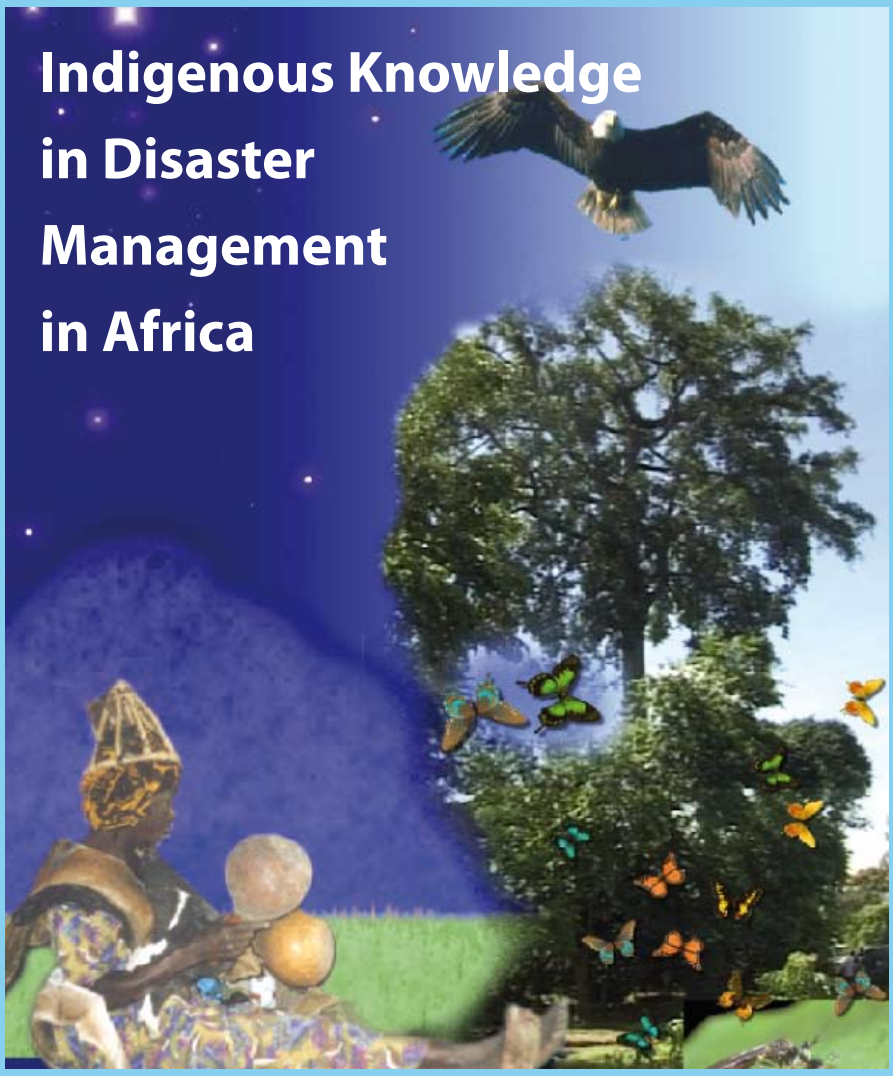
# Indigenous Knowledge in Disaster Management in Africa



UNEP

Some of the Tanzania members of the Indigenous Knowledge Research Team with elders of Mfereji village in Monduli District, Tanzania. The study in all the four selected countries sought the assistance of local elders and experts in gathering and analyzing data on indigenous knowledge systems.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# Foreword


Mr. Achim Steiner

Over the course of history, and up to this day, traditional local communities have continued to rely heavily on indigenous knowledge to conserve the environment and deal with natural disasters. The communities, particularly those in hazard-prone areas, have generated a vast body of indigenous knowledge on disaster prevention and mitigation, early warning, preparedness and response, and post-disaster recovery.

This knowledge is the sum of facts that are known or learned from experience or acquired through observation and study and handed down from generation to generation. Communities identify themselves easily with indigenous knowledge systems which have enabled them to live in harmony with their environments for generations. The systems are important tools in environmental conservation and natural disaster management.

The global scientific community acknowledged the relevance of indigenous knowledge and endorsed it at the World Conference on Science held in Budapest, Hungary, from 29 June to 1 July in 1999 by recommending that scientific and traditional knowledge should be integrated particularly in the field of environment and development. The United Nations Environment Programme (UNEP) recognizes the role of indigenous knowledge in the conservation of natural resources and management of natural disasters.

Indigenous knowledge is still intact among indigenous or local communities in many parts of Africa. However, this knowledge is not well documented and it stands in danger of being lost as its custodians are passing away. This is why UNEP together with our partners in Kenya, South Africa, Swaziland and Tanzania conducted a study in 2004-2006 to provide information on the use of indigenous knowledge in environmental conservation and natural disaster management in the four countries.

This booklet marks the beginning of a series of publications, training manuals

and an interactive website that will be produced from the study on indigenous knowledge used by communities in selected areas in Kenya, South Africa, Swaziland and Tanzania. Communities in these countries have accumulated over the centuries enormous indigenous knowledge on how to sustainably utilize their natural resources using a variety of innovations to deal with environmental conservation and natural disaster management.

I am especially grateful to the IGAD Climate Prediction and Applications Centre based in Kenya, University of the Witwatersrand in South Africa, University of Swaziland and Tanzania Meteorological Agency for their work in conducting the pilot studies.

I sincerely hope that this booklet will not only be useful to the people in the four countries but will also act as an awakening call to governments and other stakeholders in Africa to document, revive and incorporate this invaluable knowledge in sustainable development.

Achim Steiner
Executive Director

United Nations Environment Programme (UNEP)

## Executive Summary

Indigenous knowledge can be summed up as the knowledge of an indigenous community accumulated over generations of living in a particular environment. It is a broad concept that covers all forms of knowledge -- technologies, know-how, skills, practices and beliefs -- that enable the community to achieve stable livelihoods in their environment. It is traditional cultural knowledge that includes intellectual, technological, ecological, and medical knowledge.

Indigenous knowledge is still intact among indigenous (or local) communities in many parts of Africa, and in 2004-2006 the United Nations Environment Programme (UNEP) sponsored a study of indigenous knowledge in four countries, namely Kenya, South Africa, Swaziland and South Africa. The study was carried out in Kenya by the IGAD Climate and Applications Centre (ICPAC) based in Nairobi, in South Africa by the Office of the Disaster Preparedness in Africa at the University of Witwatersrand, in Swaziland by the University of Swaziland, and in Tanzania by the Tanzania Meteorological Agency. This report is a summary of the findings of the study.

### Objective and methodology

The aim of the study was to provide information on the application and use of indigenous knowledge in environmental conservation and natural disaster management in the four countries, and it was undertaken by experts from each of the project countries. The researchers used local informants and respondents to collect data. The status and availability of the data varied from country to country but attempts were made to develop a common indigenous knowledge terminology.

### Knowledge systems

The study found that indigenous knowledge systems have enabled the various communities in those countries to live in harmony with their environments for generations, and the systems are important tools in environmental conservation and natural disaster management. Nearly all the communities had powerful structures

that exercised authority to ensure smooth compliance with the observances and rules of indigenous knowledge. The study provides valuable insights into how those communities interacted with their environment. It documents the various ways the communities relied on indigenous knowledge to sustainably utilize their natural resources. The indigenous knowledge systems provided them with a variety of options and innovations to deal with the challenges of nature conservation and disaster management in the course of making a living. The knowledge systems were particularly evident in agricultural production, food preservation and storage, health care, and in dealing with natural disasters.

The communities had a vast fund of knowledge on prediction and early warning, time-tested coping mechanisms, food production and storage techniques, and an impressive plant-based pharmacopoeia for both human and animal health. For instance, in the field of prediction and early warning of disasters, the Luo community in the Lake Victoria basin had a large number of climate monitoring indicators that enabled them to tell such things as the right time to start planting in anticipation of the rains or to preserve and store food in anticipation of a dry season. These indicators included observation of the behaviour of animals, birds, reptiles, amphibians, insects, vegetation and trees, winds, temperatures and celestial bodies. In the area of animal health, the Maasai, who inhabit both Kenya and Tanzania, had at least half a dozen different medicinal plants for treating East Coast Fever alone in cattle. In farming technologies, the Matengo people, believed to have lived in the steep slopes of Matengo Highlands since the Iron Age, had developed a sophisticated system that enabled them to grow crops on hillsides while at the same time controlling soil erosion and improving soil moisture and fertility.

Conservation

Many of the indigenous knowledge approaches to environmental conservation included such technologies and practices as shifting cultivation, mixed cropping or intercropping, minimum tillage and agro-forestry, as well as transhumance. These technologies and practices were commonplace and were used with various other methods of land use and management to promote higher yields while at the same time conserving the environment. For instance, mixing or intercropping maize with other crops such as beans promoted not only efficient labour utilization but also lessened

the risk of total crop failure since chances were that if one of the crops succumbed to environmental stress others would survive. Mixed cropping or intercropping stabilized yields, preserved the soil and made it possible to harvest different crops at the same time. Other advantages were a reduction in susceptibility of the crops to pests and diseases and a better use of the environment where the combination of species grown had different light requirements or explored different depths of soil. The system also tended to provide a complete vegetation canopy at different heights and thus broke up heavy rainfall and protected the soil.

Traditions, customs, beliefs and cultural rights also played an important role in environmental conservation and biodiversity. Many of the communities in the project countries maintained shrines and protected forests which were used as places of worship and other rituals. In addition, certain trees or animals were considered sacred or totems, so they were protected.

Disaster management

The communities face many natural hazards but the major ones are drought and floods. These invariably cause famine, food insecurity and poverty. However, the communities have devised a variety of measures such as growing drought-resistant and early-maturing indigenous crop varieties, gathering wild fruits and vegetables, wetlands cultivation, livestock diversifying and splitting, that have enabled them to survive climatic hazards with little or no support from the outside world.

The communities were well aware of the disasters that faced them and in most cases had the knowledge and administrative structures to cope with them. At the same time, the communities knew that a well-conserved environment helped them reduce risks associated with natural disasters.

Disaster early warning and preparedness

Each community had an array of early warning indicators and well-developed structures through which the wisdom of the community was applied to deal quickly and efficiently with disasters. The structures included a council of elders which, as the Kenya study reports, had at its disposal "the speed and strength of numerous warriors that could be used to investigate a particular phenomenon or to pass on

urgent messages upon need."

For example, the Banyala community in Budalang'i living on the shores of Lake Victoria had a well-organized system for mitigating impeding disasters. There were elders who dealt with rainfall prediction and early warning. Each homestead had a dugout canoe ready for transport in case of heavy flooding. Each community was also required to dig trenches to control the water around the homestead and around farmlands. In addition, they were required to avoid ploughing along the lake shores when heavy flooding was predicted and were advised to catch fish during April-August rainy period when they were plentiful and preserve them by drying and smoking for use in times of scarcity. Those living on the highlands were expected to accommodate neighbours displaced by floods in the lowlands, which were flood prone areas, and so on.

In Swaziland, where drought and occasional floods are common disasters, communities took precautions after predicting disasters. For example, they used the height of the nests of the emahlokohloko bird (Ploceus spp.) on trees to predict floods. When floods are likely to occur the nesting of the emahlokohloko is very high up the trees next to a river and when floods are unlikely the nests are low down. The Swazis also used the cry of certain birds to predict rain and yields of certain wild fruit plants to predict famine. Other indigenous methods used by the Swazis to predict natural hazards includes wind direction, the shape of the crescent moon and the behaviour of certain animals.

Poverty alleviation

Poverty, defined as inability to afford basic food and non-food items, is endemic among the communities studied in all the four countries. In practical terms, poverty in these communities translates as food insecurity and the question that arose in the study was how indigenous knowledge can be utilized to improve food security. And what emerges from the study is that the value of indigenous knowledge lies in its ability to deliver social and economic goods, and that certain traditional practices, if popularized and integrated with modern knowledge systems, can help to alleviate poverty.

The study found that one of the main challenges is to popularize indigenous knowledge so that it can be used as a tool for alleviating poverty. It was established in some cases that where indigenous knowledge has been ignored there has been a deterioration of the

environment, leading to poverty. A case in point is the ill-advised release of four species of tilapia and the Nile perch in Lake Victoria in the 1950s and 1960s in disregard of the local indigenous knowledge. The consequence has been that the lake's ecosystem and habitat has been altered and traditional livelihoods partially destroyed. Another case is that of Maasai pastoralism, a system of land use and management that has assured the Maasai of a stable livelihood for generations, enabling them to optimize utilization of rangeland resources for maximum meat and milk production. However, encroachment by crop farmers from neighbouring communities is changing that.

The study clearly shows that disregard of indigenous knowledge can have negative effect on the environment. On the other hand, the use and application of appropriate indigenous knowledge systems can promote environmental conservation (land, forests, grasslands, wetlands and biodiversity) and management of disasters in disaster prevention, mitigation, recovery, prediction or early warning, preparedness, response and rehabilitation. The study also shows that indigenous knowledge systems can promote poverty alleviation through traditional food production and preservation and health care through traditional medicine practices. Further, training manuals have been developed from the study that can be used to train a wide range of stakeholders such as policy-makers, development planners, environmental and disaster managers, academics, researchers, legal and medical practitioners, teachers, students, community leaders and journalists.

## Recommendations

The study recognizes the value of indigenous knowledge in national development and notes that, because much of it has not been documented in written form, it stands in danger of being lost as the custodians of the community wisdom, the older generation, passes on. The study therefore recommends that further research should be carried out on indigenous knowledge in the four countries and that indigenous knowledge data banks and networks should be established. The study also recommends that indigenous knowledge should be incorporated into national development plans and taught in schools. Further, efforts should also be made to integrate indigenous knowledge systems with modern knowledge and appropriate laws should be enacted to protected intellectual property in indigenous knowledge. These are the major recommendations

common to all the country individual country studies.

# Chapter One

## Description of the Research Project

### Introduction

In 2004-2006 the United Nations Environment Programme (UNEP) sponsored a research project on indigenous knowledge in Africa.[1] The pilot project covered four countries -- Kenya, Swaziland, South Africa and Tanzania. All of the pilot countries have indigenous knowledge systems still intact in many of the communities although there were differences in levels and stages of their application and use. The countries were selected partly because of their location and different socio-economic profiles.

### Pilot countries

#### Kenya

Kenya and Tanzania are East African countries with a common colonial history and close economic and social ties. Kenya has a population of about 33.9 million (2005 estimate), with about 61 percent of the people living in the rural areas, mostly concentrated in the fertile southern half of the country. The country has more than 40 ethnic groups including the Kikuyu, Luhya, Luo, Kamba, and Kalenjin. The Luo and Luhya, communities featured in the study live mainly in western Kenya, while the Kamba and Mijikenda, also featured, live in eastern and coastal regions of the country respectively.

#### Tanzania

Tanzania has a population of about 36.8 million (2005 estimate) consisting of more than 120 ethnic groups. The largest ethnic groups are the Sukuma and Nyamwezi.

1 The formal name of the study is "Project on Capacity-Building through Partnership and Information and Communication Technology for Using Indigenous Knowledge for Nature Conservation and Natural Disaster Management in Africa."

Other groups of significant size include the Haya, Ngonde, Chagga, Gogo, Ha, Hehe, Nyakyusa, Nyika, Ngoni, Yao, and Maasai. People living in the rural areas make up 64 percent of the population. The population distribution is irregular, with high densities found near fertile soils around Kilimanjaro and the shores of Lake Malawi, and comparatively low density throughout much of the interior of the country.

Swaziland

Swaziland and South Africa are southern Africa countries which have close economic ties but differing colonial experiences. Swaziland is a country of nearly 1.2 million people (2005 estimate, almost all of who are ethnic Swazis. Some 77 percent of the population lives in the rural areas, most of them cultivating staple crops such as maize or herding livestock. The Swazis have a homogenous language and ethnic profile and are proud of their traditions and ancient culture, which go back many hundreds of years. Indigenous knowledge is widely in use in Swaziland and influences many aspects of day-to-day living.

South Africa

South African, on the other hand, has a multiracial and multiethnic population with black Africans making up about 77 percent of the population which is estimated at 44.3 million. The main black ethnic groups are the Zulu, Xhosa, North Sotho, Tswana, South Sotho, Tsonga, Venda and Ndebele. Whites account for 11 percent of the population, with more than half of them being Afrikaners, nearly two-fifths English speakers mostly of British descent, and nearly 10 percent Portuguese. Coloured or racially mixed people account for 9 percent of the population, and Asians (mainly Indians) account for 2 percent. More than half of the black people live in urban areas, mostly in low-income townships and rapidly growing informal settlements. The rest of the black people, numbering about 18 million, live in rural communities in the former Bantustans.

Objectives

The aim of the study project was to provide information on the application and use of indigenous knowledge in environmental conservation and natural disaster management. The project was also expected to strengthen, through training and access

to and exchange of information, the capacities of the principal stakeholders in the application and use of indigenous knowledge in the four countries.

The study was inspired not only by the obvious value of indigenous knowledge in natural resource conservation and natural disaster management but also by the need to systematically document it to avoid the knowledge being lost. It was expected that if it is documented it would enhance understanding of the application and use of indigenous knowledge in sustainable development.

## Planning meeting

In the project planning meeting held in November 2004 in Nairobi attended by government representatives and experts from the four countries, it was agreed that understanding of indigenous knowledge was an important element in changing behaviour in environmental conservation and natural disaster management.[2] The meeting noted that indigenous knowledge systems were still intact in many of the communities and countries and emphasized the need for the systematic mapping of indigenous knowledge systems in the communities.

## Call for documentation

The meeting noted that "in many parts of Africa, indigenous knowledge was considered to be primitive, outdated and inefficient."[3] Indigenous knowledge was also being weakened and eroded and young people were increasingly unwilling to acquire, use and blend indigenous knowledge with contemporary knowledge. As a result, indigenous knowledge has not been harnessed to fit into the current scientific framework for environmental conservation and natural disaster management. Furthermore, it was vested in the older generation of informal leaders and there was a general lack of, or access to, information on the subject. This was so despite growing recognition of

2 Introductory remarks by James Kamara in Meeting Report of the Meeting of Coordinators of the Project on Capacity-Building through Partnership and Information and Communication Technology for Using Indigenous Knowledge for Nature Conservation and Natural Disaster Management in Africa, organized by the United Nations Environment Programme, Nairobi, Kenya, 3-4 November 2004.

3 Introductory remarks by James Kamara. Ibid.

the importance of indigenous knowledge in environmental conservation and natural disaster management. Recognizing that the older generations were the main custodians of indigenous knowledge and death remained an important factor in the loss of the information they hold, the meeting called for the urgent documentation of indigenous knowledge in the communities.

## Capacity-building

The meeting noted that when documented the information would be available in a convenient form to a wide range of audiences including government decision makers, environmental and disaster management practitioners, medical practitioners, academics, researchers, journalists, indigenous and local communities, as well as international development agents including UNEP and other stakeholders. The study would strengthen capacity-building in indigenous knowledge and help to integrate the knowledge with other knowledge systems and development processes, particularly for environmental conservation and natural disaster management.

Data collection methods included interactive discussions, open interviews and meetings. Seen here is a focus group discussion in Kano, western Kenya.

A group interview in Ndondondo village, Muheza District of Tanzania.

## Research methodology

In each country a desk study, including a review of the relevant literature available on indigenous knowledge, was undertaken by experts from each of the project countries in preparation for the collection of data in the field. Although different methods of data collection were used in the different project countries, interactive discussions, open interviews, focus group discussions, meetings, cultural mapping and intensive interviews were intensively used in each country studies. In particular meetings were deemed important for informing and building community trust with the researchers and laying the groundwork for further research. Cultural mapping was seen as important because it involved making use of local experts, which made respondents feel that they were sharing information with fellow informants. Tape recorders were used to

ensure the fidelity of the interviews and field staff were trained to conduct interviews without the use of questionnaires where appropriate.

Data collection

Both primary and secondary data was collected and analyzed. However, the status and availability of the data varied from country to country but attempts were made to develop an appropriate checklist of common indigenous knowledge terminology used in environmental resources conservation and natural disaster management. Further, in collecting data an attempt was made to ensure that there was a clear understanding of the linkages between application and use of indigenous knowledge and cultural and spiritual values which permeate many of the communities under study. Such community cultural and spiritual values included such elements as witchcraft, superstition, taboos, totems and beliefs in ancestral spirits.

Researchers were also required to identify and categorize negative aspects of indigenous knowledge application and use they encountered. This was necessary so as to promote better understanding of their impacts on environmental resources and how they can lead to increased vulnerability. Researchers were further required to give attention to gender in the collection of data. It was assumed that gender was an important element in the application and use of indigenous knowledge in all the communities with regard to environmental conservation and natural disaster management.

Community trust

The project coordinators, experts and field staff were required to work closely with the local communities and national meteorological services to collect indigenous knowledge information on early warning predictions and indicators for natural disaster. They were also required to ascertain the scientific value of such information.

While collecting indigenous knowledge information, they were also required to take into consideration such issues as whether they were being accepted and trusted by the local communities and individual respondents and the kind of common language and knowledge used in the transactions. In selecting the sites for the collection of primary data, project coordinators, experts and field staff were likewise required

to take into account the areas of high and low potential in terms of the quality and availability of data.

The data collected was analyzed using appropriate methods. Outlined below is the particular methodologies followed in the different project countries, excluding South Africa whose investigation at the time of writing was limited to a desk study.

Kenya

In order to take into account the diversity of traditional knowledge and culture in the country, four areas were included in the Kenya study.[4] The areas were identified on the basis of their diverse environmental, socio-cultural and economic backgrounds. The strategy for collecting information included the use of diverse approaches such as interactive interviews, focused group discussions, systematic observations, and documentation from oral history, reports, research publications, mass media, articles and magazines. A questionnaire was developed for guiding discussions during focused group discussions and a supplementary questionnaire was developed to guide discussions with key informants on natural resources conservation and disaster management. The focused group discussions were carried out in all the areas under investigation.

In each location, the focussed group discussions were conducted with three discussant groups defined by age as follows: 25-40, 40-60 and above 60 years. In some sessions discussion for men and women were separated. The focussed group discussions were recorded and the information analyzed and entered into a database.

Swaziland

In Swaziland a combination of research tools was used to collect data. The Rural

4 The areas are Rusinga and Mfangano Islands in Lake Victoria and Kano in Nyanza Province and Budalang'i in Western Province; and Lamu Island and Kwale District in Coast province; and Makueni District in Eastern Province.

Participatory Appraisal (PRA) and in-depth interviews were used. The PRA method proved to be an accessible method of consultation with rural communities since bringing them to a common site reduced the time spent travelling to homesteads that are scattered.[5] The in-depth interview method through a well-structured questionnaire was also used with rural participants identified from the focus groups and selected individuals, mostly from urban areas, who were selected on the basis of their occupations.[6]

The method for data collection included a gender responsive participatory approach based on the understanding that men and women possess different indigenous knowledge regarding nature conservation and natural disaster management and respond differently to their effects. Similarly, the youths were also included as a category in data collection, as they too were custodians and users of certain categories of indigenous knowledge.

Twelve areas were selected for study based on agro-ecological zones as well as on whether they had experienced drought in the past or were under a drought condition.[7] In each Inkhundla - a local government area -- a representative sample of 15 men, 15 women and 15 youths were recruited as respondents. Focus groups ranged from 4 to 8 people. Those numbers were reasonable as they factored in possible failure to attend.

Tanzania

Tanzania used the key informant interview method based on a semi-structured questionnaire. This involved both individual and group interviews. In order to get

5 Holland and Blackburn have indicated that PRA, a qualitative research tool devised for use mainly within developing countries, is an ideal tool for carrying out research in community development and has the potential of reducing the gap between groups, be it education or status (Holland, J. and Blackburn, J. (Eds.) (1998). Who's Voice? Participatory research and policy change. Intermediate Technology Publications (1998) (Holland, J. and Blackburn, J. (Eds.) (1998). Whose Voice?)

6 The study gathered the views of communities and individuals about indigenous knowledge on air, land, water, forest, biodiversity (flora and fauna), management of natural disasters especially floods and drought disaster events, alleviation of poverty and traditional medical practice.

7 The areas selected were selected Ngwemphisi, Maseyisini and Mtsambama (Highveld); Tikhuba and Lomahasha (Lubombo plateau), Ntondozi and Mkhiweni (Middleveld); and Lubulini and Matsanjeni, Siphofaneni and Mpholonjeni (Lowveld).

the maximum amount of data and information from the interviews, a comprehensive checklist of the needed data and probing questions were used to make sure as much data as possible was obtained. In designing the interview checklist the ultimate goal of integrating indigenous knowledge with modern science in sustainable development processes - policy, legislation, development planning, programme development at different levels -- was taken into account, as well as the need for the final report to provide conclusions and recommendations that would serve as a basis for follow-up actions. The checklist included issues on knowledge of traditional indicators for predicting the onset, cessation and quality of the rainfall seasons, knowledge of historical natural disaster events and associated survival mechanisms.

In selecting respondents, gender and age-group aspects were addressed by having women, youths as well as old men among the people who were interviewed. Elders aged above 60 years were involved in each village. There was a bias towards the more elderly people due to the well-known truism that such people have a wealth of information on indigenous knowledge systems.

Incentives in the form of gifts, such as money for buying sugar, were provided in order to create good rapport. Local contact persons were also used to help make arrangements for the interviews and site visits.

Limitations

The study had some limitations. One of the most obvious ones were those pertaining to complete disclosure in the sensitive area of traditional medicine. This is freely acknowledged in the Swaziland study. Some informants in Swaziland "censored" information given to researchers on medicinal practices in an apparent effort to guard intellectual property rights or the stealing of healing secrets. In addition, much of the information given by the stakeholders on natural resources and management of natural disasters in the Swaziland study were "myths which were subject to a lot of

8 Khumalo, Thandi F. and Amusan, O. O. G. "Research Framework and Methodology" in Nature Conservation and Natural Disaster Management - Role of Indigenous Knowledge in Swaziland. University of Swaziland

speculation and cannot be replicated in other places."[8] In addition, respondents in the Swaziland study did not provide information on air, water and land resources.

Other limitations included the sampling technique of using ecological zones. Participants tended to generalize on the indigenous knowledge they possessed, without reflecting on the specific ecological zone. Other limitations included the sampling technique of using ecological zones. Participants tended to generalize on the indigenous knowledge they possessed, without reflecting on the specific ecological zone where the interview occurred. This influenced data analysis, for instance, on some food plants and fruit trees, which may not necessarily reflect ecological zone relevance.

It should also be noted that only a few communities were included in the study. The study therefore did not benefit from the rich indigenous knolwedge that exists in

the communities that were not included in the study in the four countries and other countries of Africa.

# Chapter Two

## Indigenous Knowledge

### Introduction

Indigenous knowledge can be defined as a body of knowledge built up by a group of people through generations of living in close contact with nature .[9] A broader definition is that indigenous knowledge is the knowledge used by local people to make a living in a particular environment.[10] These are simple but convenient definitions. However, indigenous knowledge is much more complex. In fact, a variety of terms have been used to describe this form of unique knowledge. These have included such terms as "local knowledge," "traditional knowledge," "indigenous traditional knowledge," "indigenous technical knowledge", "traditional environmental knowledge", "rural knowledge", "traditional ecological knowledge", and so forth. However, these terms have similar meanings.

But while there may be similarities in indigenous knowledge systems, indigenous knowledge is specific to communities and local environments. Indigenous knowledge among the Luo of western Kenya who live by the shores of Lake Victoria can hardly be the same as that of the Swazi people living in the mountainous western side of the southern Africa kingdom which is characterized by steep slopes, incidence of frost, sour grasses, poor soils and poor grazing. Even within a country, indigenous knowledge systems can differ widely; for example the indigenous knowledge of the Maasai who are pastoralists in the rangeland areas of the Rift Valley in Kenya is different from that of the people of Lamu Island on the Indian Ocean whose livelihood is based largely

9 Johnson, M. 1992. Lore: Capturing Traditional Environmental Knowledge. IDRC: Ottawa, Canada.

10 Warren, D.M. 1991. Using Indigenous Knowledge for Agricultural Development. World Bank Discussion Paper 127. Washington, D.C.

on fishing. The great diversity of the African environment, therefore, makes it difficult to generalize about the specifics of indigenous knowledge systems.

Indigenous knowledge reflects many generations of experience and problem-solving by ethnic groups at the local level, and no experience of one country can exactly replicate another. Most writers, however, favour the use of the term "indigenous knowledge" although some writers make a distinction between "indigenous knowledge" and "local knowledge". "Indigenous knowledge" is said to refer to the knowledge possessed by the original inhabitants of an area, while the term "local knowledge" refers to the knowledge of any people, not necessarily indigenous, who have lived in an area for a long period of time.[11] The National Academy of Sciences prefers to use the overlapping concept of "indigenous and local knowledge", which it defines as "specific systems of knowledge and practice, developed and accumulated over generations within a particular cultural group and region, and as such are unique to that group and region."[12] In this report the term "indigenous knowledge" is used to cover all those concepts of knowledge systems.

## Indigenous people

As we have seen indigenous knowledge relates to a particular people. It is specific in both time and space, and it is often associated with the original inhabitants of a particular geographic location who have a distinct culture and belief system. Such original inhabitants are often referred to as the indigenous people. Examples of indigenous people include the Maasai of Kenya, the San people of southern Africa, the so-called pygmies of the equatorial forests of central Africa and the Aboriginals of Australia. Other people who may not have been indigenous to an area - because they migrated from elsewhere - but have lived long enough in an area are normally thought of as indigenous as well. Most of the communities in Africa, such as the Luo of Kenya and Zulu of South Africa, fall under this category.

11 Langill, S. 1999. Indigenous Knowledge: A Resource Kit for Sustainable Development Researchers in Dryland Africa. Internet. www.idrc.ca/plaw/11e-IK.html

12 USNC/IUHPS Position Paper on Science and Indigenous Knowledge, June 2001. National Academy of Sciences. 500 Fifth Street, N.W., Washington, DC 20001

However, the term "indigenous" has become so politicized over recent campaigns on "the rights of indigenous peoples" that it tends to exclude such local communities who may have lived in an area for a long period of time and developed their own system of local knowledge but are not the original inhabitants. That is one of the reasons why some writers prefer to use other terms to describe indigenous knowledge, such as "local knowledge" or "traditional knowledge", which are broader concepts referring to the knowledge possessed by any group living in a particular area for a long period of time. Langill states that in using this concept, it is not necessary to know if the people in question are the original inhabitants of an area; the important thing is how people - aboriginal or non-aboriginal - in a particular area view and interact with their environment.[13] For instance, the Afrikaners though not indigenous to South Africa have lived long enough in the country and have developed their own indigenous knowledge, such as drying in the sun narrow strips of meat (biltong), often through interaction with the indigenous communities.

## Global recognition

Indigenous knowledge, particularly agricultural and environmental knowledge, gained international recognition after the United Nations Conference on Environment and Development (UNCED) held in June 1992 in Rio de Janeiro. Agenda 21, one of the environmental agreements signed at UNCED, emphasizes that governments and intergovernmental organizations should respect, record, and work toward incorporating indigenous knowledge systems into research and development programs for the conservation of biodiversity and sustainability of agricultural and natural resource management systems. Other international documents, such as the 1980 "World Conservation Strategy" by the International Union for the Conservation of Nature and Natural Resources (IUCN), also paved the way for the recognition of the important role played by indigenous knowledge in biodiversity and human development. The value of indigenous knowledge systems in facilitating development is now gradually being recognized by governments and developments agencies.

## Pseudoscience or anti-science?

13 Langill, S. 1999. Indigenous Knowledge: A Resource Kit for Sustainable Development Researchers in Dryland Africa. Ibid.

Indigenous knowledge develops in local contexts to solve local problems. It does not set itself in opposition to science. It is just another form of knowledge. Picture by courtesy of the IGAD Climate Prediction and Applications Centre

Best Practices

A good example of how indigenous knowledge can be integrated with modern technology is related by CARE Kenya.[14] In Nyanza province, Kenya, the Luo community uses indigenous knowledge to produce clay pots which are used to store drinking water. The climate is hot and the clay pots are used because of their evaporative cooling effect on the water. CARE Kenya used this mode of indigenous knowledge to sell to the local communities a more hygienic version of the clay pots.

In its 1996 and 1999 assessments CARE found that only 34 percent of the population in Nyanza had access to safe drinking water and the incidence of diarrhoea among children was 47 percent. Traditionally the people in these communities stored drinking water in the locally produced wide-mouth clay pots. The baseline survey indicated that over 90 percent of the residents used those pots. Water is drawn from the pots using a calabash or a cup. Often the cups, or the hands holding them, were contaminated. As a result, the water was contaminated and those who drank it became ill.

Water contamination during storage and handling resulted in diarrhoeal diseases, a problem that was further aggravated by poor water sources. Because the people were not willing to change to plastic vessels designed to reduce or eliminate post-contamination, local potters, with technical assistance from CARE, began to produce modified clay pots. They fitted the indigenous knowledge pots with a narrow mouth, a spigot, a lid and a flat base for easy water extraction. There is a space to retain sediment and the water is treated, stored and accessed through the spigot.

The technology to produce the pots relies on the indigenous skills of local potters. The modification is not a major deviation from the conventional pot; its original colour, form and function are maintained. Up to 90 percent of the raw materials are natural and available locally, while the others are available in local shops and markets. The modified pots are very popular with the local people. They can still store their water in the traditional way, which keeps the water cool and improves its palatability, while the modified design prevents the transmission of disease.

Some scientists have been concerned that the promotion of indigenous knowledge is tantamount to the promotion of pseudoscience and anti-science. Even in Africa, one of

14 CARE International in Kenya. Website: www.care.or.ke

15 Mhita, M.S. Final Draft Report on "Nature Conservation and Natural Disaster Management - Role of Indigenous Knowledge in Tanzania". Tanzania Meteorological Agency.

16 USNC/IUHPS Position Paper on Science and Indigenous Knowledge. Ibid.

the world's strongholds of indigenous knowledge, it has until recently "been regarded as being backward, static and a hindrance to modernization."[15] However indigenous knowledge is different from pseudoscience or anti-science.[16] While "pseudoscience" constitutes an attempt to be perceived as scientific, "anti-science" connotes an opposition to science. Indigenous knowledge is neither of those. It is developed with different intent and in a context different from pseudoscience and anti-science in that it neither attempts to masquerade as science nor sets itself in opposition to science.

Efforts should be focused on examining the relations between scientific knowledge on the one hand and indigenous knowledge on the other. For instance, it would be worthwhile to explore the synergy between the two forms of knowledge in such issues as how local knowledge of celestial events aided in the prediction of the El Niño torrential rains in some communities in South America, or how the Nganyi clan of western Kenya are able to monitor and predict rain using shrines that are characterized by pristine biodiversity.

Interface

How indigenous knowledge can best be integrated with scientific knoweledge is one of the important questions facing indigenous communities. Modern science is more acceptable to the indigenous communities if it is integrated with what they already know. Scientific weather forecasts, for instance, may be more credible to the communities in the project countries if ways are found to integrate them with indigenous knowledge that they have relied on for generations to predict and cope with droughts, floods, and other natural hazards. A case in point is the experience with peasant farmers who listen to weather forecasts on radio by the meteorological department but still prefer to rely on their own traditional knowledge of when to start planting. The more the "scientific" forecasting deviates from traditional knowledge the less it is used for planning purposes by the indigenous communities.[17]

17 Orindi, Victor. "Experiences with Indigenous Knowledge for Early Warning and Nature Conservation." African Centre for Technology Studies (ACTS), Nairobi, Workshop on Indigenous Knowledge for Nature Conservation and Disaster Management in Kenya.

A member of the Nganyi clan in western Kenya, well known for their rain-making powers and weather prediction. He is blowing into a special pot, used for monitoring daily weather, that is over 100 years old.

There is also the story of the Kikuyu farmers in Kenya who rejected European farming techniques at the turn of the 20th century that were being promoted by British agricultural officers. The Kikuyu farmers preferred their own agricultural knowledge

18 Warren, D.M. "Indigenous Knowledge, Biodiversity Conservation and Development". Paper delivered at the International Conference on Conservation of Biodiversity in Africa, Nairobi, 30 August-3 September 1992.

Kinga shrine in Mfangano, western Kenya, an example of the role that indigenous knowledge plays in nature conservation. Though shrines were generally used as locations for worship and communication with ancestors and gods, they also provided a sanctuary for a variety of indigenous trees, plants, animals, birds and insects. They indirectly contributed to the conservation of biodiversity

which had stood the test of time; they saw no need to tinker with what had served them so well for generations.[18]

Likewise, the story of the Nile perch in Lake Victoria illustrates the need for respecting indigenous knowledge when introducing alien innovations. The communities around the lake could fish sustainably all the year round because the lake had many indigenous species with different breeding seasons, which they understood well. But when the Nile perch was released into the lake it devoured most of the indigenous species and

the communities lost the availability of different types of fishes that were available all the year around.

Accessibility

Indigenous knowledge provides valuable insights on how communities have interacted with their local environment. Unfortunately indigenous knowledge systems in Africa have not been systematically recorded and are therefore not readily accessible to policy makers, researchers and development agents although several writers have provided detailed overviews of indigenous knowledge systems in agricultural development, pastoral management, and agro-forestry.[19] This "uncertain status" of the indigenous knowledge is of great concern.

"Very little of this knowledge has been recorded, yet it represents an immensely valuable data base that provides humankind with insights on how numerous communities have interacted with their changing environment including its floral and faunal resources," says D. Michael Warren, the Director of the Center for Indigenous Knowledge for Agriculture and Rural Development, Iowa State University, Ames, USA.[20]

He goes on to state that indigenous knowledge in the African context has long been ignored and maligned by outsiders. "Today, however, a growing number of African governments and international development agencies are recognizing that local-level knowledge and organizations provide the foundation for participatory approaches to development that are both cost-effective and sustainable"

A related problem is the loss of indigenous knowledge. Apart from the fact that the older generation, the traditional custodians of indigenous knowledge are dying off without leaving a written record of their knowledge, rapid environmental, socio-economic and political changes occurring in many African communities put indigenous knowledge in danger of being overwhelmed by globalization and new

19 Rajasekar, B., D.M. Warren, D.M. 1991. Using Indigenous Knowledge for Agricultural Development. World Bank Discussion Paper 127. Washington, D.C.; and S. C. Babu 1991. Indigenous Natural-Resource Management Systems for Sustainable Agricultural Development - A Global Perspective. Journal of International Development 3 (1): 1-15.

20 Warren, D.M. Ibid.

knowledge. It may be lost forever. Langill notes that younger generations are acquiring different values and lifestyles as a result of exposure to national and global influences and traditional communication networks are breaking down, meaning that elders are dying without passing their knowledge on to children.[21] In all of the countries in the research project - Kenya, South Africa, Swaziland and Tanzania -- not enough has been done to document indigenous knowledge, even though it permeates most aspects of life.

Importance

Notwithstanding, indigenous knowledge is of great importance in all the four countries. In Swaziland, for instance, indigenous knowledge influences many areas of life; its role in the social and economic well-being of the nation and in the management of its resources and the environment is immense.

It is beyond doubt that indigenous knowledge is important for the survival of many indigenous communities and the preservation of biodiversity. Warren notes that indigenous knowledge provides the basis for grassroots decision-making, much of which takes place at the community level through indigenous organizations and associations where problems are identified and solutions to them are determined. "Solution-seeking behavior is based on indigenous creativity leading to experimentation and innovations as well as the appraisal of knowledge and technologies introduced from other societies," D. Michael Warren notes.[22]

Another writer, Thrupp also notes that indigenous knowledge empowers local communities, contributes to development and increases self-sufficiency.[23] Indigenous food production and preservation systems, for example, contribute significantly to food security. Indigenous knowledge, in its various manifestations, also gives cultural pride and motivation to solve local problems with local ingenuity and resources. It is a crucial

21 Source: IIRR, 1996a

22 Warren, D.M. Ibid.

23 Thrupp, L.A. 1989. "Legitimizing Local Knowledge: From Displacement to Empowerment for Third World People". Agriculture and Human Values. Summer Issue. Pp.13-24.

aspect of sustainable development. For thousands of years local communities have been managing their environments using indigenous knowledge technologies and know-how. These have been proven to be superior in many cases than alien technologies. Indigenous knowledge technologies and know-how rely on locally available skills and materials and are thus often more cost-effective than exotic technologies introduced from the outside.[24]

Limitations

As with other forms of knowledge, indigenous knowledge has its limitations or weakness, and these must be recognized if its integration with scientific knowledge is going to be worthwhile. Certain indigenous knowledge practices may also become outmoded because of rapid changes in the environment or the socio-economic and cultural scene. Not all indigenous knowledge practices are naturally in harmony with the environment.

There is historical and contemporary evidence that indigenous peoples have also committed environmental wrongs through over-grazing, over-hunting, or over-cultivation of the land and it is misleading to think of indigenous knowledge as always being "good", "right" or "sustainable".[25] In particular, indigenous knowledge relating to cultural artifacts, totems, rules and taboos, beliefs and prohibitions may require critical examination. For instance, where perhaps in some distant past there was need for people to hold that women and children should not eat chicken or eggs, it is questionable whether that prohibition is justified today. The same goes for the tradition, common in many tribes, which specifies which parts of an animal or chicken can be eaten by men, women and children respectively. Many of the taboos, rules and prohibition seem no longer to be serving a useful purpose or to be rational. However, in critically re-examining those beliefs it is always useful to bear in mind their purpose,

24 IIRR, 1996a

25 Langill, Steve. Introduction to Indigenous Knowledge. The Overstory #82. This edition of The Overstory is excerpted from: Langill, S. 1999. Indigenous Knowledge: A Resource Kit for Sustainable Development Researchers in Dryland Africa. People, Land and Water Program Initiative, IDRC, Ottawa, Canada. Web site: http://www.idrc.ca/plaw/11e-IK.html

rather than their grounding. For example, among the communities in western Kenya every young boy in the village was restrained from killing frogs by creating the fear that his mother's breasts would disintegrate if he did so. The logic of this prohibition is faulty, but its purpose is sound since frogs needed to be protected to avoid extinction as they were valued by the communities for some forms of traditional medicine.

Indigenous knowledge is dynamic and evolves all the time. However, Thrupp has noted how sometimes indigenous knowledge that was once well-adapted and effective for securing a livelihood in a particular environment becomes inappropriate under conditions of environmental degradation and when change is particularly rapid or drastic, the knowledge associated with them may be rendered unsuitable and possibly damaging in the altered conditions.[26]

## Summary and conclusions

Indigenous knowledge can be summed up as the wisdom of a people for survival in their own environment. It is a broad concept that covers all forms of knowledge of a particular community living in a particular area. It is dynamic and continually evolving. Traditional communities rely on traditional knowledge and it is necessary to integrate their knowledge systems with scientific knowledge and emerging technologies. While indigenous knowledge is of great importance in the lives of the communities studied in all the four countries, little has been done to document it and there is a crying need for more research in the subject. Indigenous knowledge cannot be ignored in a

26 Thrupp, L.A. Ibid.

world where it plays such an important role in disaster management, environmental conservation and the social and economic well-being of local communities .

# Chapter Three

## Application and Use of Indigenous Knowledge in Environmental Conservation

### Introduction

The communities in the areas studied in Kenya, South Africa, Swaziland and Tanzania used a variety of innovative, effective, and in some cases unique indigenous knowledge approaches to environmental conservation. Some of the approaches, such as shifting cultivation, mixed cropping, intercropping and transhumance were commonplace. However, many of the approaches were peculiar to the local environments and cultures and could not easily be replicated elsewhere. For example, the cultivation technique known as ngoro could only have evolved in an environment like the Matengo Highlands in southern Tanzania where unusually heavy rain pounded on the landscape destroying crops planted on hillsides. The Matengo people, believed to have lived in the steep slopes of Matengo Highlands since the Iron Age, built the system to protect their farmlands against erosion and to trap the rapid run-off to improve the moisture of the soil, as well as to conserve soil fertility by composting.

The ngoro system illustrates the multipurpose function of many of the indigenous knowledge approaches to environmental conservation. For many of them it is difficult to isolate only one function, or role, or to say where one function ends and another begins. For instance, many of the traditional conservation measures were also measures for dealing with natural disasters such as drought and floods. A conservation measure such as mixed cropping or intercropping maize with pumpkins, maize with potatoes, maize with beans, etc. is not only a conservation measure in that it conserves soil fertility through the benefits of crop symbiotic relationships such as nitrogen fixation and weed control, it also minimizes the risk of total crop failure through hazards as it spreads the risk by having more than one crop variety in the field.

The effects of indigenous knowledge conservation measures and technologies also tend to pervade the entire environment. For instance, in many of the communities certain forests were protected as shrines to be used for worship and other rituals. Such protected areas in fact ended up having multirole functions as they also influenced other elements of the environment, like biodiversity, forest conservation, land use and management, and so on. Because of this interconnectedness and "cross-cutting" nature of indigenous knowledge, it is convenient to describe the different indigenous knowledge measures for environmental conservation regardless of their intended or perceived purpose and examine how they relate to all areas of conservation including land management and use, forest, wetlands and biodiversity conservation.

As a matter of fact, under indigenous knowledge practices, what may appear to be a purely land management issue may have implications for forests, wetlands and biodiversity conservation. Compartmentalization is difficult if not impossible in this area of indigenous knowledge. Nevertheless, it is in order to look at the different elements of conservation separately but while bearing in mine their cross-cutting nature.

Land management

Land management under indigenous knowledge involves a number of farming technologies that have repercussions across the whole spectrum of conservation. These include such practices as slash-and-burn, shifting cultivation, use of grass strips, intercropping, selective cultivation, and a number of other technologies and practices that seek to optimize food production under varying environmental conditions. In addition, many of the communities surveyed combined cultivation with livestock rearing.

Use of grass strips is another form of land management. In Swaziland, these are common traditional land management systems. Pieces of land, one to one-and-a-half metres wide, with traditional vegetation are left between fields to control soil erosion

and conserve biodiversity. The strips also serve as sources of medicinal plants and feed for livestock.

Rapur or kwenyagot, a western Kenya Luo hoe, an example of the simple tools used by traditional communities for cultivation. The tools were not capable of cutting big trees, clearing large tracts of land, or heavy turning of the soil. They left the environment largely undisturbed.

## Simple tools

In examining the application and use of indigenous knowledge in environmental conservation, it is logical to begin at the beginning - with land clearing and cultivation. This was done using simple tools, mostly crude iron blades made by the village smith. The communities did not have modern power saws, tractors and ploughs. Their simple implements were not capable of cutting big trees or clearing large tracts of land easily.[27] This was a mixed blessing because it also meant that big trees and forests were left

27 The tools included curved iron blades with long handles used to clear shrubs and grass, planting jembe (hoes) not capable of opening up large tracks of land and deep layers, such the Luo hand hoes including rapur or kwenyagot (V-shaped wooden stick with a thin metal piece attached to its shorter end).

largely untouched. It also helped control soil erosion as there was minimum tillage and only the top soil was disturbed.

The use of these rudimentary tools was also labour intensive. This, too, helped in nature conservation because forests in general were left intact. It was the same story with fishing. The harvesting of fish and other aquatic products was done using traditional tools and equipment including spears, nets, traps, canoes and stockades of a rudimentary nature that made overfishing difficult and did not cause stock stress.

Slash-and-burn

Given the simple tools in use, the most popular method of land clearance was "slash-and-burn". In many cases the bushes would be cleared with a slasher and then collected in heaps and burned. Alternatively, a small bush area would simply be set on fire, which was carefully controlled. This was the only method that the traditional farmers could use with ease to cultivate sizable pieces of land. The method also assisted in controlling disease vectors both for human and livestock. The fires might also destroy some nutrients and living organisms. However, the land was left to lie fallow under shifting cultivation and was able to regenerate.

Shifting cultivation

Shifting cultivation was a major form of land use and management.[28] It involved cultivating one spot of land, then leaving it lie fallow after a few years of cropping. Because land was freely available this practice was possible and convenient. Farmers could easily move from one piece of land to another to allow for natural rejuvenation of the land. The miombo woodlands in Tanzania were typically utilized in this way. In mountainous areas, such as the Uluguru Mountains of Tanzania, shifting cultivation also helped to control gully erosion by allowing natural vegetation to reclaim the land.

However, as population increased and land became not so freely available, the length

28 Ruthenberg, H., 1971. Farming systems in the tropics. Oxford University Press.

of the fallow period diminished and in many cases shifting cultivation gave way to sedentary farming.

Even as land became less freely available to support shifting cultivation, indigenous knowledge developed a number of practices in land management that promoted environmental conservation. These practices included mixed cropping and intercropping, minimal tillage and agro-forestry, agro-pastoralism, zoning, fisheries conservation, and a number of land use and cultivation technologies such as the ngoro, ufipa, ngitiri, ronjo and making maji systems that were primarily aimed at optimizing on the available land and conserving the moisture and fertility of the soil. It is necessary to describe some of these practices briefly to underline their value in environmental conservation.

### Land ownership

It is necessary first to note that land in general was communally owned and equitably available to all members of the community.[29] This practice supported shifting cultivation, ensuring that one did not need to use a particular piece of land continuously for too long. Communal land ownership also supported rotational grazing and transhumance and helped avoid excessive exploitation of vegetation, thus protecting land from overgrazing and degradation.

### Mixed cropping

Besides relying on forest or bush vegetation in shifting cultivation to regenerate the soil, mixed cropping and intercropping farming technologies were adopted to optimize the use of naturally available soil nutrients and to promote high yields. Mixed farming could also mean keeping livestock as well as engaging in crop growing at the same time, which helped improve the fertility of the soil by using the manure that came from the animals.

29 People had only user-rights but not ownership of land. In most of the communities they could not transact any land deals without the consent of the elders. However, the present-day individual land ownership rights, backed by legislation and land registration, as well as population increase have led land degradation and elders have lost their traditional control over land in most of the communities surveyed.

Shifting cultivation: A miombo woodland in the process of regeneneration in Tanzania

Mixing or intercropping maize was a common practice. It promoted efficient labour utilization and lessened the risk of total crop failure since the chances were that if one of the crops succumbed to stress others would survive. Mixed cropping or intercropping stabilized yields, preserved the soil and made it possible to harvest different crops at the same time. The advantages of those technologies were that there was a reduction in susceptibility of the crops to pests and diseases and a better use of the environment where the combination of species grown had different light requirements or explored ~~different depths of soil.[30] They also tended~~ to provide a complete vegetation canopy,

30 Spedding, C.R.W.1979. An introduction to agricultural systems. Applied Science Publishers Ltd

Mixed cropping stabilizes yields, preserves the soil and provides different types of food on one piece of land

although at different heights, and thus broke up heavy rainfall, protecting the soil as well as controlling weed growth.

Minimal tillage

Minimum tillage and agro-forestry were also practiced. These methods of land use and management were used to promote higher yields. In Tanzania, where the methods were common, bushes or forests were cleared and the vegetation burned and the resulting ash used as the initial fertilizer. Only the area where the collected vegetation

was placed and burned was tilled and planted. In Mbinga district, branches of the leguminous acacia tree were burned in heaps and finger millet (Eleusine corocana) and pumpkins were planted on the ashy spots. This often gave very high yields due to the nutrients released into the soil by the ash of the burned branches. The acacia trees were not felled; only their branches were cut, leaving the tree to regenerate new branches for future use. This was a kind of agro-forestry practice.[31]

The people also practiced what the Tanzania study described as precision farming, that is identifying parts of the field that had more fertility than others. For example, spots that used to have anthills, cattle kraals, or household wastes were selected for planting.

Agro-pastoralism

The agro-pastoral communities in the areas studied practiced controlled grazing to conserve vegetation. They practiced grazing rotation to avoid overexploitation of the vegetation. Among the Lake Victoria communities, for example, this rotational grazing was practiced as a form of transhumance where animals were grazed in the higher areas during the wet season and brought back to the river banks and lake shores during the dry seasons. In the drier areas of Makueni and Kwale districts of Kenya, livestock was moved from pasture to pasture in order to maintain the ecological balance. In Kitumbeini division of Arusha region in Tanzania the Maasai pastoralist practiced the ronjo system, a traditional method of dividing the village into pasture zones to conserve their pasturelands and prevent drought-borne disasters. However, pure pastoralism was the most common practice of the Maasai, who seasonally moved their herds to take advantage of the rangeland.

Zoning

In some cases communities "zoned" their land, according to ecological factors. The rotational grazing practised by the Lake Victoria communities, for example, was in

31 Agro-forestry system involves various combinations of woody and herbaceous vegetation with agricultural crops. It could result in multiple agronomic, environmental, and socio-economic benefits, and conserve biodiversity.

fact land zoning - using the higher grounds for homestead settlements and the lower grounds closer to the lakeshores for cultivation and animal grazing.

Ngoro system

Perhaps the most ingenious land management systems that helped to conserve the environment were the various cultivation practices used on unstable soils. These included the ngoro system, an innovation which prevents the destructive effects of surface runoff in cultivated steep slopes.[32] It had many benefits including soil moisture conservation, soil fertility retention and soil erosion control. What prompted the Matengo people of Tanzania to design this technology was the intensity of the rainfall that was experienced during those days.[33] Many farmers living in the Matengo Mountains see the ngoro system as the only feasible cultivation practice that can enhance and sustain crop production in the hilly lands.

Ufipa mound system

Another notable land management system was the ufipa mound system practiced in the Rukwa region of Tanzania. It is a method of cultivation that involves making of compost mounds called intuumba.[34]

The mounds are prepared mainly for planting finger millet, cassava, beans and maize. Like the ngoro system, intuumba helps to maintain soil fertility, control soil erosion, and conserve moisture. The ngoro and ufipa mound systems are used on land that has already been subjected to continuous cultivation; they act as alternative fertility

32 Lyimo J.G. and R.Y.M. Kangalawe: The role and dynamics of traditional farming systems in agricultural sustainability. The case of Matengo pits and Ufipa mounds systems. In Institute of Resources Assessment, University of Dar- es-Salaam, Research Report No. 100 (New Series). April 1997. 44 pp; Stenhouse, A.S. 1944. Agriculture in the Matengo Highlands. East African Agricultural Journal 10:22-24; and Pike, A.H., 1938|. Soil Conservation among the Matengo tribe. Tanganyika Notes and Records 6:79-81.

33 Rainfall over Matengo highlands is believed to have been in the range of 1500-1700 mm per year.

34 Lyimo J.G. and R.Y.M. Kangalawe: The role and dynamics of traditional farming systems in agricultural sustainability. The case of Matengo pits and Ufipa mounds systems. In Institute of Resources Assessment, University of Dar es Salaam, Research Report No. 100 (New Series). April 1997. 44 pp.

The Matego people of Tanzania practised the ngoro system, an innovation that prevents the destrutive effects of surface runoff in cultivated steep slopes

maintenance techniques because by using these systems farmers also avoid the use of expensive fertilizers.

Makinga maji

In mountainous areas with steep slopes such as East Usambara and Uluguru mountains in Tanzania, soil erosion on farmland was controlled by the construction of water channels along hill contours to divert water to the sides of the slopes. These channels were known as makinga maji. Plants with soil retaining root systems were used to

support the channel embankments or dikes and prevent them from collapsing. Common plants used for this purpose were elephant grass and sugar cane.

### Ngitiri

The Sukuma people who inhabit Mwanza and Shinyanga regions near Lake Victoria in northwestern Tanzania practice an indigenous silvipastoral system known as ngitiri or enclosure, which evolved out of the need to cope with scarcity of grazing areas particularly during dry seasons between June and October. It is almost like a zoning system. It involves the conservation of grazing and fodder lands by retaining an area of standing hay as reserve and encouraging vegetation regeneration.[35] Supplemented with tree planting, ngitiri has proved to be effective in protecting the environment and improving the livelihoods of the communities in the region. The ngitiri system was effective in conserving and protecting the soils and for reclaiming degraded lands.[36] In the ngitiri system species are selected on their suitability for conservation measures, such as soil conservation. Once selected, degraded areas are closed off to protect them from animals for a period of about five years to allow regeneration. Tree planting is also done in the degraded areas to add socio-economic and environmental value to the ngitiri. In the wet season, between October and May, the areas are closed off to animals in order to allow vegetation to regenerate. During the dry season, in June to September, once grazing areas are depleted, the ngitiri is opened bit by bit to allow animals graze.

### Conservation of fisheries

Management of water bodies was also an important aspect of indigenous knowledge in land use and management. The communities that live around water bodies such

35 Maro, R.S. (1995). In situ conservation of natural vegetation for sustainable production in agro pastoral system; a case study of Shinyanga, Tanzania. MSc. Thesis, Management of Natural Resource and Sustainable Agriculture, Agricultural University of Norway, As pp. 119; and Kamwenda, G. 1999. Analysis of "Ngitiri" As a Traditional Silvopastoral Technology among the Agro pastoralists of Meatu, Shinyanga, Tanzania. A dissertation submitted in partial fulfillment for the degree of Master of Science in Forestry of Sokoine University of Agriculture, Morogoro, Tanzania, 132 pp

36 Kilahama, F. 1994. Tree and Indigenous Ecological Knowledge about Agro-forestry Practices in the Rangelands of Shinyanga, Tanzania. PhD Thesis, University of Wales, Bangor, UK. 178 pp

## Inside Ongonye Forest

Not just anyone can go into Ongonye, the centuries-old forest that was the hunting grounds for kings, the sacred earth that received Queen Nandi, King Shaka's main umuzi. It is protected by KwaZulu Natal wildlife rangers and you need an access card to enter the 3,900 hectares of well-protected indigenous forest, which hosts 500-year-old trees and many medicinal plants and animals. The card indicates that a traditional healer has acquired sufficient knowledge of medicinal plants and understands conservation regulations governing the forest.

Biyela is one of the few traditional healers who holds a permission card for controlled harvesting of medicinal plants in the forest, located about 15 km from the coastal town of Mtunzini. Before he enters the forest, he announces his intentions to the forest rangers.

It is already sunrise and the forest is alive with sounds, many of its residents already out hunting for food. Biyela regards the palm-like plant with keen eyes. He has not forgotten the lessons his father taught him. It is a cycad. "This is the usolo tree. We use it to steam and wash with it for good luck and health," he says.

Trees, he adds, are your friends and knowing them changes your fortunes. He points to another tree, the amangwe, which he says "grinds itself from the inside". The flour-like substance that you can harvest out of the hollows of the tree cures heartaches. It also stops witchcraft and whoever bewitches you gets bewitched in return.

Not only plants that have value. This tree cockroach, he says, also has many uses. In moonlight, it shines. When crushed and mixed with other herbs, it relieves stroke.

Biyela is joined by Ngema, another well-known sangoma, who points out to another tree, the umkhondweni. "This tree brings back your wife if she deserted you," he says. "You grind it, make a hole out of a short stick, place it there and then blow it and whisper her name. And it is done."

Ngema says the white man's Viagra is unfair to women because it selfishly boosts man's libido. Our aphrodisiac, he says, must be used by both, unless the woman gets sick later. He goes on: "Use the wild bug medicine mixture to heal stroke, Zulu acupuncture, and in two weeks the affected person can dress himself....Prevent your wife from being promiscuous with a potion of wild bug mixed with other plants. Other men won't come near her."

In western Kenya communities had rules to protect forests associated with rivers and streams, which they recognized as shrines. This forest cover protects River Chalua in Mfangano. The forest itself was protected by strong traditional rules and prohibitions. The river is still intact, while others have disappeared where the forest cover was not protected.

as Kenya's Nyanza Luo and Suba Abasuba, Western Banyala in Budalang'i, Coast's Pokomo and Mijikenda along the Tana River and the Swahili people along the Indian Ocean, have used water resources as the basis for their livelihood. The practices and technologies these communities have adapted were geared towards sustainable harvesting of the aquatic resources. The communities in the Lake Victoria basin, for instance, had rules for fishing to ensure sustainable harvesting of fish from the lake. There were strict rules on sizes of nets, types of traps and methods of fishing for specific periods of the year. Any young fish caught by mistake was thrown back into

the water. The rules gave the fish opportunities for breeding while at the same time allowing the communities to fish for specific types of fish each season.

There were many types of fish species in the Lake Victoria, most of which are almost extinct today following the introduction of the Nile perch which devoured the indigenous species. The introduction of the Nile perch has upset the traditional fishing and conservation methods.

In Kenya's Lamu Island, the main fish species that were caught included nguva (dugongs) and turtles. These were carefully harvested in such a way that they had time to multiply. The strict rules on the conservation of mangroves along the coastline provided a safe sanctuary for the breeding of these marine species and contributed towards nature conservation by controlling coastal erosion, accretion and water pollution. Also, the fishing communities were conscious of protecting their main source of livelihood. Therefore, totems and taboos checked illegal fish catches and promoted compliance.

More recently, however, commercial fishing has destroyed traditional fishing. Licensed foreign fishing fleets with large factory trawlers spend months at sea hauling in large netloads of fish. The various species are now harvested non-selectively, hence the extinction of such species as nguva and turtles around the Lamu area. The traditional selective fishing methods were critical in the preservation of aquatic biodiversity. The fishing was properly managed on the basis of seasons to give the fish some breeding space. The rules were well observed since the traditional governments covered small areas and were in constant contact with the fishers.

In Kwale, Kenya, the sea was divided into riko (sub-zones) for better management of the ocean to ensure good catches of fish and conservation of the biodiversity. Each riko was put under the supervision of village elders who ensured that no fisherman would catch small and immature fish and the ban on the use of urupha, poison for catching fish was observed. Urupha kills off fish and other aquatic organisms. The village elders controlled the movements of the fishermen. A particular radius would be allocated to a fisherman beyond which he was not allowed to fish. When the fishermen landed their catch, the village elders would inspect the fish and if a fisherman was

found with small fish (finger size) he would be banned from fishing for a time decided by the elders. His fishing gear was also confiscated.

Forests conservation

Intimately tied to indigenous knowledge land management practices was the conservation of forests. Using indigenous knowledge know-how as well as rules, prohibitions and taboos, all the communities practiced forest conservation. In the communities studied in Kenya most of the farming was done on the edges of forests, leaving the thick forests untouched. This helped protect indigenous plants in the thick forests, which take a long time to mature. It also prevented land degradation.

There were also tree and plant species that were considered sacred, or as totems, or were associated with some bad omens. For those reasons they were protected. For instance, Ficus thonningii, known locally in western Kenya as pocho, is considered sacred by many Kenyan communities including the Embu, Kikuyu, Kipsigis, Luhyia, Luo, Maasai and Meru. The tree is not supposed to be cut down or its wood used for fuel. In Swaziland trees such as bhubhubhu (Crotalaria capensis) and gcolokhulu (Rapanea melanonphloeos) are protected from being used as sources of building materials. In almost all the communities, there were also plants and trees that were associated with shrines and water sources that were therefore protected.

The communities in all areas studied valued trees for their beauty and products which included fruits and berries, medicine, fuel wood and construction materials. The various communities conserved them by harvesting them in a manner that allowed them to regenerate. There were restraints on the customary right of access to forests, thus checking the indiscriminate use of forest resources. There were also taboos and restrictions on gathering of plants, which limited to some degree the harvesting of plant resources. Some taboos prevented women and young people from cutting down certain trees. Menstruating women, for example, were prohibited from collecting medicinal plants; it was believed that if they did so that would reduce the healing

37 UNEP, 1999: Cultural and Spiritual Values of Biodiversity: A Complementary contribution to the Global Biodiversity Assessment, Nairobi.

power of the plants. These taboos ensured the conservation of many species.[37] In many communities, big trees were not cut for domestic purposes; only small shrubs, reeds, and grass, which regenerate quickly were used, for example, for building houses. Among the communities in the Lake Victoria basin aquatic plants --such as papyrus reeds and water reeds commonly used in making basketry, sleeping mats, fish cages and for thatching roofs -- were harvested sustainably.

Wetlands conservation

Wetlands - marshes and swamps - are generally found at the edges of rivers, streams, ponds, lakes, along floodplains and in coastal areas protected from waves. Wetlands exist in all the project countries. They are important habitats for biodiversity as many species of flora and fauna thrive in them. None of the case studies, however, devoted any attention to the wetlands apart from perfunctory references to their use as weather indicators or places where cocoyams are grown in some cases.[38] Yet wetlands are important ecosystems which, among other things, lessen soil erosion and may improve the quality of water as they serve as sites where surface water can seep into the ground and replenish the groundwater systems.

There is no question that some of the wetlands have been lost or encroached upon in some areas. The Kenya study reports that okoko (Synalontis spp.), an indigenous fish in western Kenya, is threatened due to the encroachment of wetlands. In general, however, it can be assumed that wetlands were conserved under the indigenous knowledge systems in the course of protecting watercourses including rivers. After all, the essential characteristic of wetlands is that water flows in or out. Without water there can be no wetlands.

The conservation of watercourses - rivers, streams, wells, water pans - and associated forests were integrated. The communities had rules that ensured the conservation of all sources of water and the associated forest cover. The springs, in particular, were

38 When permanent wetlands, thidhiya as they are known in Tanzania, show signs of drying up, it indicated looming drought. Magimbi or cocoyams (Colocassia spp.) are grown in wetland gardens in Tanzania as a fallback crop in case of a famine.

protected. Shrines and the forests covering springs were not interfered with. This ensured that water loss through evaporation was reduced.

The communities also valued rivers as important sources of water and fish and a lot of emphasis was put on their management. In western Kenya, communities had strong rules to protect forests associated with rivers, which they considered as shrines. River Chalua in Mfangano, for good example, was protected by traditional rules and prohibitions. The river is still intact today. In Lamu, elders protected sand dunes, which were the only sources of fresh water for the coastal town. Nobody could dig any water well without the permission of the elders.

The communities thus observed certain practices in the management of water, which protected watercourses as well as wetlands and ensured sustainable utilization of water sources including rivers and lakes. Many of the practices were based on taboos and prohibitions. For instance, in Swaziland individuals were warned not to urinate in rivers. If they did their cattle would give birth in a river and the newborn calfs would drown and they would therefore end up being poor since cattle are a symbol of wealth. This belief protected watercourses from contamination.

Biodiversity conservation

Indigenous knowledge systems conserved the biodiversity of the local environment in many ways because of the cross-cutting nature of conservation measures. Such practices as the traditional protection of forests, shrines, watercourses, certain species of flora and fauna, as well as farming technologies that focused on indigenous food crops, contributed immensely to biodiversity. But the most notable biodiversity conservation practice was the protection of forests and shrines. In Tanzania, for example, there are misitu ya jadi or traditionally protected forests --- small patches of natural forests not less than 0.04 hectares established by ancestors for worship and other cultural rites. These sacred groves were protected by the inhabitants in accordance with customary laws. Apart from being used as places of prayer, misitu ya jadi were also believed to bring rain.

In Babati District over 46 such traditional forest reserves covering over 288 hectares

were identified in a recent study, though there are probably many more. Within the miombo woodlands in Handeni District, there are also many patches of traditionally protected forests. A total of 660 such forests have been recorded in 23 villages. The sizes range from less than one hectare to more than 200 hectares. They are found in all types of landforms and soil types and have different species of plants and animals.

The conservation value of traditionally protected forests is judged from the unique plant and animal species they harbour. Wildlife takes refuge in these forests to escape from forest fires and hunters. The protected forests therefore play an important role as habitats for a high diversity of flora and fauna. Botanical surveys in Tanzania have shown that 50 percent of plant species found in these forests are not found in the surrounding areas, and 18 percent of them are in the red list of species that are threatened, endangered, vulnerable or rare.[39] Plant species vary greatly in these forests, showing that each traditional protected forest is invaluable as a conservation haven.

Traditional leaders also designated certain areas as exclusion zones in order to conserve forests. Indiscriminate felling of trees and other vegetation in these areas was forbidden. Violators were fined some quantities of food or live animals by the village authority or referred to the colonial government for tougher sentences. Some forests were also protected by taboos that forbade people to enter them and some trees were declared sacred and felling them constituted a breach of taboo. Folklore and stories such as those claiming that witches were patronizing some forests to practice their trade and store their tools of trade helped instill fear of violating the rules.

The effectiveness of the traditional sanctions is shown by the fact that the forest reserves have been virtually untouched for generations. They stand out as ecological museums of local vegetation. Most of them are located on slopes, hills and around natural springs.

The traditional forests are not peculiar to Tanzania. They also existed in other countries although not to the same extent a. For instance, in KwaZulu Natal in South Africa the

39 Laurel, A. and Nyberg, A. (2000). Plant species composition and plant uses in traditionally protected forests in Tanzania,Minor field studies No.19, Swedish University of Agricultural Science, Uppsala.

Ongonye forest was protected as the hunting ground for Zulu royalty and medicine men (See box story, "Inside Ongonye Forest", on page 27). The forest, which is centuries old, is still intact today though it is now protected by the government. Kenya's shrines such as those in Kinga, Witewe and Itutu in Mfangano in Nyanza, the Nganyi in western and Kayas in coastal parts of the country, were places of worship, rituals and communication to ancestors and gods. They were also important havens for biodiversity as they provided a sanctuary for plants, animals, birds and insects.

Animals, fish, birds and insects

Animals, fish, birds and insects played major roles in the lives of the communities. The communities therefore saw to it that they were conserved. Some of the wildlife were eaten; others were required for medicinal purposes or rituals such as the initiation of youth into adulthood, payment of dowry, commemorating birth or death, and so forth. Rare animals, birds and insects were considered "unclean" and therefore were not hunted for food. Certain birds were respected as clan symbols and therefore protected as sacred and not hunted for food. For example, pigenons were considered as clan symbols by some Banyala clans in western Kenya and were never hunted for food.

Biodiversity in South Africa

In South Africa, where there is also rich biodiversity, the impact of many years of colonialism and apartheid is manifested in the apparent loss of indigenous knowledge in environmental conservation. It is thought that many species may have become extinct because colonialism and apartheid thwarted the application and use of indigenous knowledge. Many of what are now protected areas (national parks) were in fact established without consulting the local people. With the end of apartheid, however, the government has shown growing interest in indigenous knowledge and many changes are now taking place in that area. The Imbewu Youth Programme of the South African National Parks (SANParks), for instance, uses traditional knowledge to engender environmental awareness and SANParks "has

40 Nimpuno. K. and B. Boshoff, B. IKS in South Africa.

been undergoing a transformation towards a 'socio-ecology' management approach, increasing participation in conservation."[40]

The Imbewu Youth Programme focuses on traditional knowledge of retired indigenous park rangers or "wise elders" as they are called. The elders use oral tradition to communicate with the youth, hoping to promote interest in conservation efforts. SANParks are also seeking to transfer power and control of resources to the local people. In the past, conservation areas in South Africa were largely established through enforcement of compulsory exclusion and the history of South Africa's national parks was often characterized by conflict between the parks and neighbouring communities, mainly due to disrespect for local indigenous knowledge and traditional conservation practices. At the same time, traditional communities in South Africa have always had deep respect for nature. The Ongonye forest is a living example such respect (See box story, "Inside Ongonye Forest", on page 27).

Biodiversity in Swaziland

Swaziland, which is well endowed with flora and fauna, has developed various indigenous methods for protecting biodiversity as local communities have long recognized the value of biodiversity. The Swazis use biodiversity daily for such needs as traditional medicine, food, building materials, traditional attire, religious rites, crafts and many more. The Swazis have long-standing cultural practices and folklore that help in preserving biodiversity. These include appropriate agricultural practices, widespread existence of tribal or family totems and respect for traditional taboos.

Medicinal plants enjoy special protection in Swaziland. For example, only the part of the plant and the amount needed is harvested, and ringing the bark is discouraged as this would kill the tree. In some cases harvesters would place cow dung where the bark has been peeled off as this accelerates callus formation and regrowth of cambium layer. Other measures include not sending children to harvest medicinal plants, harvesting only mature plants, digging up secondary roots and not the main root as this may cause death of the tree and planting medicinal plants near the homestead for protection. Similar methods are used to protect indigenous food plants such as fruit trees, vegetables and tuber plants. For example, the trees are not felled or uprooted

and only the portion needed, such as a branch, leaf or root, is harvested. Some root and tuber crops are protected by harvesting only large roots or tubers through a process known as "milking" -- harvesting only large and harvestable roots or tubers. By "milking" farmers have a higher probability of not losing the crop. Crops such as cocoyam (Colocasia esculenta), Livingston potato and Zulu potato are conserved in this manner. In addition to the various protective-harvesting measures, indigenous fruit trees in particular are not commercialized to avoid overexploitation.

The Swazi communities also try to protect trees and plants by constructing fire breaks and ensuring that harvesting is done only in designated areas. Trees used for carving and weaving materials are preserved by cutting only mature trees, or by cutting branches only. In some cases harvesting can only be done with permission from the local chief. Swaziland also has natural reserves, such as Maloloja and Mlawula nature reserves, which are protected from farming, cutting down of trees and hunting.

The Swazis also conserve biodiversity by seed selection and in situ conservation. For example, farmers use the bambara groundnut (Vigna subterranean or tindlubu in siSwati) landraces of mixed colours, sizes and shapes, as an indigenous system of ensuring that the landrace is not wiped out in the event of a disease outbreak or drought to which monotypes are vulnerable. This illustrates the value Swazi farmers place in the use of mixtures as a strategy for maintaining agrobiodiversity. There are in situ and on-farm conservation of plant genetic resources of indigenous plants in designated areas and in farmers' fields, which contribute to crop diversity. The Swazis also use "grass strips" or pieces of land which control soil and water erosion and conserve biodiversity. The grass strips are "protected areas" and serve as an in situ conservation of the grass and other plants.

Wildlife is protected through traditional practices. Hunting, for example, is carried out during July-August before most game animals start giving birth in October, thus sparing newborn animals. Also tradition requires that grasslands should be burned during the hunting period when grasses have already produced seeds and newborn wildlife would not endangered by fire. In addition, only certain clans can use products of designated animals. For example, emajobo or loin coverings made from leopard skins can only be used by the members of the royal family, which means a

smaller number of leopards are killed for the purpose. The use of red feathers of the ligwalagwala , a rare bird in Swaziland, is also reserved for the royal family.

Certain totem - animals or plants - are associated with certain clans. These clans respect and protect the wild animal or plant that they are associated with. Examples of clan totems are the zebra for the Dube clan and birds for the Nyoni clan. There are also taboos associated with plants that are rare and do not propagate easily or are used for their fruits. Such plants are not used for household needs such as timber and firewood. An example is the rare umlahlabantfu tree, (Zizyphus mucronata), which is traditionally used only for bearing corpses to burial. Another is sihlangu, (Maytenus undata) which is used mostly for making wooden spoons. Folklore also helps to preserve valued wildlife. For example lunwabu (chameleon), so the story goes, was sent by God to deliver the message that human beings are to rise after death. Lunwabu is therefore seen as a friendly creature that should not to be harmed.

Thanks to the role of indigenous knowledge in preserving the biodiversity of the country. Swaziland has some of the richest flora and fauna in the region.

Summary and conclusions

Indigenous communities in Kenya, South Africa, Swaziland and Tanzania have accumulated over the centuries enormous indigenous knowledge on how to sustainably utilize their natural resources using a variety of innovations to deal with the problem of conservation. The communities have rules and prohibitions, which were mainly enforced by elders. The main indigenous knowledge approaches to environmental conservation prevalent in the areas studied focus on the management and use of lands, forests, water and biodiversity. Land was tilled and managed using technologies that helped to preserve the soil moisture and fertility and to increase productivity, even under harsh climatic and agro-ecological conditions. Forests and water resources were used sustainably through restrictions of access, prohibitions, customs, beliefs and taboos.

The approach to conservation under indigenous knowledge was holistic; land, forests and rivers were viewed as interdependent systems. In all the communities such

practices as the traditional protection of forests, shrines, watercourses, certain species of flora and fauna, as well as farming technologies that focused on indigenous food crops, contributed immensely to biodiversity. Protection of forests and shrines, which harbour unique species, was particularly important for biodiversity. Folklore, traditional practices, totems and taboos also played an important role in the conservation of species. Indigenous rules, practices and prohibitions have ensured that traditional forest reserves have remained important havens for biodiversity, providing sanctuary

for plants, animals, birds and insects. Indigenous knowledge thus provided the communities with well-tested coping mechanisms in environmental conservation.

# Chapter Four

## Application and Use of Indigenous Knowledge in Natural Disaster Management

### Introduction

The repertoire of indigenous knowledge that communities in Kenya, South Africa, Swaziland and Tanzania draw on to deal with natural disasters is enormous. The stock of knowledge includes technologies, know-how, experiences, observations, beliefs and rituals. These range from the simple to the complex, such as relying on the water beetle to identify potable water in streams and ponds, using beanstalk ashes to preserve grain, reading signs on goat intestines to divine drought and famine, and immunizing cattle against rinderpest outbreak by smearing blood from infected animals in their nostrils.[41]

This fund of knowledge served the communities well within the traditional power structures. The success was based on good prognosis, close observation and a thorough understanding of the environment. The people instinctively knew that they needed to understand their environment well to be able to foretell and cope with the occurrence of natural hazards. Elders undertook the responsibility of predicting disasters and guiding the people on the actions to take to prevent or mitigate the disasters.

41 The people in the Kagera region of Tanzania have traditionally relied on enyogoroizi, a water beetle, for the identification of clean and safe drinking water in streams, ponds or springs. In western Kenya beanstalks were burnt and the ashes used as a preservative for grain and cereals. Maasai elders frequently used the behaviour of animals and their health to foretell weather. Goat guts would be examined by a specialized Maasai elder, and if they were found to be having watery cysts on them during the month of August this would be taken to foretell that the imminent season would have a lot of rains but if the small intestine was found to be empty, drought, famine, hostility and war were to be expected in the chiefdom. When outbreaks of rinderpest occurred in game or in neighbouring villages it was common practice to assess whether the outbreak was "hot" (i.e. virulent) or "cold" (mild). If "cold", the Maasai recognized that if they deliberately infected their herds, by smearing blood or other discharges from infected animals in the mouths or nostrils of uninfected animals, a mild form of the disease could be induced with low mortality, thus conferring immunity to the disease in the animals that recover.

Often the signs of coming natural disasters were obvious to everyone, in which case people instinctively responded and prepared for the coming events without the need for prompting from the elders. At other times, according to the study made in Kenya, the signs could be complicated and required the interpretation of the elders and experts. Some of the interpretations "were known to engender major conflicts in opinion depending on the decisions that had to be made."[42]

All in all, the people revered the elders in their role of divining climatic conditions and natural disasters. For instance, elders in Kenya's communities in Rusinga, Mfangano, Kano, Budalang'i, Lamu, Kwale and Makueni monitored the progression of hazards and gave advice, which governed the behavior of the communities. In the event of an ongoing disaster, the communities would do what was asked of them without question. If the elders told them to move to a designated place in the case of floods or droughts, they would do just that.[43]

The culture and belief system of a community influenced its responses to a disaster. The people of Mfangano Island in Lake Victoria, for example, strongly believed that disasters only came when one was not at peace with God and the spirits.[44] They knew they could not stop the disasters once they were triggered by certain causes but they could mitigate their effects as every event, physical or spiritual, has a cause. The mitigation could take the form of measures that are preventive or remedial.

The attitudes to natural disasters by the people of Mfangano are typical among other communities. Among the people of South Africa, for example, there is also widespread belief that hydrological hazards are released by specific deities and God in response

42 IGAD. "Nature Conservation and Natural Disaster Management: The Role of Indigenous Knowledge in Kenya". April 2006. IGAD Climate Prediction and Application Centre (ICPAC)

43 IGAD. Ibid.

44 IGAD. Ibid.

45 Nimpuno, K. and Boshoff, B., "IKS in South Africa"

Periodic floods are some of the most common natural disasters

to human misbehavior. Consequently, mitigation is sought in acts of repentance "to restore the divine balance".[45]

## Approaches

In dealing with natural disasters, people would in general react in two ways. One way is to wait until the disaster strikes and then try to mitigate the consequences by utilizing indigenous knowledge. For instance, epidemics including cholera, dysentery, typhoid and other gastro-intestinal ailments are common during natural disasters such as floods. Early warning of the epidemic is only achieved, if at all, after some members of the community have contracted the disease. In that case the communities cope by resorting

to traditional knowledge in medicine to cure afflicted individuals or by quarantining them. This is what might be called reactive or crisis management of disasters.

The second way is to prepare for the disaster and take preventive action. If the disaster is perfectly predictable, then the community might take some preventive measures such as digging channels to divert floodwaters. This is what might be called risk management or anticipatory approach.

But the actual approach taken depends on the prediction of the disaster and its possible severity and consequences. If the disaster is impossible to foretell with certainty, or the consequences are manageable and not severe, the community might adopt a wait-and-see position. If the occurrence of the disaster can be foretold with certainty and the consequences are known to be severe, then appropriate preparations are made. The community might, for example, start preserving food in anticipation of a prolonged drought or famine.

Overlapping

Relying on indigenous knowledge, the communities are able to anticipate most of the disasters that afflict them. Disaster prediction and early warning leads to preparedness and other responses, and when the disaster impacts are brought under control recovery starts. The main aim of the recovery phase is to return the community back to normal. Recovery is usually made up of post-disaster activities. Recovery then gives way to the mitigation phase, which deals with developmental issues that ensure less vulnerability of the community to the disaster. For example, using indigenous knowledge to divine water, the community might dig wells to reduce its vulnerability to drought in future.[46] However, "there is no distinct point at which these phases change from one to the other", as the Kenya study notes.[47] There are "lots of overlaps" and differences in approach from community to community.

46 The locals in Morogoro and Tanga regions of Tanzania, use the mkuyu fig tree (Ficus spp.), a typical water catchment plant species, to divine water when locating well sites. The tree grows in water catchments.

47 IGAD. Ibid.

However, the important thing to remember is that the indigenous communities recognize that for them to be able to live with the natural disasters, they have to monitor the environmental conditions, including the weather, be able to make meaningful predictions and take appropriate actions to mitigate the disasters and associated hazards. The communities are well aware of the disasters that could affect them and in most cases had the knowledge and administrative structures to cope with them. At the same time, the communities know that a well-conserved environment helps prevent the occurrence of natural disasters and also enables people to mitigate and cope with natural disasters when they occur, as the Tanzania study points out.[48]

Types of Disasters

Kenya, South Africa, Swaziland and Tanzania suffer from a range of natural disasters including drought, floods, landslides, windstorms, thunderstorms, lightning strikes and epidemics. Drought, and the associated famine and poverty, is however the most ravaging of the natural disasters that afflict those countries. Floods and epidemics can also cause serious devastation and destruction but these are not as common or persistent as drought.

Drought

Drought affects all the countries in the study. In Swaziland, the areas that are most frequently affected are those found in the east and west of the country where rainfall is often very low even under normal conditions. Drought has had a devastating impact on the economy of Swaziland. For instance, in the 1992 drought, about 90,000 cattle died and that greatly affected the economy as cattle are a major source of wealth in the country. Because of the persistent droughts that occur in the country from time to time, food insecurity is high. Food insecurity is compounded by the prevalence of HIV/AIDS and has become one of the biggest problems facing Swaziland and possibly some of the other countries. According to figures by the United Nations Food and

48 Mhita, M.S. Ibid.

49 Edje, O.T. and Manyatsi, A. M. "Nature Conservation and Natural Disaster Management - Role of Indigenous Knowledge in Swaziland". Faculty of Agriculture, University of Swaziland

### Rain Prediction

Predicting the weather is an important aspect of indigenous knowledge. Almost all the communities studied have ways and means of predicting and foreseeing impending events, calamities and disasters. In some communities, the role of predicting events is left to the elders, families or clans that specialize in that art.

The art of traditional rainfall prediction is, however, shrouded with mystery and is considered as a gift for a few. The potential person to inherit the art is identified in good time and is taken through the process of learning the art.

The Nganyi clan of Bunyore in western Kenya is known for their powers in predicting rain. The clan has been associated with community rainfall activities for over 100 years, and they have three shrines where they worship and communicate with their ancestors and gods for the purposes of monitoring and predicting rain. Within the shrine there exists certain plants, reptiles, birds and insects that benefit from the conserved environment. The shrines are sanctuaries for nature conservation and they have been gazetted by the Kenya government as protected shrines.

People believe that the Nganyi clan can make or stop rains, lightning and hailstorm. They take their weather advisories seriously and pay some fees to the family at the end of each season in the form of a share of their harvest. The clan perfected their rain-prediction art through observation of vegetation, trees, reptiles, birds and insects in the shrines.

The Bunyore people and surrounding communities depend more on weather advisories from the clan than from the meteorological department. They are widely consuloted. They provide the community with information, for instance, on when to start preparing the land for planting, and when to undertake certain ceremonies such as burials and weddings.

The community, which relies largely on maize farming, uses the information to make decisions that include mixed cropping of maize, beans and millet; planting of cassava and potatoes; sending some of the livestock to friends and relatives living near the lake; drying and storing of food for use during drought periods.

The clan has considerable know-how for monitoring humidity changes in the environment, the Kenya study reports. The report has recommended that a study involving experts in biology, chemistry, anthropology, social sciences, meteorology and other sciences, should be carried out to demystify the shrines, and open them to the public.

Agricultural Organization and United Nations World Food Programme, quoted by the Swaziland study, production of the country's staple food, maize, has been on a long-

term decline, dropping by 70 percent over the last five years in some areas.[49] This is due to the fact that much of the arable land is uncultivated because of delayed rains, the high risk of making a loss from agriculture and shortages of seeds for alternative crops, among other reasons. In the 2004-05, cropping season the Lowveld farmers ploughed just 10 percent of their arable land. Lowveld is characterized by gently undulating terrain that is vulnerable to drought and high temperatures.

The situation in the other countries is not much better. Makueni in Kenya suffers from frequent drought that is equally devastating for the locals. Prolonged drought can be particularly disastrous in the district. In fact, the famines that are best remembered in Kenya are associated with drought. In western Kenya, the most severe famines have names that suggest the severity of the drought and famine, such as iamasero ("the famine of eating animal skins"), owukuyo ("the famine of eating fig tree fruits") and owugeke ("the famine of eating dry potatoes"). Some of the best remembered famines include those experienced in 1905, 1931, 1940 and 1949.

Floods

Periodic floods affect most of the communities in all the areas studied. In Kenya and Tanzania the worstfloods were recorded in 1961/62 and 1997/98. It is only Makueni District that rarely suffers from floods in Kenya. In contrast, communities in the Kano plains and Budalang'i in western Kenya, the Rufiji delta in Tanzania and many areas in Swaziland are affected by floods almost every year. In Swaziland, in particular, many parts of the country are prone to severe flooding during torrential rains.

The Kano plains experience heavy flooding which causes loss of lives, livestock, household property and crops, and brings water-borne disease during the long rains in April-May. However, it is Swaziland whichbest illustrates the destructive nature of floods. A majority of the rural population in Swaziland is athigh risk and extremely vulnerable to floods. The floods unleashed by Cyclone Domonia in 1984 washed away and killed a number of people and destroyed farmlands, houses and infrastructure including roads, electricity and telephone lines. Swaziland was also severely ravaged by torrential rains in 2000, which led to flooding in many parts of the country and destruction of property and health risks due to pollution of water sources.

The baobab is one of the most important plants used as indigenous early warning indicators of rainfall and drought

Famine and food insecurity, caused mainly by drought and floods is a major concern in all the countries. Famine, of course, can also be caused by other disasters such as invasion of locusts, armyworms and other pests and diseases. However, most incidences of famine are associated with drought.

Disaster prediction and early warning

Each community had an array of early warning indicators and well-developed structures through which the wisdom of the community was applied to deal quickly and efficiently with disasters. The structures included a council of elders which, as the Kenya study notes, had at its disposal "the speed and strength of numerous

One of the early warning of coming floods is the height of nests of the emahlokohloko bird in Swaziland. When floods are likely to occur the nesting is very high up the trees next to the river and when floods are unlikely the nests are low down.

warriors that could be used to investigate a particular phenomenon or to pass on urgent messages upon need."

The indigenous knowledge on disaster prediction and early warning is based on keen observation of the behaviour of animals, birds, insects, vegetation, trees, winds, air and water temperatures, clouds, earth movements and celestial bodies. However, the sets of indicators used in each community are homegrown. A brief look at the early warning systems in the different communities shows how localized the systems can be.

Early warning systems in Kenya

Every community surveyed in Kenya - in Rusinga, Mfangano, Kano, Budalang'i, Lamu, Kwale and Makueni - had its own repertoire of early warning indicators for coming disasters. The Kenya study provides a comprehensive account of the disaster prediction and early warning systems in those communities.[50] Here only a few examples are mentioned.

Animals, reptiles, birds and insects

In many areas of Kenya the presence of snakes and other reptiles, as well as wild animals, around homesteads in search of water and food indicated the prevalence and continuity of drought. Around Lake Victoria, the arrival of the common swallow (Hirundo angolenss) in large numbers circling the sky was seen as an indicator of the onset of the rains, while the changing songs and cries of the robin (Cossypha caffra) was an indicator that it would rain on that day.[51] If the birds delayed their immigration, it indicated the possibility of poor seasonal rainfall.

In Makueni district the noisy weaver birds known locally as nguni (Gema cocks) were used as indicators of rainfall failure or the coming of drought on account of their behaviour. The birds usually make more nests when a wet season was expected and less nests when a poor rainy season was expected during which they migrate from their usual nesting places. The cry of other birds such as ivutavutilya, ilumi, maolwe, and kaanga maia indicate failure of the rains. If these birds become too greedy and cannot be satisfied with food regardless of how much they are fed and fly over each other in competition for the food, this is an indication of a pending drought.

The behaviour of amphibians --mostly frogs (Africana spp.) and toads (Bufo spp.) -- was an indicator of season change. The absence of frogs and toads indicated the coming of the dry season. When frogs stopped croaking during the rainy season, even if it was still raining, it indicated that the rains would soon stop. The late appearance of lake flies moving from west to east over Lake Victoria signaled the late onset of the rains and poor rainfall. If spiders, which feed on the lake flies, set dense webs across the winds to trap the insects, that signaled the coming of lake flies followed

50 IGAD. Ibid.

51 DMCN, 2004: Traditional indicators used for climate monitoring and prediction by some rural Communities in Kenya. A contribution to the harmonization of traditional and modern scientific methods of climate prediction in Kenya. Drought Monitoring Center, Nairobi. Pilot Application Project.

by rainfall; if the webs were set late and low in density that indicated the late onset of the rains and poor rainfall.

Baobab

The baobab (Adansonia digitata) or the monkey bread or kiamba in the local language Kikamba is one of the most important plants used as indigenous early warning indicators of rainfall and drought in Makueni District.[52] The tree sheds all leaves at the end of the long rains (March-May) and remains leafless during the long dry season (June-September. Near the onset of the short rains (October-November, tender new leaves start appearing on the tree. The community also uses the fruiting pattern of the tree to divine the likely performance of the season, especially rainfall failure and drought. Prolific fruiting seems to indicate a likely poor season ahead.

Other indicators involved close observation of the wind, air temperatures, clouds and stars. In some communities there were also clans, such as the Nganyi of Bunyore in western Kenya, who specialized in diving and making rain.

Early warning system in South Africa

Among the communities in South Africa, the study found there is a wide variety of indigenous knowledge, which greatly influences the way people react to natural disasters.[53] There is, for instance, strong belief among many communities that hydrological hazards are caused by human action. They believe that such hazards are released by specific deities in response to human misbehavior. Consequently, mitigation of disasters is sought in acts of repentance which are required to "restore the divine balance."[54]

52 The others include muaa (Acacia tortilis) or umbrella tree, muthiia (Acia Mellifera), and itaa mwaka.

53 These are reported in the South Africa study, "IKS in South Africa" by K. Nimpuno and B. Boshoff

54 Nimpuno. K. Ibid.

55 This information was compiled from the group discussions of the participants at the Vhembe District training course for disaster management stakeholders.

Some primary research done in Limpopo Province reveals a mixed bag of such common beliefs.[55] The beliefs include acceptance, for instance, that floods and drought are acts of God; raping elderly women or children brings floods; a "red" moon announces the coming of floods and drought; solar eclipse causes drought; floods will come when the vlera bird cries; and so on. Some South African communities also believe that rain prediction can be sought by pleasing rain Queen Mujaji through offerings and prayers by traditional healers and leaders, and that the Raruwafemi Royal family can moderate the impact of floods and droughts.

Early warning systems in Swaziland

The Swazi communities use a variety of methods to predict the weather. Most of the indicators are based on environmental cues and the behaviour of animals. For example, the height of the nests of the emahlokohloko bird (Ploceus spp.) is used to predict

The cocoyam is a hardy crop that can remain in the ground for a long time until it is needed.

The cassava was important for famine preparedness. In some communities a cassava plantation was a "must-have".

floods. When floods are likely to occur the nesting of the emahlokohloko is very high up the trees next to the river and when floods are unlikely the nests are low down.

The cry of the phezukwemkhono (Cuculus solitarius) bird signals the start of the wet season in August-November. Farmers start preparing for the planting season upon hearing its cry. The continuous cry of frogs, following a certain pattern, is also a sign of imminent rainfall. In addition, the shape of the crescent moon is used to predict the coming of the rains. When the moon is slightly tilted to the west and the crescent is facing down during the months of September and October it is an indication of imminent rains.

Birds also help to predict rains. The abundance of swallows (Psalidoprocne pristoptera) in the sky during the months of September and October is a sign of imminent rain. When the umfuku (Centropus burchellie) bird chirps during the farming season (October to April), it is a sign of an approaching thunderstorm. The behaviour of animals and flight of guinea pigs from their enclosure are also used to predict lightning,

thunderstorm and hailstorm. The restlessness and noisy behaviour of pigs, peacocks and ducks indicates an imminent heavy storm.

When the wind changes direction to blow from the east it is a sign of imminent heavy rain without thunder. Fast-blowing wind from the west is a sign of imminent dry weather, which may lead to poor harvest and famine if it is prolonged. Towering darkened clouds on the west and fast-blowing wind are signs of an imminent fierce hailstorm accompanied by thunder and lightning.

The indigenous methods used to predict drought and famine included the abundance of butterflies (Danaus plexippus) during the farming season, presence of army worms (Spodoptera exempta). The dropping off of young avocado fruits, and the abundance of wild fruits such as emantulwa (Vangueria infausta, emanumbela (Englerophytum natalense) and umganu (Sclerocarya caffra) during the months of December to February were all signs of an imminent famine in that farming season. A detailed account of these indicators is provided in the Swaziland study.[56]

Early warning systems in Tanzania

In Tanzania, too, the communities had a wealth of early warning indicators. The Tanzania study gives an interesting and detailed account of these indicators.[57] A few examples will suffice. In Tanzania animals feature prominently in prognosis. For instance, by reading signs on goat intestines specialized Maasai elders could divine drought and famine, social conflicts, diseases, childbirth, peace or war in the chiefdom, and so forth. If the small intestine was found to be empty, drought or famine or hostility and war were to be expected in the chiefdom but if it had a lot of dung this foretold plenty of rain, no famine and peace. If more goats than usual were seen mating in August-September this was seen as sign that the season was going to have a lot of rain. Contrariwise, increased libido in donkeys was an indicator of below normal rainfall and a possible drought in the coming season.

56 Edje, O.T. and Manyatsi. Ibid.

57 Mhita, M.S. Ibid.

A Maasai elder reading signs on a goat intestine. Specialized elders could divine drought and famine, social conflicts, diseases, childbirth, peace or war by examining the insides of a goat.

The appearance of swallows and other similar birds such as narmo, dudumizi and demsi during September-October meant low amounts of rainfall and possibly drought in the following season. The appearance of pugi-wanda, the blue-spotted wood dove and ekyenselikola, a sunbird, meant impending long drought and famine. In Muheza District of Tanga, the appearance of armyworms meant delayed rainfall. If large swarms of red ants appeared in October-November, if large swarms of bees appeared flying from hills to lowlands, and if a large number of moist anthills appeared in August-September, these were signs that the season was going to be wet. However, the overabundance of swarms of armyworms in September-October heralded drought. Other items used in prediction and early warning in Tanzania included vegetation and the flowering of such trees as the Nandi flame tree (Delonix regia) and mangoes, air movements and temperatures, underground rivers, clouds and celestial bodies.

Disaster prevention, mitigation and recovery

As noted in the introduction, it is not always clear when disaster prevention and preparedness ends and mitigation and recovery begins. There is no distinct point at which these phases change from one to the other, as there is a lot of overlapping depending on the nature of the disaster. A brief look at some of the responses to natural disasters will demonstrate this.

Drought-tolerant

In all the communities, technologies and know-how in cultivating indigenous drought-resistant and early-maturing crops played a critical part in preparing for famines caused by prolonged drought or other natural calamities such as invasion of locusts or armyworms. Such crops included hardy species such as cassava (Manihot esculenta), pumpkins (Cacumis melo), cowpeas (Phaseolus multiflorus) and sorghum bicolor (Elesine corocana)[58]. So important was the cassava for famine preparedness, for example, that along the lakeshores of Lake Victoria and in river basins every family had a cassava plantation, the Kenya study reports.

In Tanzania, the cassava is viewed as equally important as a drought crop.[59] The Tanzanian study reports that the cassava not only has the attributes of being drought-resistant but can also be left in the field unharvested for a long time without spoilage, thus serving as a famine safety crop that can be harvested at any time as needed. The cassava leaves are also eaten as relish after being prepared appropriately using indigenous knowledge since certain species of cassava plants contain a quantity of hydrogen cyanide which can be fatal to humans. For the cassava roots, villagers in Tanzania use indigenous techniques of kuvundika (fermentation) and kuloweka (soaking in water) to detoxify them as they also contain hydrogen cyanide.

Cassava, jugo beans, bambara groundnuts, sweet potatoes, sorghum and pumpkin are grown particularly in drought-prone Lowveld and Lubombo regions of Swaziland.

58 The drought-resistant crops in western Kenya included sweet potatoes, pumpkins, cowpeas, cassava, finger millet and sorghum, yellow maize, groundnuts, sim-sim and a variety of indigenous vegetables such as the black nightshade.

59 In Tanzania cassava, cocoyam, pigeon peas, finger millet, sorghum, bulrush millet, cowpeas and sweet potatoes are the favoured crops for mitigating drought and associated famine.

Other sources of food during drought periods are Strychnos spp., Sclerocarya birrea and Phaseolus aureum.

Cocoyam

Another important crop for mitigating the effects of drought and famine, was the cocoyam (Colocassia spp., which is common particularly in Kenya and Tanzania. Known as magimbi in Tanzania, cocoyam grows in wetlands and is very handy when there is threat of famine.[60] It is grown in many parts of Tanzania side by side with other crops such as maize and beans as a food security standby crop in case drought occurs. Some varieties of cocoyam matured early and thus produce yields even in cases of a shortened rain season. In addition, the cocoyam is more resistant to pests and diseases than other crops.

Cowpea

The cowpea is another celebrated indigenous knowledge drought-resistant crop used for survival. Apart from providing food during the rainy season, it is harvested, boiled, dried and stored in granaries to be consumed during the dry season. It is particularly useful because it can be grown in mixed cropping. Other indigenous knowledge survival crops include bambara groundnuts (tindlubu), jugo beans (mngomeni), wild vegetable and fruits, which are particularly important in drought-prone Swaziland and some parts of Kenya and Tanzania.

The communities relied on indigenous knowledge on the three Ws and one H of indigenous crop production --what, when, where and how. Village elders, particularly in western Kenya, took an active part in giving advice and directing the communities on what crops to plant, when to plant them, where to plant them and how, depending on

60 It can be grown upland during a wet rain season but it is mainly grown in wetlands throughout the year.

the agro-ecological conditions. Once planted and harvested there was also indigenous knowledge know-how required on how to process, preserve and store them and other food products gathered from the wild to ensure food security during drought and times of scarcity.[61] Other survival tactics included intercropping, mixed cropping, crop zoning and timely planting according to the rain calendar, water conservation, stock diversifying, herd-splitting and destocking, transhumance, bonding with family and community members and kuhemea (Tanzania Swahili word for seeking help from neighbours).

Dissemination

The various communities had different ways of disseminating information on impeding disasters. The methods included specific beats of drums and sounding of horns by clan elders. In western Kenya, the drums and horns were used to alert people to come together at known meeting points where the specific warning, instructions or advice was communicated and appropriate actions decided upon. In Tanzania, communities used a mortar known as kinu to warn distant villages about the occurrence of a calamity. This was achieved by beating the mortar with heavy sticks to make a cacophony that clearly signified danger. This was done in the evening or at night when the still, cool and quiet atmosphere enabled the sound to travel far and wide. In other areas, a drum known as lamgambo was beaten by a chief's drummer. This would produce a characteristic tune that signaled to villagers to assemble at the chief's home at the earliest opportunity for some important announcements. This gave rise to a Swahili saying: Lamgambo likilia ujue kuna jambo ("When the lamgambo makes a sound know that there is an important event around").

Preparedness and response

61 Normally any unusually heavy rainy seasons is expected to be followed with a rainfall deficient season or drought. It is this time that elders in western Kenya would give advice to the people to plant drought resistant plants such as budho or amatawu (pumpkin), bo or ikuwi (cowpeas), amariwua (cassava), sweet potatoes, millet and sorghum. In Rusinga and Mfangano Islands, the elders played very important roles in disaster management regarding early warning to response and recovery. During a normal and good rainfall season, the elders would advise the community to enhance land preparation and the planting of high yield crops. When a bad season and drought is expected the elders would advise the communities to plant drought resistant crops.

All in all, soon after a disaster, there was always the need to deal with the immediate calamity. The aim of such response was to provide relief and safety of the affected people, to meet their basic needs until more permanent and sustainable solutions could be found. However, in nearly all cases preparedness was critical, which made early warning extremely useful. A brief look at the approach taken by the Budalang'i community of western Kenya gives an insight into some of the strategies for preparedness. Though thedetails of the strategies are peculiar to this particular community, they nevertheless illustrate the nature of the application of indigenous knowledge in natural disaster management. The Budalang'i community had to observe or carry out, among others, the following in preparation for any impeding disasters:

- Each homestead has to have a dugout canoe for transport in case of heavy flooding.
- Elders should dig trenches to control the water around the homestead and around farmlands.
- People in higher grounds should accommodate the people from flood prone areas.
- No ploughing is permitted along the shores when heavy flooding is predicted.
- Land preparation starts in November-January when it is dry. This plan was based on observing the nature of the winds and changes in fauna and flora.
- Plant maize, millet, peas, beans and cowpeas in February. The cues for this activity are associated with wind patterns, the kind of birds and the changes in vegetation and constellation.
- Harvest in July-August when the dry winds are experienced, the sky is covered with bright stars and days have long periods of sunshine under which grains harvested are dried.
- After harvesting, plant cassava and sweet potatoes which need little rain

to survive. Sweet potatoes mature very fast and become a backup for food security.

- Stock enough fuel wood for food preservation and cooking during the rainy season in April-August

- Catch fish during April-August rainy period when they are plentiful and preserve them by drying and smoking.

Summary and conclusions

The communities in the areas studied face many natural hazards but the major ones are drought and floods. These invariably cause famine, food insecurity and poverty. Over the years, however, the communities have evolved indigenous knowledge technologies, know-how, experiences and beliefs that aid them not only in predicting the natural disasters but also in devising techniques and coping mechanisms to deal with the disasters. The communities focus on disaster prevention and preparedness. Thus, they take measures such as growing drought-resistant and early-maturing indigenous crop varieties, gathering wild fruits and vegetables, wetlands cultivation, transhumance, livestock diversifying and splitting, preserving and storing food for use in times of scarcity. All these measures enabled the indigenous communities to live with climatic

hazards with little or no support from the outside world.

# Chapter Five

## Indigenous Knowledge and Poverty Alleviation

### Introduction

As we saw in Chapter 2, traditional knowledge refers to the knowledge, innovations and practices of indigenous and local communities. Developed from experience gained over generations and adapted to the local culture and environment, indigenous knowledge is mainly of a practical nature. Its value lies in its ability to deliver social and economic goods.

The role of indigenous knowledge in enhancing food production and reducing poverty was therefore an important question in the study of indigenous knowledge systems in Kenya, South Africa, Swaziland and Tanzania. These countries have masses of poor people, defined as those who cannot afford basic food and non-food items.

In Swaziland 69 percent of the people live below the poverty line, and in South Africa almost 60 percent of children aged under five are malnourished.[62] In Kenya the poor constitute slightly more than half the population.[63] In Tanzania an estimated 36 percent of the population lives below the poverty line.[64]

The study found that indigenous knowledge is a tool, actual or potential, for poverty alleviation. However, the study also showed that poverty often drove people to violate indigenous knowledge rules and prohibitions, for instance when they cut down trees in forests to make charcoal for sale so as to eke out a living. The Kenya study pinpoints this problem particularly with regard to the shrines in the country. "Due to increasing

62 Estimate by Swaziland Household Income Expenditure Survey; SHIES, 2000-2001. The poverty line is an income of 57 emalangeni for the rural areas and 104.00 emalangeni per month for the urban areas. (Dollar equivalent needed)
63 The actual figure is 52 percent according to the 1997 Welfare Monitoring Survey, quoted in Common Country Assessment for Kenya 2001, United Nations.

64 Poverty and Human Development Report 2003. United Republic of Tanzania, p 5.

pressure on land in the community and lack of fuel wood, strangers have now started stealing some of the biodiversity in the shrines," the study notes. "Some of the trees being destroyed are over 100 years old. There is urgent need for proper fencing and proper legal protection...together with the introduction of some education and tourism activities based on the shrines. These could introduce new income-generating activities in the area that will enable the community to see the value of biodiversity in the shrines and the need for their protection." The Tanzania study also aptly observes: "Poverty forces people to look for ways to obtain quick returns from resources exploitation. Poverty also discourages investment in measures to conserve and sustain utilization of nature resources."

The Kenya study also points out that the Luo living in the Lake Victoria basin encouraged married sons to move out of their parents homesteads and start their own. This practice led to continuous subdivision of the family land, making the plots too small for any meaningful agricultural activity. This has resulted into poverty and land degradation. In Lamu Island, on the other hand, it was a requirement that for newly wed first-born daughters an extension had to be added vertically to the old family house. This practice conserved kinship and maximized on the use of the limited land available on the island for settlement, leaving the rest for other uses.

Even so, there is no evidence that indigenous knowledge per se causes poverty. On the contrary, it is the lack of application, or inadequate application, of indigenous knowledge that leads to poverty or deterioration of poverty. For example, when in the 1950s and 1960s authorities ignored local indigenous knowledge and introduced alien species of tilapia and the Nile perch into Lake Victoria, the result was the destruction of the ecosystem, changes in traditional fishing patterns and pollution of the habitat.

Maasai pastoralism

The study of the four project countries shows clear evidence that when the "best practices" in indigenous knowledge are disregarded, when there is environmental degradation and poor natural disaster management, poverty sets in and grows. Maasai pastoralism, an indigenous knowledge skill acquired over centuries, illustrates this point. The Maasai move their herds throughout the year to optimize utilization of

Cattle being moved from Masika to Kiangazi in Tanzania: Pastoralists move their herds throughout the year to optimize utilization of rangeland resources for maximum meat and milk production.

rangeland resources for maximum meat and milk production. As a result of well organized livestock movement, the herds stay healthy and produce a reliable supply of milk and meat that meets the demands of pastoral households.[65] This is possible because of the application of indigenous knowledge in rangeland utilization[66], an ecological approach to disease prevention[67], and appropriate division of labour.[68]

The Maasai indigenous knowledge technologies and know-how, including a thorough knowledge of their environment, livestock genetics and breed selection, medicinal

65 For a detailed assessment of this indigenous knowledge, see "Best Practices on Indigenous Knowledge". MOST/ CIRAN. Internet: www.unesco.org/shs/most.

66 In rangeland utilization, Maasai warriors supervise grazing techniques and provide instruction on animal grazing behaviour, while elders order warriors to conduct ecological skirting, which includes identifying and classifying plants and accurately assessing the water-holding capacity of distant pastures. They then draw up movement itineraries on the basis of the warriors' reports.

67 The Maasai pastoralists conduct transhumance, not only in search of forage and water but also to carry out organized skirting of the ecology of the area. In this way, they can avoid grazing areas where wild animals might prey on the herd or where there may be a risk of disease.

68 Maasai pastoral households divide their members up into groups and each herds different classes of livestock in such a way that is compatible with the composition and functions of the pastoral household economy.

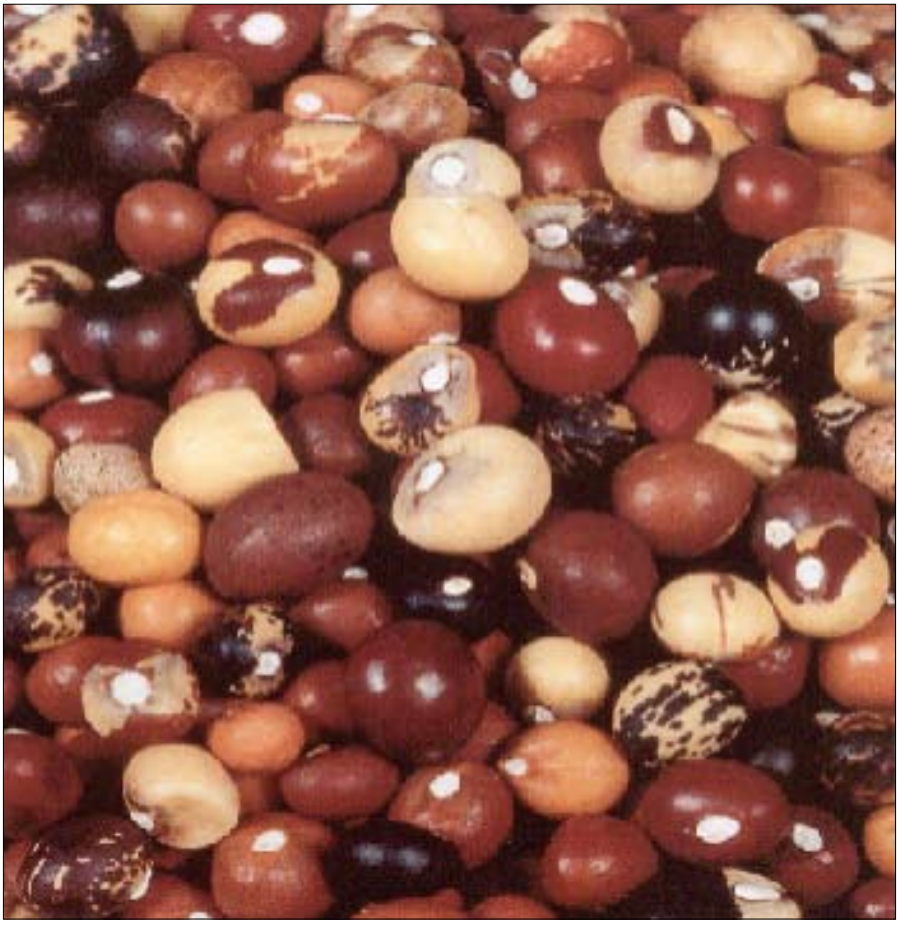
plants and weather forecasting have enabled them in the past to make a stable livelihood and reduce poverty. However, today the Maasai, particularly in northern Tanzania, are now losing grazing land as a result of crop farmers from other areas encroaching upon their land. Combined with an expanding human population, the increased density of livestock has led to problems with diseases, which indigenous knowledge strategies are unable to cope with. As a result, the traditional pastoral economy and culture of those Maasai is in jeopardy.[69] Another case in point -- this time positive -- is the introduction of modified traditional clay pots for storing drinking among the Luo in Kenya (See box story, "Best Practices", on page 25).

Food security

There is no question that food security and reduction of poverty are dominant themes in indigenous knowledge. In fact, one could probably say with certainty that indigenous knowledge existed mainly for mobilizing efforts and commitment around food production, poverty alleviation activities and conservation of natural resources. Indigenous knowledge has much potential in ensuring food security and alleviating poverty. Noting that drought is the major contributing factor to persistent poverty in the country, the Swaziland study suggests that the good practices, for instance, of food preservation used in traditional Swazi society, such as drying food-fruits and vegetables, if popularized could "ensure food security and reduce dependency on food aid". The study also points out the importance of indigenous crops and plants in providing food security and alleviation of poverty. The marula tree (Sclerocarya caffra), for example, is used not only as a source of food during drought ( its fruits are eaten and soup can be made from its nuts) but it is also used make a traditional beer which is a source of income for many families.

Food preservation and storage were important components of food security in traditional societies. Perhaps no other area of indigenous knowledge was as important to those communities as the technologies and know-how needed for food production and preservation. The communities viewed nature -- plants, animals, birds and insects --in terms of its ability to provide for human needs and the indigenous knowledge

69 Best Practices on Indigenous Knowledge MOST/CIRAN. Internet: www.unesco.org/shs/most



Swazi farmers use the bambara groundnut landraces of mixed colours, sizes and shapes. This ensures that the landrace is not wiped out in the event of a disease outbreak or drought to which monotypes are vulnerable.

systems were developed as enabling tools for that purpose.

Food security was assured by the application of many indigenous knowledge practices such as the use of indigenous seeds, cultivation of drought-resistant crops, mixed cropping, valley farming, livestock diversification, harvesting wild fruits and berries, food storage and preservation. Many of these practices have already been covered in previous chapters. To avoid too much repetition, only a selection of the more relevant

practices are discussed here.

## Indigenous seeds

The selection of seeds was the beginning of food production. Proper selection was important in achieving food security. The seeds were selected for specific rainfall conditions and ecological zones under the guidance of the elders. The indigenous seeds did not have the problems of reduced yields as would be the case with modern-day hybrid seeds. In the islands of Mfangano and Rusinga in Lake Victoria, for example, the people relied on their own seeds, which were identified during harvesting and preserved for the next season. That is how old dependables, such as sorghum, millet, yellow maize and other popular food crops, were produced among the indigenous communities. They were dependable because of their high tolerance to drought conditions.[70] The communities also devised many native technologies and approaches to ensure there was food security given the climatic hazards and uncertainties. These included land management styles as well as the preservation, sharing and storage of the food produced. In land management, care was taken to avoid not only the degradation of the natural resource but to minimize possible damage to the food that was being produced.

A good knowledge of cultivated indigenous cereals played an important part in food security, as did knowledge in foods that grew in the wild. In particular, knowledge of drought-tolerant and early-maturing crops was critical. Using such indigenous knowledge, farmers were able to make a living even in harsh environments. Cassava, cocoyams, pigeon peas, finger millet, sorghum, bulrush millet, cow peas, bambara groundnuts and sweet potatoes were well known crops for their ability to produce yields even under harsh climates.

## Cassava

Cassava (Manihot esculenta), for instance, has the attributes of not only being drought-resistant but can also be left in the field unharvested for a long time without spoilage,

70 Potatoes, cassava, yams and bananas were also grown, for instance, along the lakeshores and in river basins through irrigation as a means of mitigating drought related disasters.

thus serving as a famine safety crop that can be harvested when needed. Its leaves are also eaten as relish after being prepared appropriately since cassava plants contain a quantity of hydrogen cyanide poison. The cassava roots, too, contain hydrogen cyanide but villagers use indigenous knowledge techniques of fermentation and soaking in water to detoxify them.

Cocoyams

Many communities also used their indigenous knowledge to cultivate cocoyam (Colocassia spp.), which is actually not a drought crop but is grown in wetlands such as river valleys, hillsides seeping with underground water and upland areas during the wet seasons. It is traditionally used by families to sustain themselves during times of famine. Like the cassava, it a hardy crop that can remain in the ground for a long time until it is needed. In Tanzania, where it is known as magimbi, it is grown side by side with other crops such as maize and beans in mixed cropping as a standby crop in case of drought. Some of the cocoyam varieties mature early and produce yields even in cases of a shortened rain season. Cocoyams are also more resistant to pests and diseases than other crops.

Diversity of livestock

Other food security measures included diversifying livestock to ensure that some livestock species survived even under severe environmental conditions.[71] "Herd-splitting" was also used to reduce or spread the risk of livestock loss; if all the animals are kept together, particularly during dry or drought periods, the risk would be greater. Females used for milk production were also kept near the homestead where the majority of the members of the pastoral families, particularly women, children and the elderly, were living. The herd-splitting also reduced grazing pressure on forage near the homestead and improved foraging conditions for animals producing milk for

71 Thomas, A. S., 1945: The vegetation of some hillsides in Uganda: Illustration of human influences in 72 Thomas, A.S., 1945. The vegetation of some hillsides in Uganda: Illustration of human influences in tropical ecology, IIJ. Ecol.33:153-172.

the most vulnerable members of the family.

### Valley farming

Valley farming was an indigenous farming technology that enabled farmers to grow crops throughout the year, even during the dry season. Valley farming utilized the micro-catchment areas of river banks and valleys. Through valley farming, known as dambo or vinyungu in some parts of east and central Africa, farmers were able to add to their food reserves such foods as maize, beans and pumpkins. Valley farming was an important stop-gap measure that contributed to food security in such areas as the Ruvuma region of Tanzania.

### Ngitiri

Other farming methods, such as ngitiri which was practiced by the Sukuma of northwestern Tanzania, were important indigenous knowledge innovations for achieving food security and alleviating poverty.[72] Ngitiri evolved out of the need to cope with the scarcity of grazing areas, particularly during the dry seasons between June and October. Supplemented with tree planting, ngitiri has been proven to improve the livelihoods of communities in the region.

### Animals, fish, birds and insects

Apart from the food plants which were the main source of food for most of the communities, animals, fish, birds and insects were also utilized as food. These were, in many cases, sustainably harvested through indigenous knowledge rules which depended on beliefs, prohibitions and taboos for their enforcement by community elders. In Kenya, for example, some communities hunted seasonal birds such as the chisuli (brown quails), which were trapped and eaten just before the crops in the field were ready. This was the specific time sanctioned for hunting them.

### Hunting

72 Ngitiri involves the conservation of grazing and fodder lands by retaining an area of standing hay as reserve and encouraging vegetation regeneration.

Hunting for eatable wildlife, in fact, was done in all communities. It was usually carried out by groups of people using traditional weapons such as spears, clubs, bows and arrows, slings and catapults, as no modern hunting weaponry was then available to the communities. The spears and arrows were sometimes tipped with poison. Traditional traps, pitfalls, nooses, snares, glues, lures and decoys, nets, as well as drugs and hunting dogs were used. Ropes and liana from special plants such as miombo (Brachystegia spp.) were used to make nooses and nets. The traps were usually placed in game tracks or watering places. The meat obtained was usually shared among the groups or exchanged for other goods and services such as grain and labour. However, the living things consumed varied widely from community to community depending on folklore and what was available locally. For instance, in South Africa mopane (caterpillars), locusts, termites and the stink-bug were popular as food but not so in some of the other countries.

Fish

The most important, and common, wildlife consumed was fish, which formed an important element of food security for the communities living near bodies of water, such as the Nyanza Luo and Suba Abasuba, Pokomo and Mijikenda along the Tana River and the Swahili people along the Indian Ocean, as well as the inhabitants of the South African coastline. In those communities fish provided cheap proteins and a basis for alternative livelihoods. For example, during the rainy period, April to August, the communities living along Lake Victoria benefited from huge catches of fish that were preserved by drying and smoking them for trade and future use.[73] For the "river people" or abantu bomlambo of South Africa, fish has been a source of food for thousands of years, providing an important protein supplement to the inhabitants of the rural areas where the typical diet is predominantly maize-based carbohydrates.[74]

The fishing methods employed by the communities took into account the sustainability of this valuable and cheap food resource that meant so much food security. Simple but

73 The fish could, for instance, be used in barter trade to buy grains.

74 The consumption of other sources of protein, such as cattle or goat meat, was usually restricted to infrequent traditional rituals, the South African study reports.

effective traditional fishing technologies were used while the elders kept a watchful eye to make sure that rules and prohibitions were observed. The technologies, which embodied the indigenous knowledge of the particular communities, were geared towards sustainable harvesting.

Wild fruits, berries and vegetables

Indigenous knowledge in wild vegetation and plants enabled villagers to pick fruits, berries and vegetables from the wild, which were an important source of minerals and vitamins and were usually available during the dry season --which made them extremely useful in supplementing other foods.[75] The wild products also served as relief food during times of famine, and were seen as a free source of food. In Swaziland, many wild fruits, berries and vegetables play an important in providing food security. Some of the wild food trees provide not only fruits but also leaves used as vegetables, such as the ng'wandu tree (Adansonia digitata), which grows wild in Sukumaland, Tanzania. Other edible plant products gathered from forests include roots, seeds, nuts, tubers and mushrooms, which are consumed in times of famine. In Lindi and Mtwara regions of Tanzania villagers would eat roots of a plant known as mnghoko available during the rain season, i.e. before the harvests in the period between March and May. In Arusha region, also in Tanzania, an indigenous round tuber plant known as erukunyi was also consumed in times of famine.

Food preservation and storage

There were periods of abundant food and periods of extreme lack of food. Therefore the communities devised methods of preserving and storing food in times of abundance to be used in times of scarcity. The technologies used varied from community to community and the kind of food stored.

Kenya

75 For instance, the ihyogu (Eugenia spp.) wild fruit found in Ruvuma region of Tanzania ripens in the middle of the rainy season, February-March when certain foods may not be available. Other fruits from the same region include mambua or madonga, which ripen during the October-November dry season. This fruit, including others like ubuyu (Adansonia digitata) and ukwaju (Acacia nilotica), is good for juice-making.

In Kenya the technologies included drying and smoking and storage in pots, baskets, granaries and on structures placed above the fireplace. The number of granaries full of grains was a good indicator of the food security in the home. The granaries were built outside the main hut. All women had their own granaries for storing millet and cereals.[76] There were also much smaller granaries, which were hidden inside the huts. In addition, there was the granary of mondo, the owner of the home, which was never used except under serious famine conditions and even then, only the owner of the home could decide the amount of the food to be given out to each household. These ensured food security and helped to mitigate hazards such as extended droughts.

There were fish species that were convenient to store; once dried they are not easily attacked by pests. The crops, such as bananas, cassava, potatoes, also formed important food sources during drought. Cassava and potatoes could be left in the ground until needed; they played a critical role in food security. The main vegetable for storage was the cowpea, which was cooked, dried in the sun and then stored. Other foodstuffs dried and stored included blood, meat and fish. These were kept in traditional pots and baskets, which were hung above fireplaces.[77] The smoke from the fireplaces dried the food and also acted as protection against pests. Sweet potatoes, cassava and bananas were pounded into small pieces then dried to be ground later for making a bread-like staple.

Swaziland

Swaziland had extensive indigenous knowledge skills for the storage and preservation of food, which in many cases improved the nutrition and taste of the food. Both wild and cultivated food types were stored for use during times of scarcity. In the southern part of the country women picked melons, cowpeas and pumpkin leaves in February and preserved them as dried green vegetables (morogo). The dried vegetables were stored away in big clay pots and sealed with fresh cow dung to prevent pest invasion. This activity continued into March and April. Beans, jugo and lentils were harvested, dried

76 Ochieng, W. R., and Sharmon, M. (eds), 1979. Kenya's people round the lake. Published by Evans Brothers Ltd.

77 For instance in Rusinga, Mfangano and Kano in western Kenya the communities used degi (pots) and atonge (baskets).

and stored away. To keep pests out, wood-ash was added. The dried vegetables could keep for up to three years without pest infestation. This aided greatly in food security. Green mealies (maize), cowpeas and jugo beans were cooked in big pots with the skin on and dried; these were then stored away in clay pots or bags for future use.

This method of preservation controlled pests. The households could re-cook the preserved food whenever it was needed. Grain was preserved in grass baskets able to take 10-20 bags of sorghum or millet, which were buried in the kraal. The corn on the edges of the grass basket would soak up but not germinate. The grain would have the taste and smell of kraal manure, but the inside grain would remain fresh and wholesome. Cowpeas, melon pips and peanuts were processed into powder and stored away in clay pots or calabashes ready to be used as soft porridge mixed with milk and mealie-meal for children. The main use of peanuts and pips was to make nutritious dishes by mixing them with preserved green vegetables. The Swazis processed whole grain embryo meal rich in protein, oil and mineral salts by grinding it on a stone to a variety of products to feed young babies. Other products produced included mealie-meal, samp, mealie-rice and bran. The bran leftovers were used as feed for pigs and chicken. A variety of nutritious dishes could therefore be prepared even in a bad season. This is was a crucially important aspect of indigenous knowledge in food production and preservation.

Tanzania

In Tanzania, food was stored in granaries made of different materials depending on the area. In Morogoro they were made from barks of mhongola trees and were known as lindo. In Iringa, Ruvuma, Rukwa and many other parts of the country the granaries were known as vihenge or visanja. Some of vihenge comprised of large baskets placed on boulders or on stilts and thatched with grass. The baskets were made of tree branches or strips of bamboo and often reinforced with mud plaster. Some of the vihenge had walls made purely of mud and thatched with grass.

Some tribes in Tanzania used honey as a preservative for cereals and other seeds to be used during famine. Different types of cakes were prepared using honey, such as honey-maize and honey-baobab fruit cakes made in Iringa, honey-finger millet cake made in Kondoa, and honey-yam and honey-banana cakes made in Moshi. These cakes were preserved so that they could be eaten during famine or when one was away on

a long safari or was working for long hours in the field away from home.

Community bonding

Indigenous knowledge was not just about technologies and know-how. It was also about spiritual or communal bonding, especially when disaster struck. "The success of traditional disaster management practices, which included those used for pre- and post-disaster periods, together with those applicable for relief and interventions during the disaster period, relied on strong family and community bonding," reports the Kenya study. "People had feelings for each other and shared freely." The Tanzania study also reports that "if food supplies in a village were inevitably low, the villagers would cope by seeking food from other villages." They called this kuhemea, another form of communal bonding.

Summary and conclusions

In all the communities studied food production is a major area where indigenous knowledge is applied. The communities relied upon food crops which include both indigenous and exotic species that have become staples over the years, such as maize, which was originally introduced from South America. The indigenous crop varieties, both old and new, play a critical role in food security and poverty alleviation. Food security cannot be separated from poverty alleviation and vice versa.

Poverty is endemic among the indigenous communities in Kenya, South Africa, Swaziland and Tanzania. In practical terms poverty in these communities translates as food insecurity and the question that arises is how indigenous knowledge can be utilized to improve food security.

What emerges from the study is that certain indigenous knowledge technologies, know-how and practices, if popularized and integrated with modern knowledge systems can help to alleviate poverty. The study often refers to the cultivation of indigenous drought-resistant and early-maturing crop varieties and traditional techniques of food preservation and storage as some of the best practices. However, the main challenge to indigenous knowledge as a tool for alleviating poverty is that it has not been popularized as an effective way of dealing with many of the environmental and food

security challenges that face the communities.

# Chapter Six

## Indigenous Knowledge and Traditional Medicine Practices

### Introduction

What is traditional medicine? The World Health Organization (WHO) states that it is difficult to assign one definition to the broad range of characteristics and elements of traditional medicine. It notes, however, that a working definition is essential.[78] We shall not attempt to define African traditional medicine because of the diversity and complexity of its nature and practice as manifested in the communities studied in Kenya, South Africa, Swaziland and Tanzania. Instead, and as our working definition of sorts, we shall describe its value, utility and importance as observed in the case studies. One thing that is certain, however, is that even though African traditional medicine involves some aspects of "mind-body interventions" and use of animal-based products, it is largely plant-based. It is not for nothing that the people of Tanzania call it miti shamba -- a terse but apt Swahili term meaning, literally, plants derived from the shamba (garden or field).

The importance of traditional medicine for humans as well as animals in Africa, both now and in the past, is enormous. For most of the communities studied, indeed for much of Africa, traditional medicine is the only affordable and accessible health care. For many members of the communities traditional medicine is the health care of choice, or at the very least a critical stop-gap measure before the patient consults a modern health facility or medical practitioner. In some cases, traditional medicine is the only form of health care available due to lack of access to, or affordability of, modern medicine. The use of traditional medicine is widespread especially in those areas where people live far away from clinics or cannot afford hospital fees or the

78 The WHO's Centre for Health Development defines African traditional medicine as the sum total of all knowledge and practices, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental, or societal imbalance, and relying exclusively on practical experience and observation handed down from generation to generation, whether verbally or in writing.

charges of a doctor or a veterinarian.

African traditional medicine thus plays an almost inestimable role in health care delivery, and the pharmacopoeia of indigenous prescriptions traditionally used in Africa, including the communities studied, is colossal.[79] In Swaziland and Tanzania it is estimated that over 80 percent of rural people still depend on traditional healers and traditional herbs for their primary health care needs. In Tanzania the area of Old Moshi alone has 176 plant species with medicinal properties used in the treatment of the gastrointestinal tract, coughs, homeostatic needs, dental problems, dermatological problems and veterinary uses.[80] A study of traditional healers in Durban and Kwazulu Natal in South Africa showed that 70 percent of the patients consulted healers as first choice.

African traditional medical practice includes diverse health practices, remedies, approaches, knowledge and beliefs incorporating plant, animal and mineral products, spiritual therapies and charms. Traditional healers utilize a variety of techniques, media, methods and approaches to diagnose, treat, or prevent illness.

Over-exploitation

In traditional society, healers treated the whole range illnesses occurring in their communities. People respected and revered them. And their vocation was not as commercialized as it is today; they were usually paid in kind and not in cash and the practice was strictly regulated to guard against not only quacks but also overexploitation of the medicinal plants, which were regarded as community resources. This ensured the sustainable exploitation of the plant resources.

Many of the plants used were collected from the wild, as there were few instances of domestication of the significant medicinal plants. In some communities, such as the Maasai of Kenya, people walked for long distances in search of medicinal plants,

79 The WHO estimates that up to 80 percent of the population in Africa makes use of traditional medicine as a mean of theirprimary health care. In Sub-Saharan Africa, the ratio of traditional healers to the population is approximately 1:500, while medical doctors have a 1:40 000 ratio to the rest of the population.

80 Mahunnah, R. 1990. Utilization and conservation status of medicinal plants in Tanzania. Proceedings of the first National Workshop held in Arusha, Tanzania, 16 - 20 January 1990. Dar es Salaam, Tanzania: Benedictine Publications.

reserving the ones near the homestead as emergency supplies.

Plants of significant medical importance were never cut down for any reason, and efforts were made to plant these near the homesteads to improve accessibility. Harvesting was done in such way -- for instance by removing only a slice of the bark -- that the main plant was left intact in most cases. However, because of the continuous need for herbal products and an ever-growing population, in many instances the demands have exceeded the supply.

Emergency medicine

In Kenya, as in the other project countries, various types of diseases were more common during the occurrence of certain disasters, such as floods and drought. In most cases, plants and trees were used to prepare medicine for the treatment of those diseases, which included headaches, cholera, tuberculosis, pneumonia, eye infection, and malaria. Plants such as tithonia and okita were used to prepare medicine for treating malaria. Some of the disease outbreaks, such as nundu (small pox) which used to kill many people in areas like Mfangano and Rusinga islands in Lake Victoria, had no known effective traditional cure but were controlled through quarantine.

Tanzania

In Tanzania traditional medicine for humans, as well as animals, is enormously important. Traditional medicine is the only affordable and accessible health care in many parts of rural Tanzania. Common plant treatments are known and used by the majority of the rural population and there is a large vocabulary of plant names. Local people have a wealth of knowledge and ancient wisdom on medicinal plants.[81]

Indigenous medicines sold by traditional healers in different parts of Tanzania include the bark of Warburgia salutaris, which is used for the treatment of malaria, colds, diarrhoea, and general body pain. The bark of Olea europaea is used as a bottle sterilizer and a round worm repellant in animals and people; while Lannea schweinfurthii is used for stomach ulcers and stomach problems in pregnant women,

81 Dery, B., Otysina, R. and Ng'atigwa, C. (eds) 1999. Indigenous knowledge of medicinal trees and setting priorities for their domestication in Shinyanga region, Tanzania. Nairobi, ICRAF 87 pp.

to give but a few examples of the medicinal plants in common use.

Different regions of the country have their own repertoire of traditional remedies utilizing mainly local plants. In Ruvuma region, for example, traditional healers use mtumbati (Pterocarpus angolensis) to treat syphilis, mkuguti (Olea europaea) and mpera (Psidium guava) to treat diarrhea, lugobedi (Cardammom like) to treat fever, and one's own urine to treat a wound, among other remedies. In Morogoro they use lugobedi (Cardammom family) to treat fever, mkwaju (Tamarindus spp.) to treat diarrhea, and mbuyu (Adansonia digitata) to treat stomachache and body swellings. In Arusha they use olwayi (Acacia drepanolobium) to promote milk let-down in lactating mothers, a sausage tree known locally as ormukutan (Kigelia spp.) to treat tapeworm and other intestinal worms, and kilorit (Acacia nilotica) bark and fruit to treat loss of appetite, typhoid, hernia and stomach pains. In Tanga they use mkwinini (Cincona spp.) to treat malaria, and mkwanga (Stagnothaena spp.) and kambaku to treat running nose allergy locally known as kambaku and donondo (Pcynostachys

The Swazis use the umsutane plant (Lippia javanica) to treat blood pressure, cold, flu, running stomach and vomiting.

umbros) to treat asthma. The pharmacopoeia is almost endless.

Medicines for livestock

Being mainly livestock keepers, the Maasai in Tanzania have a rich heritage of herbal cures for livestock. For example, they use osendu (Combretum mucronatum) to treat olchotai (guinea worm which attacks throats of cows which they catch while drinking water), armme (Euphonobia cuneata) to treat abortion (brucellosis) in cattle and olorien (Olea africana) to sterilizing milk gourds and treat East Coast fever in cattle. The Maasai have nearly a dozen different herbs to treat various ailments in livestock. For example, apart from olorien they have at least five other different plants to treat East Coast fever.[83] The olorien is also used to sterilize milk gourds.

Taboos in harvesting

In Tanzania - and this is probably true in the other countries - taboos and restrictions on gathering medicinal plants and the nature of tools used for harvesting helped to limit the volume harvested. Studies carried out in Duru-Haitemba and Udzungwa mountains revealed the importance of myths and taboos in harvesting medicinal plants. Traditional healers in those areas claimed that some medicinal plants could only be harvested or reached after wearing special black clothes, leaving specially treated coins under a plant the night before harvesting or making a special prayer before collecting roots of certain tree species, the Tanzania study reports.

Healing practices

Tanzanians practice a variety of healing techniques. Most of the techniques do not distinguish between the physical and psychological elements of an illness. However, many tribes in Tanzania have a dual classification for diseases. They have those diseases that have natural causes and those that are due to witchcraft or angered ancestoral spirits. However, the Tanzania study reports that most of the diseases classified by healers have a scientific equivalent in western medicine, and that diseases are

83 These include Olorien (Olea africana), Olesayet, Osugurei, Olmatasia, Olgarai, Oluisugim, and Endijiai plants

generally diagnosed by a healer according to both the cause and the classification of the illness. Diseases attributed to natural causes are generally treated by a herbalist (or at a hospital). If the illness is due to witchcraft, a sorcerer is needed to employ "counter-magic". However, if the disorder is the result of angered ancestors or evil spirits, a ritual or ceremony is held to placate them. If the cause of the illness is broken cultural rules or taboos, an act of penance or restitution is prescribed.

Swaziland

The Swazis have an extensive body of knowledge on traditional medicine, and over 80 percent of the population rely on traditional medicine for their primary health care. The information gathered for this study was provided not only by traditional medical practitioners (TMPs) but also by ordinary members of the public. This suggests that traditional cures are widely known and used.

The TMPs number in their thousands. A 1983 survey carried out to establish the prevalence of traditional health practices in Swaziland and to determine how it could be integrated into conventional medicine revealed that there were approximately 5,000 TMPs, 45 percent of who were women, and the TMP to population ratio was about 1:110. The number of TMPs has increased over the years and the current estimate is about 10,000 TMPs with a practitioner to population ratio of about 1:100.

TMPs are much revered and accorded positions of great importance in Swazi society. They are like the Zulu healers of South Africa. Along with traditional chiefs, they control power in the community and are consulted by all classes of people not only on health problems but also on other social needs and problems. People think of them first when they fall ill or have spiritual, moral, psychological or social problems.The TMPs include men and women of all ages but almost half of them are women. Each category of TMPs has different information regarding how indigenous knowledge is used in traditional healing but they are often reluctant to divulge the information, the Swaziland study found.[84] Partly responsible for this secrecy are the international drug

84 Amusan, O.O. G. 'Indigenous knowledge and health care' in: Nature Conservation and Natural Disaster Management - Role of Indigenous Knowledge in Swaziland.' University of Swaziland.

The leaves of the umsilinga (Melia azedarach)are used by the Swazis to prepare medicine for vomiting, running stomach, ulcers, high blood pressure, de-worming dogs and treating wounds in livestock.

companies who have been accused of using the knowledge of the traditional healers to develop new drugs without giving them a fair share of the profits. This breach of intellectual property rights is of great concern not only in Swaziland but also in all the other three countries studied.

The study notes that the acceptance and popularity of traditional health care in Swaziland is due to a variety of cultural factors that influence people's perception of life. sIt states that traditional health care is anchored in the religious system of the people and is closely linked to beliefs on the causes of illness. Traditional medicine adopts a holistic approach to the prevention of disease and healing. A person's body, mind and soul are viewed as an indivisible whole connected to the social, physical and spiritual world.

The majority of the Swazis, particularly in the rural areas, cannot afford conventional

The Swazis use lihala (Aloe saponaria)to make preparations for treating high blood pressure, bile with nausea, fever and lethargy, snake bite, colon irritation, stomach ache. Ash from the leaves of the lihala can be used as cooking soda and as an ingredient for snuff, used by adults only.

drugs; the use of herbal medicine is the only option. Herbal remedies are used to treat a wide range of diseases in humans as well as in animals. These include such diseases as anaemia, cancer, chest pains, dizziness, glaucoma, heartburn, infertility, malaria, venereal diseases, gynaecological problems, skin diseases, toothache, diarrhea, vomiting, and so on. Treatment also includes life-threatening diseases associated with HIV/AIDS. Treatment of fractures is also done with traditional mixtures (umhlabelo). The Swazis are a livestock-keeping people and veterinary remedies also exist to cure animal illnesses.

The TMPs use different parts of medicinal plants as their main ingredients in the preparation of remedies. In some cases, they use different parts of the same plant for treating different diseases. They also use animal and animal products but to a lesser extent than plants. Locusts, for example, are used for treating bed-wetting, and honey

Plant That Dispels Darkness

A wonder plant known in science as Sutherlandia frutescens, has been used for centuries as a potent medicine by traditional healers in South Africa. The indigenous San people call it Insisa ("the one that dispels darkness") and used it as an energy booster and a powerful anti-depressant. The Tswana know it as Mukakana for its power in treating gonorrhea and syphilis.

Zulu traditional healers, the sangoma, call it Unwele, the great medicine that was used to ward off the effects of the devastating 1918 influenza pandemic, which claimed 20 million lives worldwide. Afrikaners call it the Kankerbossie or cancer bush, because of its properties in treating people suffering from internal cancers and wasting.

The plant is a sub-species of Microphylla, reputed for its immune-boosting properties. There is anecdotal evidence suggesting that it can improve the quality of life for thousands of people with HIV/ AIDS.

Sutherlandia contains a powerful combination of molecules, which have been identified and used in the treatment of patients with cancer, tuberculosis, diabetes, schizophrenia and clinical depression. It is also an antiretroviral agent. A pharmaceutical company has contracted farmers to plant acres of the plant to prevent wild supplies being over-harvested.

Sutherlandia should remain accessible to anyone. Plants which have well-documented folk use cannot be patented, the South Africa study notes.

is used for treating colds and athletes foot.

Over 100 species identified

In addition, the TMPs use traditional recipes to deal with supernatural or magical situations. For example, they use herbal preparations to bring back ancestors, drive away evil spirits, influence luck, achieve success in litigation, catch thieves and prevent wild animals and snakes from entering homes. They also prescribe recipes for casting a spell on someone, enticing someone who has deserted to return, charming young women so as to win their love (kulumba), driving away evil spirits, and preventing lightning strikes (kubetsela). This latter practice is so popular that in a recent court case, a TMP reported that he was making a lot of money from the sale of recipes for

preventing lightning.

Some 148 plant species have been identified as sources of herbal medicine. Some of the medicinal plants are cultivated food plants, such as the inkakha (Mormodica involucrata) used for treating diabetes and hypertension; umgwaava (Psidium guajava) used for treating coughs, running stomach and painful menstruation (dysmenorrhoea); pawpaw (Carica papaya) used for treating erection problems, tooth ache, burns and wounds; and peaches (Prunus persica) used for treating running stomach. Others are non-cultivated fruit plants collected from the wild such as the umphushane (Mimussops spp.) used for treating coughs; and umganu (Sclerocarya birrea) used for treating bile, wounds, chest pain, and running stomach.

Different parts of medicinal plants are used as main ingredients in the preparation of traditional medicine. These include roots of the Ficus natalensis, which are used to treat broken bones; leaves of the lemon grass, which are used for treating cold and flu; bark of the Elaeodendron transvaalense, which is used for treating running stomach; bulbs of the Siphonochilus aethiopicus, which are used for cold and flu; seeds of the Cannabis sativa, which are used for ulcers; fruits of the Vangueria infausta, which are used for treating ulcers; flowers of the Dombeya rotundifolia, which are used for reducing mortality in chicks; and stem of the Helichrysum aureonitens, which is used for high blood pressure.

In some cases different parts of the same plant are used for treating different diseases. The leaves of Cannabis sativa, for example, are used for chest problems, high blood pressure, stomach ache, asthma, colds and headache, while its seeds are used for ulcers and plantar warts and its roots are used for hysteria. Another example is guava; its leaves are used for treating cough and running stomach while its roots are used for treating continuous menstruation. Some of the plants are used for treating both human beings and domestic animals. In some cases they are used for the same ailment in both humans and animals. For example, the intfombe or umhlabelo (Ficus natalensis) is used for treating fracture in both humans and livestock, while the gobho (Gunnera perpensa) for treating uterus problems in both humans and livestock.

The Swazi collection of traditional remedies is huge. It underlines the importance of

indigenous knowledge in the health care of traditional communities.

South Africa

In South Africa, which like Swaziland has extensive knowledge of medicinal plants, traditional healers are prevalent. A study of traditional healers in Durban, KwaZulu Natal, showed that 70 percent of the patients would consult traditional healers as a first choice, sangomas (herbal medicine practitioners) were the most popular and a significantly large number of patients consulted traditional healers even for life-threatening conditions. The South Africa study reports that traditional healing is an integral component of health care in South Africa.

There are opportunities in South Africa for both traditional and western health care providers to come together in attacking many ailments including HIV/AIDS. The South African indigenous medicinal plant Sutherlandia frutescens, for centuries used by traditional healers to cure immune-related disorders, is already being investigated for possible use in treating the millions of poor people living with HIV/AIDS.

The traditional healers in South Africa use innumerable ingredients from all sources of nature including plants, animals and minerals. The herbalist or diviner administers imithi (emetics) which are usually of vegetable origin to treat diseases or ailments. These raw herbs are ground into powders to be taken with water, or are boiled as barks or roots that are drunk as decoctions. Other imuthi (infusions) are used in bath water, rubbed into incisions (ukuchaza), inhaled as smoke (ukuqhumisa), nibbled on (especially roots), or licked from ones fingers (ukuncinda).

A survey conducted at the Mai Mai bazaar, a complex of muti shops (herbal medicine shops) in Johannesburg, showed that 36 percent of the plants had medicinal uses for physical disorders or ailments such as diarrhoea, epilepsy, asthma, coughs, parasitic infections, madness and headaches. The most common category of psychoactive plants used in South Africa is for treating epilepsy and madness. There are approximately

150 such plants.

Marine resources

Marine resources are also used by the "river people" or abantu bomlambo, who believe in the supernatural potency of the sea. As a result, many shellfish and other marine species are used for their medicinal or therapeutic properties. For example, water collected after boiling crabs is used against bladder problems, though crab meat itself is not eaten as the crab is associated with ancestral spirits. Diviners collect octopuses and dry them for medicinal purposes. When mixed with water, dried octopuses are said to cure a variety of ailments including idliso (poisoning by witchcraft). Limpets are cooked, ground, and fed to babies to quicken the development of their milk teeth, while shells in general are also used to ward off evil spirits. Numerous other therapies utilizing marine products are popular.

Charms

The magical uses of muti are important in traditional healing in southern Africa and in South Africa in particular. The following are some categories of medicines which have particular uses:

- Ama-khubalo are plant medicines such as roots or barks often worn around the neck and nibbled on. These muti are used for self-fortification and to ward off evil spirits. Some of the plants used for these include Alepidea amatymbica, a plant also used for treating lung conditions such as bronchitis by drinking a decoction made from it. The term ama-khubalo is also used to refer to compounded medicines prepared only by professional practitioners and prescribed by them.

- Intelezi is a generic name for all medicinal charms, the object of which is to counteract evil by rendering the causes innocuous. The intelezi is often a mixture of plants and is often boiled and preserved. It can be sprinkled (uku-chela) or spurted from the mouth (uku-khafula).

- Umkhando is a class of medicinal charms to gain influence, supremacy, or

ascendancy over another in love matters.

- Isibethelelom is a love charm used to "fix up" a girl to a man, so that she will love him only.

In Swaziland, there are nearly two million marula trees (Sclerocarya caffra), which are indigenous in southern Africa and are used by the local communities for nutrition, medicine and cosmetics. The trees produce vitamin C-rich fruits which are eaten by children and goats. The women also collect the fruits, which drop to the ground when ripe around February each year, and make a local brew known as buganu. The importance of the brew in the socio-economic life of the local communities is recognized by Swazi royal family. People travel hundreds of kilometres to bring their first brews of the marula fruit for the King and Queen Mother to sample in Bugani Tasting Ceremonies.

Different parts of the marula are used for different purposes including as an aphrodisiac. A not-for-profit company has been set up under the patronage of the Queen Mother to create a Swazi natural products industry, enabling rural women to generate income from the sustainable use of the marula using traditional indigenous knowledge.[85] The company is producing marula oil which is extracted from the nuts of the tree and has many uses. The oil is rich in anti oxidants, notably oleic acid and Vitamin E, which are well known for their anti-aging properties. Swazi women have traditionally used the oil for moisturing and rehydrating the skin; the oil was, for example, used during pregnancy to avoid stretch marks. The company is also producing a marula soap which has the same skin care qualities.

Witchcraft, spirits and magic

Though African traditional medicine is predominantly herbal remedy, a number of illnesses were treated through the medium of spirituality (such as charms, amulets and totems) and there were numerous alternative treatment modes depending on the area and culture. In South Africa, for example, religion and illness causation were

85 See "The Magic of Marula" in Swazi Secrets. http://www.swazisecrets.com/images/index2a.jpg

closely interwoven and healing through charms was common. Among the Zulu the notion of disease (isifo) encompasses physical sickness together with misfortune and imbalance. Thus, anything that brings one into disharmony with the environment or other people was perceived as potentially illness-causing. In the Gauteng province, illness was often ascribed to witchcraft or ancestral spirits that needed appeasing. And among the Xhosa umthakathi (witches) are believed to have the mystical ability to harm others; they can become possessed by evil spirits, change shape and use medicines to harm others or send agents such as animals to do evil deeds. The Xhosa also have their baloyi (sorcerers) who are capable of similar misdeeds.

Witchcraft, spirits and magic, are forces to be reckoned with and protected against in the lives of many southern Africans, and this is an important area of traditional medicine. There is widespread trade in intelezis or protective plant charms that are believed to thwart the malicious intentions of others who are sometimes believed to be witches.[86] Often such witches are people who are jealous of the success of others.

Problems

The problems facing traditional healing in southern Africa today is loss of the knowledge over time because much of it is not documented. In fact, much of the rich medicinal plant lore has already been lost. In addition, the younger generation are moving away from traditional customs and practices. South African healers themselves have acknowledged that they are losing their influence.

Another problem is that the dynamics of the trade in muti is changing to the detriment of conservation. There has been an increase in the number of gatherers selling muti directly to the public and this is leading to over-exploitation of wild muti reserves since the gatherers often disregard conservation-friendly collection methods, which

86 One such other popular charm used to protect people from witchcraft attacks is made from umathithibala (Haworthia fasciata), a plant that is grown around the homestead (mainly for that protective or therapeutic purpose). The medicinal or magical herbs are used in conjunction with spiritual and ritual treatments to neutralize the believed sources of misfortune, and restore balance and health.

traditional healers often abide by.

Still another problem is the lack of accountability for malpractice by traditional healers. Now there is nothing that protects the patient from malpractice by traditional healers. There is no registration of healers and therefore it is difficult to control them or hold them to account. Lawyers are also arguing for the regulation of traditional healers and traditional medicine, as well as for the application of human rights principles in the traditional healing profession.

## Summary and conclusions

Traditional medicine is crucially important in Kenya, South Africa, Swaziland and Tanzania. An overwhelming percentage of the people in those countries rely on traditional medicine for their basic health care. However, the emerging problems of overexploitation of the plant resources that form the basis of indigenous medicine, the lack of legal protection of the intellectual property rights in traditional medicine, gradual loss of knowledge because of lack of documentation, are eroding the viability of the system. Indigenous knowledge in traditional medicine is threatened in all the

four countries unless something is done to reverse the situation.

## Chapter Seven

Conclusions and Recommendations

The communities studied in Kenya, South Africa, Swaziland and Tanzania have well developed indigenous knowledge systems covering practically every aspect of life from food production and health care to nature conservation and natural disaster management. The indigenous knowledge systems are culture-specific and have evolved over time to cope with particular environments. While the systems may differ in detail, depending on local culture and environment, they share similarities and common challenges. Some of the more significant similarities and common challenges are:

- Indigenous knowledge relies on informal rules for its application and enforcement.
- Indigenous knowledge faces the danger of being lost if not documented.
- Indigenous knowledge is neither pseudo-science nor anti-science; it is just another form of knowledge system.
- Indigenous knowledge is rich in herbal medicine know-how.
- Indigenous knowledge influences the lives of millions of people in the project countries without formal government acknowledgement or recognition.

Indigenous knowledge systems have enabled the various communities to live in harmony with their environments for generations. However, the coexistence is not always perfect and latter-day socio-economic pressures in particular have exposed some of the weaknesses of the knowledge systems. For instance, the power of the community elders, responsible for enforcement of traditional rules, is being eroded in many cases.

But indigenous knowledge remains an immensely potent force, at least potentially, in environmental conservation and natural disaster management. The communities had powerful structures that exercised authority to ensure smooth compliance with the rules and obligations in times of disasters such as floods, drought and famine. Every member of the community grew up knowing the rules and a quick justice process in the courts of elders ensured efficient enforcement of judgments and strict observance of the rules.

New challenges

The indigenous knowledge practices in nature conservation and natural disaster management worked well within the power structures of the traditional communities. However, fast population growth and new socio-economic impacts including science and technology are posing challenges to indigenous knowledge systems. It is clear that some hybrid incorporating indigenous knowledge systems and the new knowledge systems is required.

The studies in the four countries have come up with recommendations to deal with some of the challenges and the status of indigenous knowledge in the project countries. Some of the recommendations made by all the individual country studies include the following:

- Further country research on indigenous knowledge should be carried and data banks established.

- Indigenous knowledge should be documented urgently to avoid the information being lost as the elderly custodians of the knowledge disappear from the scene.

- Indigenous knowledge should be incorporated into national policy and development documents.

- Laws to safeguard intellectual property rights relating to indigenous knowledge should be enacted.

- Indigenous knowledge systems should be integrated with modern knowledge.

- Indigenous knowledge should be taught in schools and popularized among members of the public.

Kenya

The various communities in Kenya, in common with the other communities surveyed in Tanzania, Swaziland and South Africa, had elaborate systems for nature conservation, early warning, and disaster management, enabling them to cope with nature. The communities instinctively understood that their survival depended on how best they could harness nature and utilize in a sustainable manner the natural resources it provided. They sought to conserve their local environments through a set of strict traditional laws that included taboos and heavy penalties under the guidance of the elders.

They had specific and comprehensive strategies and structures to tame and conserve nature, which were often activated quickly and efficiently during disasters. The structures included a council of elders, which had at its disposal the speed, strength of numerous warriors that could be used to investigate a particular phenomenon or to pass on urgent messages. In many instances, indicators that were weather-based were simple to interpret, as the natural processes were visible to many and thus interpretation was consensual. Other indicators were not so simple, and some must have engendered conflicts in opinion depending on the decisions that had to be made.

But the major challenges facing indigenous knowledge is the increasing pressure on land and demand for fuel wood as a result of fast growing populations and increasing poverty. In many cases people have now started to violate some of the traditional rules that enabled the communities to conserve nature and its biodiversity and live harmoniously with it. Taking into account the challenges facing the indigenous knowledge systems, Kenya, in addition to the common recommendations already stated, has made the following further recommendations:

- Experts from biology, chemistry, anthropology, social sciences, meteorology,

and other sciences should study the rain-making and divining shrines of the Nganyi clan of western Kenya.

- Public education, awareness and tourism activities based on the shrines should be introduced.

- The government should identify all the trees and birds which have traditional value as climate indicators, or otherwise, and declare them protected species.

- The communities need to be empowered through capacity building and encouraged to make positive use of indigenous knowledge practices.

South Africa

South Africa, having come lately into the scene as an independent African country, is making efforts to promote indigenous knowledge. For example, the Department of Science and Technology's Indigenous Knowledge Systems Policy aims at establishing an enabling framework to stimulate and strengthen the contribution of indigenous knowledge to social and economic development in the country. The National Research Foundation has also begun to develop research capacity in the field of indigenous knowledge and its role in nation-building. Consequently it has identified a number of research themes which include:

- Indigenous medicine and pharmacology, encompassing both human and animal health medicine

- Indigenous methods and systems of food supply, processing and preservation, as well as the potential for value addition through use of modern technology.
- Socio-cultural systems focusing on the contrasts, impacts (historical and current) and dynamics of modern and indigenous knowledge.

- Sustainable livelihoods and the eradication of poverty.

- Environment and natural resources utilization

- The South African desk study also points out that there is need for research on indigenous sources of food such as mopane worms (caterpillars), locusts and termites and the edible stink-bug which are important sources of protein in South Africa.

Swaziland

The knowledge base of the Swazi society is rooted in traditions that are passed from one generation to the next. The traditions embody considerable knowledge on how to manage and protect the local ecosystems and best utilize the natural resources. This knowledge is applied in most areas of daily life including health care, and a lot of it is already in the public domain. However, although the knowledge is pervasive in the Swazi society there is a need to acknowledge the contribution by women in indigenous knowledge systems. The Swazi study further recommends:

- Indigenous knowledge food preservation techniques, such as drying food fruits and vegetables, should be popularized to ensure food security and reduce dependency on food aid.

- The medicinal plants reported in the study should be investigated scientifically.

- Interest in environmental conservation and management should be inculcated in every Swazi.

- Medicinal plants should be planted, not just gathered from the wild, especially those in most demand.

- People should be taught how to sustain and utilize indigenous food and fruit plants not formally cultivated so as to promote better food security and nutrition at household level and to protect biodiversity.

- Replanting of indigenous trees programmes should be implemented at

community level, supported by all stakeholders from the chiefs down to community members.

- Capacity building should be provided to promote indigenous knowledge in Swaziland.

- Environmental protection legislation should be enforced. Outdated legislation should be reviewed.

Tanzania

The recommendations made by the Tanzanian study have already been stated, as they are the same as those commonly made by all the four studies. However, it is worth noting that in Tanzania indigenous knowledge on land use and management is particularly well developed. An outstanding example is the ngoro and intuumba systems, used to maintain soil fertility. The systems control soil erosion and conserve moisture on land subjected to continuous cultivation. Farmers still use these techniques to avoid the use of expensive fertilizers.

The ngoro and intuumba systems are just two of the many techniques that the indigenous communities in Tanzania developed over time to cope with their environment.[86] Yet in Tanzania, as in the other project countries, there has been inadequate support for the formal promotion of the traditional technologies and know-how. Indigenous knowledge has not been harnessed to fit into the current scientific practices for environmental conservation and natural disaster management. In fact, until recently indigenous knowledge has been regarded as backward, static and a hindrance to modernization.

87 The ngogo system is a cultivation method used in the Matengo highlands to protect land against soil erosion while the intuumba system is used in the Rukwa region in Mbinga Districh to make compost mounds.

This attitude has undermined the capacity of the local or indigenous communities to innovate, in a fast changing world.

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