

Draft

**Biodiversity, Adaptation, Livelihoods and Food Security: Lessons from
the Field for Policy Makers**

Sandra McKenzie

Helen Baulch

Balakrishna Pisupati

Bhujangarao Dharmaji

IUCN Regional Biodiversity Programme, Asia

Table of Contents

Purpose	3
Introduction	4
Identification of concepts	5
Biodiversity	5
Adaptation	6
Livelihoods	7
Food Security	9
Identifying Linkages between Biodiversity Conservation, Adaptation, Livelihoods, Food Security and Development.	13
Case Studies	28
Mangrove Restoration by the Pred Nai Group in Thailand	28
The Garifuna Emergency Committee in Honduras	32
Community based floodplain resources management program in Haor Basin, Bangladesh	36
Community-Based Rangeland Rehabilitation for Carbon Sequestration by Gireigikh Rural Council in Sudan	Error! Bookmark not defined.
Mamiraua Sustainable Development Reserve (MSDR), Brazil	46
Mamiraua Sustainable Development Reserve (MSDR), Brazil	52
The Uganda Food Security Initiative	55
Kalinga Mission for Indigenous Children and Youth Development Inc. (KAMICYDI) - Philippines	59
Making the links – Suggested Actions for Policy Makers	62
References	66
Making the links – Suggested Actions for Policy Makers	Error! Bookmark not defined.
References	76

Acknowledgements

We wish to thank the various community leaders and reseach team contacts that assisted in proving comments on the manuscript. Key contacts included Jaruwan Kaewmahanin, Supaporn Worrapornpan, Somsak Sukwong, Suzanne Shende, Munzulo Hannan Khan, Erika Spranger –Siegfried, Martin Paul Vogel, Piyasoma Benthota, Ana Rita Alves, Alan Alemian, Vanaja Ramprasad; Peter Oduol, Remen Swai, Lawrence Mhwambo, Donato Bumacus and Shireen Samarasuriya. This paper has also benefited from discussions held with participants at the IUCN World Conservation Congress held in November 2004 in Bangkok and the Global Biodiversity Forums held in June 2004 in the Philippines and Tanzania. We are also grateful to Michael Hooper and Sean Southey from the UNDP Equator Initiative for supporting the consultations with authors and providing access to submission made to the Equator Imitative Awards 2003. Balakrishna Pisupati is thankful to Equator Initiative for providing the opportunity to serve as Chair of Asia-Pacific Group to select list of finalists for the 2004 Equator Awards which provided the inspiration for this work.

Purpose

This report seeks to address the gap between field-based outcomes and policy initiatives by exploring the state of knowledge on the links between conservation, livelihoods and food security. The report documents lessons from field projects that seek to improve local livelihoods and health by undertaking actions for biodiversity conservation and poverty reduction. This report has been prepared in consultation with project managers and the wider conservation and development community in an effort to formulate guidelines for future project development.

Introduction

The level of consensus in the global community to meet the challenge of achieving a significant reduction in environmental degradation (in particular biodiversity loss) by 2010 is laudable. The global community has committed itself to achieving a significant reduction in environmental degradation, with a particular focus on biodiversity loss. Labeled the “Biodiversity Challenge”, this 2010 commitment has been hailed as “one of the most important declarations ever to be made in support of environmental protection for sustainable development” (UNEP/WCMC 22nd May 2003). Speaking of this commitment, UN Secretary-General Kofi Annan has captured the urgency and broad importance of biodiversity conservation, saying: “Biological diversity is essential for human existence and has a crucial role to play in sustainable development and the eradication of poverty. Biodiversity provides millions of people with livelihoods, helps to ensure food security, and is a rich source of both traditional medicines and modern pharmaceuticals (Montreal, 22 May 2003).

Multilateral agreements such as the UN Framework Convention on Climate Change (UNFCCC), UN Convention on Biological Diversity (CBD), UN Convention to Combat Desertification (UNCCD), and the Millennium Development Goals (MDGs) all constitute important guiding frameworks for policy makers. In turn, countries have developed National Biodiversity Strategy Action Plans (NBSAPs), Poverty Reduction Strategy Papers (PRSPs), National Communications on Climate Change, National Action Plans to address Desertification and National Strategies for Sustainable Development (NSSDs). Each of these instruments is typically accompanied, however, by its own administrative structure and reporting mechanisms, with little communication among them. Greater communication and “mainstreaming” is therefore needed to ensure appropriate overlap and synchrony between these instruments at the national and global levels and to ensure that they have a chance at addressing the poverty-environment nexus at the ground level.

In November 2004, the IUCN hosted the World Conservation Congress which brought together scientists, policy makers, governments, non-governmental organizations (NGOs), community-based organizations (CBOs) and traditional peoples from around the world. There was overwhelming consensus that the areas of biodiversity conservation, poverty reduction and development should be mainstreamed. On closer inspection, however, it would appear that at country level governments and development agencies are still slow to accept conservation as a valid part of development strategies, particularly

in the fields of economic and social reform. Similarly, some conservationists and academics are hesitant to accept poverty reduction, small enterprise, health and social development as a part of the conservation mandate. It could be argued that in a number of cases (particularly in the instance of protected areas where communities are resettled) conservation even precludes the ability to develop civil societies and engage in sustainable livelihoods.

On the ground, despite a plethora of local anecdotes, relatively little is known of how outcomes for conservation and development overlap. This is despite a growing recognition that appropriate access to biodiversity and sharing of its benefits are fundamental to both livelihood security and poverty reduction in many of the world's poorest communities.

This publication introduces the some of the most critical issues in climate change, biodiversity conservation and sustainable development, and explores important linkages among these topics (Part 1). The study clearly illustrates that conservation measures, ranging from agro-biodiversity conservation, designation of protected areas, introduction of no-fishing zones and forest protection measures, must also take into account the fact that poverty and livelihood issues are often intertwined with conservation issues and must be dealt with in tandem.

The key linkages documented in this paper are illustrated using case studies of projects that have achieved multiple benefits (Part 2). Using these case studies, the paper proposes a series of recommendations on how to move from an appreciation and improved understanding of these linkages towards a more supportive policy environment. (Part 3).

Identification of concepts

Biodiversity

Conservation Actions are generally referred to as those actions that seek to halt the decline in the world's biodiversity. Biodiversity in simple terms refers to the variation among life forms on earth, including genes, species and ecosystems. It is widely accepted that biodiversity is under stress at each of these levels (United Nations, 1992). However, academics and scientists may argue that it always has been under stress. The question they ask is whether the current levels of stress are historically critical because of human intervention and the push for development. Gaia theorists may ask whether the earth is merely getting ready to impose another major event that will yet again "clear the decks" through mass extinction. The conservation lobby often proceeds on the assumption that it is the former hypothesis that is relevant and it is from this pretext that global conventions have been drawn.

The loss of biodiversity has been attributed to a range of factors. The (1995) UN and ADB report on the State of the Environment in Asia and the Pacific stated the main direct

causes of biodiversity loss as being: habitat loss, unsustainable use of biological resources, environmental pollution and conflict in policies. Underlying causes of biodiversity loss are quoted as being international trade, population growth, poverty and (invasive) species introduction (UN and ADB, 1995). Ten years later, it would appear that these factors continue to be the major causes of biodiversity loss.

When looking at the linkages between biodiversity, development and poverty reduction, biodiversity is often referred to in terms of its 'use' values i.e. agro-biodiversity, non-timber forest products, bush meats, medicinal plants and as a source of pharmaceutical properties. However coupled with this is a string of non-use values such as ecosystem services (watershed protection, soil organisms and habitat for natural pollinators and predators which can lead to significant savings in fertiliser and pesticide use and human assisted pollination) as well as existence values (such as the aesthetic, spiritual, moral and cultural values associated with retaining species and ecosystems).

The CBD which entered into force on 29 December 1993 presents a framework for developing and developed countries to prevent biodiversity loss through a series of targeted actions. It is becoming clear, however that the conservation of biodiversity needs to move beyond the Convention on Biological Diversity which is guided by the goals of biodiversity conservation per se, sustainable use of its components and sharing of benefits from these components. Instead a wider picture needs to be taken which sees human populations as part of the ecosystem, allows for adaptation against climate change and the valuing of biodiversity in food security and poverty reduction programs.

Climate Change Adaptation and Mitigation

Climate change adaptation and mitigation activities seek to reduce the impacts of climate change felt by communities. Climate change is commonly referred to as the variation in the average state of the climate for an extended period of time that can be directly or indirectly attributed to human activities which have altered the composition of the atmosphere (United Nations, 1992).

There are fundamental differences in the definitions of mitigation and adaptation. Mitigation deals with the causes of climate change whereas adaptation addresses the consequences (IPCC, 2001b). Mitigation strategies seek to limit the extent of climate change, by reducing emissions of greenhouse gases or by enhancing carbon sequestration while adaptation options seek to help ensure resilience of communities and ecosystems to a changed climate. Adaptation activities may have positive effects immediately, or in the short-term, with these benefits accrued by the people who implement them, whereas mitigation activities affect global climate and global carbon so benefits are accrued by a wider populace, including those who have not invested in the process (IPCC, 2001b).

Adaptation activities may involve changing practices, like fostering organic farming or agro-forestry projects to maintain soil structure and moisture levels and prevent erosion. They may also involve promoting drought resilience through changes in crop varieties,

promoting infrastructure such as small dams or embankments to prevent flooding, encouraging revegetation of steep slopes prone to landslides or restoring coastal vegetation to prevent tidal surges [this list gets a bit long...].

Effective adaptation planning incorporates the uncertainty associated with current climate change models, presenting planners with a range of potential changes, and potential implications both to ecosystems and to human settlements and livelihoods. Climate change adaptation may also take into consideration links that seem tenuous at first consideration. For example the forestry sector will have to consider implications of changed precipitation patterns and temperatures on forest growth and regeneration, but also on the frequency of pest outbreaks and forest fires (IPCC, 2001a). Industries may have to contend with changes in water availability, and governments may have to negotiate trans-boundary water-use agreements that account for climate-related changes in water flows (IPCC, 2001a). Impacts on the health sector may include contending with increased heat-related mortality and increased frequency of disease outbreaks (Watson, Zinyowera and Moss, 2000).

Mitigation activities include reducing outputs of greenhouse gases into the atmosphere from livestock or industry, changing behaviour patterns of consumers and developing and disseminating technologies to reduce emissions. Carbon-plantations may also be established, where vegetation is planted specifically to sequester carbon (IPCC, 2001b). Although mitigation is key to addressing the issue of climate change, there is debate about the validity of some approaches to mitigation. For example, establishing carbon plantations in some marginal agricultural areas may enhance carbon sequestration on the site, but agricultural activities may simply be displaced elsewhere, leading to deforestation and associated carbon loss in adjacent lands. This type of problem is termed 'leakage'. Likewise, the permanence of carbon sinks is an issue of debate. Forest plantations to sequester carbon cannot show the same permanence as carbon stored within fossil fuels in the ground, so attempts to mitigate climate change by reducing burning of fossil fuels are favoured by some, while others see considerable biodiversity benefits to increasing forested areas.

Livelihoods

Singh and Vangile (1994) of the International Institute for Sustainable Development (IISD) advocate that people's capacity to generate and maintain their livelihood or means of living is "contingent upon the availability and accessibility of options which are ecological, socio-cultural, economic, and political and are predicated on equity, ownership of resources and participatory decision making" and translate to the creation of livelihoods that empower individuals to earn enough money to provide for basic amenities such as food, clothing and shelter. It also enables people to lead a life of dignity in a sustainable manner (Singh and Vangile, 1994).

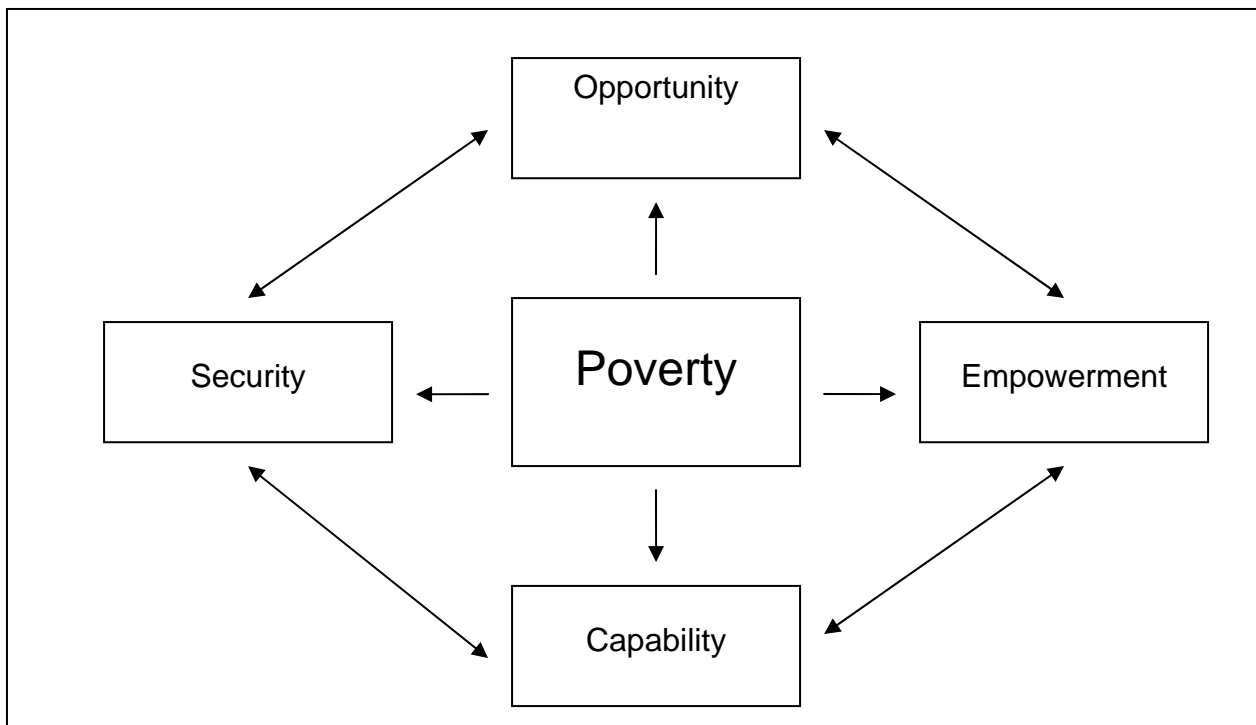
Sustainability in this context generally refers to the definition put forward by the World Commission on Environment and Development of "development that meets the needs of the present without compromising the ability of future generations to meet their own

needs" (WCED, 1987). The Stockholm Environment Institute however reminds us that the definition of sustainable livelihoods should go beyond the basic requirements for living (food, shelter and clothing) to take into consideration local cultures and customs and environmental constraints.

A fundamental aspect of the livelihoods approach is being able to recognize the various dimensions of poverty. Defining poverty requires moving on from traditional definitions of “dollar a day” and poverty line type assessments (which assess the level of per-capita consumption required to satisfy basic nutritional needs). The research framework used in this case study project builds upon the World Bank’s (2000) conceptualization of poverty to incorporate four main elements (as motioned by Oviedo, 2004; Figure 1):

- Opportunity (access to markets, resources and income generating opportunities leading to wealth creation),
- Empowerment (influence on state institutions and participation in political processes and local decision making),
- Security (reducing vulnerability to risks such as ill health, economic shocks, natural disasters, and seasonal or annual variations in resource availability) and
- Capability or human capital, which addresses the ability of the poor to utilize economic opportunities, including education, skills, and health

There are significant inter-linkages between these four dimensions and the relationship between them needs to be addressed in an integrated fashion if meaningful outcomes are to occur at the field level (Oviedo, 2004).



The relationships between the different dimensions of poverty are mediated by a diverse set of institutions that affect decision-making. At the micro-level these include resource tenure arrangements, social/power relations (including gender), labor arrangements, capital endowments, and technologies. At a macro-level, these include macro-economic policies, markets and prices, donor approaches, governance, political conflict, and demographic changes. In effect, the linkages between poverty, environment and development are rather more complex than have traditionally been assumed.

Implementation of the livelihood approach and poverty reduction is guided by the international frameworks such as Poverty Reduction Strategy Papers (PRSPs). These strategies reflect an approach jointly led by the IMF and World Bank, and are intended to help coordinate national activities and ensure adequate donor support.

One of the major weaknesses of PRSPs and Interim PRSPs has been addressing the environment-poverty linkage. The majority of poverty reduction and food security strategies ignore their impact on biodiversity and the opportunities that biodiversity conservation presents. Conversely, many strategies and action plans in the area of biodiversity neglect the poverty dimension. The implementation of “Poverty Reduction Strategy Papers (PRSP)” needs to be coordinated and conducive to ‘National Biodiversity Strategies and Action Plans (NBSAP)’. Biodiversity is an important natural asset that contributes to the achievement of sustainable livelihoods for poor people and provides livelihood opportunities in the form of a natural resource base for food security, income generation, healthcare, shelter and cultural and spiritual practices. To date Bangladesh is one of the very few countries that have included biodiversity conservation as an important chapter of an effective PRSP (African Energy Policy Research Network, 2004).

Food Security

Hunger in the world has decreased from 25% in 1970’s to 17% in 1995. By exception, hunger in Africa has shown little change and may even be rising. In the 1990’s, while the average number of underweight children declined in the developing world, there was little change in Africa, with eastern Africa showing a 5% increase to reach a prevalence rate of 35% in 2000 (UNDP and UNICEF, 2000).

Many would claim that the green revolution and improvements in cereal crops has led to an increase in world food supplies. However, the developing world is faced with the phenomena of hidden hunger where an increased focus on starch and oils has been at the expense of micronutrients. This ramifies itself in dietary deficiencies such as Vitamin A deficiency which leads to infertility and blindness (Olusola and Yemisi, 2003). Food security depends on not only having enough food to eat, but having quality foods with sufficient nutritional value. Addressing dietary diversity therefore requires a multidimensional approach focusing on nutritional and health status; socio-cultural traditions, income generation and biodiversity conservation (Figure 2). This in turn has the ability to help reach the goals of self-sufficiency, resilience and continuity, increased productivity and poverty reduction.

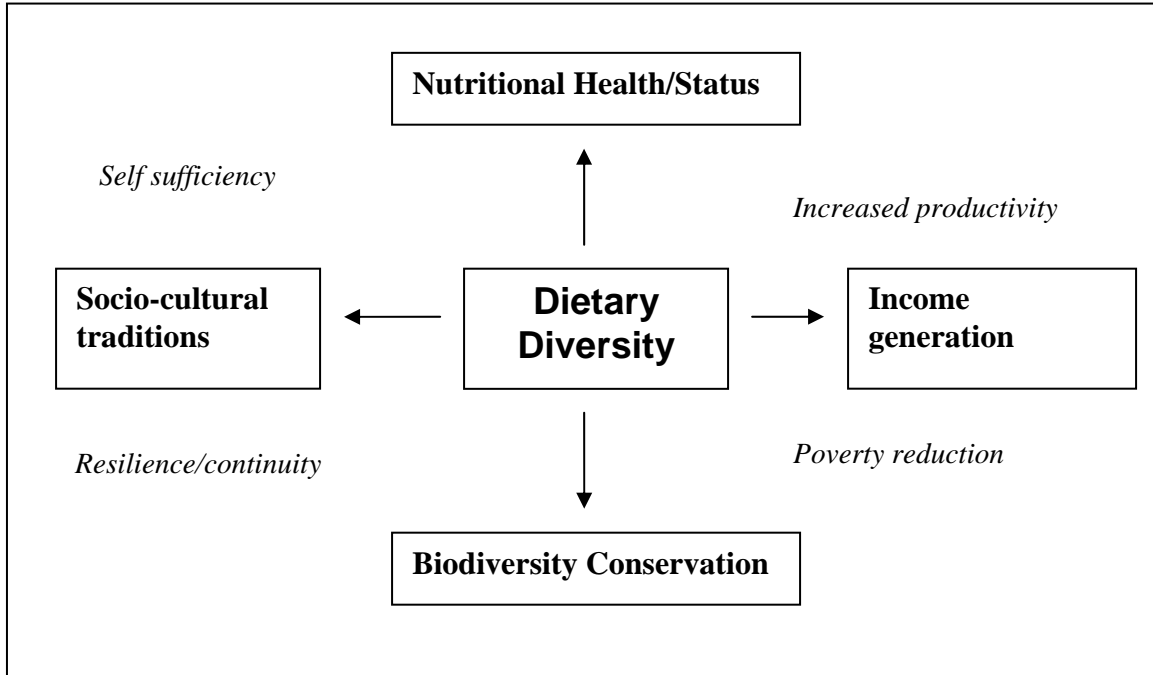


Figure 2: Addressing dietary diversity requires addressing the dimensions of nutritional health/status; socio-cultural traditions, income generation and biodiversity conservation.

An example of the way poor people may find themselves caught in the conflict between these four dimensions which in turn affects the safety of their food. An example is provided by the Kalpitiya region of Sri Lanka which is situated on low-lying sands which form a peninsular within the dry zone on the west coast. With the use of shallow wells, “lift” irrigation and large quantities of fertilizers a few wealthier powerful farmers have been able to develop large cash crops of tobacco, onions, chilies and other crops. Unfortunately, although the crops look productive and healthy, and provide employment opportunities for poor families in the area, they are a major health risk as leaching of agrochemicals into the groundwater has resulted in many irrigation wells having levels of nitrates up to 40mg/L (Lawrence and Kuruppuarachchi, 1986; Ministry of Environment and Natural Resources, 2002). The World Health Organization recommends levels of nitrate-nitrogen to not exceed levels of 10mg/L in drinking water (UNEP, UNICEF, WHO, 2002).

A dangerous side effect of elevated nitrate levels is “blue baby syndrome” (methaemoglobinaemia). There have been many reports of this becoming a serious problem in Kalpitiya (LBO, 2004). Ordinarily nitrates are relatively non toxic but upon entering the human body they are reduced to nitrites which interfere with the body’s ability to carry oxygen to the body. Infants under the age of six months are particularly vulnerable, and their skin may take on a bluish tinge when afflicted. Ordinarily this

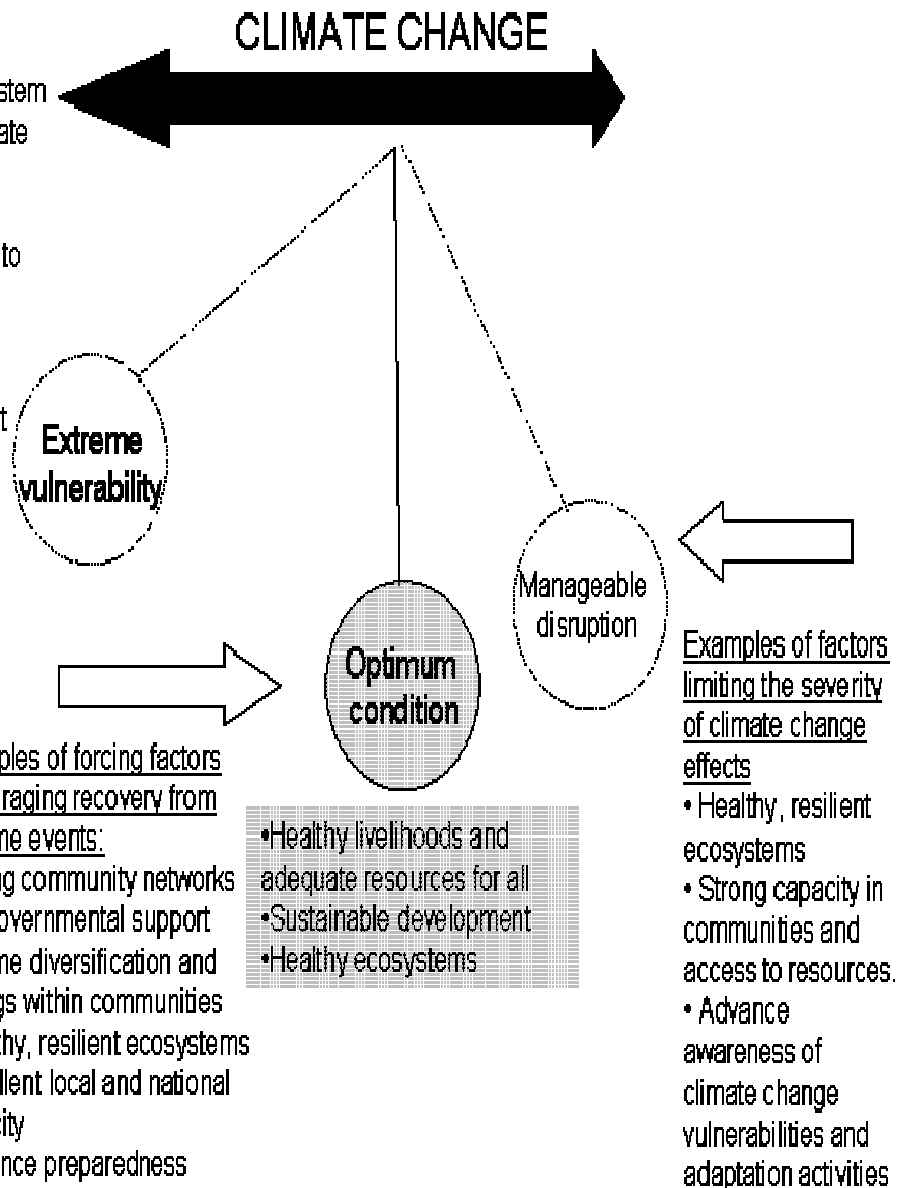
disease is rare when the nitrate-nitrogen concentration in drinking water is less than 10 mg/l as per the US Health Standards (UNEP, UNICEF, WHO, 2002).

Despite an awareness of the risks of drinking contaminated water, the poor remain faced with an inability to compete against a wealthy constituency of agricultural land users and have little opportunity to simply 'move elsewhere'. Assistance has been provided through the UNDP Small Grants Program to invest and train local people in well remediation using local vegetation. People are encouraged to plant densely rooted vegetation around the wells. These plants take up nutrients, including nitrates, and reduce the concentrations in well water.

While a lack of safe food and water presents innumerable challenges to the world's poor, even when it is available, the manner in which it is prepared may render health problems. For instance, charcoal burning and its trade is an important food security strategy for Arid and Semi Arid Lands households in sub-Saharan Africa. It is estimated that approximately 82% of Kenya's urban population depends on charcoal as a source of energy. Petroleum-based fuels such as (kerosene, LPG, natural gas) and electricity are too expensive for many of the urban and rural poor, and are likely to remain so. Harvesting wood from local forests to make charcoal has long been recognized as one of the key factors causing environmental degradation in the region. This over-harvesting has led to decline in forest-foods which are an important source of food security during times of hardship (Muyango, 2004). The use of charcoal indoors also leads to direct health effects - smoke inhalation is a key cause of respiratory illness and poor health, especially in women who perform most of the cooking (WHO, 2002; Listorti and Dourmani, 2000).

Examples of forcing factors leading to extreme vulnerability to climate change:

- Poverty
- Ecosystem degradation
- Characteristics of natural ecosystem (e.g. low-lying) and regional climate change effects
- Inadequate capacity to adapt
- Inadequate capacity to respond to disasters
- Inadequate infrastructure and technology
- Allowing risk-prone development



Identifying Linkages between Biodiversity Conservation, Adaptation, Livelihoods, Food Security and Development

The relationships between these four concepts of biodiversity, adaptation, livelihoods and food security are mediated by a diverse set of institutions and stresses. They can not always be attributed to simple cause and effect relationships and can become even more complex when they are linked to development strategies.

If we take these relationships to the level of subsistence economies it can be seen that many poor people's livelihoods rely on biodiversity for provision of food items, healthy soils, medicines, fibers and wood. This relationship brings with it several stresses, especially when circumstances promote over-consumption or destruction of natural resources through inequitable tenure arrangements, lack of suitable markets, insufficient income to ensure household food security or increased population growth in an area of finite resources.

Climate change, with its associated impacts of global warming and altered weather patterns may also bring specific challenges to livelihoods, requiring communities to halt unsustainable practices such as overgrazing or deforestation that exacerbate the destructive impacts of weather extremes such as floods, droughts and storms. Furthermore, it may require communities to adapt to weather events through altering agricultural practices, installing new technologies for water harvesting or setting up early warning systems.

In both instances of declining biodiversity and altered weather cycles (human or non-human induced) food security becomes a key issue. Destruction of biodiversity through deforestation has been blamed as one of the key factors in exacerbating the impact of extreme weather events such as hurricanes and droughts (Zalkeilden and Ahmed, 2004; Telford *et al* 1998). Inevitably these have led to chronic food shortages and the need for foreign aid. This is one example where greater integration between conventions such as the CBD, UNFCCC and UNFCCD and the PRSPS could have benefit in guiding country level responses.

While efforts are being made to promote synergies between conventions, it is becoming increasingly apparent that relationships need to be built with the development sector. One of the first questions to ask in forming these relationships however, is what do we mean by development. Development has become a term subject to a myriad of definitions but it can be generally accepted though that it involves a state by which something moves towards a more advanced stage. In terms of this study we define development in terms of the Millennium Development Goals as the state towards which the UN and other contributing parties have determined the world must move from less desirable states such as hunger, poverty, disease and lack of empowerment to one of sustainable development. The Millennium Development Goals consist of eight key areas of development as outlined below.

1. Eradicate extreme poverty and hunger
2. Achieve universal primary education
3. Promote gender equality and empower women
4. Reduce child mortality
5. Improve maternal health
6. Combat HIV/AIDS, malaria and other diseases
7. Ensure environmental sustainability
8. Development a global partnership for development

The following table taken from information presented by Balakrishna Pisupati and Warner (2003) shows the potential impacts of Biodiversity Loss and Climate Change on achieving the Millennium Development Goals (Table 1).

Table 1: This represents a brief reflection on the direct and indirect impacts of climate change and biodiversity loss on the Millennium Development Goals. It is important to note the relevant impacts on food security and livelihood security in this context to show the linkages between climate change, biodiversity conservation, livelihoods, food security and development.

Millennium Development Goal	Impacts of Climate Change	Impacts of Biodiversity Loss
Eradicate extreme poverty and hunger (Goal 1)	<p><i>Direct impacts</i></p> <p>Reduction of livelihood assets i.e. health, access to water, homes and infrastructure</p> <p>Alteration of the path of economic growth due to change in natural systems and resources, infrastructure and labour productivity and ultimately reduced income opportunities</p> <p>Alteration of regional food security</p>	<p><i>Direct impacts</i></p> <p>Local poverty reduction strategies under natural assets such as agrobiodiversity, timber forest products which are essential (income) security.</p> <p>Local ecosystem services undermined, soil filtration by forests to provide fresh water, biodiversity, vegetation for temperature regulation, natural pollinators and predators for healthy ecosystems</p>
Health related goals Combat major diseases Reduce infant mortality Improve maternal health (Goals 4, 5 and 6)	<p><i>Direct impacts</i></p> <p>Increased heat related mortality and illness</p> <p>Increased prevalence of vector related diseases (i.e. malaria and dengue fever) and vulnerability to water, food or person to person borne disease (i.e. cholera and dysentery). This is particularly important for pregnant women who are susceptible to water and vector borne diseases.</p> <p>Reduced quality and quantity of drinking water</p> <p>Threatened food security and increased levels of malnutrition due to reduced natural resource and agricultural productivity</p>	<p><i>Direct impacts</i></p> <p>Decreased availability of natural medicinal plants and nutritional supplementation.</p> <p>Increased malnutrition, maternal nutritional deficiencies, low birth weight children, growth retardation and nutrition related diseases.</p> <p>Decreased natural regulation of diseases and vector borne diseases due to declining ecosystems</p> <p>Loss of knowledge relating to traditional practices such as herbal and Ayurvedic medicine</p> <p>Loss of pharmacologically useful species</p>
Achieve universal primary education (Goal 2)	<p><i>Indirect impacts</i></p> <p>Loss of livelihood assets (natural, health, financial and physical) leading to reduced opportunities for full time education.</p> <p>Children's time diverted to household tasks</p> <p>Increased displacement and migration preventing continuous schooling</p>	<p><i>Indirect impacts</i></p> <p>Loss of income generating opportunities and schooling</p> <p>Children's time diverted to household tasks</p>
Promote gender equality and empower women (Goal 3)	<p><i>Indirect impacts</i></p> <p>Additional burdens placed on women's health and household commitments thereby reducing time for participation in decision making and income generation activities</p> <p>Increased stress on assets, especially were</p>	<p><i>Direct impacts</i></p> <p>Increased time taken to perform household tasks, provision of food and water and collection of fuel due to increasing scarcity of natural resources</p> <p>Increased burden of disease due to malnutrition and water and physical stress suffered from</p>

**Millennium
Development Goal**

Impacts of Climate Change

Impacts of Biodiversity Loss

Ensure environmental
sustainability
(Goal 7)

women often have fewer assets to start with
Direct impacts
Alteration of quality and productivity of natural
resources and ecosystems, some of which may
be irreversibly damaged
Increased stress on already degraded
ecosystems and further reductions in
biodiversity

distances to collect food, water, fodder and
Direct impacts
Increased pressure to find sustainable alternatives
organic materials for energy consumption
charcoal
Declining integrity of natural systems to
such as (non timber forest products and
opportunities), watershed protection, and
prospecting and sustainable harvesting practices
existence values such as preservation of
Increased pressure to clear vegetation and
destructive practices in order to earn an

Global partnerships
(Goal 8)

Direct impacts
Climate change is a global issue which requires
an effort by all countries to cooperate.
There is a increased need to help least
developed countries adapt to climate change,
particularly in those countries prone to natural
disasters, storm surges and coastal inundation.

Direct impacts
Biodiversity loss is a global issue which
cooperation to halt unsustainable use practices
unregulated trade, lack of Environmental
Assessment for mines, dams and other
damaging activities.
Loss of biodiversity leads to increased pressure
on finite resources forced by population
displacement of people to marginal lands
development in sensitive areas.

The recognition that livelihoods, climate change and biodiversity are linked is not new, nor is the suggestion that initiatives to address these issues should be linked. Despite this, much work remains to ensure that projects to address each of these issues accounts for effects on the others, and, hopefully to ensure that future projects are designed with intrinsic goals to achieve gains in two or more of these areas. For project managers and grant providers who have traditionally worked in only one of these areas, it can be difficult to envision how these multiple gains can be achieved, and to understand the value of these multi-sectored approaches. The next section of this document uses case studies to illustrate how successful projects have helped achieve gains in each of these areas. Successes are highlighted in these case studies, but also challenges, and future opportunities. Table 2 – below, summarizes a few of the benefits accrued in the case studies we highlight.

Benefit	Climate Change Adaptation	Biodiversity Conservation	Poverty Reduction
Mangrove Restoration	Stabilisation of shore lines to act as a buffer against extreme climatic events and associated erosion through coastline destruction and salt - water intrusion.	Conservation of genetic material and provision of breeding ground for economically and ecologically important species such as fish, crabs, molluscs and turtles.	Improved fisheries-yields and incomes.
<i>Pred Nai</i>	Conservation of species that maintain beneficial environmental services such as controlling tide surges, filtering debris, slowing water flow and stabilising soils and shorelines.		<p data-bbox="1688 263 2034 367">- Development of village savings fund for education and career-development</p> <p data-bbox="1688 412 1976 548">-improved access to resources and benefit-sharing within local community.</p> <p data-bbox="1688 594 2066 841">Increased food security and a diversity of income opportunities through creations of habitats for species with medicinal, income generating and home nutritional benefits.</p> <p data-bbox="1688 886 2053 1023">Stabilisation of the mangrove banks translate to large savings on dyke maintenance*</p> <p data-bbox="1688 1068 2066 1243">Buffering of the coastline protects communities against devastating losses in lives, property and livelihoods in the event of typhoons.</p> <p data-bbox="1688 1289 2028 1425">Provision of food and medicinal items as well as fibres and building materials.</p> <p data-bbox="1688 1471 2060 1611">Stabilisation of shorelines to protect communities in low lying areas against tidal surges and shorelines</p>

Benefit	Climate Change Adaptation	Biodiversity Conservation	Poverty Reduction
<p data-bbox="556 73 913 186">Sustainable Fishing Practices</p> <p data-bbox="556 186 913 332"><i>Pred Nai</i></p> <p data-bbox="556 332 913 414"><i>Haor Basin</i></p> <p data-bbox="556 414 913 511"><i>Mamirua</i></p>	<p data-bbox="913 73 1270 300">Increased opportunities for species to breed leads to opportunities to increase genetic diversity of populations. This increases species chances of adapting to new pests and diseases brought about by changing environments and climates.</p>	<p data-bbox="1270 73 1669 365">Sustainable fishing practices such as “crab banking” and closed seasons allow species as well as their natural predators to flourish which in turn supports ecosystem services.</p>	<p data-bbox="1669 73 2072 365">erosion. Sustainable fishing ensures that the natural resource will be available for future generations to earn income and contribute to village saving and development programs.</p>
<p data-bbox="556 511 913 592">Sustainable Agricultural Practices</p> <p data-bbox="556 592 913 673"><i>Gireigikh Rural Council</i></p> <p data-bbox="556 673 913 755"><i>Garifuna</i></p> <p data-bbox="556 755 913 1611"><i>Uganda</i></p>	<p data-bbox="913 511 1270 722">Ensures adequate supplies of water, food and timber for communities during climatic extremes. Protects soil resources against flooding and erosion. Ensures responsible use and disposal of water to prevent local hotspots of vulnerability during climatic events. Encourages more sustainable water management techniques and allows for modification of practices that exacerbate damage from climatic events such as landslides and water erosion.</p>	<p data-bbox="1270 511 1669 738">Prevents loss of biodiversity, accelerated by farmers clearing land in areas vulnerable to flooding, landslides or other erosion forces.</p> <p data-bbox="1270 738 1669 950">Increases soil fertility and encourages conservation of wild food species through diversification practices.</p> <p data-bbox="1270 950 1669 1469">Encourages more sustainable water management techniques and allows for modification of practices that exacerbate damage from climatic events such as landslides and water erosion. Allows targeting of regionally important areas for vegetation and watershed protection thereby protecting valuable biodiversity such as mangroves and vegetation on dunes and steep slopes.</p> <p data-bbox="1270 1469 1669 1611">The incorporation of community forestry agreements ensures</p>	<p data-bbox="1669 511 2072 771">Increases productivity per unit of land area thereby increasing income and increasing food security by increasing nutrition and food options during times of hardship.</p> <p data-bbox="1669 771 2072 982">Reduces economic burden placed on communities when the need for reconstruction arises following extreme weather events.</p>

Benefit	Climate Change Adaptation	Biodiversity Conservation	Poverty Reduction
		traditional practices continue to preserve forests and wetlands in a sustainable manner and in turn the biodiversity they harbor	
Swamp forest restoration	Stabilises soil/substrate during monsoons and reduces the intensity of waves, which threatened to destroy villages and infrastructure.	Provision of habitat for fish, bird, insect and other important wetland species.	Villages are provided with food security and a diversity of income opportunities through the reestablishment of food and fibre resources.
<i>Hoar Basin</i>	Provides a refuge for species to flourish, which may be important in a successional role during climate changes.	Restoration of substrate encourages growth of wetland plants, algae and provides shelter for aquatic fauna to breed and hide in.	Alternative means for creating income enables community savings and revolving funds to be set up for development projects.
Agroforestry	Encourages the growth of algae and more vegetative matter thereby creating a carbon sink to increase sequestration.	Assists in restoring local hydrological processes, which are important for cycling of nutrients and supporting species lifecycles that are dependent on these.	Provides substrate for commercially valuable species such as bivalve molluscs containing the prized pink pearl, snails for feeding ducks and preparing poultry and fish meal, Unio shells for pearls and lime production and freshwater plants for food.
<i>Garifuna</i> <i>Gireigikh Rural Council</i>	Preserves genetic diversity of tree species, stabilises soil in vulnerable areas such as steep slopes bunds and areas subject to landslides, provides a buffering effect against extreme weather conditions.	Submerged trees prevent net fish thereby providing safe shelter for fish species to breed and predators to roost such as cormorants, turtles, monitors and fishing eagles.	Unlogged areas provide habitat for species and solid substrate for the growth of reeds which in turn provide habitat for birds and other wildlife which may be useful pollinators and predators for agriculture
		Increases the relative diversity of the landscape by	Plantations provide alternative income sources through fibres, wood, fruits, fuel and fencing materials. Provides products such as stakes for climbing beans, fodder, firewood, building materials, seeds and

Benefit	Climate Change Adaptation	Biodiversity Conservation	Poverty Reduction
	Assists in carbon sequestration.	promoting species with specific human related uses, attracting fauna and flora associated with trees into the landscape.	medicinal products thereby reducing the cost of external imports and ensuring greater food security and income opportunities.
	Promotes increase in woody biomass for carbon sequestration. Incorporation of trees promotes increased soil quality and protection against droughts and other extreme climatic events.	Increases available habitat for tree dependent species in the agricultural landscape. Encourages on-farm conservation of tree species.	Multi-purpose tree species provide income opportunities through food, fodder and fuel sources. This reduces the burden on women who are the traditional custodians of the family “food basket”
	Incorporating vegetation cover into farm landscape increased resistance of cultivated land to climatic extremes such as droughts, heavy rainfall and erosion.	Extension of existing biodiversity through provision of corridors between isolated forest remnants and protected areas. Increased diversity of natural predators and pollinators such as birds, bats and insects.	Vegetation cover provides ecosystem services that increase productivity of land thereby improving living conditions for farming families
Conservation of beels, lakes, kuas and canals	Ensures supplies of water and provides refuge for biodiversity in times of drought or unpredictable seasons.	Ensures conservation of species during dry months and ensures they have the opportunity to breed and replenish stocks during the monsoon	Provides a source of food and water security during lean times.
<i>Haor Basin</i> Micro-finance programs	Allow communities to invest in more effective energy options such as solar power.	Provides villagers with the funds to pursue alternative livelihood options and reduce pressure on biodiversity through logging and hunting..	Provides funds for alternative livelihood options such as duck rearing, nursery establishment and development of plantations or vegetable gardens.
<i>Hoar Basin</i> <i>Gireigikh Rural Council</i>	Reduces pressure on stabilising vegetation such as trees and reeds that protect villages from monsoon damage and		Provides opportunities to assist marginalised groups such as women

Benefit	Climate Change Adaptation	Biodiversity Conservation	Poverty Reduction
Medicinal Plant Gardens	Provides a variety of medical options for diseases favored by increased rainfall and other impacts of climate change	Provide for the conservation of biodiversity that is beneficial for human health.	Provides a ready source of medicines and encourages the preservation of traditional knowledge thereby reducing reliance on expensive imported medicines
<i>Haor Basin</i>			
Solar power	Reduces reliance on fossil fuels and reduces the amount of greenhouse gases emitted to the atmosphere.	Reduces reliance on harvesting local trees and therefore reduces pressure on local biodiversity	Reduces household costs and allows income to be stretched further for food and recreational items such as televisions.
<i>Haor Basin</i>			
Turtle Hatchery And crabs	Increasing population sizes of species may give them a higher probability of surviving catastrophic events or adapting to climate changes.	Species breeding programs help species increase in numbers when their population size in the wild may not be big enough to achieve adequate population growth	Turtles are hunted as a food source so increased numbers bring greater food security and protein options for local diets.
<i>Pred Nai</i>			
<i>Haor Basin</i>			
Floating Gardens	Provides an effective means of climate change adaptation by allowing the growth of food crops during monsoon floods.	Provides substrate for biodiversity to flourish upon.	Provides an additional sources of income during monsoon and another form of food security
<i>Haor Basin</i>		Encourages the proliferation of natural pollinators and predators, which in turn support the ecological food chain.	
Participatory Natural Resource Management	Development of Peoples Mangrove Forest Network ensures that everyone understands the importance of mangrove conservation.	Creates local ownership and control over the future of biodiversity assets and increases knowledge of how to manage mangrove forests to conserve local ecosystem processes.	Environmental management practices become central to livelihoods strategies ensuring mangrove forests are protected to ensure income generating opportunities, food security and continuation of fisher lifestyle.
<i>Pred Nai</i>	This in turn ensures that the mangroves and their resources remain intact along the coastline and continue to act as a buffer		
<i>All the othres</i>			

Benefit	Climate Change Adaptation	Biodiversity Conservation	Poverty Reduction
Environmental Education	The conservation of local knowledge ensures that future generations are able to monitor biodiversity as it relates to pressures brought about by climate change and develop appropriate management strategies.	Creates local pride in looking after biodiversity and promote understanding of mangrove ecology. Learning from elders also ensures that traditional biodiversity knowledge and management practices are kept alive for future generations.	Knowledge on the utilisation of mangrove products and the importance of conserving the ecosystems that provide such goods ensure food security and poverty reduction strategies for the future.
All of them	Familiarity with the main climate risks in the region and how they link to livelihood vulnerability and resilience.	Increased understanding of the importance of retaining biodiversity, its attributes and ecosystem services and associated pride in its conservation.	An integrated approach to combining improvements in social and natural capital to promote poverty reduction and biodiversity protection.
Revegetation of Rangelands	Biodiversity helps to redress the balance between methane production by animals inhabiting the rangelands and the amount of carbon being sequestered by vegetation.	Increased understanding of the intrinsic value of local knowledge of biodiversity and the significance of biodiversity to tourists and the global community Increased knowledge about restoration methodology and species choice Replanting of key rangeland species assists in the conservation of biodiversity by providing habitats for insects, birds and mammals. Other Native Plant species also benefit from the stabilized soil and microclimates provided by the revegetation.	Formation of partnerships with international NGO's and government bodies to fund skills development and purchase of equipment for forest studies thereby reducing reliance on timber extraction and other destructive forest activities. Revegetation improves the carrying capacity of the land for agriculture thus ensuring a greater level of food security rather than having to rely on cultivation of marginal grasslands and unrestricted goat grazing.
<i>Gireigikh Rural Council</i>	The rehabilitation of the rangelands encourages the growth of species that may be more suited		

Benefit	Climate Change Adaptation	Biodiversity Conservation	Poverty Reduction
Grain Storage and Credit Programs	to future climatic changes and can provide fodder reserves for livestock during times of drought. Grain storage provides an adaptation strategy for climate change by ensuring feed is available for livestock and seed stock is available in the event of poor harvests due to drought.	Safe, long term storage facilities ensure that grain supplies are available during times of drought, thus reducing reliance on biodiversity.	Grain storage and associated credit systems help create food security by ensuring supplies are available during times of drought and thus reducing the impacts of hunger and malnutrition.
<i>Gireigikh Rural Council</i>			
<i>Hoar Basin</i>			
Community Vegetable Gardens	Gardens ensure that species aren't lost from the environment due to drought and desertification. The installation of irrigation and hand-dug wells allows for a level of drought proofing and increases yield of plants.	The development of gardens by local women's groups ensures the preservation of important medicinal and food plant species.	Gardens ensure food security by enabling a wider variety of species to be used in the diet and ensuring a more reliable supply. Coupled with credit and micro-enterprise programs women are able to generate income.
<i>Garifuna</i>			
Sustainable Forestry Management	Regulation of local climate, protection of land from climatic extremes and provision of carbon sinks	Large-scale forest protection leading to the protection of a diversity of habitat types and species with varying range requirements.	Alternative income opportunities through ecotourism and sustainable harvest of timber and NFTP's (ie. food, fibre, spices, bushmeats and medicines).
<i>Garifuna</i>			
Ecotourism	Incentive for protecting large tracts of forest thereby securing carbon sinks and future carbon credits.	Creates local pride in looking after biodiversity and increases awareness and knowledge of local wildlife and ecosystem processes.	Incentive for conserving forests and preventing further clearing due to forest being valued as an alternative income source.
<i>MESCOT</i>			Income derived from ecotourism is used in revolving fund for development projects

Benefit	Climate Change Adaptation	Biodiversity Conservation	Poverty Reduction
<p>Farmer Field Schools</p> <p><i>Garifuna</i></p> <p><i>Green Foundation</i></p> <p><i>Gireigikh Rural Council</i></p>	<p>Allows for the development of new farming norms whereby vegetation and trees are included as a valuable component of the framing system to prevent erosion and buffer against climate change.</p>	<p>Villagers and regular forest users often have an intimate knowledge of the lifecycles, times when plants are most potent and the pollinators and predators. This knowledge is important in implementing appropriate soil and land conservation measures.</p>	<p>By delivering training in a manner that is locally relevant and guided by local people, farmers can continue to share benefits of knowledge and skills thereby buffering the future impacts of poverty through widespread adoption of sustainable agricultural practices across the landscape.</p>
<p>Agricultural Diversification</p> <p><i>Gireigikh Rural Council</i></p>	<p>Intensive crop rotation involving intercropping and relay-cropping increases plant cover of soil and reduces erosion. It also reduces incidence of pests and insects, thereby reducing chemical applications.</p>	<p>Allows for greater productivity per land area, thereby reducing pressure to clear any remaining natural vegetation</p>	<p>Intensive agriculture lowers labour costs relative to production and income generation and ensures livelihood security through a greater diversity of farm products.</p>
<p>Improved road access</p> <p><i>Uganda</i></p>	<p>Manages access so as to prevent erosion of the landscape and further losses of biodiversity</p>	<p>Allows for coordination of movements through biologically sensitive areas thereby preventing their fragmentation by paths and tracks.</p>	<p>Allows more direct access to the market for exchange of food products, seeds and other locally crafted goods thereby increasing income opportunities and food security.</p>
<p>Nutritional Education</p> <p><i>Uganda</i></p>	<p>Promoting links between nutrition and soil conservation prevents unnecessary deforestation.</p> <p>Promotes conservation of medicinal plants and food items essential for combating diseases encouraged by climate change</p>	<p>Places a value on biodiversity and encourages its sustainable use as a means of achieving dietary diversity and food security</p>	<p>Provides opportunities for communities to achieve self sufficiency and resilience against disease and malnutrition which result in human and financial costs.</p> <p>Allows for continuity of customs and traditions associated with food.</p>

Benefit	Climate Change Adaptation	Biodiversity Conservation	Poverty Reduction
<p>Seed banking</p> <p><i>Green Foundation</i></p>	<p>Conservation of species suited to specific ecological niches and identification of species suited to changing climatic conditions</p>	<p>Conservation of genetic material and representative specimens of species with agricultural and home nutritional benefits that are disappearing from the landscape.</p>	<p>Farmers are provided with food security, seed security and a range of crops to choose from thereby reducing reliance on seed suppliers, diversity of income opportunities through seed and produce sale and the reduction of mono cropping which limits income opportunities.</p>
<p>Re-installation of traditional agricultural practices</p> <p><i>Gireigikh Rural Council</i></p> <p><i>Green Foundation</i></p>	<p>Increase in genetic diversity of cultivated species leading to increased ability to adapt to new pests and diseases brought about by changing environments and climates. Species may be able to withstand drought, grow in poor soils, and resist insects or diseases.</p>	<p>Traditional agricultural practices such as vermiculture, composting, soil water conservation, agro-forestry and companion planting promote increase soil biodiversity and allow natural predators and pollinators to flourish which in turn supports ecosystem services and other levels of the natural food chain.</p>	<p>New varieties of agricultural crops may give higher protein yields and produce better tasting food due to naturally occurring genes. Local crops are less dependent on expensive pesticides and chemical fertilisers than higher yielding varieties. Soil and water conservation initiatives like composting regenerates soil nutrients and results in more nutritious and tastier food.</p>
<p>Participatory Crop Improvement</p> <p><i>Green Foundation</i></p>	<p>Creates local pride in looking after biodiversity and increases awareness and knowledge of local ecosystem processes.</p> <p>Identification of landraces that have evolved through natural selection and exhibit resistance to abiotic and biotic stresses.</p>	<p>Recognition that farmers indigenous knowledge is central to the revitalisation of the land and performance of landraces in respect to genotype and agronomic traits.</p> <p>Distribution of a diversity of seeds ensuring farmers are better equipped to make decisions on crop choices in relation to seasonal variations in rainfall or pest outbreaks.</p>	<p>Farmers work together to form community seed banks that decrease farmer's reliance on seed companies. Community farming reduces reliance of individual farmers on external inputs and subsequent indiscriminate use of fertilisers, pesticides and mechanized agricultural practices.</p>

Benefit	Climate Change Adaptation	Biodiversity Conservation	Poverty Reduction
<p>Women's Self Help Groups</p> <p><i>Garifuna</i></p> <p><i>Green Foundation</i></p>	<p>Women are provided training in setting up and managing seed banks thereby conserving genetic material, which may be better suited to climatic change.</p> <p>Community farming amongst women's sanghas allows degraded and fallow land to be reclaimed thus improving its resilience to drought and climatic extremes.</p>	<p>Women play a major role in conserving seed at the farm and kitchen garden level. Women's indigenous knowledge of biodiversity conservation and agricultural/ecological systems are conserved and passed onto future generations thereby ensuring "biodiversity knowledge conservation."</p>	<p>Women work collectively to ensure food and seed security. Establishment of income generation programs help create alternative income for poor and marginal farmers and acts as a backup to the local markets. Community farming with seed provided by the Green Foundation benefits women farmers who have land but are unable to cultivate it due to extreme poverty. Women have access to micro-credit programs and freedom from restrictions according to caste or creed.</p>
<p>Organic Farming Practices</p> <p><i>Green Foundation</i></p> <p><i>Others...</i></p>	<p>Maintenance and enhancement of soil fertility and moisture availability thereby reducing vulnerability of cultivated land to droughts</p>	<p>Increased soil biodiversity through use of green fertilizers such as leguminous crops, manure and ecological ploughing promoting cultivation of earthworms, symbiotic relationships and natural predators and pollinators.</p>	<p>Increased production and decreased reliance on artificial fertilizers reducing farmer input costs and increasing financial returns</p>

In depth analyses of Case Studies

Mangrove Restoration by the Pred Nai Group in Thailand

Based on information provided by Dr Somsak Sukwong, Mrs Samnao Pedkaew, Ms Jaruwan Kaewmahanin and Ms Supaporn Worraponpan for the 2004 Equator Awards (UNDP, 2003). Further information gathered from presentation by Ms Jaruwan Kaewmahanin at the Health, Poverty and Conservation in the Asia Pacific Region, Public Sponsored Workshop. World Conservation Congress, Bangkok. Friday 19th November 2004.

There are numerous examples of successful mangrove restoration activities with benefits to biodiversity, development, and climate change mitigation and adaptation. However the Pred Nai Mangrove Restoration demonstrates significant benefits for biodiversity conservation and poverty reduction through the creation of valuable habitat for fish and crustacean species - species that have been on the decline. The restoration of this area has high national importance as the last remaining mangrove forest ecosystem on Thailand's Eastern Seaboard. It was estimated that the area once covered 48,000 ha whereas today it covers 4,800 ha.

Rehabilitation of the mangrove forests of Pred Nai started when a group of Pred Nai people attempted to restore the degraded forestland following its destruction through charcoal mining and by water pollution brought about by commercial prawn farms. The group gained momentum when Pred Nai villages, under the leadership of a respected monk enlisted the support of surrounding villages to create the Community Coastal Resource Management Network – Trat Province.

The project is successful in that it clearly recognizes the linkage between biodiversity conservation and livelihood security through the development of a management plan. It supports the principle of addressing conservation and establishing private enterprise based on natural resources to ensure livelihood security and development outcomes. Restoration of the mangrove forests not only delivers conservation benefits but the income and food security ensured by the project boosts the local economy. This means that micro-credit programs can be initiated to extend the ability of communities to engage in development projects. Mangrove forests also play an important role in stabilising shorelines thus buffering villages against the effects of tropical storms that result in severe erosion – storms that may increase in frequency as a result of climate change. From an ecosystem services perspective mangroves also contribute to carbon storage, nutrient cycling and waste processing.

Pred Nai villagers have been successful in protecting the mangroves in the immediate vicinity of their villages and creating a sustainable inshore fishery of crabs and other aquatic species. The community has recorded a marked improvement in the biodiversity of the mangrove forest. Not only has the abundance of crabs increased, but shrimp, fish

and birds have also increased in abundance. Villages have reported monkeys returning to the area, and the locally useful species Hoy Lod (razor snail) which had been unseen for 20 years due to lime pollution from shrimp farming is reappearing.

While significant moves have been made to protect the inshore fishery, there is a need to protect the offshore areas where species such as crabs migrate during specific times of their lifecycle. Although by law, commercial boats have to stay at least 3km away from the shoreline, push net and trawlers encroach on this boundary and destroy habitat by uprooting marine plants, and threatening the inshore fishery. In addition, drag nets used within the mangroves damage the substrate, pulling mud away from the roots of the trees, and leaving only sand and gravel which do not hold the roots as firmly or allow new mangroves to germinate. A community patrol is enforcing the regulation against push nets with local government support.

Despite the obvious benefits of forestry co-management and the large amount of international recognition given the Pred Nai community's efforts (including a Green Globe Award in 2002 and a prize by the Royal Forest Department in 2004) legislative supports to recognise the local management efforts in Thailand continue to be debated. In the last couple of years the people's organisations and their supporters drafted their own Community Forestry Bill and collected 52,698 signatures before submitting it to the Thai Parliament. The drafted bill was finally approved despite dissolution of parliament. However a key component of the Bill was omitted. This section addressed how villagers who had settled in the forests before they were protected could continue to sustainably use the forest's forest products.

Moves are underway by the national government to declare all mangrove areas as protected areas. This needs to be implemented in a manner that allows for partnerships and trust at the local level. The Pred Nai community believes that it is only through effective involvement of local people that environmental, social and economic solutions to food security and poverty reduction can be achieved.

Key strategies for linking conservation and poverty reduction in this project included:

The reestablishment of the mangroves which has assisted the community to restore the local crab fishery. Part of the community's strategy has been to voluntarily close the fishery during the crab's reproductive season in October. This measure has helped increase harvests of grapsoid crabs (*Metopograpus sp*) from 8kg/day in 1998 (involving six collectors) to 15kg/day in 2003 (involving thirty collectors) which is equivalent to a near doubling of income per collector.

Villages have sought to increase numbers of more economically valuable species such as mud crab (*Scylla serra*) by taking females with eggs to a "crab bank" where the next generation are reared. Since beginning their efforts, families in the have seen their

income from each “crab crop” rise from 10,000 Baht (involving six families) to 15,000 Baht per 3 month season (involving ten families).

Realising that poverty reduction is a long term goal; the villagers have initiated a Village Saving Fund. Villagers own stocks in the fund and are able to borrow money for investing in their careers and their children’s education. Yearly profits from the fund are set aside for member’s welfare and village development. The membership of the fund has grown from 37 members and 9000 Baht to 514 members and 2 million Baht in 2003.

Villagers were responsible for demarcating forest areas and ensuring its protection though the development of local rules and regulations to govern its use. The resulting sustainable harvest and production practices have ensured that non-timber forest products can be processed and marketed for the benefit of the community. A People’s Mangrove Forest Network has also been established to ensure that everyone has a say in the decision making process and sharing of benefits.

Lesson Learnt

Co-management for Conservation

Conservation driven projects need to reach a level of momentum where the natural environment can provide goods and services with enough resilience for sustainable harvesting. The key element in this project is that it is community driven and there is a clear enough understanding of key threatening processes (such as non-selective fishing and logging) that the community will take the initiative to defend their work against future environmental harm.

Sukwong (2003)

Viewpoint

Co-management for Conservation

Legislative supports to recognise the local management efforts continue to be debated in Thailand despite communities managing and protecting forests. In the last couple of years the people's organisations and their supporters drafted their own Community Forestry Bill and collected 52,698 signatures before submitting it to the Thai Parliament. The drafted bill was finally approved despite dissolution of parliament. However the key component of the bill Article 18, which outlined the process by which villagers settled in forests prior to the date they were declared protected, could register to continue to manage and make sustainable use of forest products was omitted.

Moves are underway by the national government to declare all mangrove areas as protected areas for conservation and restoration. This needs to be implemented in a manner that allows for partnerships and trust at the local level. The Pred Nai community believes that it is only through effective people involvement that village and government will be able to achieve environmental, social and economic solutions to food security and poverty reduction in the mangroves. Sukwong (2003)

The Garifuna Emergency Committee in Honduras

Based on information prepared by Ms Suzanne Shende for the 2004 Equator Awards (UNDP, 2003); Telford, J. Arnold, M and Harth, A. (2004) Learning Lessons from Disaster Recovery: The Case of Honduras. Working Paper Series No. 8. The World Bank Washington, D.C. June 2004; and Griffin, W (2004) Garifuna NGO Recognized for Protecting the Environment. Honduras This Week Online. Published by Marrder Omnimedia <http://www.marrder.com/htw/special/environment/120.htm>

When Hurricane Mitch struck Honduras in 1998, there was little doubt that human factors contributed to the severity of the disaster which killed 18,000 people, and injured a further 13,000 more. Environmental degradation including widespread deforestation, rapid population growth, and inadequate infrastructure especially for flood management likely contributed, as did massive disparities in the distribution of wealth which resulted in extreme vulnerability of the poorest.

In the days following the disaster, it was estimated that over 1 million landslides occurred in Honduras, displacing hundreds of thousands of people and destroying infrastructure throughout the country. Economic losses were estimated at some US\$4 billion. A recent report by The World Bank described the country as being vulnerable and unprepared in terms of policy, systems, and resources for rapid recovery.

One of the major areas that have been overlooked in planning for disaster recovery is appropriate environmental management. Lessons from nearby Belize have shown that the maintenance of forested areas, mangrove forests and barrier reefs can greatly reduce the impact of extreme weather events such as storms and tidal surges. In Honduras massive deforestation, inadequate drainage systems for agriculture, river straightening practices and loss of coastal vegetation are all blamed for removing protective environmental services and increasing the destructive capacity of landslides and floods.

One of the most vulnerable groups in Honduras is the Garifuna community. The Garifuna, an Afro-Honduran people own a broad swath of land along Honduras' north shore dotted by small villages, sometimes only connected by canoe. The farmers in this area are mostly poor women who work in non-mechanised, subsistence farming. Their land has long been under siege by a variety of developers and their political power compromised by racial prejudice. To complicate matters further their existence in this low lying environment can best be described as precarious as scientists predict rising sea levels and increased instances of extreme weather events with climate change.

It is becoming more apparent that biological and cultural diversity are the most effective mechanisms for distributing and alleviating risk at the larger scale. The Garifuna Emergency Committee came together after the hurricane. Recognizing that disaster preparedness extends far beyond just having a good emergency response program, this group has embarked on an ambitious revegetation program along the shoreline, and has encouraged the adoption of more sustainable agricultural practices. Developing new

markets for agricultural and artisanal products to ensure a greater degree of financial security and put in place measures to reduce wood consumption thereby protecting the forests. While this may not ensure them completely against damage from hurricanes it is hoped these steps will lessen the effects of future disasters. A good overview of the lessons learnt for disaster recovery can be found in Telford *et al* 2004.

This project is effective in that it shows how a project focused on poverty reduction and disaster mitigation can encourage stewardship by local communities. It also illustrates how biodiversity resource conservation can ensure nutritional security and promote health. Furthermore it promotes sustainability by ensuring all beneficiaries of the project must help someone else in the future, thereby ensuring that lessons learnt are passed from one generation of land users to the next. As most of the farmers are women, this shows a genuine commitment to women's empowerment and participation, which led it to be acknowledged as a "best practice" by the global women's network, the Huairou Commission (Griffin, 2004).

The project relied on the following key methodology to achieve its aims:

Hardwood nurseries and associated reforestation projects were initiated to replenish stands of mahogany, cedar, and bay trees. These trees are locally important as they are used to make a variety of products including canoes, mortars, graters and drums.

A pioneering project was introduced in five towns to reforest areas with "balaire" or "bayal", a wild vine which provides the material used to make basket sifters and strainers (which are used in the production of cassava) and other artisanal and household goods. Growing the vine also protects the other trees and shrubs that it relies on for support and locally protected sites called "Area Verde" have been set up for its conservation.

Reforestation projects were undertaken along the beaches using wild fruit plants which were formally abundant including sea grapes, almonds, camacamas, nance, cashews and jicacos as well a fruit trees including oranges, avocados, cacao and coco-plums.

The Committee organized political marches to protect Garifuna land and protested against an illegal road which was damaging water supply. In particular, they have undertaken to protect mangrove forest reserves from illegal exploitation of charcoal, sand extraction and dumping of waste.

Diversified agriculture was encouraged through planting of fruit trees and other plants such as ginger. Traditional crops are also being re-established including taro root, red grow yams, white yams, "badu", arrowroot and sweet potatoes. Following Hurricane Mitch, these food items were very scarce and the Garifuna Emergency Committee struggled to obtain "seed" tubers for distribution to communities. Coconut stocks were also being threatened by the disease Lethal Yellowing and the Committee has helped

introduce disease-resistant coconuts. The new fruit trees are reported to provide better nutrition for youth in particular.

A Garifuna market ‘Wabagari’ (Our Life) was established by the Garifuna Emergency Committee in Trujillo. Farmers from one village are reported to make around \$370 from the sale of fruit on the market. Women also earn an income from selling prepared and processed foods including cassava which is in demand but seldom produced in the cities. Trainees engaged in a young Artisan’s course also earn around \$30 a month from selling their products at the market.

Organic farming techniques such as “Bocaschi” a form of composting and the use of organic pesticides were promoted to naturally improve productivity and reducing reliance on expensive chemical inputs. The introduction of better banana farming methods such as disinfecting plantain seeds, pruning plantain leaves and preventing soil erosion are also helping to improve crop productivity and conserve soil.

Within the 16 towns the project covers the Committee elected representatives called the “tool bank” who lend communal tools so that farmers can undertake their work.

New technologies were introduced such as a Yucca mill (which helps store yucca for food security) and the Justa Stove which creates less smoke and saves women time and labour in collecting firewood. The Justa Stove is reported to use 50-60% less firewood than traditional cooking methods.

Actions were undertaken to restore mangrove communities and Land defence committees and ecological defence units have been established to protect shoreline vegetation from destruction. The shoreline vegetation is valued as a valuable mitigation measure against storm surges and beach damage.

Emergency responses and local governance structures were tested with varying results to ensure Early Warning Systems and Disaster Relief efforts are effective in the future.

Challenge***Recognising Traditional Land Ownership***

Land policies administered by the National Agrarian Institute (INA) of Honduras define occupation on the basis of constructions, improvements or other alterations to virgin tracts. This presents innumerable challenges to the Garifuna community as the land appears unused to the outside observer. In reality the land is used on a seasonal basis for hunting and gathering. When it is used for cultivation it may be subject to extended fallow periods as per indigenous farming systems to extend soil fertility. Furthermore, it is also used for religious and cultural purposes. These uses however, do not justify ownership under Honduran law meaning that Garifuna communities may be legally prohibited from entering the areas that they manage on a long term scale. This results in non-Garifuna community members clearing the forest and claiming the land as owners of “the improvements”. The Garifunas have resorted to planting fruit trees along the beach, although at opposition from the community, to show they are the owners of the land.

Griffin (2004) Navajas (1995)

Community based floodplain resources management program in Haor Basin, Bangladesh

Based on information presented by IUCN (2004) Fact sheet: "Treading Water" available from IUCN Bangladesh, House #11, Road #138, Gulshan 1, Dhaka 1212 Bangladesh and presentation by Mr Munzulo Hannan Khan at the Health, Poverty and Conservation in the Asia Pacific Region, Public Sponsored Workshop. World Conservation Congress, Bangkok. Friday 19th November 2004. Also: Agrawala S., Ota T., Ahmed A.U., Smith J. and van Aalst, M. (2003) Development and Climate Change in Bangladesh: focus on coastal flooding and the Sundarbans. Working Party on Global and Structural Policies. Organisation for Economic Co-Operation and Development; and African Energy Policy Research Network - AFREPREN (2004) Bangladesh NAPA proposal: enabling activities to facilitate the preparation of a National Adaptation Programmes of Action (NAPA) for Bangladesh. Proposal for funding for the preparation of a National Adaptation Programmes of Action (NAPA) May 2004

The north-eastern corner of Bangladesh has a unique landscape, where natural patterns of flooding have created very productive fisheries in the wet season, and allow rice harvest in the dry season. The productivity of these wetlands, called haors, has contributed to a food surplus in this region, and many believe that there is potential for further increases in rice yields. However, the land is fragile and insecure, and changed patterns of flooding threaten the richness of the ecosystem and the livelihoods of local people.

In the Sunamganj district, the way of life of the 80% of people who work as sharecroppers or landless labourers has been threatened by these flash floods. When the floods come early, before the rice harvests can be collected, the impact is felt by the whole of Bangladesh. Its loss has serious implications for national food security as the Haor Basin provides up to 10% of the national granary.

Threats to local livelihoods are not solely confined to wet season catastrophes. During the dry season the landscape changes to reveal small water bodies called beels and kuas as well as lakes and canals which are critical for breeding and maintaining stocks of fish. If these dry season water sources are over-fished, the critical monsoon fishery is threatened along with local food security. Unfortunately insensitive human developments and natural occurrences have resulted in many canals becoming blocked. This prevents migration and spawning of fish that replenish the haors during the monsoon. Land-use change due to tree-clearing has also affected fish productivity. For example, submersed trees provide an important substrate for algal growth, so without the trees, fish have less algae to graze upon, and fish populations may be further reduced. Migratory bird species and other natural populations are also affected by this deforestation. By revegetating local areas, not only protected from highly erosive but critical food sources and biodiversity be conserved. With these waves removing as much as shoreline in a year, benefits terms of protecting the land are easily observed.

While a limited degree of protection can be afforded through engineering and construction solutions, the impacts of climate change and biodiversity loss call for a more integrated approach of habitat restoration, climate change adaptation and social organisation. To help address the need for sustainable management, IUCN is implementing the “Community Based Haor Management” program. This is a component of a larger effort called the Sustainable Environment Management Program” run through Bangladesh’s Ministry of Environment and Forest and funded through the United Nations Development Program.

Within A further challenge to the new management program lies in the need to address trans-boundary issues. The Hoars Basin is adjacent to the haor Indian border and Meghalaya Hills where large-scale deforestation is occurring. Upstream communities also contribute to pollution loads in the basin, re-vegetating local areas has been critical to protecting them. By replanting trees and ensuring soil cover, the physical infrastructure of local due to industrial, urban and agrochemical activities. A series of trans-boundary negotiations and agreements need to be developed that address indiscriminate control and regulation of water flows in these upper riparian zones.

Villages are protected from highly erosive flood waters, and critical food sources and biodiversity can be conserved. With these waters removing as much as 1.5 m of shoreline in a year, benefits in terms of protecting the land are easily observed. To help with future revegetation efforts, over 100 community wetland nurseries have been established to provide saplings. Villagers have planted wetland tree species such as Hizal and Karoch and management plans that allow for sustainable harvest have been established. Replanting these trees has led to natural regeneration of grass and reed species, including local medicinal plants such as Bontulashi, and as a second added benefit, the tree branches interfere with net fishing, so during the monsoon this area is a naturally protected fish breeding ground. Villagers have reported bigger fish as well as more species of fish indicating positive effects on biodiversity. The growth of Chailla grass has also been encouraged. This grass used both as cattle feed, but also for making barriers to protect houses and crops from wave erosion. Villages are taxed for harvesting the grass with the funds going into community programs.

Canals, “dead-rivers” and beels have been excavated and demarcated as sanctuary areas for wildlife. Special consideration has been given to designating conservation areas for the globally endangered Pallas’s Fishing Eagle, cormorants, bat colonies and snails. Studies have also been completed on threatened Ganges Dolphins and the status of butterflies. A wildlife conservation area has also been established. A further 7 fish conservation areas have been prioritised with 2 sanctuaries being established. In one of

the communities a turtle hatchery has been established and 100 hatchlings released.

Training has been delivered to 500 community members on livelihood security and sustainable Haor resource management. As a result, alternative livelihood opportunities have been created for approximately 30,000 person days.

Micro-credit programs have been established to fund livelihood options such as duck rearing, establishing nurseries and plantations and planting vegetable gardens. Funds have also been used to introduce solar power programs. Prior to solar power, households spent 100 taka/month on kerosene. With solar power households pay 20 taka/month for each light bulb and 30 taka/month for a television. Some communities decided to provide one light bulb and electricity free to the thirty poorest families in the village. Community Environment Funds have been used to strengthen the income generating activities of 1200 poor women.

In the Madhumati Floodplain 23 environmental groups have been formed to provide micro-finance incentives. To date environment funds have been disbursed among three groups. A similar program has been started in the Padma-Jamuna Floodplain with funds distributed to four groups. Medicinal plant and associated traditional medical knowledge is being preserved with five demonstration sites being created in Madhumati Floodplain and a further two in Padma-Jamuna Floodplain.

A further challenge to the new management program lies in the need to address trans-boundary issues. The flash-floods that have affected the Hoars basin are generated across the Indian border in the Meghalaya Hills. These hills are the location of large-scale deforestation – contributing to the flooding problem. Industrial, urban and agrochemical activities in upstream communities also contribute to pollution loads in the basin. Trans-boundary negotiations and agreements need to be developed that address watershed management. Specifically, joint efforts are required to ensure that land-management practices start to reverse this trend of increased flooding. By revegetating the hills area, the overland flow of water can be slowed, and more water will seep into local soils for storage, and less water will flow into the Haor Basin during floods.

This program has provided diverse benefits. The biodiversity benefits of establishing conservation areas to protect threatened and endangered species are clear, but the biodiversity benefits of revegetating with natural wetland tree species and encouraging sustainable use of the forest products should not be underestimated.

However, without recognition of the needs of local communities to maintain and enhance livelihoods opportunities, this project would be unlikely to succeed. By ensuring that the positive effects of revegetation and fisheries had positive effects on local livelihoods, the conservation activities have been successful. Land clearing in other areas of the watershed, climate change may have already contributed, and may lead to further changes in the frequency and severity of flooding. By increasing the stability of land, and thus the resilience of landscapes and communities, the communities have begun adapting to climate change. However, because of Bangladesh's extreme vulnerability to climate change, much more work is required. Finally, the revegetation efforts likely constitute a carbon sink which will help mitigate effects of climate change. Likewise, where kerosene was used previously, a switch to solar power reduced reliance on fossil fuels and reduced carbon emissions. Both of these gains are may be minor in the context of global carbon budgets, but should not be overlooked.

Lesson Learnt
The Role of Local Leadership

Community involvement requires an appropriate degree of community organization and capability. The Hoar Basin project in Bangladesh found that this was most effective when at least one group within the community has resource management or conservation as its primary focus and can act as a leader for those villagers around them and assist in raising awareness. (IUCN (2004))

Lesson Learnt
Need for defined land ownership

The Hoar Basin project in Bangladesh shows that local communities generally have ancestral or historic rights to land and its resources such as fish in and around the villages based on traditional systems. They have also developed rules and regulations based on their own ecological knowledge, rather than depending on scientific management solutions that are often proposed with less knowledge of the local environment and needs of local people. Meaningful engagement of traditional and indigenous knowledge is therefore needed to ensure appropriate livelihood and cultural outcomes. Despite this, the communities may not have documented legal rights regarding land ownership. This results in conflicts between villagers, former leaseholders, and local government authorities. To amend this situation, clear government and legal support is needed for communities to manage the land and derive livelihood benefits from it.

Community-Based Rangeland Rehabilitation for Carbon Sequestration at Gireigikh Rural Council in Sudan

Based on information presented by Zaki-Eldeen, S. and Hanafi, A 2004 Environmental Strategies for Increasing Human Resilience in Sudan: Lessons for Climate Change Adaptation in North and East Africa. Case study report prepared for Assessment of Impact and Adaptation to Climate Change (AIACC) project AF-14: Environmental Strategies for Increasing Human Resilience in Sudan: Lessons for Climate Change Adaptation in North and East Africa; Dougherty, B, Abusuwar, A and Abdel Razik, K (2001) Community Based Rangeland Rehabilitation for Carbon Sequestration and Biodiversity SUD/93/G31 Report of the Terminal Evaluation. April/May 2001 UNDP (Unpublished); and Spanger-Siegfried, E. Hanafi, A. Zaki-Eldeen, S. Goutbi, N and Osman, B. (2005) The Role of Community-Based Rangeland Rehabilitation in Reducing Vulnerability to Climate Impacts: Summary of a Case Study from Drought-Prone Bara Province, Sudan. Prepared for The IC/IISD/IUCN/SEI project on Climate Change, Vulnerable Communities and Adaptation. Unpublished

This project is an exception to many of the projects in this publication as it was designed specifically to promote adaptation and mitigation actions through biodiversity conservation. Natural resource management actions such as revegetation of degraded or vulnerable lands and the promotion of sustainable agricultural practices are seen as important components of an adaptation strategy. Mitigation actions are also addressed by revegetating large tracts of land to help redress the balance between methane production by animals and carbon sequestration by vegetation. The social and economic wellbeing of the communities throughout the Gireigikh Rural Council is also integrated through the development of alternative livelihood options which reduce pressure on local biodiversity.

The Gawama'a and Kawahla tribes of the Bara province of the North Kordofan State of Sudan, have suffered several blows to their livelihood with three droughts in the between 1976 and 1992. Most of the country is desert, semi-desert or arid savannah. The lands have low productivity, and are highly susceptible to drought and climate change. Land degradation due to multi-decadal trends of declining rainfall, in conjunction with unsustainable agricultural practices such as overgrazing and clearing of the land has exacerbated the situation. With rainfall as the primary determinant of food security, the prognosis for improved food security in a changing climate is poor. However, with the adoption of adaptation strategies, 17 communities within the Gireigikh Rural Council have been able to take some steps towards improving their livelihoods. Through the project "Community-Based Rangeland Rehabilitation", sustainable agricultural practices have been adopted and land degradation is being arrested, and even reversed.

Before the start of the project, the farmers depended upon shifting cultivation and livestock production. Marginal lands were quickly being converted into agricultural uses, but the land quickly degraded as the natural vegetation was removed. Farmers abandoned lands as they lost their fertility, but left them without ground cover, and susceptible to erosion. Goats were the primary livestock species, as cattle couldn't cope with drought. However, uncontrolled goat grazing had a large impact on the lands, contributing to desertification.

With the assistance of this GEF and UNDP funded project, the communities have been able to develop more sustainable practices, and even worked to rehabilitate degraded lands.

Measuring the success of projects such as this is exceedingly difficult. From a community perspective the project can be seen as successful because it has built the resilience of communities to climate change through building sustainable livelihoods and lowering the impacts of current and future drought. A community resilience profile was developed by the research team to measure five types of capital: natural, financial, human, physical and social. Due to improvements in rangeland productivity substantial improvements were noted in natural capital particularly in relation to improved meat and milk supplies from livestock. The diversification of income sources also meant that the community was no longer solely reliant on rain-fed agriculture which led to significant financial improvements. Human capital was increased through the fostering of effective extension services and social capital also benefited from the greater number of women and marginalized groups involved in decision making. Substantial improvements were also seen in physical capital (i.e. grain stores, mills and water pumps) though the ongoing drought meant that there had been little or no surplus grain.

While improvements can be seen in the five areas of capital, quantifying the outcomes for climate change adaptation and mitigation become much more difficult. Some scientists claim that carbon sequestration can only become meaningful when measurements are conducted over long time spans (i.e. a minimum of 3-5 years) utilising precise methods. It is suggested that, value in carbon sequestration efforts in dry land ecosystems, is produced by the large expanses of land where even low areal rates of carbon sequestration can make a substantial difference. However in order to fully capitalise on this, up to 50% of the cultivated and fallow land would have to be converted to grazing land to achieve a breakthrough in sequestration and the project would have to be scaled up to encompass around 1,000 Rural Councils (Dougherty *et al* 2001). However, scaling the project up, may mean that solutions may no longer be locally appropriate and a balance between the social and economic needs of the community and environmental benefits would need to be met.

The methodologies the project used to derive benefits in relation to natural, financial, human, physical and social capital included:

Through an incentive program that ensured support for the continuance of the project, many farmers have been able to replace their goatherds with sheep, which have a lower impact upon the ecosystem, and are more profitable but less resilient to the impacts of drought. One sheep was provided for every five goats sold outside the project area leading to the replacement of up to 80% of goat herds in the poorer segments of the population. The replacement of goatherds with sheep has meant that farmers can engage in grazing as a profitable enterprise and rely less on converting large areas of land to broad scale cropping which destroys biodiversity.

Sustainable grazing methods, including rotational grazing and fodder conservation have been adopted in some areas and farmers have been planting more drought-tolerant species. Seedlings of native trees have been cultivated and planted in rangelands and forests to help stop the encroachment of sand dunes, and provide shelterbelts to croplands. The seeds of native trees, shrubs and grasses have also been spread across rangelands to help maintain vegetative cover, improve fodder production, increase soil fertility, and increase rates of carbon fixation.

More than 700 hectares (about 30% of grazing land and seven times the planned acreage) was set aside for rehabilitation. Grazing and fuel-wood collection were prohibited in these regions until they were adequately rehabilitated. Upon seeing the benefits of this action, a further 500 hectares of private land was also voluntarily set aside equating to a further 166 farming families becoming part of this exercise.

Villagers have been encouraged to change house-building techniques to use mud to build walls instead of wood. This new method is found to save about 30 medium-sized trees of 20-25 years per household per year, equating to approximately 49 hectares of trees across the 17 villages. In addition, new, more fuel-efficient woodstoves were installed in almost 100% of the homes.

Groups of 40 to 60 local women have established 17 community gardens that grow low-water demand vegetables, with the help of hand irrigation using water from nearby dug wells. The vegetables have helped people (particularly pregnant women and children) meet their nutritional needs, while extra produce is sold at market to support the further development of the garden and purchase of more seeds.

A revolving funds program has been established to finance local income generating activities such as “disaster resistant income generation businesses and enterprise diversification”. A sub-committee in each of 17 villages oversees the fund. Training and

extension programs have also helped large numbers of villagers to develop the skills to take on new projects and income generating activities.

Grain storage and credit programs have been established to prepare for droughts and the associated impacts of hunger and malnutrition. The credit based food security and risk management system provides grain storage facilities for emergency food supplies and seeds for replanting of failed crops in each village. This initiative is capable of providing grain credits of up to 80% of the project population in the event of crop failure and the need to tap into emergency food supplies.

Five pastoral women's groups were established, each with access to revolving credit programs and access to female facilitators that train others in value adding activities such as rangeland management, sheep fattening, cheese and milk marketing, wool weaving, poultry rearing and other activities that contribute to micro-enterprises and the diversification of household income and food security. The incorporation of women into the project was crucial as many men leave for other parts of the Sudan in pursuit of seasonal employment due to the lands poor carrying capacity for agriculture.

Village water supplies were developed through the construction of 17 deep bore holes. Water management sub-committees were set up to ensure the long-term viability of the wells. The wells serve the purpose of irrigating the home vegetable and fruit gardens; increasing the nutritional value and variety of plants in the gardens; and providing fresh drinking water. This significantly reduces the amount of time women have to spend collecting water.

In areas where desert encroachment was threatening economically sensitive areas, approximately 5 kilometres of denuded sand dunes were revegetated and stabilised. A further 195 km of windbreaks were constructed, buffering approximately 30 farms.

Lesson Learnt: Importance of local institutions and effective representation

The strengthening of local institutions was found to be crucial. Local leaders, Committees and the local branch of the Sudanese Environmental Conservation Society (SECS) all played major roles in the implementation, success and sustainability of the project under study. This was expected as they represent the primary beneficiaries. However, they were also very effective in the enforcement of certain regulations, such as those for retaining vegetation cover on council lands. The role of some NGOs, particularly those working in the field of the environment, (namely SECS) were found to be very significant as they conveyed messages related to environmental conservation in a very simple way, particularly when the members were from the community – thereby ensuring popular support. In spite of these very efficient institutions, the absence of active unions such as the farmers’ and the herders’ unions was thought to lead to the loss of many opportunities that would have positively affected the community. Zaki-Eldeen and Hanafi (2004)

Lesson Learnt : Importance of linking microfinance programs to markets

A sheep-fattening activity was made possible through loans provided by a revolving-fund program. It was found that the beneficiaries only needed the grant only once, and thereafter they depended on themselves to continue the activity. This injection of financial capital was thought to play the biggest role in the improvement of the livelihoods as it gave households the space to find alternative ways for making a living. The effectiveness of credit repayment was found to be excellent (88%). The success of the sheep-fattening measure could be attributed largely to good access to markets (local, national and regional), facilitated by the presence of retailers and their movement between the project area and big centres (good road network). The fattened, good-quality sheep find their way to Arabic Gulf Markets.

Lesson Learnt : Recognising Community Needs

The Community-Based Rangeland Rehabilitation project (CBRR) was constructed around two basic assumptions:

First, that community participation was essential to improving rangeland management, and that to enlist this participation would involve devising an implementation strategy that was structured around local, traditional social institutions, such as leadership mechanisms, social discipline, alliances and reciprocity.

Secondly, a range of activities that did not directly contribute to carbon sequestration would be needed in order to create the necessary good-will of the community and secure their support for implementation. To this end, the project was designed to target and alleviate certain local vulnerabilities through activities such as improved fodder production and water development, livestock restocking, development of village-level irrigated gardens, introduction of revolving credit systems, and drought contingency planning. Through such activities, the project aimed to meet villagers' near term needs, thereby relieving pressure on the resource base and increasing the prospects for long-term improvements.

Lesson Learnt : Linkages with government policy

The linkages between government policies and income-generating activities before and after the project are not entirely clear. Upon the completion of the project, all its moving assets were added to the property of the Rangeland and Pasture Administration in the region. The people believed that this negatively affected the sustainability of many income-generating activities and there were complaints about taxes and zakat. However, the government in the region has taken the step of selling subsidised grains to the credit committees, so they can sell them to beneficiaries at reasonable prices. This was found to have a very positive effect in the performance of the Credit Committees.

Ample opportunities exist in both the NAPA and the Adaptation Policy Framework to “plug in” these types of experiences and secure a place for community-based sustainable livelihoods activities in national adaptation strategies. This should be accompanied by a communications strategy that ensures community members are fully aware of their onground impacts.

Spanger-Siegfried *et al* (2005); Zaki-Eldeen and Hanafi (2004)

Sagarmatha (Mt Everest) National Park

Based on information presented by Nepal, S.J. (2000) Case Study 7: Sagarmatha (Mt. Everest) National Park, Nepal. In Indigenous and Traditional Peoples and Protected Areas: principles, guidelines and case studies. (Ed. Javier Beltran and Adrian Phillips). Best Practice Guidelines Series No. 4. World Commission on Protected Areas. IUCN and Cardiff University; and Stevens, S.F. (1993) Claiming the High Ground: Sherpas, subsistence and environmental change in the highest Himalaya. University of California Press. USA.

Protected Areas have long been used as a method of in-situ conservation as per the CBD Article 8. Today protected areas cover at least 11% of the earth's surface conserving valuable areas of biodiversity. These are set to increase with the designation of marine protected areas to protect oceans and fish stocks. Unfortunately, Protected Areas have often been established with little "social conscience" leading to the exclusion of local and indigenous peoples causing hardship and poverty. Although Protected Areas were never designed with poverty reduction in mind, there has been increasing efforts to engage local communities. This is often a difficult task for park managers as parks often only exist in paper or as name only and there is often a critical lack of financial or human resources for management actions, with resources for poverty reduction being non-existent.

While resources are lacking in formal management structures, examples from around the world are illustrating the capacity for effective community protected area management. A good example of the tradeoffs and consequences of protected area management for community level poverty reduction can be seen in Sagarmatha (Mt Everest) National Park in Nepal.

Political reforms and changes in government policies concerning land and forest resources has meant that indigenous communities are increasingly being seen as partners in resource management and conservation. For many however this is a case of "too little too late". Historically Sherpas have had a strong sense of community stewardship over the forests, to the extent that a powerful group of local villagers, the "shingii nawa", annually elected forest guardians. This traditional system of management was soon destroyed when the Forest Nationalization Act of 1957 declared all forest cover within the country as government property. This effectively undermined any local rights and responsibilities for forest management. Nepal (2000) and Stevens (1993) report that this led to gradual forest destruction (reported as rapid in other parts of the country) which was further compounded by the increased demands for firewood as tourism expanded. The solution was deemed to be the reservation of the Sagarmatha (Mt Everest) National Park as a protected area.

Despite its protected area status, the popularity of the area as a tourist destination continues to create numerous problems for park management. It would appear that while this conservation led initiative may run parallel with continued poverty reduction for the Sherpa population it is having a detrimental effect on the environment as it ignores traditional management systems. During peak tourist months, visitors to the park may exceed the local population by a factor of five. It is estimated that this influx may have provided income and employment opportunities for between 60-80% of the population.

The indigenous communities of Sherpas have therefore become very affluent compared to average Nepali citizens as they find positions as labourers and porters for tourist hotels and trekkers. This has come at the expense of cultural erosion as present day Sherpa life revolves around tourists at the expense of community and spiritual mores.

The park actually has no jurisdiction and control over tourist related activities. A lack of governance has meant tourism has given rise to problems such as garbage pollution, trail damage, contamination of drinking water sources and other socio-cultural “anomalies”. Furthermore, despite the adoption of more sustainable energy options or energy saving devices by some lodges, the plundering of the native forests still continues.

In response to the rising discontent between local communities and park managers, a new Forestry Act was passed in 1993 followed by the Forest Rules 1995. These held a provision to return up to 60% of park revenues to local community-based development programs. It also legitimised the devolution of management responsibilities to independent, local Forest User Groups (FUGs). The enactment of a Buffer Zone Management Act enabled buffer zones to be set up around protected areas where local communities are supported through community-based development programs. Despite these intentions, the Act and concept of buffer zones are relatively poorly understood by park officials and local people (Nepal, 2000). In 2001, Community Forestry Inventory Guidelines were introduced.

The Ministry of Population and Environment reported in 2002 that over 848,000ha of forests had been handed back to the community and were now managed by about 11,000 FUGs representing 1.2 million households and 2.9 million trees protected in private forests. Although the forests still remain under ownership of the State, FUGs (providing they meet criteria on accessibility, traditional use rights, willingness and capacity to manage resources) now make all management decisions with each household having equal rights over resources. In these instances outsiders have no access.

It is assumed that without the designation of the park, the Solu-Khumbu region would have suffered much greater levels of destruction (Nepal, 2000). However the earlier top down approach taken towards park management, the inability to effectively engage the Sherpa community until after “crises point” and the lack of governance for environmentally sensitive tourism has left a legacy that is difficult to turn around.

Lesson Learnt : Ensuring appropriate levels of access and benefit sharing

The Sagarmatha (Mt. Everest) National Park project found that more protection orientated (passive) management styles led to under-utilisation of the forests capacity which in turn led to a waning of interest due to inadequate benefits to the local community. This in turn led to the degradation of adjoining forests through over-use. The completion of a national forestry master plan in 1988 and new forestry legislation coupled have brought significant changes and a new commitment to co-management of resources. This has led to greater incentives for people's participation in a sustainable use (albeit actively production oriented) approach to conservation. This change in mindset was needed to create the conditions necessary for achieving conservation and poverty reduction aims. Communities are entitled to use all products raised through management and may use all income raised for development purposes.

Fisher (1995); Nepal (2000)

Forest User Groups (FUGs) have been seen as an integral component of the Nepal's National Action Plan for implementing the UNCCD. From a gender perspective it is realised that land degradation impacts both men's and women's ability to achieve food security. Although firewood consumption has been decreasing over the years, deforestation and desertification has been increasing, with women and children (being the main collectors of firewood) being the primary victims. 440 FUGs are exclusively comprised of women (although this still only comprises 4% of the total number of FUGs). There is an increasing realisation of the need to involve women in not only FUGs, but all development programs.

MOPE (2002); UNCCD (2004)

Model Ecologically Sustainable Community Tourism Project (MESCOT), Malaysia

Based on information prepared by Mr Robert C. Ong, Mr Mohd Hasim Abd Hamid, Ms Joanna Kitingan, Mr Jeflus Sinajin, Mr Abdul Latiff Kadok and Ms Caroline Pang (2003) for the Equator Initiative Awards 2004. (UNDP, 2003).

The designation of protected areas has often had negative impacts for many of the world's forest dwelling communities. This project illustrates how protected areas conservation can lead to environmental improvements when issues of poaching, expansion of plantations and unsustainable timber harvesting are addressed. Secondly it illustrates how environmental improvements can lead to poverty reduction.

The Lower Kinabatangan catchment, in Malaysia, has been recognised by conservationists as a site of “mega biodiversity”, namely due to its very high concentrations of lowland wildlife which include large mammals and primates. The community of Batu Puteh, which is made up of five villages, are completely surrounded by the Supu Forest Reserve and the Kinabatangan Wildlife Sanctuary. These areas have been declared protected, due to the wide variety of forest types which contain all ten species of Bornean primates, 9 out of 11 known species of hornbill and several other of the world's rarest birds. Traditionally the villagers of Batu Puteh have been heavily reliant on the forests for timber and livelihood. A compromise was therefore needed whereby adequate conservation protection could be afforded to the forests without leading to increased poverty for the local community.

As a means of securing alternative livelihood options, the MESCOT Project sought to develop a community-lead ecotourism industry. With the support of WWF Norway, the Sabah Forestry Departments Kinabatangan District Office and Sabah Ministry of Tourism, Culture and Environment, local people were assisted in the identification of suitable tourist features and training in customer service. The main products to come out of this project include a home-stay program, village boat service, guiding service, and culture group and handicraft outlet.

Like many similar projects involving protected areas around the world, one of the key outcomes has been raising the awareness of the local population for conservation. This was achieved by actively involving villages in the documentation of resources at the initial stages of the project, engaging their assistance in forest fire fighting and restoration activities and developing their skills in guiding visitors. This is reported to build the links between community pride and the value of the forests as a “commodity” to attract tourists.

To date the outcomes of this approach appear to be relatively effective. In its first year of operation, the home stay program received over 1000 bed nights and generated returns of over RM70, 000. In its second and third years it received the bed nights remained stable and income grew to RM104, 000. This is a substantial return given the average per capita income for the region is RM3, 600 to RM9, 600.

The project was successful in engaging local unemployed youth from the five villages. The project provided proper training and helped identify appropriate roles for these youth in the ecotourism program. Although the increase in income translates to between ten and 30 full time jobs, this benefit has been shared among more than 100 people, on a part-time basis. There are also 20 families alone in the home stay program with numerous others involved in boat services, nature guiding, culture groups and other coordination type roles. The MESCOT program has another innovative feature, in its creation of a community fund built on tourist contributions. Each year, the fund amounts to about RM9000 which is invested into micro-credit programs for improving access to sanitation, water, electricity and adequate housing. The funds are paid back through household income generated through tourism and the program has rotated/reused funds twice to date.

It appears that a great deal of pride has been built within the community for the forest and villagers are seeing the benefits of undertaking habitat restoration as well as preservation. Funds were sought by the MESCOT program to plant more than 30,000 trees and restore more than 50 ha of degraded fresh water swamp forest. Interestingly the forest restoration techniques learnt in this program have also benefited the local oil palm industry that lost vast areas of oil palms during the floods of 2000. Information on restoration techniques and species selection has been shared with both the private and government sectors. Forest ecology and its restoration has also become another product to offer the tourist market. Many eco-tourists are keen to contribute to restoration efforts, learn about rainforest ecology and share in the traditional knowledge of the villagers.

To minimise any negative effects of tourism, a code of conduct has been established to ensure socio-cultural and environmental sustainability. This has been beneficial in increasing the authenticity of the tourist experience. Local culture is adopted during the tourist stay in the villages, and has promoted the sharing of local lifestyles and culture and minimised negative feedback from tourists and local villagers.

In order to effectively engage local community support for the protected areas, a five stage process was undertaken which started in May 1997 and was finally operational in March 2000. This included:

Research Phase – MECOT group gathered and documented information about the surrounding biodiversity and recorded and documented “aural” histories, traditional beliefs, medicines, uses of forest resources, culture and the history of the area.

Exposure Phase – Training and study trips were undertaken of various tourist facilities and destinations of Sabah and Sarawek. This gave first hand experience of service skills, marketing strategies, interpretation and communication requirements, visitor management and reduction of site impacts. The trip also exposed the difficulties of travelling and touring to participants. This phase also involved basic computer training so research and community plans could be documented.

Brainstorming Phase – All potential tourism activities, products and developments were identified and prioritised according to those that would deliver multiple benefits to the

community by being suited to the community's capabilities, being appropriate to local culture and not impacting adversely on the local environment.

Detailed Planning Phase – MESCOT conducted detailed discussions and wider community dialog and further consultations on the development of tourism activities. Budgets were drawn up, implementation strategies were agreed upon, decisions were made on suitable packaging and pricing, appropriate legal procedures for licensing and registration were clarified, internal rules and regulations were established and the code of conduct was formulated.

Operational Phase – Community tourism activities were made operational and registered with the Ministry of Tourism. Although this project is relatively young and the results are small scale, it appears to have established an appropriate set of conditions by which conservation led environmental improvements (such as reduced poaching and logging pressure and rehabilitation) bode well for the indigenous peoples of the Batu Puteh area and overall poverty reduction.

Lesson Learnt :Ecotourism a panacea for poverty reduction?

Ecotourism is often offered as an alternative livelihood solution for local communities displaced from their traditional lifestyles as a result of designating protected areas. However, many projects often overlook the need for clearly and legally guaranteed rights and responsibilities – of all actors in the initiative (GBF, 2004). The MESCOT project has paid special attention to strengthening local institutions through the clarification of legal rights and responsibilities and developing internal systems of governance. It has also set out to empower the local community through giving them the opportunity to experience tourism options from other areas and prioritise tourist activities and products according to their capabilities. An important lesson for the group was that although ecotourism can provide livelihoods benefits, markets may take some time to develop, and must be carefully researched. In addition, effects of ecotourism on the environment and local culture should be considered.

Ong *et al* (2003)

Lesson Learnt : Effective Community Led Forest Conservation

The MESCOT project illustrated that community forestry conservation can be effective when the community has control over decision making processes. Most importantly they need to be provided with the opportunity to learn skills for conservation and its sustainable use through ecotourism. This gives them a space to develop a sense of pride in the natural resources. In contrast, top down management approaches often do not give the space needed for self regulation or have little understanding of the relationships between biodiversity and livelihoods.

Ong (2003)

Clearly, protection of this area has had important impacts upon local biodiversity, but halting unsustainable forestry revegetation can help increase carbon stores, mitigate climate change. Healthier ecosystems may also be more resilient to negative effects of climate change.

Mamiraua Sustainable Development Reserve (MSDR), Brazil

Based on information provided by Mr Andrew Taber and Ms Ana Rita Alves for the 2004 Equator Initiative Awards (UNDP, 2003).

The Mamiraua Sustainable Development Reserve (MSDR) is found deep in the flooded forests (or Varzea) of the Amazon and is the meeting place for the Solimoes and Japura rivers in Brazil. The area has been described as the world's largest floodplain, an area the size of England which for six months every year is flooded to the tree-tops; equating to a 12-metre rise in water. It covers a total area of 1,124,000 hectares and is home to over 1,668 people, in 23 settlements with a further 3,600 from the 37 surrounding settlements also dependent on the forests for their livelihoods and nutritional needs.

The area was designated as a fully protected Ecological Station by the State Government of Amazonas in 1990. Initially, this decree allowed neither the residence of human populations in the area, nor the use of its natural resources. People and nature were deemed incompatible. In response to the exclusionary nature of the legislation the Sociedade Civil Mamiraua was established in 1992 by a group of Amazonian researchers. In 1992, the group successfully took on the role of co-management of the area with the Institute for Environmental Protection of the State Government of Amazonas (IPAAM) and National Science and Technology Council (CNPq). This partnership has been remarkably successful in promoting sustainable development in the reserve.

Sociedade Civil Mimiraua's belief that the conservation of biodiversity in the Amazon ought to be closely related to the alleviation of poverty has heralded a new era in protected area management. The group has embarked on a two phase process:

Producing a Management Plan for the reserve which addresses both how to sustainably manage the reserve, and how to improve local livelihoods by allowing sustainable use of the natural resources and by improving access to social services; Manage sustainably the biodiversity of the MSDR through partnership between local residents and users, and local institutions.

The group has also successfully lobbied for legal recognition of forest communities rights. The result of this lobbying, was the development of a new legal category, a "Sustainable Development Reserve", which was introduced in 1996 by the State Government to help meet the needs of the Mimiraua. In a country where land access is restricted to a traditional, small but powerful class of people, the establishment of such a precedent for landscape use is crucial for the millions of peoples that rely on forests for their livelihood requirements.

Caution is being exercised in the use of this new protected area category. As the Amazon is one of the most bio-diverse forest areas in the world, it is acknowledged that strict protection still needs to be advocated by policy-makers and practitioners in more threatened areas. Today, there are nine Sustainable Development Reserves throughout Brazil with the Sociedade Civil Mimiraua managing the Mimirauá as well as the Amana Sustainable Development Reserves.

The population density in the forest areas is relatively low compared to other tropical forest regions of the world. Those that legitimately use and protect the Reserves' natural resources live in "smallholders" communities of about 100 people. They are mostly located on the river margins and have very limited infrastructure and access to social services. Birth rates are very high, and life expectancy is very low. Livelihood requirements are met through fishing, hunting, slash and burn agriculture and timber exploitation. Most fishing and agriculture occurs during the low water period, creating a highly seasonal economy, and heavy work loads during the low-water season. During periods of high-water, timber extraction is carried out. When the community can produce a surplus of food it is sold or bartered for other products with itinerant river traders – *regatões* - or is sold directly to markets in the local urban areas. But these markets are often unreliable, and farmers often have to commit to production before harvest. If the *regatões* or others default on original orders other markets cannot be found, and the produce cannot be sold, resulting in extreme poverty.

The Sociedade Civil Mimiraua introduced the Economic Alternatives Program in 1998 to help the local community develop income generation projects and re-orientate traditional resource use practices to achieve sustainability. The group worked with communities associations and households to investigate fisheries and forest management, ecotourism potential, agricultural practices and handicraft production. Specific attention was paid to

strengthening local institutions by encouraging local producers to become politically organised. Efforts were also made to reduce the community's dependence on commercial capital and move the production of forest, agricultural and fisheries products closer to regional end-markets (such as hotels, restaurants and the plywood industry) rather than relying on barter systems or the *regatões*. With this greater access to the market economy, income levels are higher. For instance, communities are now able to sell their pirarucu fish (*Arapaima gigas*) for twice as much as before.

The increased commercialisation of natural resources appears to not have had a negative effect on the environment. Fish monitoring programs have indicated a 100% increase in populations of black-caymans (*Melanosuchus niger*) and 300% in adult pirarucu – both “top predators” in the river food chain. The community is also seeing the benefits of improved forest management. Over the last 10 years there has been a considerable decrease in the amount of forest habitat being converted to agricultural land. This is primarily due to improved agricultural practices, the use of swamps and beaches for farming and fishing and opportunities to diversify income with forest management and ecotourism

ventures. This has important benefits for biodiversity conservation as it gives an alternative to the rapid deterioration of the environment – often for relatively short term economic gains. The use of markets which favour sustainably harvested products has been a strong incentive with communities being able to sell timber which is exploited through forest management plans at 100% to 150% more than timber extracted through unsustainable means. The decrease in the amount of land being converted to agricultural land also has outcomes for climate change mitigation as it ensures that the carbon sink afforded by the forest maintains a higher level of integrity.

Lesson Learnt

Capacity building and institutional strengthening for income security

By paying attention to capacity building, the development of partnerships and better modes of production this project has created the conditions necessary to allow a rise in average annual family income. Rises of 50% to 99% have been experienced in some areas of the local community. Local communities are now organized in producer's associations (rather than being represented by the commercial elite) and access to natural resources is now negotiated among and within communities through participatory local forums (or sector meetings). This has ensured that biodiversity resources benefits are more equally distributed amongst local beneficiaries.

Sociedade Civil Mamiraua (2003)

The Uganda Food Security Initiative

Based on information provided by Professor Steven. C. Smith, Mr Alan Alemian, Mr Abdalla Meftuh and Dr Brima. F. Ngombi for the 2004 Equator Initiative Awards (UNDP, 2003); Gerrits A, 1999. Indigenous knowledge about fodder trees and shrubs. AFRENA report (in press). Kabale, Uganda; KARI-KEFRI-ICRAF, 1998. Calliandra for livestock. Technical Bulletin No.1. Embu/Kenya; and IFPRI (2002) Policies for Sustainable Land Management in the East African Highlands. Outcomes of the Reducing Hunger, Poverty and Environmental Degradation in the Highlands Conference to present new research on strategies to improve agricultural and environmental practices in Ethiopia, Kenya and Uganda. Addis Ababa, Ethiopia April 24-26, 2002

South western Uganda is very densely populated. Densities of around 400 people per square kilometre mean that land holdings are fragmented and farmland is critically scarce. Most people must survive on farms smaller than one hectare and problems of rural poverty and malnutrition are severe. The situation is worsening in many areas, as already low agricultural productivity is declining due to land degradation – this in an area once considered amongst the most fertile in the tropics.

The ability to grow two crops a year is key for survival in the region, but this intensive farming has led to rates of nutrient depletion in the soil that are among the highest in sub-Saharan Africa, and high rates of erosion further threaten soil fertility. There are two ways of addressing this loss of soil fertility, the first is encouraging use of inorganic fertilizers, and, the second is encouraging the use of low-cost, low-external input practices such as composting which will return nutrients to the soil (IFPRI, 2002).

In addition to declining land fertility, farmers lacked access to good quality seeds. Road infrastructure in the region is poor, so without external sources, farmers were using seeds from previous harvests, and many of the beneficial genetic traits in the seed stock had eroded over time. The crops were not blight tolerant, and a combination of degradation in soil quality and poor seeds meant that yields were declining and food insecurity was worsening. Effects within the community included very high levels of preventable health problems among children, including protein deficiency, malaria, diarrhoea and parasitic worms. A lack of access to markets also meant that communities were relying on subsistence agriculture and excess produce could not be sold to obtain food items from other areas. When middlemen did visit the community, the prices paid for local produce were very low.

The Africare Food Security Initiative has been operating in the south-western Uganda District of Kabale since 1997. This program has shown significant success in reducing poverty. It has also led to improved resilience of farming systems to climatic disruptions. Diversified income sources, improved and more resilient seed stocks have built a more robust agricultural economy. The project also presents benefits for climate change adaptation as communities are able to, in addition, by building the fertility of soils the

program has been able to reduce the pressure on farmers to expand agriculture into other lands including steeply sloped areas unsuitable for agriculture, as well as and national parks, forest reserves, and wetlands. This has not only helped reduce the rate of desertification in Uganda, but has also helped maintain and enhance existing carbon sinks and protect remaining areas of natural vegetation and its associated biodiversity.

Given the complex nature of the interrelated problems of South West and the seemingly endemic poverty and environmental degradation, an integrated rural development program was needed. Areas of intervention included:

Planting tree species with good ecological and commercial properties. Over 5,337,000 tree seedlings have been raised on community nursery beds.. At least 18 different tree varieties were chosen according to their ability to replenish soil fertility, stabilize soils and control erosion, and provide products such as wood, timber, high value fruits; fodder and medicinal products. Examples of the species planted include *Calliandra calothyrsus* and *Sesbania sesban*. These species provide superior fodder and help enhance soil fertility by fixing nitrogen. They also provide stakes for climbing beans; building materials for houses; firewood and opportunities for income generation through seed sales.

Improved land management practices were implemented including the use of natural fertilisers, seed selection, new crops (such as leafy vegetables) to add much-needed minerals to the diet and communal seed multiplication schemes were established for crops such as potatoes, beans and bananas. This was accompanied by integrated production and pest management practices. New production technologies and techniques to increase productivity of small plots were introduced (such as building contours with vetiver grass) to minimise expansion into steeply sloped, environmentally sensitive areas.

Farmer field schools were established to provide farmers with learning opportunities about integrated pest management practices and different genotypes of potatoes, from which they select the varieties that best suit their needs. In the early phases of the project 401 farmers (223 women and 178 men) from five watersheds were trained in agro-forestry, using manure fertilisers, composting, crop spacing and using border hedges improve soil fertility, control erosion and aid in water capture. These farmers are in turn training others. Particular attention was paid to waste management and recycling. Agricultural by-products are now used as fertilizers or animal feeds, or used to improve productivity of fish farms.

Roads were upgraded to allow farmers to visit markets within the area to sell their produce and get a sense of the demand for different products. This allows for information

exchange and farmers have learned more about different methods to grow and process products for market. As a result, some temperate crops that are suited to this high altitude environment (approx 2500 metre) have been introduced. For example, apples were once imported, but are now grown locally. The new roads have also be crucial for improved access to medical care and schools through upgraded roads. Cash cropping options were provided. Root-rot resistant Irish potatoes are now grown for the potato chip manufacturing market. This was deemed an effective strategy for sustainable commercialisation and income generation.

Encouraging farming of small animals such as rabbits and poultry has led to increased protein intake and added income. As well, the project has helped improve nutritional and health education and improve health monitoring by measuring child growth and managing disease. More efficient wood stoves have also helped reduce the severity of indoor air pollution.

Challenge

Valuing Local Biodiversity Over Introduced Species.

Scientists from the Agroforestry Research Network for Africa (AFRENA) make the observation that there is a relatively low level of indigenous knowledge among farmers in regard to native fodder sources. Few patches of natural forest remain in the area because much of the forest has been cleared for cultivation over successive decades and stands of the introduced *Eucalyptus grandis* now dominate the landscape replacing the local tree species that were traditionally used for timber, poles and fuel. Farmers have also become interested in new, exotic tree and shrub species, some of which grow much faster than local species. Fodder from *Calliandra*, for example, is ready for harvesting in the second year. Some farmers also indicated that they had adopted Christianity and no longer believe in the traditional and spiritual uses of trees. The disappearance of local tree species and fading indigenous knowledge are a real threat to biodiversity conservation. AFRENA has investigated the full potential of local tree species and surveys show that *Sesbania sesban*, *Vernonia amygdalina* and *Indigofera arrecta* are promising fodder trees and despite growing more slowly, their high-value products make it worth growing them on farms. The challenge lies in being able to promote the value of indigenous tree species ahead of the popular new exotic species.

KARI-KEFRI-ICRAF (1998); Gerrits (1999)

Lesson Learnt

Recognising Gender Issues in Food Security

The Uganda Food Security Project found that increased productivity did not necessarily translate to improved food utilization in the community. There are often strong cultural beliefs and taboos surrounding food. In order to improve food utilisation community based education centres were established to teach women about nutrition and build pride in traditional food products (particularly fruits and green leafy vegetables) as well as discussing health issues such as AIDS.

Women in the Uganda Food Security Project were directly trained in farming methods. There is a major effort to ensure women are represented on all relevant committees. In the planning stages, men, women and youth met separately to decide on priorities. This ensures that all voices are heard – thereby avoiding the problem of women being reluctant to speak up in mixed groups.

Smith (2003)

Facilitation of Seed Banking by GREEN (Genetic Resource, Energy, Ecology and Nutrition) Foundation, India

Based on information provided by Vanaja Ramprasad and Krishna Prasad (Green Foundation) for the Equator Prize 2004 (UNDP, 2003)

Winning the 2004 Equator prize for its work highlights the success of the Green Foundation in promoting conservation actions that have driven environmental improvements and helped reduce poverty. By conserving agrobiodiversity and encouraging sustainable farming practices, this organization is strengthening partnerships between farmers, their communities (in particular women's *sanghas*) and NGOs.

The conservation of traditional seed varieties on farm has crucially improved food security for poor and marginal farmers in the rain fed dry lands of the Indian state Karnataka where the project is centered. This method of conservation, through on-farm selection of high yielding, pest and disease resistant strains also provides a source of constantly adaptive options against future significant climatic changes.

In introducing conservation driven actions to address food security issues, the group has therefore provided opportunities to enhance livelihoods, empower women and reduce poverty. Specifically the group has worked to:

Revitalize many of the traditional practices in Karnataka to ensure preservation of traditional crop varieties. Over four years, the Green Foundation has facilitated the collection and conservation of over 90 varieties of finger millet, 85 of paddy, 55 minor millets, 25 pulses and numerous oil seeds and vegetables.. This has ensured the conservation of species that may be disappearing from large-scale agricultural systems. Increase participation of farmers, and expand the work to different villages and climatic zones to ensure maximum conservation and benefit. Between 1994 and 2003, the number of farmers participating in the seed conservation program increased from 10 farmers in two villages to 1,500 farmers in 161 villages throughout 6 climatic zones in southern India. By 2004, over 2000 farmers are participating in farmer to farmer seed exchanges.

Reduce the farmer's dependence on external markets for seeds and other inputs, (including foodstuffs) by increasing crop yields, extending the variety of crops grown and thus enhancing both the security and the nutritional value of food available to the community.

Encourage the use of both traditional and new agricultural practices such as mixed cropping, intercropping and nursery production of seedlings to increase the diversity and

yield of crops grown. For example, a transplanting program introduced for finger millet and paddy cultivation lead to a 25% improvement in yields compared to broadcasting and line sowing. Similarly, new and indigenous practices of agro-forestry and livestock management have improved soil fertility and water retention and enabled the production of bio-pesticides, again reducing dependence on external inputs.

Promote kitchen gardens: this is another major aspect of the Green Foundation's work. 450 families are now benefiting from their kitchen gardens to provide food, fuel, medicines and fodder for livestock. Fundamental to the success of the kitchen gardens was the building of water tanks, the introduction of drip irrigation and the use of vermicompost, green manures and mulching techniques, assist with the marketing of surplus produce from kitchen gardens, seeds, vermiculture and bio-pesticide sales to farmers in local markets by establishing communal marketing arrangements supported by micro credits. Sales of food products such as papads, millet mix, soapnut in urban markets and saplings for reforestation programs are also supported. Small loans are made to support similar new income generating projects. These activities all provide a small amount of extra income, mainly to the women, which is saved and used as collateral for future loans. For example, individual farmers are reported to have earned up to Rs 2000 per year (after accounting for their own farm use) from vermiculture enterprises. Women make on average Rs 500 per year each selling organic seed to commercial farmers and Rs 600 per season from their kitchen gardens; two women's groups earn approximately Rs 1000 per year selling bio-pest regulators.

Promote knowledge of sustainable farming practices through the identification of 'expert' farmers who may earn Rs 250 per day consulting. Campaigns such as 'Seed Yatras' and Seed fairs as well as Seed Management Committees and Seed saver networks also spread knowledge and provide organised opportunities for selling seeds.

Lessons Learnt : Recognising Gender Constraints

The Green Foundation experience has illustrated that gender and biodiversity are linked not only symbolically but also materially. Women play a major role in conserving seed at the farm level and have a deep understanding of all agricultural practices and seasonal variations in bio diversity. Their traditional knowledge needs to be conserved in a manner which ensures that its value is recognized and passed to future generations, and that this knowledge can be applied to facilitate adaptation to climate change, and is used to understand the consequences of biodiversity loss.

It is claimed that modern agriculture not only ignores the large contribution of women but also systematically marginalizes them through the introduction of new technologies. Therefore it is important to acknowledge the significance and vitality of women's knowledge of both agricultural systems and biodiversity and ensure that this knowledge can be used in a practical manner that delivers demonstrable benefits.

Women who own land may not be able to cultivate this resource due to extreme poverty.

Alternatively they may be landless with limited opportunity to engage in this sector.

Teamwork through the formation of *sanghas* or Self Help Groups represents an effective means for women to share knowledge and derive monetary benefits through sharing their land. As well, women-specific micro credit programs have helped improve women's access to resources. These initiatives have contributed to poverty reduction and reclamation of degraded lands. Ramprasad (2003)

Lesson Learnt Participation and Effective Communication

The Green Foundation project's strength lay in its project design. From the outset, it was designed to ensure sustainability and good communications. The project began with an exploratory period where a few farmers were engaged in a pilot study. Attention was paid to gathering information, developing the capacity of staff and ensuring strong links with other organizations involved in similar activities. The next stage involved an evolutionary period whereby the network was extended to include a wider network of climatic zones and villages. Finally, the project took care to undergo a consolidation phase to lay foundations for strengthening and reviving culture, traditional health systems, improvements in value based education and the encouragement of leadership and decision making in the community, Stabilization of economic conditions through the promotion of sustainable agricultural practices is key.

Ramprasad (2003)

Valuing Miombo Biodiversity for Poverty Alleviation and Food Security in Tanzania

Based on presentation, associated paper and interviews provided by Peter Oduol and Remen Swai (World Forestry Centre) and Lawrence Mhwambo (Tanzania Forestry Research Institute) in their presentation “Valuarisation of Miombo Biodiversity for Poverty Alleviation and Food Security” made at the 4th regional session of the Global Biodiversity Forum for Africa: Biodiversity and Livelihoods in Africa: Delivering on the Millennium Development Goals. 9-11 June 2004, Dar es Salaam, Tanzania. See also; Temu R.P.C. and Chihongo A. 1998. Field survey of wild and under utilised edible plants of Ruvuma region, Tanzania. COSTECH Dar es Salaam 46p; and Nsubemuki L, Ramadhani T, Nyakimori, Swai R and Mziray W. 1997. Status of use and marketing of Miombo of fruits in Tanzania. Paper presented to the planning workshop on domestication of indigenous fruits of the Miombo, Mangochi, Malawi, 2-5 June 1997.

The Miombo Woodlands in Tabora region, western Tanzania are characterized by a diverse range of landscapes and climatic conditions and a rich biodiversity. Like many countries in Africa, Tanzania has faced the hardships of food shortage, widespread poverty, malnutrition, HIV/AIDS and degradation of renewable resources.

Most of the rural communities in Tabora depend on several tree species in the Miombo woodlands that provide food, medicinal products and opportunities to generate income. Eighty three indigenous tree species, which bear edible fruits and nuts through out the year, have been identified in the Tanzania miombos, while more than fifty fruit trees are found in Tabora, region Miombos (Temu and Chihongo 1998).

While rural communities use a wide variety of edible fruits both for their own food needs, and to sell in local markets, it is estimated that only 10 - 30% of available fruits are harvested, with the rest going to waste. This is due in part to poor markets and limited harvest and processing technology, as well as natural limits on harvests such as fruits dropping to the ground, and herbivory (Nsubemuki *et al* 1997). Increasing the fruit harvests could contribute significantly to household nutrition and income within these poor farming communities as the forest fruits are rich in sugar, essential vitamins, minerals, oils and proteins

Importantly, these fruits are available year-round, and can then help improve food security during the dry season, when food shortages often occur. Experiences from other parts of Africa and Asia have shown that the effective processing and marketing of indigenous fruits products and medicinal trees can significantly contribute to wealth creation and poverty reduction.

The woodlands not only provide fruits, but firewood, poles and timber are also taken from the forests to sustain local communities. In addition, the forests can be used to produce honey, but to date the industry is very small. Numerous improvements in

practices, including access to local processing, improved technologies, better marketing, and improved quality control are required to expand honey production.

Biodiversity also plays an important role in local health care systems. About 80% of rural people in Tanzania depend on traditional healers and traditional herbs for their health care needs and over 300 medicinal trees in the Miombos have been identified to cure more than 100 human diseases in Tanzania (Dery et al 1999). Despite the enormous potential inherent in this area, biodiversity resources are continuously threatened by deforestation, which is currently estimated at 130,000 – 150,000 hectares annually in Tanzania.

With the assistance of International Centre for Research in Agroforestry (ICRAF) and Agriculture Research Institute in Tumbi (ARTI) local populations have been able to make more efficient use of the natural products from local fruit trees and transform these into products that give high food and cash value relative to the more common fruit species such as mango, papaya, orange and avocado fruits - that are normally preferred by most farming communities. It is anticipated that the higher value placed on fruit and medicinal trees for poverty reduction and food security will create the conditions necessary for the conservation and sustainable use of biodiversity.

The main methodologies used to create the conditions necessary for effective use of the native fruits and woodland products are detailed below:

In 1997, ICRAF in collaboration with national partners in Southern Africa started the domestication programme for indigenous fruit and medicinal trees in the Miombo ecozone. The programme started with a priority setting exercise in Zimbabwe, Zambia, Tanzania and Malawi to determine farmer's choices of indigenous fruit and medicinal trees for domestication (Maghembe *et al* 1998, Dery *et al* 1999). Work started on documenting the available indigenous knowledge on these species, germplasm collection, germination studies, propagation techniques and agronomic and horticultural evaluations. In addition, sensitization of farmers on the importance of indigenous fruits and medicinal trees and how to add value through processing and marketing of their various products to improve nutritional status, health, income and livelihoods of rural communities. The top indigenous fruit tree species and popular exotic fruits selected by farmers based on their availability, multiple uses and commercial value have been planted on station, farmers and schools fields. These include *Vitex doniana*, *Adansonia digitata*, *Parinari curatellifolia*, *Uapaca kirkiana*, *Strychnos cocculoides*, *Vitex mombassae*, *Sclerocarya birrea*, *Flacourtia indica*, *Tamarindus indica* and *Berchemia discolor*, *Mangifera indica*, *Carica papaya*, *Passiflora edulis*, *Citrus sinensis*, *Ananas comosus* and *Musa spp.* Ten different varieties of medicinal trees have also been planted on stations, farmers' fields and schools. *Securidaca longipedunculata*, *Zahna africana*, *Cassia abbreviata*, *Entada abyssinica*, *Turraea fischeri*, *Albizia anthelmintica*, *Entandrophragma bussei*,

Combretum zeyheri, *Zanthoxylum chalybeum* and *Terminalia sericea*.

In 1998 ICRAF and Agriculture Research Institute in Tumbi (ARTI) started training women groups in processing of indigenous fruits into juices, jams, and wines. To date, about 2100 women from 41 women groups have been trained in agro-processing around Tabora. The trained women are now involved in processing various products, which include peanut butter, pickles, juice, jam, wine, chutney, cake, cooking oil and beer among others. Some of the women trainees are now earning cash by selling their products in local markets at Tabora town, Mwanza, Arusha and Dar es Salaam.

About 100 farmers have introduced beehives in the woodlots. Honey harvesting has the potential to generate income for small holders as a profitable enterprise. More women are now participating in this activity that was previously dominated by men.

Lesson Learnt
Recognising roles of gender and culture

The Miombo Woodlands Project illustrated the need for project designers to be aware of the role of gender in the community. While 40 people including men originally joined the fruit processing project, only 20 remained in the group. As the fruit processing involved cooking which is generally women's work the men dropped out. The Miombo Woodlands Project in Tanzania highlighted some interesting cultural lessons for promoting native fruits as a means of increasing nutritional diversity. When interviewed one of the women from the Mpombwe Village in the Sikonge District stated that her husband feels ashamed and cannot eat guava in front of his children but if she makes guava juice he feels proud taking in front of his children. This has also been observed with regard to other indigenous fruit, which people generally regard them to be inferior and only fit to be eaten by children, but when processed into jam and juice they are widely accepted and consumed.

Oduol *et al* (2004)

Lesson Learnt
Making Food Security Cost Effective

Dialogues with participants of the Miombo Woodlands Project have found that even when the production technologies are available for processing wild fruit varieties the equipment (such as bottles and seals) needed to safely process the food items are very expensive, inhibiting larger scale production of food products.

The Miombo Woodlands Project found that despite the enthusiasm of the community to adopt new techniques for fruit and honey production the lack of market information, unstable prices, high market fees, poor storage and packaging facilities, poor quality control and use of obsolete technologies (and the risk of snakebites during fruit collection) were considerable barriers to making these viable enterprises. Inadequate extension services and poor research facilities also affect development of the industry. Furthermore, the complex and expensive certification process by Tanzania bureau of standards serves to limit the commercialisation of forest products.

Oduol *et al* (2004)

**Kalinga Mission for Indigenous Children and Youth Development Inc.
(KAMICYDI) - Philippines**

Based on presentation by Donato B. Bumacus (Kalinga Mission for Indigenous Children and Youth Development, Inc) at the Fourth Asian Regional Session of the Global Biodiversity Forum (GBF): Southeast Asia, 20 – 23 June, 2004, Manila, Philippines; and information prepared by D.B. Bumacus for the Equator Initiative Awards 2004 (UNDP, 2003)

Like many indigenous communities around the world, the Kalinga way of life has been threatened by a lack of legal recognition of land tenure and traditional modes of land use, spiritual ties and indigenous based legal systems. The Philippines government has claimed indigenous land as belonging to the state, which has opened the land up to exploitation. Indigenous lands have been targeted for the development of large infrastructure projects including hydroelectric dams and geothermal power stations that have destroyed or defiled sacred sites as well as key agricultural areas.

The Kalinga have a long history of traditional land management practices that support their diet of rice, root crops, and other vegetables. Like many indigenous peoples around the world, the Cordillera lifestyles and cultures are shaped and nourished by the wealth of their environment. In their belief systems, trees, rivers, mountains and natural elements are regarded as sacred dwelling places of ancestral spirits which must be regarded with utmost respect.

To strengthen their capacity to cope with the challenges of poverty reduction, food security and protection of traditional lands, many indigenous communities throughout the Philippines have formed Indigenous People's Organisations (IPOs). The KAMICYDI group, made up of indigenous peoples, students and professionals, formed as an IPO in 1984. This group used its peoples respect for the environment and traditional knowledge to help foster sustainable development. In particular, encouraging traditional methods of sustainable harvest of wild animals has helped meet protein needs within local communities, but has been paired with activities to ensure forest protection. Returning watershed management responsibilities to families as a part of the PINAGWA system has encouraged reforestation, but has also enabled families to guard and protect their resources. And, a communal irrigation systems has connected these watersheds to rice fields, to improve irrigation. Over 90 systems have been repaired and 18 new irrigation systems have been constructed. This in conjunction with the changes in watershed management allows continuous supply of water to local rice terraces. Finally, the group has encouraged introduction of fish and vegetables into rice terracing systems, which has

improved the nutritional diversity of local diets and ensure greater food security.

KAMICYDI was working for more than ten years before it was officially registered as with the Philippines Securities and Exchange Commission in 1996. This formal registration has been essential to cement the group's voice as an advocate for law change, and garner funding support for the expansion of the technologies introduced by the project.

KAMICYDI has created the conditions necessary for achieving food security by looking at elements of the natural environment holistically and recognizing the value of traditional agricultural practices in ensuring sustainability. Forests, water, rice terraces, fish and vegetables are used in an integrated fashion as has been done for centuries. The project has worked in seven indigenous communities in Kalinga (with 1,071 households or families). The results have been impressive, in the poorest regions, family incomes have increased by 36%, and reports indicate that this work has allowed protection of 81% of forested lands in the province of Kalinga, including many hectares of old growth forest.

The KAMICYDI group has ensured it is able to “scale up” the effects of its work by undertaking advocacy and creating partnerships to replicate sustainable technologies, encourage multi-stakeholder partnerships in implementing the technology and advance policies sympathetic to traditional management. To date they have formed effective partnerships with nine local government units, who have become members of local indigenous networks. Other indigenous groups in the Cordillera and other parts of the Philippines have requested help to replicate this project and where funding has permitted the project has responded. Other indigenous communities in neighbouring communities have now learnt from the initiative and today rice terraces exist throughout the Cordillera Administrative Region with a total of 72% of the forest resources being protected. This equates to the protection and sustainable management of 108 watersheds.

The KAMICYDI group has become a respected voice in their community. Their advocacy efforts were successful in influencing the passage of the Banaue Rice Terraces Commission, Indigenous Peoples Rights Act of 1997 and termination of environmentally destructive project such as Chico River Dam Project and Batong Buhay Gold Mines, Inc.

Some of the traditional methods advocated by the KAMICYDI group have included:

The group initiated the Kalinga School of Heritage and Living Tradition to teach local communities about traditional farming methods and enabled the sharing of traditional knowledge from one generation to another Promoting Sustainable Indigenous Peoples Environment Friendly Enterprise Development (SIPEFED) utilizing indigenous arts and handicrafts in promoting environment friendly “One Community, One Product Manufacturing” to generate income and employment. As a result, KAMICYDI successfully joined in local and national trade fairs and won awards

A Mobile Environment & Enterprise Education (Mobile e3) program was initiated for Indigenous Peoples Women, Children and Youths to empower them to protect their environment and assist them establish alternative livelihood/enterprise to generate income & employment. This is particularly important for those peoples that do not own rice terraces themselves.

Promoting Biodiversity and Women's Health through SIPAT transfer in Tabuk as the only alternative to a highly chemically dependent farming system. As a result, we put up a Community Learning Farm to transfer SIPAT and promote the use of traditional rice varieties (TRVs). At present, high nutritious red rice or UNOY and organic products like beans, mongo and coffee are being sold.

Lesson Learnt : Recognising Traditional Knowledge and Land Ownership

The KAMICYDI group's success lay in its ability to build on existing traditional knowledge to improve the sustainability of local agriculture and forest management. Its use of effective advocacy techniques and willingness to share information with other NGOs and tribal groups and create partnerships with local government has meant that the technology has spread throughout the Philippines. They have also been willing to share fiscal resources where available so that other groups can take up appropriate technology.

The KAMICYDI group found that the growing international concern for environmental protection was significant threat to many indigenous communities of the Philippines. International financing was seen to be attracting greater interest in the protection of remaining forests and unexploited areas. Government agencies and non-government organisations were perceived to compete for funds and control over what are, in fact, indigenous lands. This further compounded the problems associated with the disregard for prior rights of tribal communities. Thus, most indigenous people's organizations (IPOs) appeal to international funding agencies to channel their funds directly to indigenous peoples so as to have global impact.

Bumacas (2004)

Making the links – A summary of the key outcomes

Making the link between on-ground field actions, Global Conventions and country level policies is often considered exceedingly difficult but essential if we are to reduce the gap between the decision makers and those most reliant on the natural environment for their day to day existence.

The case studies presented in this publication have shown a range of approaches to integrating conservation actions with poverty reduction and climate change adaptation and mitigation. With recent disasters such as the Asian Tsunami and Hurricane Mitch actions such as coastal forest restoration and sustainable agricultural practices have come under close scrutiny for their ability to not only deliver biodiversity conservation benefits but also disaster mitigation. Similarly, in times of threatened food security the use of grain banks and seed selection becomes a heightened issue.

We invite you to examine the summary in table below to see how actions can have numerous benefits and presented in this section

Dimensions of Poverty	Entry Points	Suggested national policy/political interventions	
		Climate Change Adaptation and Mitigation (as indicated by Kyoto Protocol and lessons from field projects)	Biodiversity Conservation (as indicated by CBD and lessons from field projects)
<p>Lack of assets and opportunities</p>	<ul style="list-style-type: none"> - Employment - Value-added investments - Access to capital, technology and markets - Resource tenure - Trade Policy - Competition Policy 	<ul style="list-style-type: none"> • Investigate ways to create employment opportunities associated with reforestation programs, building or operation of renewable energy systems, construction of technology for cleaner production or recycling projects. • Undertake agronomic research to identify crops that show resistance to drought or water logging. Train agricultural extension officers to assist farmers in diversifying crops, shifting to greenhouse or intensive agriculture (where appropriate) and practicing methods in soil conservation and water conservation to buffer against the effects of drought. • * Promote markets in ecosystem services (through incentives or market instruments) to reward communities that maintain carbon sinks or undertake reforestation and watershed protection activities to benefit downstream users. 	<ul style="list-style-type: none"> • Investigate means to improve small businesses as biodiversity conservation (Bovarnick and Gupta) • Investigate local means of sustainable non-timber forest products, fruits, fibres, construction or medicinal plants increasing their production through nursery forestry enterprises. • Investigate transfer to compensate losses community steward commitments. • Build measures of sustainable use or certification agreements that use products so as not to detract from communities. • Encourage the uptake of agricultural practices soil biodiversity and productivity thereby reducing pressures on in-situ • Support research to seek to identify potential traditional crop species develop means for their integration in agriculture

			<p>production.</p> <ul style="list-style-type: none"> • Assess competition ensure fair trade of products and ensure are sympathetic to i farmers and process biodiversity produc • Promote markets in services that support livelihoods and pro for local and indige communities in retu protection of impor biodiversity*.
Power and Voice	<ul style="list-style-type: none"> - Participation - Democratic decision making - Rule of law (equality before law) - Access to information - Accountability and transparency 	<ul style="list-style-type: none"> • Develop and implement education and public awareness programs on climate change to improve understanding of the importance of mitigation measures. • Design early warning systems in conjunction with local communities so as all parties understand predictions of climate change impacts and their roles in adaptation or mitigation measures. • Ensure rules governing cleaner production or use of environmentally friendly technologies take into account the financial capacity of individuals and organisations to meet environmental requirements. 	<ul style="list-style-type: none"> • Investigate possible for the reform of po legislative systems recognise and guaran rights and responsib indigenous and loca communities to play managing natural re access common pro resources. This may processes of restitut rights were previou away. • Ensure thorough co consultation at onse management projec adequate assessment economic impacts a to access and benef specific gender need
Vulnerability	<ul style="list-style-type: none"> - Diversification - Insurance - Prevention - Early 	<ul style="list-style-type: none"> • Identify areas of greatest vulnerability to climate change i.e. small islands: low-lying coastal zones: arid 	<ul style="list-style-type: none"> • Investigate ame forest regulation access to non-ti products by loca



	warning/prediction systems	<p>and semi arid areas: areas liable to floods, drought and desertification; fragile mountainous ecosystems; areas vulnerable to salinity and establish appropriate early warning systems and land management systems to minimise the effects on vulnerable populations.</p> <ul style="list-style-type: none">• Identify infrastructure in climatically vulnerable areas that can be used for food banks and permanent water sources to minimise the effects of hunger and thirst during times of drought or flood.• Identify potential hotspots for diseases induced by climate change i.e. vector borne diseases such as malaria and dengue and investigate ways to reduce the intensity of outbreaks• Assess the capability of existing infrastructure i.e. bunds, drains, waste water disposal systems and altered river courses to cope with increased rainfall, to prevent the spread of water borne diseases such as cholera and dysentery. (- some of these changes would be too expensive to undertake immediately – worth emphasizing that future projects should be planned with these considerations in	<p>communities du hardship.</p> <ul style="list-style-type: none">• Allocate preference and resources for up of actions and that bridge gaps conservation and development.• Promote a food build pride in m local agro-biodi increase the nut diversity of loca• Promote initiati seed saving netw seed banks to en conservation of biodiversity and supplies of seed nutritional diver absence of food markets and to adequate suppli following droug (could link this study?• Support initiativ promote ex-situ of biodiversity livelihood or fo such as agro-for nurseries, kitcha and plantations• Investigate mea biodiversity for livelihood (or lo options such as
--	----------------------------	--	---

		<p>mind).</p> <ul style="list-style-type: none"> • Support research, promotion and local innovation for cleaner production systems and new and renewable forms of energy at the household level, especially for areas where lack of available energy has severe ramifications for health during times of intense cold or heat or there is an over reliance on firewood. • Provide training for extension staff to assist women's groups in identifying special needs for women and children as part of disaster mitigation plans i.e. special child/mother clinics during flood and drought. 	
<p>Lack of capacity and capability</p>	<ul style="list-style-type: none"> - Literacy - Health - Provision of basic services - Access to information 	<ul style="list-style-type: none"> • Provide training for local agricultural and/or community development officers to assist households prepare emergency plans that complement early warning systems for natural disaster. • Ensure access women are able to access appropriate micro-finance programs to employ new technologies or seek financial assistance during times of hardship. • Investigate means of creating support groups for women who are landless or have lost family so as they have a 	<ul style="list-style-type: none"> • Conduct research on agro-biodiversity security options for production and consumption of bush fruits, vegetables, meats and invest in the development of linking this production to local markets. • Support the development of local language radio to inform communities of new rules and regulations involving biodiversity conservation or community awareness conservation of the need to protect ecosystems.

		<p>safety net during times of drought or flood.</p> <ul style="list-style-type: none"> • ** Encourage the inclusion of traditional knowledge on climate change and associated adaptation and mitigation practices in both formal school curricular and in community development training programs. • Encourage projects that build social capital in the form of effective partnerships or relationships between different sectors of the community so as to increase the effectiveness of early warning systems and emergency response operations. 	<ul style="list-style-type: none"> • Recognise local actions leading to the achievement of global targets i.e. Equator Awards, local involvement, knowledge networks allow the sharing of information, experience and innovations. • Provide support for programs, exchange programs and other initiatives for sharing information on best design and new approaches for combining conservation and development. • ** Encourage the use of traditional knowledge and modern biodiversity conservation practices both formal school and in community development training programs to encourage recognition of biodiversity and its components and the need for sustainable practices.
--	--	---	--

* The use of incentives in direct or indirect form is a frequently debated and emerging area of environmental economics. A critical review of the use and misuse of incentives can be found in Giger (1999). The 19th GBF acknowledged incentives for alternative energy uptake and biodiversity conservation (as called for in Article 11 of the CBD) need to be considered more broadly in the context of CBD Article 6b as impacts on biodiversity and energy are likely to be profound and extend beyond issues of climate change.

** Ideally these education actions for climate change adaptation and biodiversity conservation should be delivered in a way that recognises the synergies between both sectors and conventions.

References

- Agrawala S., Ota T., Ahmed A.U., Smith J. and van Aalst, M. (2003) Development and Climate Change in Bangladesh: focus on coastal flooding and the Sundarbans. Working Party on Global and Structural Policies. Organisation For Economic Co-Operation And Development.
- African Energy Policy Research Network - AFREPREN (2004) Bangladesh NAPA proposal: enabling activities to facilitate the preparation of a National Adaptation Programmes of Action (NAPA) for Bangladesh. Proposal for funding for the preparation of a National Adaptation Programmes of Action (NAPA) May 2004
- Balakrishna, P. and Warner, E. (2003) Biodiversity and the Millennium Development Goals. IUCN Regional Biodiversity Program and UNDP. Sri Lanka. 40 pages.
- Bumacus, D.B. (2004) Kalinga Mission For Indigenous Children And Youth Development, Inc. (KAMICYDI). Presentation to the Fourth Asian Regional Session of the Global Biodiversity Forum (GBF): Southeast Asia – 20 – 23 June, 2004, Manila, Philippines.
- Chambers, R. and Conway, G. (1992) *Sustainable rural livelihoods: Practical concepts for the 21st century*. Institute of Development Studies discussion paper no. 296. Brighton, GB: University of Sussex Institute of Development Studies, 1992. 42 p.
- de los Reyes A.J. and de los Reyes A.M. (1987) *Igorot: a people who daily touch the earth and sky* (Baguio City: Cordillera Schools Group, 1987). http://daga.dhs.org/cca/resources/ctc/ctc02-02/ctc02-02h.htm#_ftn1
- de Sherbinin, A. Dompka, V. and Bromley, L. 1996 Water and Population Dynamics: Case Studies and Policy Implications. Report of a Workshop produced as a companion to the IUCN (World Conservation Union), PRB (Population Reference Bureau), and USAID summary booklet titled "Water and Population Dynamics: Local Approaches to a Global Challenge" October 1996 Montreal, Canada <http://www.aaas.org/international/ehn/waterpop/front.htm>
- Dery, B.B., Otygina, R., and Ngatiwa C. (1999). Indigenous knowledge of medicinal trees and setting priorities for their domestication in Shinyanga region, Tanzania. ICRAF report 87p.
- Dougherty, B, Abusuwar, A and Abdel Razik, K (2001) Community Based Rangeland Rehabilitation for Carbon Sequestration and Biodiversity SUD/93/G31 Report of the Terminal Evaluation. April/May 2001 UNDP (Unpublished)
- Dregne, H. E., and N-T. Chou. 1992. Global desertification dimensions and costs. In *Degradation and restoration of arid lands*. Lubbock: Texas Tech. University.
- FAO (1997) Preventing Micronutrient Malnutrition - A Guide to Food-based Approaches: Why policy makers should give priority to food-based strategies. Prepared by Food and Agriculture Organization of the United Nations and International Life Sciences Institute

FAO (1998) The State of the World's Plant Genetic Resources for Food and Agriculture. Prepared by Food and Agriculture Organization of the United Nations. Rome.

Fisher R. J. (1995) Collaborative Management of Forests for Conservation and Development. IUCN - The World Conservation Union and World Wide Fund for Nature. September 1995

Gerrits A, 1999. Indigenous knowledge about fodder trees and shrubs. AFRENA report (in press). Kabale, Uganda

Giger, M. (1999) Avoiding the Shortcut: moving beyond the use of direct incentives. A review of experience with the use of incentives in projects for sustainable soil management. Centre for Development and Environment. Institute of Geography. University of Berne. Switzerland.

Griffin, W (2004) Garifuna NGO Recognized for Protecting the Environment. Honduras This Week Online. Published by Marrder Omnimedia
<http://www.marrder.com/htw/special/environment/120.htm>

Holt-Giménez, E (2000) Measuring Farmers' Agro-ecological Resistance to Hurricane Mitch in Central America. World Neighbors.
<http://www.agroecology.org/people/eric/resist/synopsis.htm>

IUCN (2003) Global Biodiversity Forum – Third Regional Session for Asia. Workshop on Sustainable Development and Livelihoods. Islamic Development Bank, Bhaban, E/8-A Rokeya Sharani, Sher-e-Bangla Nagar Dhaka, Bangladesh. Hosted by IUCN (World Conservation Union) 16-18 June 2003 online: <http://www.gbf.ch/>

IUCN (2004) *Treading Water*. Fact Sheet prepared by IUCN Bangladesh, House #11, Road #138, Gulshan 1, Dhaka 1212 Bangladesh. Unpublished

IPCC (2001a) *Climate Change 2001: Impacts, Adaptation and Vulnerability*. (Editors James J. McCarthy, Osvaldo F. Canziani, Neil A. Leary, David J. Dokken and Kasey S. White) Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change Published for the Intergovernmental Panel on Climate Change. Cambridge Press 1032 pages Online:
http://www.grida.no/climate/ipcc_tar/wg2/index.htm

IPCC (2001b) *Climate Change 2001: Mitigation*. Contribution of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change Published for the Intergovernmental Panel on Climate Change. Cambridge Press 1032 pages Online: http://www.grida.no/climate/ipcc_tar/wg3/index.htm

Kaimowitz, D. (2000) Useful Myths and Intractable Truths: The Politics of the Link Between Forests and Water in Central America, Unpublished Manuscript, Centre for International Forestry Research (CIFOR).

KARI-KEFRI-ICRAF(1998) *Calliandra* for livestock. Technical Bulletin No.1. Kenya Agricultural Research Institute, Kenya Forestry Research Institute and The International Centre for Research in Agroforestry. Embu, Kenya.

Lanka Business Online (2004) *Drinking Poison*. 21 May 2004 11:30
<http://www.lankabusinessonline.com/archiveView.php?newsCode=1252802259>

Lawrence , A.R. and Kuruppuarachchi D.S.P. (1986) Review of the Pollution Threat to Ground Water in Sri Lanka. *Journal of the Geological Society of Sri Lanka* Vol. I (1988):85 - 92.

Listorti, J.A. and Dourmani, F.M. (2000) Environmental Health: *Bridging the Gaps*. WORLD BANK DISCUSSION PAPER NO. 422 *Africa Region Finance, Private Sector and Infrastructure Family*. Online:
<http://www.worldbank.org/afr/environmentalhealth/wholebook.pdf>

Maghembe J, Simons A.J. and Kwesiga F (eds) 1998. Selecting indigenous fruit trees for domestication in southern Africa: Priority setting with farmers in Malawi, Tanzania, Zambia and Zimbabwe pp 1-85. Nairobi, Kenya.

Ministry of Environment and Natural Resources (2002) Impacts of Unsustainable Agriculture on Quality of Groundwater with Special Reference to Kalpitiya Peninsular. (Dr D.S.P. Kuruppuarachchi) Position Paper prepared for National Action Plan for Combating Land Degradation in Sri Lanka. Natural Resources Management Division, Department of Environment and Natural Resources Rajamalwatta Road, Battaramulla. Sri Lanka. http://www.unccd.int/actionprogrammes/asia/national/2002/sri_lanka-eng.pdf

MOPE (2002) Nepal National Action Plan on Land Degradation and Desertification. Ministry of Population and Environment. Kingdom of Nepal.

Muyanga, M. (2004): Household Food Insecurity In Agro Semi Arid Lands: Underpinning and Coping Strategies, Paper Prepared for NARO Conference.

Navajas, H (1994) Integrated Programme for Environmental Conservation and Cultural Revitalization: la Mosquitia & the Caribbean coast. Monitoring Report on Programme Activities – 1994. UNDP and Government of Honduras. March 1995

Nsubemuki L, Ramadhani T, Nyakimori, Swai R and Mziray W. 1997. Status of use and marketing of Miombo of fruits in Tanzania. Paper presented to the planning workshop on domestication of indigenous fruits of the Miombo, Mangochi, Malawi, 2-5 June 1997.

Oduol, P.A. Swai, R. and Mhwambo, L. (2004) Valuarisation of Miombo Biodiversity for Poverty Alleviation and Food Security. World Agroforestry Centre, Tabora, Tanzania

OECD (2001) Strategies for Sustainable Development: Practical Guidance for Development Co-operation. Organization for Economic Cooperation and Development Available at <http://www.nssd.net/pdf/gsuse.pdf>

Olusola O. B. and Yemisi A. (2003) Improving Traditional Cassava Processing for Nutritional Enhancement. Paper presented at the Second International Workshop on Food-based approaches for a healthy nutrition. Ouagadougou, Burkina Faso 23-28 / 11 / 2003. http://www.univ-ouaga.bf/fn2ouaga2003/abstracts/0602_FP_Int3_Nigeria_Oyewole.pdf

Oviedo, G.T.C (2004) Poverty and Conservation - *IUCN's Approach to Conservation: Making it work for People's Livelihoods*. Plenary Speech made to 4th Regional Session of the Global Biodiversity Forum – Southeast Asia Gonzalo T. Oviedo C. IUCN Senior Adviser, Social Policy, Manila June 2004

Pisupati, B and Warner, E (2003) *Biodiversity and the Millennium Development Goals*. IUCN Regional Biodiversity Program, Colombo, Sri Lanka.

Spanger-Siegfried, E. Hanafi, A. Zaki-Eldeen, S. Goutbi, N and Osman, B. (2005) *The Role of Community-Based Rangeland Rehabilitation in Reducing Vulnerability to Climate Impacts: Summary of a Case Study from Drought-Prone Bara Province, Sudan*. Prepared for the IC/IISD/IUCN/SEI project on Climate Change, Vulnerable Communities and Adaptation. Unpublished

Singh, N. and Vangile T. (1994) *Adaptive strategies of the poor in arid and semi-arid lands: in search of sustainable livelihoods*. IISD working paper. Winnipeg: International Institute for Sustainable Development. 31 p.

Stockholm Environment Institute (2001) *Implementing Sustainability – Sustainable Livelihoods*. Definitions.

<http://www.york.ac.uk/inst/sei/sustainability/livelihoods/def.html>

Telford, J. Arnold, M and Harth, A. (2004) *Learning Lessons from Disaster Recovery: The Case of Honduras*. Working Paper Series No. 8. The World Bank Washington, D.C. June 2004

Temu RPC and Chihongo A. 1998. Field survey of wild and under utilised edible plants of Ruvuma region, Tanzania. COSTECH Dar es Salaam 46p.

UICN. 2000. *Comunidades y Gestión del Bosque en Mesoamérica*, Series Forest, people and policies, San José: CICAFOC/UNOFOC/UICN.

UNCCD (2004) *Draft Framework Background Document*. South Asia Sub-regional Workshop on the Development of the Sub-regional Action Program for Combating Desertification and Promoting Sustainable Land Management (SA-SRAP) 2nd July 2004. 5-8th July Colombo Sri Lanka

United Nations (1992) *Convention on Biological Diversity*. Online:

<http://www.biodiv.org/doc/legal/cbd-en.pdf>

United Nations (1992) *United Nations Framework Convention on Climate Change*.

Online: <http://unfccc.int/2860.php>

UNDP and UNICEF (2002) *The Millennium Development Goals in Africa: promises & progress*. Report prepared by UNDP and UNICEF at the request of the G-8 Personal Representatives for Africa New York • June 2002.

<http://www.undp.org/mdg/mdgreportinafrica.pdf>

UNDP (2003) *Human Development Report 2003*. Millennium Development Goals: A compact among nations to end human poverty. United Nations Development Program. Oxford University Press, New York.

UNDP (2003) *Equator Prize 2004 Nomination Reports*. Prepared by the Technical Advisory Committee of the Equator Initiative. United Nations Development Program. 15-17th November 2003. Montreal, Canada.

UNEP (2004) 'Alien Species' Secretariat of the Convention on Biological Diversity. United Nations Environment Program <http://www.biodiv.org/programmes/cross-cutting/alien/>

UNEP and WCMC (2003) Press Release: 'You Have Got Seven Years '2010 Global Biodiversity Challenge Begins the Race for Life' United Nations Environment Program and World Conservation Monitoring Centre, Montreal, 22nd May 2003 available at http://www.unep-wcmc.org/gbc/press_release.htm

UNEP, UNICEF and WHO (2002) Children in the New Millennium: Environmental Impact on Health. Online: <http://www.unep.org/ceh/>

United Nations and Asian Development Bank (1995) State of the Environment in Asia and the Pacific. Economic and Social Commission for Asia and the Pacific. United Nations, New York. 638 pages

Velasco, Y (2003) Overview of the United Nations Framework Convention on Climate Change: Synergies with other Conventions. (Eds. Dharmaji, B., Pisupati, B., Baulch, H.) *Mainstreaming Biodiversity and Climate Change: Proceedings of the Asia Regional Workshop*. Regional Biodiversity Program - Asia, IUCN. Colombo Sri Lanka

Watson, R.T. Zinyowera M.C. and Moss R.H (2000) The Regional Impacts of Climate Change: an assessment of vulnerability (Editors Robert T. Watson, Marufu C. Zinyowera, Richard H. Moss and David J. Dokken. Produced for 6th Conference of the Parties to the United Nations Framework Convention on Climate Change in The Hague, The Netherlands, 13-24 November 2000. Online: <http://www.grida.no/climate/ipcc/regional/index.htm>

WCED 1987 *Our Common Future*. World Commission on Environment and Development Oxford University Press. p43

WHO (2002) Health in the Context of Sustainable Development. Background Document. Prepared by Y. von Schirnding and C. Mulholland for World Health Organisation meeting 'Making Health Central to Sustainable Development: Planning the Health Agenda for the World Summit on Sustainable Development.

Williams, J. (2001) *Australia State of the Environment Report 2001 (Theme Report)*. Prepared by: Dr Jann, RMIT University. CSIRO Publishing on behalf of the Department of the Environment and Heritage. Commonwealth of Australia.

World Bank (2000) World Development Report 2000/2001: Attacking Poverty. August 2000. Oxford University Press. 352 pages online: <http://www.worldbank.org/wbp/wdrpoverty/report/index.htm>

World Commission on Environment and Development 1987 *Our Common Future*. Oxford University Press. p43

Sumaya Zaki-Eldeen and Ahmed Hanafi Abdel-Magid 2004 Environmental Strategies for Increasing Human Resilience in Sudan: Lessons for Climate Change Adaptation in North and East Africa. Case study report prepared for Assessment of Impact and Adaptation to Climate Change (AIACC) project AF-14: Environmental Strategies for

Increasing Human Resilience in Sudan: Lessons for Climate Change Adaptation in North and East Africa (Balgis M. Osman and Nagmeldin Goubti, Higher Council for Environment and Natural Resources, Sudan, and Erika Spanger-Siegfried, Stockholm Environment Institute, USA) Khartoum, June 2004.

http://www.aiaccproject.org/aiacc_studies/aiacc_studies.html