangu/Ihefu swamp configuration resulting in reduced through flow; losses in Ifushiro swamp – no Ruaha through flow during dry season, a natural process; western wetland replaced by irrigation fields that collectively hold and evaporate water unlike the wetlands which slowly drain through the outlet. The factors considered to have a minor influence on the drying of the Ruaha include climate change where rainfall is not declining over time; indirect relationship between wet season irrigation and Ruaha National Park; weak relationship between irrigation and hydroelectric power cuts; deforestation; and degradation of wetland sponge by cattle.

Abstraction of water in Usangu has increased as rice plots are now irrigated for up to 300 days, there is early season mosaic planting and late season cascade plot-to-plot irrigation even through plots that are not planted. There is therefore much larger evaporation over a greater area than necessary. Water use efficiency is greatly reduced. Farmers are encouraged to use technologies to reduce field to field losses and introduce by-laws to encourage transplanting when water arrives at the spot. National Agriculture and Food Corporation (NAFCO) farms also use water inefficiently because of their field preparation and irrigation methods with the result that much more water is used per area and the water is exposed to longer periods of evaporation. But solutions do exist to save water in NAFCO farms. There are also modern intakes and water rights that legitimize increased abstraction. There is poor monitoring of water use.

The effects on water, livelihoods, and natural resources include: decreased development and negative trends in local livelihoods as a result of reduced water availability; water dependence of tail enders; exclusion of pastoralists from Usangu for grazing and watering; agriculturalists/ pastoralist conflict in Usangu; exclusion of fishermen from Usangu great Ruaha; effects on wildlife (breeding, survival and behaviour); increased wildlife/human conflict; overall biodiversity loss due to poor land use; and future effects on tourism visits to Ruaha National Park.

One of the problems is that the seasonal swamp area has been replaced by irrigation, shifting water upstream during the flooding season and at the end of the flooding season water is held in rice fields rather than in the swamp ready to drain. The drains act as canals extending to fields. The intake rates should be reduced and water management should be improved to meet the diminishing water requirements at the end of the season, the remainder should stay in rivers to recharge the wetland.

Figure 6. Farming in Ruaha wetland

The World Wide Fund for Nature (WWF) is involved as partners in Usangu because of the hydrological changes during the 1990s which have changed the river from permanent to seasonal river due to the drying up of the river; the wildlife mortality and environmental harm done in the Great Ruaha National Park; hydroelectric power cuts from Mtera/Kidatu; increase in rice and non-rice area irrigated; and changes in designs of irrigation intakes. The goal is that by 2010 the people of the Great Ruaha River catchment area are planning, managing and utilizing their water and related natural resources sustainably, with year round flow in the Great Ruaha River restored. The purpose is to achieve sustainable water resources management in the Great Ruaha River catchment by the support of integrated capacity building and action at catchment, district and community levels.

The expected outputs include: integrated river basin management plan completed and operational in the Great Ruaha River catchment area; effective local government and community participation in water resource management in line with the Water Policy of 2002; identified key water management issues relating to the decreased flow of the Great Ruaha River addressed whilst proving solutions that contribute to improved livelihoods; and local governments and communities are aware and understand water resources management and related environmental issues in the Great Ruaha River catchment area.

Key support areas include research on the dynamics of the Ruaha subcatchment; capacity building and demand-led training on water productivity, efficient use, and integrated water resources management; conflict mediation with water users and "dialogue" support; provision of technologies and advice to manage water; and identification and setting up of alternative sources of water. The challenge of river basin management requires that multiple users/uses are recognised; emphasis is on "water to the higher value user to maximize economic benefit", but water needs of other sectors (e.g. domestic, poor people, agriculture, the environment) are crucial; demand management saves water in one sector to flow to another sector where it can be

used to greater benefit (distinguish gross from net needs); supply management boosts or delivers water; there should be a central basin management authority for planning, monitoring and management, and decentralised/parallel activities that affect water.

The story of the Ruaha is a dry season story but activities in and technologies used for, the wet season impact on the dry period. There are over ten responses to the drying up of the Ruaha, but the river is yet to flow year round. Do we really understand the main causes? Do we recognise and appreciate the complex relationships between poverty, natural resource use and environmental sustainability? What is the minimum flow required to keep the system functioning? Finding a balance in water use in the dry season is a difficult undertaking that requires the collaboration of all key Parties in a priority setting. What is the vision for water distribution? Should water be used for productive livelihoods in the Usangu Plains, or for the downstream environment or for distribution between both? What solutions exist to boosting/saving/sharing water: redistribute net needs; redistribute gross needs if savings can be made; or add supply side solutions (storage or boreholes). What legal, institutional, economic, or technical framework or strategies to effect these solutions in cost-efficient ways?

15. MANAGEMENT OF SHARED ECOSYSTEMS: THE CASE OF LAKE TANGANYIKA

Lake Tanganyika lies between latitudes 3'20' and 8'48' South, and longitudes 29'05' and 31'15 East. The riparian countries are Burundi, Democratic Republic of Congo, Tanzania and Zambia. Rivers flowing into the lake are Rusisi and Malagarasi and many small rivers. The only out flowing river from the lake is Lukuga river. The surface altitude of the lake is 773 metres. It is the second oldest lake in the world. The mean width of the lake is 50 kilometres, mean length is 650 kilometres, mean depth is 570 metres, and the surface area is 33,000 km2 while the drainage area is 231,000km2. The population in the drainage area is 10 million, there are over 2,000 aquatic organisms and at least 600 endemic species.

The threats to the lake are mainly man-induced and include excessive sedimentation, pollution, over fishing and habitat destruction. Climate change is both natural and man induced. Sedimentation increases due to inappropriate land use activities, leading to habitat destruction, eutrophication, reduced light penetration, and reduction in water quality, reduction in biodiversity and decline in lake productivity.

Gombe and Mwamgongo are similar, small wetlands with different land use histories. Gombe Stream National Park has low population density, it is forested, and the littoral and sub-littoral are preserved, and it has biodiversity. Mwamgongo, which is adjacent to Gombe, is heavily populated, largely deforested, and the littoral and sub-littoral habitat is destroyed and with reduced biodiversity.

Excess sedimentation is from major increases in soil erosion with sediment loads of up to 100 tonnes per hectare per year. Sediment plume is discharged into Lake Tanganyika by the Rusisi River in Burundi and the Malagarasi River in Tanzania. About 40% to 60% of the forest in the basin has been cleared, and 100% of the original forest in the northern basin has been cleared. The clearing of forests is mainly due to fuel wood, slash and burn agriculture and pastures, hill slope agriculture and cassava plantations, stream bank cultivation and refugee settlements.

Figure 7. Part of Lake Tanganyika, which is a shared watebody between Tanzania, Congo and Burundi

Pollution is from the poorly planned settlements along the lake shoreline and from agricultural runoff by increased use of agrochemicals; domestic effluents, storm water e.g. from Kigoma town, sediments with agrochemicals and Bujumbura industrial wastewaters; oil spills from boat accidents, Kigoma TANESCO and Mpulungu, Uvira and Kalemie ports.

Between 165,000 and 200,000 metric tonnes of fish per year are caught. The potential is 1,500,000 tonnes per year. There is insecurity, poor fishing gear are used and industrial fishing has scaled down; use of destructive fishing methods. There is increasing demand for fish for local consumption and for international markets. The number of boats is 17,000 and that of fishermen is 45,000. Traditional, artisanal and industrial fishing methods are used.

Wind velocities in the lake declined by 30% since late 1970s and the stability of the water column (density gradient) increased by 97% between 1913 and 2003. The attribute of increasing temperatures and decreasing wind speed reduces the mixing depth which impairs nutrient hydrodynamics; diminish deep water nutrient inputs to the surface waters hence decline in primary production rates. An air temperature increase of 1.3 to 1.7 degrees Centigrade is predicted for the Great Lakes region in the next 80 years. Temperatures in the north basin increased by 0.2 degrees Centigrade between 1913 and 2000 near the lake bed, and 0.9 degrees at 100 metres below the lake surface. The north end air temperatures increased by 0.81 degrees over the last 27 years.

Restoration efforts have involved two projects. First, the Lake Tanganyika Biodiversity Project (LTBP), 1995 to 2000 supported by UNDP/GEF whose outputs were five special study reports that addressed all the threats in all the riparian states, a strategic action programme, a legal convention signed in 2003 and ratified in 2004 by Burundi, Tanzania and Zambia, and 44 articles

and 5 annexes achieved covering biological conservation and the lake institutional arrangements. The second project was the Lake Tanganyika Management Planning Project (LTMPP) from 2002 to 2003 also supported by UNDP/GEF. Outputs of the project included proposals for future interventions and prioritization of threats in each country. In Tanzania sedimentation and pollution threats were addressed in two projects; in D.R. Congo and Zambia sedimentation threat was addressed in one project and in Burundi pollution threat was addressed in one project. More development partners were also sought.

The development objective of the catchment component of the project was to ensure both conservation of lake aquatic biodiversity, and improvement of local peoples' living conditions. The immediate objective was to reduce soil erosion in the catchment and improve community's living standards. The outputs were: awareness to stakeholders raised and management capacity strengthened; heavily degraded areas rehabilitated; land use practices and soil conservation measures in pilot villages adopted; environmentally compatible sustainable livelihood strategies introduced and adopted; deforestation reduced using bio-energy technologies; sediment flows into the lake monitored; the project component efficiently and effectively managed, monitored and evaluated. The outcome was that sedimentation was reduced, lake habitat was modified, biodiversity was conserved and local peoples' sustainable livelihoods significantly improved.

The objective of the wastewater management component was to protect and conserve lake aquatic biodiversity and sustainable use of natural resources of the lake. The outputs of this component were that wastewater institutional capacity was strengthened; wastewater system design was developed for Kigoma Township satisfying Lake Biodiversity conservation requirements; wastewater flows and quality into Lake Tanganyika known; wastewater plant was constructed for collection and treatment in Kigoma Township; and the project component was efficiently and effectively managed, monitored and evaluated. The outcome was that wastewater management in lake shore areas was strengthened; point pollution levels of lake waters reduced; biodiversity habitat was modified; and water quality was improved and monitored.

Fisheries management component objective was to reduce poverty in the Lake Tanganyika basin, improve social and health conditions, and strengthen food security. The outputs were that fisheries were developed in a sustainable manner, and infrastructure was rehabilitated and local development was improved. The outcomes were that over fishing was controlled, bad fishing techniques were abandoned, and sustainable fishing was achieved.

The conclusion is that restoration calls for integrated approach, and sustainable management of the lake calls for effective participation of all stakeholders from individuals to international organisations. The recommendation is that the Convention should be ratified by all riparian states and be implemented. An African Lakes Environmental Facility (ALEF) should be created.

16. RESTORATION OF DRYLAND ECOSYSTEMS: THE CASE OF SHINYANGA REGION, TANZANIA

Dryland resources are confronted with enormous pressure from the growing human and livestock populations. Shiyanga region with 2 million human and 4 million livestock population has 50,781 km2 in the semi-arid areas that receive 600 to 800 millimetres of rainfall annually. Forest reserves occupy 7,042.2 km2. 90% of the population are subsistence farmers and 95% use fuel wood as a source of energy. The Sukuma people are agro pastoralists and 80% of the households keep livestock which is supported by the grasses that form part of the woodlands.

In the early 1920s, Shinyanga was extensively forested with acacia and miombo species, and forest products and services were available. By the 1970s the area was under severe ecological strain, with severe land degradation. The degradation was caused partly by conflicting policies such as the tsetse flies eradication programme, expansion of cotton production for foreign markets, the rural transformation programmes of villagization; and by the tradition of overstocking, that results in overgrazing.

The degradation resulted in shortage of fuel wood and building materials, shortage of fodder and other non woody forest products, shortage of water and declining soil fertility leading to food insecurity. The solution to the problem has involved several initiatives: In the 1970s the government, the World Bank and other agencies initiated reforestation activities through the regional development programme (RIDEP) which had top-down approach and did not get much community support. In 1986 government initiated the land rehabilitation project "Hifadhi Ardhi Shinyanga" (HASHI). The main goal of HASHI was vegetation restoration for improved livelihood security and poverty reduction. The project started to work with 210 severely degraded villages, the main function being to promote adoption of sound land use technologies through awareness raising (extension methods), action research and capacity building and empowerment. The initial approach was technology centred, with tree planting from hand-outs of exotic tree species seedlings from central nurseries. This approach failed because of the harsh weather, termite attack, low acceptance and poor management leading to little impact.

The HASHI project then went through self-reflection and reformation with the aim of promoting community involvement through change of attitude and behaviour towards landscape restoration and management for sustainable development. This involved sensitization on capacities, rights, responsibilities and obligations; and making people feel that they are responsible for the destruction and the restoration of the landscape. The revised approaches included the participatory extension approaches and the technological approach using participatory agroforesty research and development. The guiding principles developed were: go to the people, listen to them, start with what they know, build on what they have, and start slowly. Good rapport and mutual trust was therefore built.

The results were the revival and use of indigenous knowledge, attitudes and practices, such as "Ngitili", a customary land use system, and "Sungusungu" which empowered the people and command respect. Agroforestry technologies and options developed included rotational woodlot,

fodder bank, improved fallow, improved ngitili, domestication of indigenous medicinal and fruit trees and improved beekeeping.

Figure 8. Restored Ngitili in Shinyanga

There were social, economic and environmental impacts of the interventions. The social impacts include ownership and access to products and services such as fuel wood, fodder and ritual sites; improved security of social services including houses, classrooms and increased enrolment in schools; and health issues support from green medicines and nutrition from wild foods. Economic impacts include increased consumption from ngitili, increased household income through sale of honey, fodder, gum, fuel wood and charcoal; and improved food security. Environmental impacts: restoration rate increased from 2,000 ha/yr in 1986 to 21,000 ha/yr in 2005; about 350,000 – 500,000ha has been restored in 833 villages; increased vegetation cover and biodiversity- 145 birds and 152 plant species were recorded in ngitili; and improved soil fertility and water regime. 61% of the households use ngitili for fuel wood and 21% use ngitili for animal fodder.

In recognition of the achievements of HASHI, UNDP honoured the project with the Equator Initiative Award in 2002 at the World Summit on Sustainable Development (WSSD).

Lessons learnt:

- Tree planting is not the only solution to land degradation problems.
- The use of traditional knowledge, practices and local institutions is crucial in achieving development goals.
- There is a positive link between woodlands ecosystems management and livelihood security.
- Ngitili practice is practical, cost-effective and sustainable way of managing the woodland resources in the semi-arid areas.
- Participatory agroforestry development (on-farm interventions) contributes to high adoption.
- Conflicting approaches among service providers create mistrust to the communities.

The challenges facing HASHI include:

- Increased pressure on restored woodlands due to the growing human and livestock populations.
- Damage to crops and livestock by the increased vermin population, e.g. hyenas.

- Insecurity of tenure and increasing land scarcity.
- Fragility of the ecosystem.
- Growing demand for wood resources.
- Resistance to attitude and behaviour change especially some of the technocrats.
- HIV/AIDS pandemic

The way forward includes maintaining the achievements in Shinyang region, and scaling up sound natural forest resources management and agroforestry practices for improvement of livelihoods through participatory development of management strategies; capacity strengthening and community empowerment; information packaging, dissemination and networking; promotion of cultural heritage and eco-museum, participatory research, socio-economic studies and promotion of indigenous knowledge on agroforestry development; establishing and maintaining partnership with internal and international organisations; and participatory monitoring and evaluation. Scaling up of the HASHI experience has started in Mara and Mwanza regions and will most likely be extended to other areas.

17. ECOSYSTEM MANAGEMENT IN UGANDA: AN OVERVIEW

The key issues include persistent degradation and loss of critical ecosystems some of which are of international significance. The key driving forces in the degradation are high population growth rates of 3.4% per annum, and socioeconomic activities such as urbanisation, industrialisation, agricultural expansion and trade. The other key issues are unsustainable harvesting of ecosystem services where resource exploitation is above the maximum sustainable yield; and the growing realisation of the critical importance of ecosystems to poverty eradication and improved livelihood.

The current initiatives and interventions in ecosystem management in Uganda include the following: creation of policy, legislative and institutional frameworks, for example regulations on management of river banks, lake shores, and hilly and mountainous areas; mainstreaming of environment into the Poverty Eradication Action Plan (PEAP) and other sector policies; eviction of people illegally settled in sensitive ecosystems; targeted studies in critical areas (valuation studies, environmental impacts); climate assessment and carbon sequestration; and creating and strengthening partnerships in the management of trans-boundary ecosystems (NBI, LVEMP, KBO). Other initiatives include public-private sector partnerships; education and awareness raising on the importance of ecosystems, e.g. through workshops and community meetings (barazas); collaborative management schemes; sharing information on ecosystems; integrated approach to the use and management of some ecosystems, e.g. water resources and land resources; and other initiatives such as environmental accounting, ecosystem restoration activities and creation of markets for ecosystem services.

The opportunities for ecosystem management in Uganda include the existence of supportive legal, policy and institutional frameworks; information sharing avenues/ opportunities; international support, e.g. UNEP and UNDP Poverty and Environment Initiative, UNEP' Integrated Assessment

Project, and DFID UPPAP; political will; regional and international initiatives; and the Sector Wide Approach (SWAP) to planning and budgeting.

There are key challenges and constraints to ecosystem management in Uganda such as ensuring equitable sharing of ecosystem benefits; harmonising environmental/ecosystem concerns with political interests; enhancing ecosystem productivity as a means to improved livelihood and poverty reduction; attracting public and private investment as a means of value addition to ecosystem services; linking ecosystem concerns to policy making, especially budgetary allocations; and creating viable alternatives to the poor as a means of relieving pressure on ecosystem.

Other key challenges and opportunities include meeting the increased demand for ecosystem services while at the same time maintaining their quality and integrity; restoration of degraded ecosystems; creating markets for ecosystems services as a strategy for poverty reduction; resource gaps (technical, financial) for carrying out ecosystem assessments; information gaps, e.g. inventories of ecosystem goods found in different ecosystems; and streamlining policy to meet the changing ecosystem concerns.

The way forward involves capacity building in ecosystem assessments; mobilisation of resources for undertaking ecosystem assessments; forging appropriate strategic partnerships (regional, national and community levels); and dissemination and replication of best practices, e.g. the Shinyanga-HASHI experience.

18. SAfMA: SYNTHESIZING ASSESSMENT FINDINGS AND IDENTIFYING PRIORITIES

In moving from assessment to action we need to establish what decision makers need to know and how priorities can be set. Trade-offs are fundamental issues in integrated assessment, and they involve difficult choice between multiple and often equally compelling options. Trade-offs exist between different ecosystem services, for example food vs biodiversity; uses of a service such as water for conservation vs irrigation; ecosystem services and human well being, e.g. energy production vs good air quality; location in space, upstream vs downstream; and periods of time, dry vs wet seasons, now vs future. Trade-offs, for example between food production and biodiversity, can be assessed through irreplaceability analysis. Irreplaceability is the importance of an area towards achieving a goal – its uniqueness. It is context dependent and target-based and can be applied to any ecosystem service for which spatial data is available.

Irreplaceability analysis does not reveal where thresholds lie (how much overlap is possible?). For example in north western Zimbabwe scattered human populations at < 1 person per km2 had little impact on elephant population density, but at >16 persons per km2 elephants disappear, showing a clear threshold effect.

The South African Water Act's classification system shows how trade-offs between water protection and utilisation can be managed: it is used to describe different levels of ecosystem

health, ecosystems in each class offer different goods and services, and it allows for choice between protection and utilisation of water resources.

Ecosystem services fail to provide human well being benefits because of inadequate supply relative to demand, ineffective distribution, use of service has negative effects on health, and compromised capacity of ecosystem to continue delivering services over time.

Decision makers need to know that the achievement of MDGs for hunger, child mortality, disease, and environmental sustainability is likely to be compromised unless specific attention is paid to ecosystem services; governance is a critical uncertainty at all scales; many services require transbounadry coordination; all ecosystems are critical; all ecosystems support communities, whether local or global; and human well being is also affected by numerous other factors which can support or hinder maintenance of ecosystem services.

The criteria for setting priorities for identifying critical ecosystems should therefore include:

- High endemism/rarity
- High threat or degradation
- Importance to human well being
- Economic importance
- Linkages to other ecosystems (rivers, corridors)
- Combination of the above

We should also identify critical ecosystems that Tanzania cannot live without; which services these ecosystems provide; to how many people and at what scales; and whether these ecosystems are replaceable or substitutable.

19. SUMMARY OF MAIN ISSUES EMANATING FROM THE DISCUSSIONS

- Many ecosystems are degraded mainly due to pressure from population and inadequate management. Government action has involved policy making and some action programmes including participatory initiatives, e.g. the National Environmental Policy (1997); the National Environmental Management Act No. 20 (2004) which provides for coordination of environmental management and establishment of ecosystem management, e.g. mountains, wetlands and eroded areas; and MKUKUTA that focuses on social well being and quality of life, and links ecosystems and economic growth.
- The concept of environmental valuation and accounting should be used to influence policy. Strategic environmental assessment should be used as a management tool.
- The criteria for identifying critical ecosystems should include those listed in sections 6 an 18. Furthermore there is need to develop common methodologies on the inventory and prepare a strategic action programme to guide the inventory of critical ecosystems and to develop indicators for assessing ecosystems especially at the district level.
- The impacts of tourism on ecosystems and the impacts of refugees on ecosystems should be studied.

- One potential threat to forest ecosystem management is the decrease in the number of professional foresters. There is need for studies of forest catchments to establish the services they provide.
- There is need to integrate depreciation of natural capital into macro-economic indicators, and in this regard, national environmental accounting committees should be established. Eco-labelling should be used as a tool for ecosystem management.
- Strategies for relocating communities living in stressed ecosystems need to be developed; design ways of reclaiming lost critical ecosystems such as wildlife corridors; and develop criteria for delineating ecosystem boundaries. A case should be made for investments in environment and natural resources from the budget.
- Lessons learnt from Mount Kilimanjaro ecosystem should be used in developing management plans for other ecosystems, for example the 'trash-in trash-out' policy to control pollution from the growing tourism.
- An environment management fund should be established as required by EMA (2004).

20. FIELD VISIT TO AMANI NATURE/BIOSPHERE RESERVE

The workshop participants spent one and a half days studying the integrated approach to ecosystem management and try to identify critical ecosystems for future work. Participants learnt about the activities of the Amani Nature Reserve, which are mainly conservation and management of the forest reserve and related activities of the 19 villages surrounding the reserve.

Participants visited Majengo village where there is butterfly farming. 250 farmers in 4 villages around the nature reserve participate in growing butterflies and exporting their larvae to Europe and the USA, each farmer earning about 80,000 Tanzania shillings (Tshs) per month. East Usambara Forest reserve has 16 fragments, but now people have been removed from the reserve to create the Derema wildlife corridor and to allow regeneration to connect the forest fragments.

Figure 9. Butterfly farming as an income-generating activity

The East Usambara Tea Company (EUTCO) which is within the Amani Nature Reserve has 2,200 ha of tea producing 4 million tons of tea per year from two factories. The tea is sold through auction in Mombasa, Kenya. EUTCO also has 1,400 ha of natural forests to supply some of the 15,000 cubic metres of fuel wood required per year. The tea estate does not practice irrigation but uses agrochemicals.

Figure 10. Tea estate inside the reserve. EUTCO also manages forests within the reserve for sustainable harvesting of fuelwood that is used in the tea factory

Figure 11. Pits left by artisanal gold miners

Participants visited Sakale village to see the impacts of the "gold rush". Village officials said that the population of the village increased from less than 2,000 to over 50,000 people during the gold rush. People came from different parts of the country and hence the social services were overstressed. Land was sold at 35,000 shillings for a two metre square piece during the gold rush, and gold was sold at 15,000 shillings per gram. Scars of open pits and blocked river channels were visible not only in Sakale but also in the forest reserve.

Finally, the participants visited Mgambo village to discuss community participation in conservation. The village has prepared a management plan for Handei forest and has a village forest management committee. The forest is only 156 ha and is degraded in some areas. Villagers have a five metre wide zone around the forest for their fuel wood collection. The villagers requested to have a copy of EMA (2004) to assist them in their management of the forest resources.

21. WORKING GROUP REPORTS

The workshop broke into four working groups each with a set of questions to work on. Group one was to identify the key issues on ecosystems arising from the presentations, and indicate the disciplines that should be included in the ecosystems assessment study.

All ecosystems are degraded at various degrees due to human induced activities, inadequate management interventions, inadequate resources, low levels of awareness, and limited sustainable opportunities. Policy issues: sectoral policies need to be refocused to meet MKUKUTA targets; there is poor implementation of policies; outdated or irrelevant laws; conflicting and overlapping policies; policy gaps; and need for evaluation studies for informed decision making. Concerning poverty reduction and improved well being, MKUKUTA to a reasonable extent addresses and captures ecosystem concerns. However, the major challenge is to translate this commitment into increased and regular budgetary allocations; raise awareness about MKUKUTA targets and public commitment towards the realisation of its goals. For management of ecosystems there is a need for inventorisation and assessment of different ecosystems. Because there are inadequate resources, there is need to operationalise the environment fund.

There is need for conventions to effectively manage the shared transboundary ecosystems, and a need for equitable sharing of the benefits from the ecosystems. Ecosystem values need to be recognised.

Degraded ecosystems have adverse impacts on the communities dependent on them. Coping mechanisms should be devised by the affected communities, and indigenous knowledge should be recognised, acknowledged and utilised in the management of critical ecosystems. The actual and potential threats to the ecosystem should be identified and lost ecosystems should be reclaimed.

The working group made the following suggestions: encourage eco-tourism for environmentally friendly sustainable alternative livelihoods; research gaps need to identified and researched on, for example on marine mammals, migratory species, and impact of tourism on ecosystems; resource information centres need to be established at district level; need for indicators to measure changes in the quality of the ecosystems; carrying capacities on ecosystems should be studied and established; the maximum sustainable yield (MSY) of resources need to be established for each ecosystem; impact of trade liberalisation on ecosystems need to be studied; and partnerships among environmentalists should be promoted to exchange ideas and experience on ecosystems at international, regional, national, and local community level.

The disciplines to be included in ecosystem studies include: ecology, environmental socio-economics, environmental hydrology, environmental geology, environmental sociology, botany, zoology, forestry, meteorology, engineering, information technology, environmental law, environmental health, environmental chemistry, agriculture and livestock. The choice of discipline should depend on the nature of the study.

There is need for prioritisation of critical ecosystems, of setting the criteria on critical ecosystems, and of associated trade-offs. Stakeholders need to be involved to decide or identify site specific priorities.

Group two reported on how to define boundaries of ecosystems. An ecosystem can be defined by name, describing its characteristics in terms of functions, or knowing its components and their interactions. Therefore, the boundary of an ecosystem cannot be defined by delineating a clear cut line to include the area covered by a particular ecosystem only, but may include the entire area of influence.

A critical ecosystem can be defined as "an ecosystem that we can not live without (at local, national and global level) and its goods and services (economically, ecologically, culturally, socially and politically) are not replaceable or substitutable". The criteria for defining an ecosystem (from the perspective economists, scientists, politicians, community, international NGO, public servants) include: biodiversity value (richness, endemism, rarity, threatened); high threats or degradation (structure, functions, and components); support to livelihoods (food, economy); services (recreation, energy, security, water, environment); spiritual and cultural values; linkages to other ecosystems like rivers, corridors, marine. These criteria can be applied as single or as a combination of several.

Working group three dealt with how to identify ecosystems that are environmentally stressed and how to go about carrying out an inventory of mountains and mountain ecosystems. The group identified the following as ecosystems which could be under stress: wildlife corridors; marine ecosystems; wetlands, e.g. Usangu, Kitavi; lakes, e.g. Manyara, Jipe and Tanganyika; mountains; grazing and rangelands; forests and woodlands; and urban areas (footprint on other systems). These ecosystems could be stressed because of pressures including: demand for energy, especially charcoal; illegal use, e.g. logscam; pollution; agriculture: overgrazing; artisanal mining; poverty; population and migration; human settlements; destructive resource use, e.g. dynamite fishing; poor governance (lack of rights of communities to land/resources, lack of enforcement of regulations, corruption); trade (regional and global).

The purpose of inventory of mountain ecosystems is that the inventory is a requirement by EMA (2004) in order to achieve sustainable resource use, know present status and trends, and lead to action and improved management. In order to carry out an inventory of mountain ecosystems the following steps are necessary: determine the contents of the inventory and indicators to be measured/assessed, and how this will be used at national and local levels; develop database; identify mountain systems on agreed definition using GIS; conduct desktop review of existing data, maps, information on mountain ecosystems; identify gaps and prioritise mountain ecosystems for field work; conduct field surveys including participation of stakeholders (local government, local communities); develop routine monitoring of status of mountain ecosystems (part of local government authority and environmental monitoring systems); disseminate and use inventory.

The contents of the inventory should include description of the ecosystem and resources; socioeconomic description; traditional and cultural values; services the mountain provides; linkages to other ecosystems; threats to the ecosystem; existing management interventions; and interventions required.

Examples of mountains presumed to be under stress include Kilimanjaro, Usambaras, and Uluguru Mountains; and examples of mountains with little data are Livingstone, Kipengere, Matengo and Rungwe mountains. Threats on the Kilimanjaro mountain ecosystem include: tourism; collapse of coffee price has led to change in farming systems and increase in land degradation; breakdown in traditional water management; population and settlement increase; fragmentation of land holdings; conflict with wildlife; commercial irrigation; deforestation and forest degradation; and climatic change.

Working group four reported on how to stimulate growth in marginalised communities surrounding ecosystems, and on how to assist in reducing problems in environmental hotspots like Usangu. To stimulate growth, first identify who the marginalised are and what causes their marginalisation; then make an inventory of ecosystem services and products within the area; reach into the community and raise awareness and get them involved in decision making and in resource assessment to identify potential uses, benefits and costs, responsibility and accountability and opportunities to tap the benefits. This should be followed by preparation of management plan, creation of institutional arrangements for community involvement, and the identification and development of legal framework. The next step is broad capacity building for community involvement, business management, resources management; develop by-laws to govern community operations; develop management agreements; and identify alternative income generation activities.

To reduce problems in hotspots, the following should be done: raise awareness; carry out stakeholder analysis including institutions; develop stakeholder forum; assess resources and resource use including current and potential users in the area; identify threats to the ecosystem and conflicts between users; rationalisation of ecosystem use; and establish a system of payments for ecosystem services, targeting the big users. Other steps include identifying and creating incentives; develop new institutions or strengthen existing ones and their roles; and develop land use (river basin management) plans; and identify mechanisms for integrating processes into political agenda – manifesto.

22. THE WAY FORWARD IN ECOSYSTEM ASSESSMENT IN TANZANIA

Section 58 of the National Environmental Management Act No. 20 (2004) requires NEMC in consultation with local government authorities to identify, within five years of coming into operation of this Act, hilly or mountainous areas which are at risk from environmental degradation. A hilly or mountainous area shall be regarded to be at risk from environmental degradation if it is prone to soil erosion; land slides have occurred or are likely to occur in that area; vegetation cover has been removed or is likely to be removed from the area faster than it is

being replaced; or any other land use activity in that area is likely to lead into environmental degradation. A list of the landscapes, mountains and hilly areas regarded at risk from environmental degradation shall be treated as protected areas for which NEMC shall prescribe strategies for their management.

There is need to develop a strategic action programme on identifying and inventorising the different ecosystems that are stressed or at risk of degradation, including mountain ecosystems. The criteria to be used for identifying ecosystems under stress will be approved by a panel of experts.

The following ecosystems have been identified among others to be under stress: mountains; wetlands, e.g. Usangu, Kitavi; lakes, e.g. Manyara, Jipe and Tanganyika; wildlife corridors; grazing and rangelands; forests and woodlands; marine ecosystems; and urban areas (footprint on other systems). These ecosystems could be under stress because of pressures including: demand for energy, especially charcoal; illegal use, e.g. the logscam; pollution; agriculture: overgrazing; artisanal mining; poverty; population dynamics; human settlements; destructive resource use, e.g. dynamite fishing; poor governance (lack of rights of communities to land/resources, lack of enforcement of regulations, corruption); trade (regional and global).

The first step in the strategic action programme should be to organise a stakeholder's forum of carefully selected experts, local government authorities and resource users to debate and agree on the suggested criteria for identifying ecosystems that are threatened. The forum should also consider the sequence and timeframe for assessing different ecosystems as suggested in the strategic action programme.

The first activity in the strategic action programme should be the identification and assessment of mountain ecosystems in Tanzania. The following steps are necessary for carrying out an inventory of mountain ecosystems: determine the contents of the inventory and indicators to be assessed; develop database; identify mountain systems on agreed definition by using Geographic Information Systems (GIS); conduct desktop review of existing data, maps and information on mountain ecosystems; identify gaps and prioritise mountain ecosystems for field work; conduct field surveys (integrated assessment) including participation of stakeholders (local government and local communities); develop routine monitoring of status of mountain ecosystems (part of local government authority and environmental monitoring systems); propose measures and actions to be taken to restore/conserve the integrity of the ecosystem; and disseminate and use inventory. Where applicable, stressed mountain ecosystems should be declared environmental protected areas.

Examples of mountains known to be under stress include Kilimanjaro, Usambaras, and Uluguru Mountains for which information is available, but there is little or no information on other mountains such as Livingstone, Kipengere, Matengo and Rungwe mountains which could also be under stress. The inventory of mountain ecosystems should also assess the status of these other mountains which at the moment do not have much data.

It would be useful if a critical mountain ecosystem was selected immediately so that it could be used as an example by the Tanzanian delegation participating in the training course at Rhodes University in September 2005, and later to be used as a "pilot" study on integrated mountain ecosystem assessment.

The second activity in the strategic action programme should be to select another ecosystem such as river basins and wetlands using the criteria that will be agreed upon by the stakeholders' forum, and carry out an inventory and assessment of the ecosystem. If resources allow, this second activity could be carried out simultaneously with the inventory and assessment of mountain ecosystems.

Other activities in the strategic action programme would follow: inventory and assessment of rangelands, forests and woodlands, lakes, marine ecosystems and urban areas.

The strategic action programme will seek relevant teams of researchers for each ecosystem assessment, and these should include central government ministries, local government authorities, district councils, local community organisations and resource users, institutions of higher learning and research, and the private sector. There is need to start mobilising resources from government, UNDP, UNEP and other partners for the inventory and assessment of mountain ecosystems.

23. APPENDICES

Appendix 1. Workshop programme

DAY	ACTIVITY	RESPONSIBLE
DAY 1: Sunday 26 June	Arrival of participants	
2000Hrs	Core group meeting	Secretariat
DAY 2: Monday 27 June	Chair: Mr. R. N. Muheto – Director, Planning and Research	
0800 – 0900	Registration	FK, AM
0900 – 0910	Introduction of Participants	
0910 – 0930	Welcome remarks	Director of Planning and Research, NEMC
0930 – 1000	Opening	Senior Permanent Secretary, VPO
1000 – 1030	Group photo + Coffee break	
1030 – 1100	(Overview of) The Millenium Ecosystems Assessment Report and its implications to Tanzania	Erin - SAfMA
1100 – 1130	MKUKUTA and Ecosystems Management	David / Cheche
1130 – 1200	The EMA and Ecosystems Management	R. Muheto – NEMC
1200 – 1300	Discussion	
1300 – 1400	Lunch break	
1400 – 1430	Restoration of Dryland Ecosystems: The Case of HASHI	Mr. Njau - HASHI
1430 – 1500	Marine Ecosystems: The Case of Jozani – Chwaka Bay	Forestry Division – Zanzibar
1500 – 1530	Marine Ecosystem: Menai Bay	O. A. Amir – MBCA, Zanzibar
1500 – 1600	Discussion	
1600 – 1630	Coffee/tea break	
1630 – 1700		
1700 – 1730	Discussion	
1700	END OF DAY 2	

DAY 3: Tuesday 28 June	Chair: Prof. S. Misana – UDSM	
0900 – 0910	Major issues raised on Day 1	Facilitator/Secretariat
0910 – 0940	SAFMA Approach and Findings	Erin - SAfMA
0940 – 1010	From the Smaller Highlands to the Indian Ocean: an Ecosystem Assessment of the Great Ruaha Basin	Lucy Kashaija - WWF
1010 – 1100	Discussion	
1100 – 1130	Coffee/Tea break	
1130 – 1200	Management of Shared Ecosystems: The Case of Lake Tanganyika	Dr. Nkotagu (UDSM)
1200 – 1230	Disturbance, utilization, Threats and Management Effectiveness of the Eastern Arc Mountain Process	Dr. P.K.T. Munishi – SUA
1230 – 1330	Discussion	
1330 – 1430	Lunch	
1400 – 1500	Ecosystems Management in Uganda: An Overview	Kaggwa, R and Byaruhanga J.
1500 – 1530	Mountain Ecosystems: The Case of Mt. Kilimanjaro	Dr. Gamasa – CAWM

1530 – 1630	Discussion	
1630 – 1700	Coffee/Tea Break	
1630	END OF DAY 3	

DAY 4: Wednesday 28 June	Chair: Dr. Nkotagu - UDSM	
0900 – 0915	Major issues raised in Day 2	Facilitator
0915 – 0945	Prioritizing Critical Ecosystems	SAFMA
0945 – 1015	Discussion	
1015 – 1045	Coffee/Tea Break	
1045 – 1200	Group discussion (Needs assessment)	Erin - SAFMA
1200 – 1300	Group presentations and discussion	Groups/Facilitator
1300 – 1400	Lunch	
1430	Preparation of field visit	All
Day 5: Thursday 30 June	Field Visit	All
Day 6: Friday 01 July	Field Visit	All

Appendix 2. List of Participants

S/ No	Name	Institution	ADDRESS/TELEPHONE E-MAIL
1.	Mr. R. Mollel	Senior Permanent Secretary, Vice President's Office	Vice President's Office, Dar-es-Salaam
2.	Mr. R. N. Muheto	National Environment Management Council (NEMC)	P.O. Box 63154, DSM 0744-692 282 muhet@yahoo.co.uk
3.	Prof. P. Maro	University of Dar-es-Salaam	P.O. Box 35049 DSM O744-464852 maropaul@Yahoo.co.Uk
4.	Prof. S. Misana	University of Dar-es-Salaam	P.O. Box 35049 DSM 0741-351558/0748-639595 Smisana@ud.co.tz
5.	Dr. H. Nkotagu	University of Dar-es-Salaam	Hudson@udsm.ac.tz
6.	Ms. E. Bahensky	University of Pretoria /SAFMA	P.O. Box 6103 South Africa erin@sin.ac.za
7.	Mr. R. Kaggwa	NEMA - Uganda	P.O. Box 22255, Uganda rkaggwa@nemaof.org
8.	Mr. J. Byaruhanga	Uganda Ministry of Finance	John.byaruhanga@finance.go.ug
9.	Mr. D. Howlett	Poverty Eradication Division	P.O. Box 9182, DSM david.howlett@undp.org
10.	Mr. M. Dengo	Tanga Municipal Council	P.O. Box 178 Tanga 0741-226726 mdengo@Kanbu tanga.com
11.	Mrs. L. Kashaija	WWF	P.O. Box 63117, DSM lkashaija@wwftz.org.
12.	Mr. O. A. Amir	Fisheries Department, Zanzibar	P.O. Box 774, Zanzibar oamakando@Yahoo.com
13.	Mr. M. Kitwana	Forestry, Zanzibar	
14.	Mr. L. Melamari	WCST	
15.	Mr. E.T.W Minja	NAFRAC (HASHI), Shinyanga	P.O. Box 797, Shinyanga 0745-737466 minja@nabrac.go.tz
16.	Mr. Njau	Tropical Pesticides Research Institute	Arusha
17.	Dr. P. K. Munishi	Sokoine University of Agriculture	Morogoro
18.	Mr. L. Kyaruzi	Division of Environment	P.O. Box 5380, Dar-es-Salaam 0748-687461 Leoky2001@Yahoo.com
19.	Mr. S. Mosha	TFCG	
20.	Mr. D. Mwikila	National Environment Management Council	P.O. Box 63154, Dar-es-Salaam
21.	Ms. J. John	National Environment Management Council	P.O. Box 63154, Dar-es-Salaam
22.	Ms. H. Mbaruku	National Environment Management Council	P.O. Box 63154, Dar-es-Salaam
23.	Dr. F. Khatibu	National Environment Management Council	P.O. Box 63154 0748-306 156 fad_hemed@yahoo.co.uk
24.	Mr. A. Mapinduzi	National Environment Management Council	P.O. Box 63154, Dar-es-Salaam 0748-279 542 amapinduzi@hotmail.com
25.	Mr. A. Matungwa	NEMC - Arusha	Arusha
26.	Ms. R. Lugoe	National Environment Management Council	P.O. Box 63154, Dar-es-Salaam
27.	Eng. J. Ngeleja	National Environment Management Council	P.O. Box 63154, Dar-es-Salaam
28.	Mr. B. Dominico	National Environment Management Council	P.O. Box 63154, Dar-es-Salaam

29.	Mr. B. T. Tarimo	National Environment Management Council	P.O. Box 63154, Dar-es-Salaam
30.	Mr. G. Mwamsojo	National Environment Management Council	P.O. Box 63154, Dar-es-Salaam
31.	Mr. R. Hassan	National Environment Management Council	P.O. Box 63154, Dar-es-Salaam
32.	Mr. Mwaruka	National Environment Management Council	P.O. Box 63154, Dar-es-Salaam
33.	Mr. H. I. Dulle	College of African Wildlife Management;	P.O. Box 3031, Moshi 0748-389152
34.	Dr. J. V. Wakibara	Tanzania National Parks	Arusha 0744-026-327
35.	Mr. L. W. Kahana	CAWM - Mweka	P.O. Box 3031, Moshi 0745-824314 lwk@mwekawildlife.org
36.	Ms. N.J. Mwina	Ministry of Natural Resources Tourism	P.O. Box 1994 DSM neborata@hotmail.com
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