

A COMPENDIUM OF CASE STUDIES



Advance Guard

CLIMATE CHANGE IMPACTS, ADAPTATION,
MITIGATION AND INDIGENOUS PEOPLES

Kirsty Galloway McLean



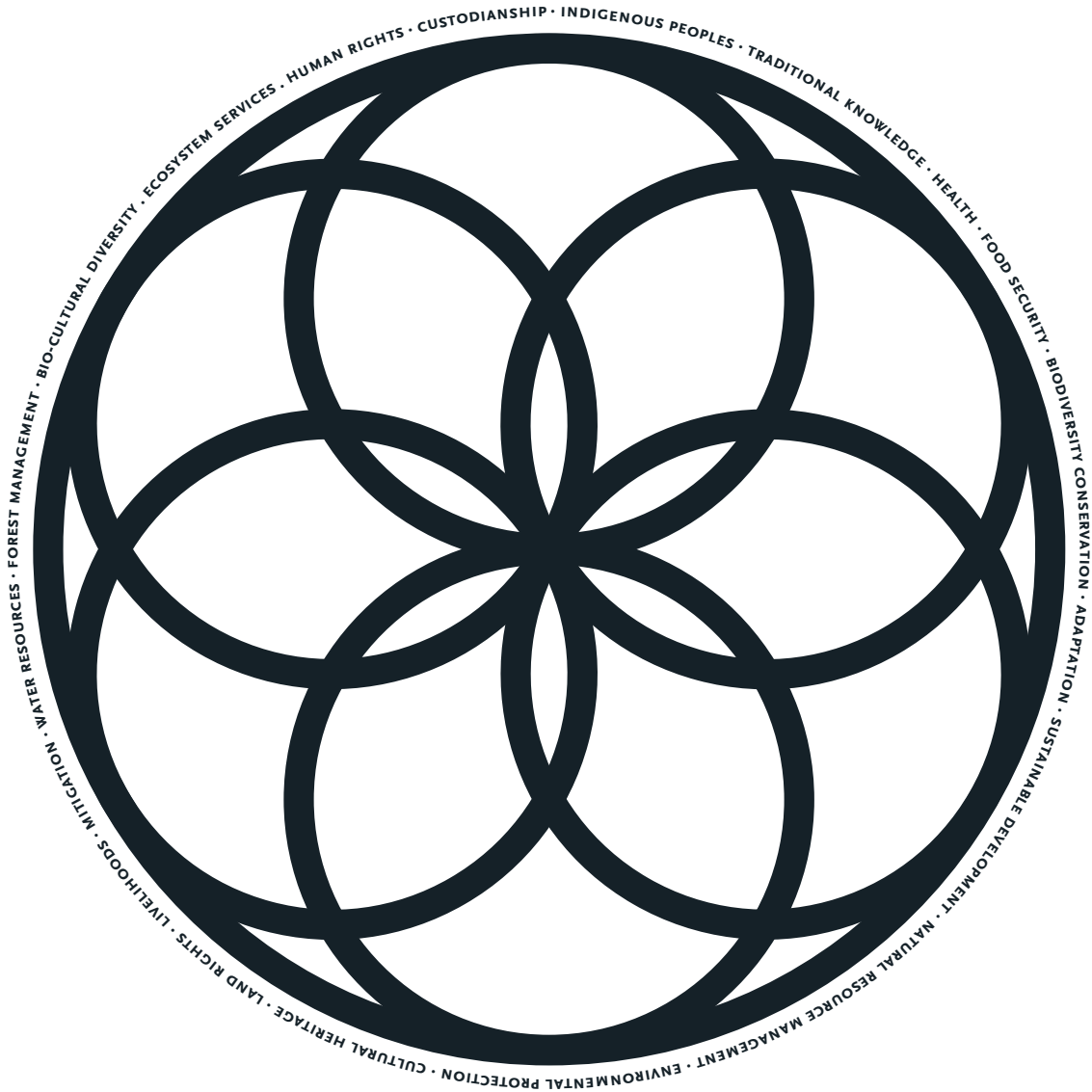
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MITIGATION AND INDIGENOUS PEOPLES**

Kirsty Galloway McLean

*United Nations University – Institute of Advanced Studies
Traditional Knowledge Initiative*

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Design

The cover design by Qualia Creative is based on the “Flower of Life” symbol, which has appeared in many cultures all over the world and symbolises creation, growth, and universal energy. In addition, this symbol also reflects a Venn diagram representing collaboration across communities and the sharing of knowledge.

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Disclaimer

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EXECUTIVE SUMMARY

This compendium presents a wide-ranging overview of more than 400 projects, case studies and research activities specifically related to climate change and Indigenous Peoples. It provides a sketch of the climate and environmental changes, local observations and impacts being felt by communities in different regions, and outlines various adaptation and mitigation strategies that are currently being implemented by Indigenous Peoples – the world’s “advance guard” of climate change – as they use their traditional knowledge and survival skills to trial adaptive responses to change.

Effective adaptation planning relies on the best available knowledge base, and the urgent need to respond to the pressures of climate change has put a premium on the generation, interpretation and use of information in this regard. In recent years, there has been an increasing realisation that the observations and assessments of indigenous groups provide valuable local level information, offer local verification of global models, and are currently providing the basis for local community-driven adaptation strategies that are way past the planning stage and are already being implemented and tested.

Local observations of direct effects of climate change by Indigenous Peoples corroborate scientific predictions, and include temperature and precipitation changes; coastal erosion; permafrost degradation; changes in wildlife, pest and vector-borne disease distribution; sea-level rise; increasing soil erosion, avalanches and landslides; more frequent extreme weather events, such as intense storms; changing weather patterns, including increasing aridity and drought, fire and flood patterns; and increased melting of sea-ice and ice-capped mountains.

Specific vulnerabilities and early effects being reported by Indigenous Peoples include cultural and spiritual impacts; demographic changes, including displacement from their traditional lands and territories; economic impacts and loss of livelihoods; land and natural resource degradation; impacts on food security and food sovereignty; health issues; water shortages; and loss of traditional knowledge. Impacts are felt across all sectors, including agriculture and food security; biodiversity and natural ecosystems; animal husbandry (particularly pastoralist lifestyles); housing, infrastructure and human settlements; forests and natural resource management; transport; energy consumption and production; and human rights.

In spite of these impacts, Indigenous Peoples also have a variety of successful adaptive and mitigation strategies to share. The majority of these are planned adaptive responses that are based in some way on their traditional ecological knowledge, whether they involve modifying existing practices or restructuring their relationships with the environment. Indigenous strategies include application and modification of traditional knowledge; shifting resource bases; altering land use and settlement patterns; blending of traditional knowledge and modern technologies; fire management practices; changes in hunting and gathering periods and crop diversification; management of ecosystem services; awareness raising and education, including an increasing use of multimedia and social networks; and policy, planning and strategy development.

This report incorporates material from different disciplines and covers a diversity of approaches to data collection and project reporting drawn from the literature. Whilst the compendium of projects and case studies does not claim to provide an exhaustive list of ongoing activities related to climate change and Indigenous Peoples, it does contain a representative and illustrative survey of current effects and adaptive responses. It is hoped that this review provides an insight into the ecological and cultural complexity of sustainable development issues surrounding climate change and Indigenous Peoples, and highlights instances that may be useful in providing guidance for future policy development.

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388	FAO	Globally Important Agricultural Heritage Systems initiative (GIAHS)	
389	FIRST PEOPLES WORLDWIDE	Indigenous Stewardship Initiative	
390	FIRST PEOPLES WORLDWIDE	The Indigenous Peoples Climate Action Fund	
391	GAIA FOUNDATION	Community Ecological Governance	
392	GEF	Community Management of Protected Areas for Conservation (COMPACT)	
393	GEF/UNDP	Small Grants Programme	
394	IIED	Community Based Adaptation Exchange (CBA-x)	
395	IFAD-IFPRI	Strategic Partnership to Develop Innovative Policies on Climate Change Mitigation and Market Access	
396	INTERNATIONAL ALLIANCE	The Indigenous People's Network for Change	
397	INSIGHT	Indigenous Issues Climate Change (video)	
398	IPCCA	Indigenous Peoples' Climate Change Assessment Project	
399	IUCN	Indigenous and Traditional Peoples and Climate Change	
400	UN-REDD	UN-REDD Programme (FAO, UNDP, UNEP)	
401	MSV	Many Strong Voices	
402	TBTEBBA	Indigenous climate portal	
403	PFAR	Agrobiodiversity and climate change	
404	UNDP-GEF	Community-Based Adaptation Program	
405	UNDP-RIPP	Asia-Pacific Regional Initiative on Indigenous Peoples' Rights and Development	
406	UNESCO	Management of Social Transformations (MOST) Programme	
407	UNESCO-NHK	Heritage Images Archive Initiative	
408	UNESCO-LINKS	Climate Frontlines	
409	UNESCO	Learning and Knowing in Indigenous Societies Today (LINKS)	
410	UNFCCC	Local Coping Strategies (Adaptation) Database	
411	UNU	Indigenous Perspectives on climate change videobrief series	
412	UNU	Traditional Knowledge Bulletin	
413	UNU	The REDD Site	
414	WORLD BANK	Climate Investment Funds (CIF)	
415	WORLD BANK	Development Marketplace (DM)	
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INTRODUCTION

BACKGROUND

Human activities, particularly fossil fuel based energy production and use, have led to increases in the atmospheric concentration of greenhouse gases (GHG), mainly carbon dioxide, methane and nitrous oxides. The primary direct impacts of such emissions on the environment include increases in the Earth's surface temperature, altered rainfall patterns, sea level rise, and increased frequency and severity of storm surges, floods, droughts and heat waves. These changes in turn have follow-on impacts that adversely affect many communities, for example through agricultural-related economic losses, reduced access to clean water, loss of livelihoods and increased incidences of vector and water-borne diseases.¹

There is now a strong consensus that climate change presents an urgent challenge to the well-being of all countries, particularly the poorest people living in them. Even if efforts to reduce GHG emissions are successful, it is no longer possible to avoid some degree of global warming and climate change. The poorest countries and communities of the world are likely to suffer the most because of their geographical location, low incomes, and low institutional capacity, as well as their greater reliance on climate-sensitive sectors like agriculture. Adaptation to climate risks and change therefore is increasingly important and countries are undertaking significant efforts to adjust to ongoing and potential effects of climate change.

Indigenous Peoples from all regions of the world have an identity and culture that depends upon the natural environment. Their rich and detailed traditional knowledge reflects and embodies a cultural and spiritual relationship with the land, ocean and wildlife. However, as human activity is changing the world's climate, it is altering the natural environment to which Indigenous Peoples are so closely attached and on which they so heavily rely.

Reflecting their role as environmental stewards of the environment and drawing upon their traditional knowledge, Indigenous Peoples are at the vanguard of climate change. They have been among the first communities to actively engage with the impacts of climate change – through recording their observations of changes in the climate and its effect on the natural environment, through implementing their own activities to adjust to ongoing and potential effects of climate change ('adaptation'), and through reaction to actions being taken by other countries to reduce greenhouse gas emissions ('mitigation').

Indigenous Peoples form approximately 5% of the world's population (between 250 to 300 million people). They manage 11% of the world's forest lands and customarily own, occupy or use 22% of the world's land surface. It has been estimated that within their lands and territories, they maintain an overwhelming 80% of the planet's biodiversity and are located in or adjacent to 85% of the world's protected areas.² It has been estimated that Indigenous lands and other protected areas created to safeguard land rights, indigenous livelihoods, biodiversity, and other values contain more than 312 billion tons of carbon.³ Ironically however, despite having contributed the least to global warming by traditionally leading 'low carbon' ways of life, they are disproportionately adversely affected by climate change because they usually live in ecosystems particularly prone to the effects of climate change (polar regions, small islands, high altitudes, humid tropics, coastal regions, deserts), because they are heavily dependent on lands and resources for basic needs and livelihoods (food, medicine, shelter, fuel, etc.), and because they are amongst the poorest people globally. Compounding these vulnerabilities, programs being implemented by non-indigenous people to mitigate and adapt to climate change also have the potential

to adversely affect Indigenous Peoples' livelihoods' as well as undermine their customary rights to lands and natural resources if not properly designed and implemented.

Climate change therefore poses a significant threat to the survival of Indigenous Peoples' communities. But at the same time, because of their close traditional relationship with the environment, Indigenous Peoples are uniquely positioned to adapt to climate change. Through their culture of intergenerational transmission of knowledge over thousands of years, Indigenous Peoples are unique repositories of learning and knowledge on successfully coping with local-level climate change and effectively responding to major environmental changes such as natural disasters. Historically and currently, Indigenous Peoples play a fundamental role in the conservation of biological diversity, protection of forests and other natural resources, and their traditional knowledge on climate change can also substantively enrich scientific knowledge and adaptation activities of others.

In a very real sense, therefore, Indigenous Peoples are the advance guard of climate change. They are the first communities to observe climate and environmental changes first-hand, and are already using their traditional knowledge and survival skills – the heart of their cultural resilience – to trial adaptive responses to these changes as they occur today. Moreover, they are doing this at a time when their cultures and livelihoods are already undergoing significant stresses due not only to the environmental changes from climate change, but influenced also by the accelerated development of natural resources from their traditional territories that has been stimulated by trade liberalisation and globalisation.

There is a significant amount of literature on projected, possible and likely impacts of climate change, and adaptive strategies that are being developed to combat these eventualities.⁴ However, this publication does not deal with theoretical assessments of potential responses, nor conjectures about how such measures might reduce climate damages under hypothetical scenarios of climate change. With an explicit focus on real-world behaviour, the attached compendium includes hundreds of examples of climate impacts already being observed by indigenous communities, and adaptive practices *currently* being implemented by Indigenous Peoples, in the hope that the global community can also learn from these invaluable experiences as we plan for our collective future.

The compendium includes projects and case studies that identify and conserve biodiversity; implement land, water and soil management practices that are based on traditional Indigenous knowledge; help increase the resilience of Indigenous Peoples to climate threats; and innovative adaptation plans and communication strategies based on Indigenous systems that are designed to accelerate learning and knowledge sharing on climate change adaptation. There is still much to study and understand about climate change and its effects on the biospheres and ecosystems that are important to Indigenous Peoples and other communities throughout the world. To this end, this compendium makes the experiences of many peoples available to their brother and sister communities in the hope that the lessons learned by one community can be shared with many, and work to benefit all.

The majority of projects that address Indigenous Peoples and climate change are small in scale and sample size, and are often reported only through specialised channels, or in non-professional and grey literature. This meta-analysis has therefore been undertaken to capture generalisations across case studies, and to ground individual community experiences in a more global context. The resulting information affirms and supports the observations and activities being reported at community level and, it is hoped, provides an impetus to enable future action.

Selection of projects and case studies for inclusion

Selection criteria

For inclusion in the compendium, projects and case studies were expected to meet both criteria listed below (i.e. relevant to both Indigenous Peoples and climate change).

(a) Relevance to climate change

Adaptation measures are rarely taken in response to climate change alone. Typically, indigenous initiatives to address or report on climate change are embedded within broader sectoral initiatives such as sustainable development, conservation of biodiversity, diversifying livelihoods, and disaster management planning. Therefore, many of the observations and interpretations given in the case studies reflect an interaction between climate change and other factors, rather than being the result of climate change in isolation.

An important criterion for inclusion in this compendium was that any observations or responses were identified by Indigenous Peoples participating in the process as deliberate responses to climate triggers.

For the purpose of this review, large scale (typically international) projects that included response to climate change as at least a secondary objective were included; while for the more numerous small scale projects, only those that included response to climate change as a primary objective were incorporated.

(b) Relevance to Indigenous Peoples

Projects were selected for inclusion in the compendium primarily on the basis that they demonstrated either full engagement by Indigenous Peoples (i.e. projects that were either implemented by an indigenous organisation, or designed exclusively to benefit Indigenous Peoples) or strong involvement of Indigenous Peoples (i.e. distinct components or sub-projects benefiting and targeting Indigenous Peoples, or carried out by an indigenous organisation).

Case studies that mainly comprised individual observations of climate change have typically been excluded, although reviews and case studies that took into account observations from a number of community representatives within a region were included.

In regions where Indigenous Peoples may lack recognition as Indigenous Peoples, relevant case studies may have been drawn from local populations who practice traditional lifestyles. In such instances, the population may, or may not, be indigenous to the location.

Coverage of activities

Entries in this compendium have been selected following a review of several thousand projects identified via major international reports and organisations, local and global assessments on the impact of climate change on Indigenous Peoples and their ways of life, case study databases, meeting reports, studies and reviews, web resources, and other reports. Where appropriate, this was supplemented by direct communication with indigenous organisations reporting on-the-ground impacts. The unpublished works selected for inclusion in the analysis required, at a minimum, to have been subject to some form of collaborative investigation (e.g. presentation and consideration at a regional workshop, or formal project review mechanism by a donor agency). Whilst the compendium does not claim to provide an exhaustive list of ongoing activities related to climate change and Indigenous Peoples, it does contain a representative and illustrative survey of current effects and adaptive responses.

Each entry in the compendium includes information about the primary country or region in which the activity is implemented, a short summary of the initiative and its outcomes, and reference details for further information. Activities selected for inclusion in the compendium typically address either the impacts of climate change on Indigenous Peoples, or adaptive activities being taken by them to address the effects of climate change.

The compendium focuses on reported impacts from climate change and adaptive responses that are being undertaken by Indigenous Peoples in response to, or in anticipation of, these impacts. Research projects that focus exclusively on possible future effects were excluded from the compendium. A selection of projects that may be considered “failures” by Indigenous Peoples (for example, projects that were intended to involve full engagement but did not do so) have also been included in the compendium to ensure that the lessons learned from such activities are also addressed. Annex II contains information about how to suggest activities for inclusion in a future edition of the compendium.

Detailed information on the case studies

The compendium incorporates material from different disciplines and covers a diversity of approaches to data collection and project reporting drawn from the literature. Because of the wide variety of sources, the studies examined include a mixture of published and peer reviewed literature, grey literature, informational websites and multimedia presentations. The nature of data, indicators and analyses used ranges from population ecology, vegetation analysis, climate modeling, and economic analyses, to interviews, inventories and cultural domain analysis. It therefore includes both quantitative and qualitative reporting. The projects from which the case studies have been drawn have, in most cases, produced a separate report or reports elsewhere, which contain more thorough discussions of methods, approaches, and results. References are provided to allow more detailed examination of each of these activities than is possible in this overarching review.

It is hoped that this review provides an insight into the ecological and cultural complexity of sustainable development issues surrounding climate change and Indigenous Peoples, and highlights instances that may be useful in providing guidance for policy development. The list of background materials in Annex I includes additional resources consulted in the creation of this review that provide access to a wide variety of literature that will be of use to the reader.

OVERVIEW OF IMPACTS OF CLIMATE CHANGE ON INDIGENOUS PEOPLES

The continued existence of Indigenous Peoples is intertwined with the success of their fragile environment and its resources. Many Indigenous Peoples depend on fishing, hunting and agriculture for their survival – and as foods, medicines, fuels and habitats are disappearing, small communities are suffering particular hardships, and indigenous cultures, traditions and languages are facing major challenges to their continued existence.

The effects of climate change alter according to specific locations and ecosystems, and Indigenous communities are interpreting and responding to these changes in creative ways, drawing on their traditional knowledge of the natural resource base and other technologies to find solutions. And just as the effects of climate change vary according to location, the strategies employed to cope with these changes vary; from introducing farming techniques in higher altitudes when the

mountain glaciers melt, to choosing animals with lower food requirements in drought prone areas. The specific and urgent vulnerabilities of indigenous and local communities of the Arctic and Small Island States are beginning to be recognised at an international level.⁵ However, Indigenous Peoples living at high altitudes, and in dry and sub-humid lands, are also reporting accelerated climate change, making indigenous and local communities in this region also highly vulnerable.

Most observations of impacts and responses are not stand-alone effects or measures, they are most likely related to a combination of factors – such as sustainable development or disaster management planning. The effects of climate change on Indigenous Peoples must also be viewed in the context of their usual status as marginalized peoples, in that climate impacts can sometimes magnify existing problems and reduce resilience. It is important to note, too, that despite the overwhelming focus in reporting on negative impacts, in some instances, climate change can bring new prospects for Indigenous Peoples, such as economic opportunities in clean energy generation through wind power, or provide access to new food sources.

Drawing on the case studies and projects covered in the compendium, the summaries below provide a brief overview of climate change projections as well as the effects being reported by Indigenous Peoples on a region-by-region⁶ basis, broadly in accordance with the continental-scale regions used by the Intergovernmental Panel on Climate Change, as well as the socio-cultural regions used by the UN Permanent Forum on Indigenous Issues: Africa, Arctic, Asia, Northern America, Latin America and the Caribbean, and the Pacific. This is followed by a sectoral introduction to the approaches being adopted by Indigenous Peoples across the globe as they react to these changes, and overarching observations about the contents of the compendium as a whole.

Africa

According to the regional climate projections of the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPPC 4AR)⁷, warming in Africa is very likely to be larger than the global annual mean warming throughout the continent and in all seasons, with drier subtropical regions warming more than the moister tropics. Annual rainfall is likely to decrease in much of Mediterranean Africa and the northern Sahara, with a greater likelihood of decreasing rainfall as the Mediterranean coast is approached. Rainfall in southern Africa is likely to decrease in much of the winter rainfall region and western margins. There is likely to be an increase in annual mean rainfall in East Africa.

Although the vast majority of African peoples can be considered to be “indigenous” in the literal sense, in practice identity as Indigenous Peoples is claimed mainly by those ethnic groups whose economies and cultures fall outside the dominant national systems by a variety of historical and environmental circumstances – typically they are distinct communities who have been living by hunting and gathering, or by migratory nomadic pastoralism. They are reliant on the sustainable use of natural resources and their cultures are closely linked to the distinctive environmental conditions under which they have survived – for example deserts, savanna drylands and equatorial rainforests.

Indigenous African communities have long experience in developing local adaptation strategies to cope with extreme weather events, such as droughts. But the current changes in climate, and the subsequent impacts—especially on water availability, agricultural production and human health—are severely straining the coping capacity of many Indigenous Peoples in the region. Increasing desertification in particular is having wide-ranging consequences, from migration in search of employment and increased conflict over resources, to changes in traditions and in women’s roles.

Deteriorating food security is a major issue particularly for Indigenous Peoples residing in dryland areas, and effective water resource management is critical in a context of increasing dependency on rain-fed agriculture. As the traditional resource base for pastoralist communities diminishes, the traditional practices of cattle and goat farming are disappearing, with associated loss of knowledge and culture.

Land alienation and loss of biodiversity are putting the livelihoods of nomadic, pastoral, hunting and herding peoples at risk. Significant challenges being experienced by Indigenous Peoples in the region include food insecurity, displacement, famine, drought, floods, loss of livelihood assets, shrinking and scarcity of water resources, loss of culture, disappearance of traditional knowledge, health impacts, and further dispossession of land. The potential for adaptation in this region is being constrained by limitations on migration and mobility, destruction of biodiversity, and long-term land degradation due to drought.

The effects of climate change in Africa are heavily entwined with human rights issues, and many of the major policy responses identified by the region to support Indigenous Peoples’ adaptation and mitigation efforts focus on implementing a human rights framework. Other strategies being used in the region include engaging indigenous knowledge; creating institutional and policy support for mobility; initiatives that empower indigenous women; and encouraging peaceful co-existence by designing programs that allow different kinds of land use.

Asia

Asia is a culturally diverse region and home to the largest number of Indigenous Peoples (between 60-70% of the world’s Indigenous Peoples live in the Asia region), who are often living in border areas, and are among the most marginalized and vulnerable groups in society.⁸ Indigenous Peoples in Asia are rarely recognised as distinct peoples, with only the Philippines, Taiwan and recently Japan officially recognising Indigenous Peoples within their boundaries.

According to IPCC 4AR projections, warming is likely to be well above the global mean in central Asia, the Tibetan Plateau and northern Asia, and above the global mean in eastern Asia and South Asia. Precipitation in boreal winter is very likely to increase in northern Asia and the Tibetan Plateau, and likely to increase in eastern Asia and the southern parts of Southeast Asia. Precipitation in summer is likely to increase in northern Asia, East Asia, South Asia and most of Southeast Asia, but is likely to decrease in central Asia. It is very likely that heat waves/hot spells in summer will be of longer duration, more intense and more frequent in East Asia. Fewer very cold days are very likely in East Asia and South Asia. There is very likely to be an increase in the frequency of intense precipitation events in parts of South Asia, and in East Asia. Extreme rainfall and winds associated with tropical cyclones are likely to increase in East Asia, Southeast Asia and South Asia.

Indigenous Peoples in Asia are particularly vulnerable to changing weather conditions resulting from climate change, including unprecedented strength of typhoons and cyclones, and long droughts and prolonged floods. Communities report worsening food and water insecurity, increases in water- and vector-borne diseases, pest invasion, destruction of traditional livelihoods of Indigenous Peoples, and cultural ethnocide or destruction of indigenous cultures that are linked with nature and agricultural cycles.

In Central Asia (particularly the high altitude regions in the Himalayas), melting of the glaciers and permafrost are bringing to light issues with the water supply, as they affect hundreds of millions of rural dwellers who depend on the seasonal flow of water, and the local people in these areas are also experiencing new weather systems and food security issues. Some communities are reporting beneficial impacts

from more water and warmer weather for short-term agriculture, but they are aware this will mean less water long-term as glaciers and snow cover shrink.

Sea-level rise is also an issue in this region. For example, Indigenous communities in low-lying areas of Bangladesh could be displaced by a one-meter rise in sea levels. Such a rise could also threaten the coastal zones of Japan and China. Salt-water intrusion on inland rivers threatens fresh water supplies.⁹

Indigenous Peoples in Asia also report significant suffering arising from attempts at climate change mitigation being implemented by other communities, such as expansion of biofuel plantations, building of dams under the Clean Development Mechanism, uranium extraction, and inclusion of tropical forests for mitigation under schemes to reduce emissions from forest degradation and destruction. Indigenous Peoples in urban areas report impacts from climate change that arise from limited access to profitable livelihood opportunities and higher exposure to flood and other climate-related risks in areas where they are forced to live.

Solutions offered by Indigenous Peoples in Asia often include focus on sustainable traditional agriculture practices, agro-forestry and low-carbon lifestyles, development of locally-controlled small scale energy projects, and rehabilitation of coral reefs and mangrove forests.

Latin America and the Caribbean

The very diverse 'Latin America and the Caribbean' region includes Central and South America, and ranges from the Chilean deserts, to the tropical rainforests of Brazil and Ecuador, to the high altitudes of the Peruvian Andes. In the five Latin American countries with the largest indigenous populations (Bolivia, Ecuador, Guatemala, Mexico, and Peru), Indigenous Peoples represent 10% of the region's population and the largest disadvantaged group in Latin America. In some countries, Indigenous Peoples represent a significant share of the population (in Bolivia, for example, they are the majority). As elsewhere, Indigenous Peoples' use of biodiversity is central to environmental management and livelihoods.

According to IPCC AR4 predictions, annual precipitation is likely to decrease in most of Central America and in the southern Andes, although changes in atmospheric circulation may induce large local variability in precipitation response in mountainous areas. Winter precipitation in Tierra del Fuego and summer precipitation in southeastern South America is likely to increase. Sea levels are likely to rise on average during the century around the small islands of the Caribbean Sea and Indian Ocean and all are very likely to warm during this century. Summer rainfall in the Caribbean is likely to decrease in the vicinity of the Greater Antilles but changes elsewhere and in winter are uncertain. Annual rainfall is likely to increase in the northern Indian Ocean.

In the Andes, alpine warming and deforestation threaten access to plants and crops for food, medicine, grazing animals and hunting, and the consequent uprooting of Andean indigenous people is putting their cultural survival at risk. Increasing temperatures have forced Indigenous Peoples to farm at higher altitudes to grow their staple crops, which then adds to deforestation. In the Amazon, the effects of climate change are compounded by deforestation and forest fragmentation and, as a result, more carbon released into the atmosphere, in turn exacerbating climate change. The droughts of 2005 resulted in western Amazon fires, which are likely to recur as rainforest is replaced by savannas, severely affecting the livelihoods of the region's Indigenous Peoples.

The Caribbean region is most impacted by extreme weather events arising from climate change, including flash floods, tsunamis, earthquakes, intensified hurricane force winds, coastal erosion, coral bleaching, and major landslides and in many instances heavy loss of life and property. Coastal Caribbean communities are often the center of government activities, ports and international airports, and as a result these extreme events often cause extensive infrastructural damage and impacts on food security and economic decline. The relationship between climate change and water security is also an important issue in the Caribbean, where many countries are dependent on rainfall and groundwater supplies.

The Latin American region has emphasized the importance of Indigenous Peoples and traditional knowledge in finding sustainable solutions to the climate challenge. They have particularly highlighted the need for education and capacity development around the issue of climate change – particularly where this enables Indigenous Peoples to revitalise and make use of their traditional knowledge; the need for sustainable alternatives for climate adaptation and mitigation; and the need for Indigenous Peoples to create a joint agenda for dealing with climate change adaptation and mitigation. The Caribbean region has focused on capacity-building needs to enable Indigenous Peoples to make use of their traditional knowledge to build community resilience.

Arctic

The Arctic regions of Alaska, Canada, Greenland, northern Scandinavia and Siberia are homelands for a diverse number of Indigenous Peoples who live on the resources of land and sea under some of the harshest conditions on Earth. The indigenous populations range from 80% in Greenland to as little as 3-4% in Arctic Russia. Settlements vary from a few large industrialized cities to numerous small nomadic communities following a traditional lifestyle.

The circumpolar north is now experiencing some of Earth's most rapid and severe climate change. According to IPCC AR4 predictions, the Arctic is very likely to warm during this century more than the global mean. Warming is projected to be largest in winter and smallest in summer. Annual arctic precipitation is very likely to increase, and it is very likely that the relative precipitation increase will be largest in winter and smallest in summer. Arctic sea ice is very likely to decrease in its extent and thickness. Indigenous Peoples, their culture and the whole ecosystem that they interact with is very much dependent on the cold and the extreme physical conditions of the Arctic region. However, in the past few decades, the average Arctic temperature has increased twice as much as the global temperature.

The Arctic region currently implements several robust regional assessment processes that place a high value on the input of Indigenous Peoples, such as the Arctic Climate Impact Assessment.¹⁰ According to Indigenous Peoples' observations in this region, sea ice is less stable, unusual weather patterns are occurring, vegetation cover is changing, and particular animals are no longer found in traditional hunting areas. Local landscapes, seascapes and icescapes are becoming unfamiliar. Communities across the Arctic report changes in the timing, length and character of the seasons, including more rain in autumn and winter and more extreme heat in summer. Coastal indigenous communities are severely threatened by storm-related erosion due to melting sea ice. In several Alaskan villages (such as Shishmaref), entire indigenous communities are having to relocate due to thawing permafrost and coastal erosion. Sea ice melting and longer summers also create other changes that impact Arctic communities, such as increased accessibility of the Arctic regions for human development and other activities.

Concerns facing Indigenous Peoples in this region include the reduced availability of traditional food sources, growing difficulty with weather prediction, and travel safety in changing ice and weather conditions. Climate change is also having a negative impact on the health of Indigenous Peoples, and leading to increased economic development of the Arctic. In 2009, the Arctic Ocean sea ice shrank to the smallest size ever seen in satellite images, opening previously ice-jammed waterways, such as the Northwest Passage, for navigation.¹¹

Indigenous Peoples depend on wildlife, such as polar bears, walrus, seals and caribou, herding reindeer, fishing and gathering not only for food and to support the local economy, but also as the basis for their cultural and social identity. Reindeer husbandry, for example, has a long history in the Arctic, and is practiced by more than 20 different Indigenous Peoples in Norway, Sweden, Finland, Russia, Mongolia, China, Alaska, Canada and Greenland. This livelihood involves some 100,000 herders and around 2.5 million semi-domesticated reindeer, which graze on approximately four million square kilometers of land in Eurasia.¹² For Saami communities, reindeers are vital to their culture, subsistence and economy and herding represents a model for sustainable management of vast barren circumpolar areas of that has developed through generations. Changes in reindeer migration and foraging patterns, sparked by fluctuating weather patterns, have caused problems also in this region, where communities have witnessed unpredictable and unstable weather and shorter winters. Reindeer herders have documented negative impacts from some species replacing others, such as the spreading of shrubs into the barren tundra areas, which contribute to a hard packing of snow during the tough winter months and make access to food a challenge for reindeer. Increasing variability in the climate is especially challenging during the winter, where longer periods of mild weather, with rain followed by cold frost periods, forms ice layers in the snow and blocks the reindeers' access to lichen, a vital food source.¹³

To adapt to rapidly changing circumstances, while at the same time preserving important elements of their culture, Indigenous Peoples of the Arctic believe they need to find a balance between old and new ways, between scientific and experience-based knowledge. There are many examples in this region of fusion between traditional knowledge and scientific technologies, such as the use of satellite-based snow maps by reindeer herders.

North America

According to IPCC AR4 predictions, the annual mean warming in North America is likely to exceed the global mean warming in most areas. Seasonally, warming is likely to be largest in winter in northern regions and in summer in the southwest. Minimum winter temperatures are likely to increase more than the average in northern North America. Maximum summer temperatures are likely to increase more than the average in the southwest. Annual mean precipitation is very likely to increase in Canada and the northeast USA, and likely to decrease in the southwest. In southern Canada, precipitation is likely to increase in winter and spring but decrease in summer. Snow season length and snow depth are very likely to decrease in most of North America except in the northernmost part of Canada where maximum snow depth is likely to increase.

Indigenous Peoples from this region include First Nations and Metis living in Canada, and Native America tribes living in the continental United States, including parts of Alaska and the island state of Hawaii. They comprise a number of distinct tribes, states, and ethnic groups, many of which form intact political communities with sovereignty or independence from the national government. About 1.2 million North American tribal members live on or near reservations, and many pursue lifestyles with a mix of traditional subsistence activities and wage labour. Many reservation

economies depend heavily on agriculture, forest products and tourism. Indigenous Peoples in Mexico are concentrated in the central and south-eastern states, and constitute about 30% of the population.

Climate change in North America is posing a significant threat to Indigenous Peoples' food security and food sovereignty as changes in temperature, precipitation and water quality are threatening Indigenous subsistence agricultural methods. The impacts currently felt by First Nations Peoples include temperature increases, precipitation changes, disappearing glaciers and snow cover, rising sea level, unpredictable weather and seasons, extreme weather (such as hurricanes and other severe storms, floods, droughts, etc.), and increasing wildfire and insect outbreaks with the associated loss of forest resources for communities living in these areas. These climate-related shifts are causing significant changes in animal and fish populations, behaviour and migration – wild species that are crucial to the livelihoods and well-being of Indigenous Peoples are shifting in range and abundance.

Indigenous Peoples in this region are active in arguing for the rights to self-determination, land, water, and cultural practices that are essential for the effective action to mitigate and combat climate change. The region has vocally rejected solutions such as nuclear power projects, "clean coal" development and genetically modified food systems and has generally cautioned against market-based mitigation strategies that threaten Indigenous sovereignty, ecosystems, rights and livelihoods. However, one positive effect that is noted by several communities in this region is the opportunity for generating wind power to sell to both the central and remote grids.

Pacific

According to IPCC AR4, average sea levels in the Pacific region are likely to rise around the small islands of the northern and southern Pacific Oceans. All North and South Pacific islands are very likely to warm during this century, and annual rainfall is likely to increase in equatorial Pacific. Warming in Australia and New Zealand is likely to be larger than that of the surrounding oceans, but comparable to the global mean. Precipitation is likely to decrease in southern Australia in winter and spring. Precipitation is likely to increase in the west of the South Island of New Zealand. Increased mean wind speed is likely across the South Island of New Zealand, particularly in winter. Increased frequency of extreme high daily temperatures in Australia and New Zealand, and a decrease in the frequency of cold extremes is very likely. Extremes of daily precipitation are very likely to increase, except possibly in areas of significant decrease in mean rainfall (southern Australia in winter and spring). Increased risk of drought in southern areas of Australia is likely.

Many of the present-day Pacific Island nations are under the local control of Polynesian, Melanesian and Micronesian peoples. In New Zealand, the indigenous Maori constitute nearly 15% of the total population, and indigenous Australians (Aboriginal people and Torres Strait Islanders) account for about 2.5% of the total population. Subsistence agriculture has existed for several hundred years in the Pacific islands, and local food production is vital to small islands, even those with very limited land areas. Agriculture in the Pacific region is becoming increasingly vulnerable due to heat stress on plants and saltwater incursions. Hence, food security is of great concern to the region.

Most of the Pacific region comprises small island states where the low elevation and large amount of insular coastline make the Pacific a very vulnerable and high-risk region to impacts of climate change, particularly rising sea levels. Prominent environmental changes include loss of coastal land and infrastructure due to erosion and other coastal hazards; inundation and tidal surges, and increase in frequency and severity of cyclones; destruction of coral reefs and sea ecosystems on which

the livelihoods of the islanders depend from warming oceans; loss of food sources (sugarcane, yams, taro, cassava and banana plantations) from extreme temperatures, changes in the seasons and severity of rainfall; and loss of drinkable water through changes in rainfall, sea-level rise and inundation by sea water. Sea-level rise also threatens vital infrastructure, settlements and facilities that support the livelihoods of Indigenous islanders.

Migration is becoming a major issue in the Pacific and Torres Strait Islands. For example, the people of Papua New Guinea's Bougainville atoll island of Carteret are moving to higher ground on the mainland. The people of Sikaiana Atoll in the Solomon Islands have been migrating primarily to Honiara, the capital, and there has also been internal migration from the outer islands of Tuvalu to the capital Funafuti.

Warmer temperatures have led to the bleaching of the Pacific Island's main source of survival – the coral reefs. Continued bleaching ultimately kills corals, but coral reefs and other marine ecosystems are an important shelter for sustaining island fisheries. This is particularly important as many small islands in the Pacific have poorly developed infrastructure and limited natural, human and economic resources, and small island populations are often dependent on marine resources to meet their protein needs. Another concern is the impact of climate change on the tourism industry, which is a growing source of income for some indigenous communities. Frequent periods of flooding and drought are leading to a loss of place-specific cultural heritage practices and fragmentation of indigenous nations.

Aboriginal traditional knowledge relating to fire management remains strong throughout much of northern Australia, and several projects in this region involve re-applying this knowledge to landscape management. Maori also have significant interests in land management through their ownership and management interests in large areas of pastoral farmland, and exotic and indigenous forests. Many areas of Maori land are steep and vulnerable to storms and erosion; however, options for creating forest sinks may significantly benefit Maori landholders. In areas of marginal hill country, extra returns available for forest planting could assist Maori landowners to attract external investment.

Science institutions, such as the New Zealand National Institute for Water and Atmospheric Research and the Australian Bureau of Meteorology, are increasingly recognising the importance of indigenous knowledge and perspectives on weather, climate variability and change. Examples of indigenous climate knowledge include traditional forecasting techniques, as well as seasonal calendars based on observations of environmental change. For example, the Australian Bureau of Meteorology, in collaboration with indigenous communities has developed a website showcasing the weather and climate knowledge of countless generations of Aboriginal and Torres Strait Islanders.

Several New Zealand and Australian projects focus on mitigation options and economic opportunities. One of the few examples of Indigenous Peoples collaboration with the private sector is an Australian project, where participants in the West Arnhem Land Fire Abatement Project receive significant funds for their role in reducing greenhouse gas emissions in Australia's fire-prone tropical savannas.

Adaptation activities in the Pacific islands have concentrated heavily on resilience and mitigation strategies, particularly regarding future relocation strategies, and the importance of participating in relevant political discussions and processes.

INDIGENOUS OBSERVATIONS OF CHANGES IN CLIMATE

Much of the existing climate change literature reflects the approach of Western science, which uses a knowledge base built on systematic observation to monitor changes in climate, to provide forecasting services, and to plan adaptation options. However, systematic observations and data availability are limited in many fragile ecosystems, such as islands, mountainous and coastal ecosystems. These very fragile systems are those in which most of the world's indigenous people are living.

While international communities discuss and predict the potential impacts of climate change on the world at large, for Indigenous Peoples and local communities, these impacts are already a grim reality. As predicted by many researchers¹⁴, indigenous and local peoples are feeling the effects of climate change earlier than other communities, particularly since so many indigenous communities live in ecosystems that are already suffering the impacts of other stressors as a consequence of historical social, political and economic rejection and exclusion.

Effective adaptation planning relies on the best available knowledge base, and the urgent need to respond to the pressures of climate change has put a premium on the generation, interpretation and use of information within communities, regions, countries and globally. In recent years, there has been an increasing realisation that the observations and assessments of indigenous groups provide valuable local level information, offer local verification of global models, and are currently providing the basis for local community-driven adaptation strategies that are way past the planning stage and are already being implemented and tested.

The local observations of direct effects of climate change by Indigenous Peoples corroborate scientific predictions, and effects include temperature and precipitation changes; coastal erosion; permafrost degradation; changes in wildlife, pest and vector-borne disease distribution; sea-level rise; increasing soil erosion, avalanches and landslides; more frequent extreme weather events, such as intense storms; changing weather patterns, including increasing aridity and drought, fire and flood patterns; and increased melting of sea-ice and ice capped mountains.

Most Indigenous Peoples are not strangers to climate and weather induced vulnerabilities. They have generations of experience in creating mechanisms to cope with such volatility. However, anthropogenic climate change concerns are more recent. Most indigenous communities are lucky enough to have experts with the capabilities and knowledge to undertake and maintain systematic, long-term climate observational programs, along with the capacity to undertake analyses of this climatic information. Their experts are community elders, who rely on centuries of traditional knowledge and oral history as a sound knowledge base, on which they are then able to undertake their own monitoring of changes and make predictions.

Indigenous Peoples depend directly on diverse resources from ecosystems and biodiversity for many goods and services and Indigenous communities hold within their traditional knowledge base historical climate data that ranges from temperature, rainfall and the frequency of climatic events, as well as current fine-scale information that relates across all sectors including water resources, agriculture and food security, human health, and biodiversity. Almost every indigenous community on the planet has already reported some type of adverse impacts from changing climatic conditions on the terrestrial, coastal and marine ecosystems on which they depend.

Thus far, every indigenous community surveyed has specifically reported that they have observed impacts from temperature changes, although the degree varies and is more apparent in different seasons. Certain communities report very visible indicators, like disappearing sea-ice in the Arctic region, or measurable disappearance of snow and ice surfaces by Indigenous Peoples in the Andean region. Others note more indirect impacts of warming weather, such as changes in the distribution of both plant and animal species. These range from the disappearance of essential food sources (for example lowered viability of food sources in North America, through loss of access to critical species of caribou whose migration patterns depend on being able to cross frozen rivers and wetlands, or changing times of salmon runs) to the introduction of new species, which can either provide new resources to the community, or – more frequently – are pests with devastating consequences (like the bark and spruce beetles destroying the boreal forests in the northern hemisphere). Of particular concern are impacts on those species that have special cultural significance to the communities.

Temperature impacts on certain crops that are particularly vulnerable to changing temperatures (due to narrow production temperature windows) are also being reported. In some instances, these changing temperatures can serve to highlight the wisdom of traditional cultivation methods – during an unprecedented freak frost in the Andean highlands of Peru in February of 2007, for example, only those potatoes planted in the traditional way survived. Temperature variability is also an issue, with the Coordinadora Andina de Organizaciones Indigenas (representing Indigenous Peoples in the Andean region) documenting increased temperatures during the dry season throughout the region, leading to the loss of biodiversity and decreased food security, as well as record low temperatures that are affecting the health, alpaca, and food production in the Andes.

A minority of indigenous communities report positive impacts from the increasing temperatures, these generally result in the ability to grow new crops that previously did not survive in the area, such as reported, for example, by Aymara Indians in Bolivia. More indirectly, various communities have reported benefits arising from new income streams related to climate change, such as payment schemes for ecosystem services.

Many communities report changes in rainfall, particularly with regard to the reduced predictability of precipitation (less regular, more or less intense, coming at different times). These changes can impact heavily on their livelihoods, for example winter rain in areas inhabited by reindeer herders in the Arctic prevents reindeer from accessing vital food sources. The lack of rainfall and a succession of droughts have had a severe impact on many communities, and in drastic cases this has altered the very fabric of their culture – as in the case of the pastoralist Boran community in Ethiopia, who in the past few years have had to make dramatic changes to their way of life as they move from herding cattle to planting crops to survive. Reductions in rainfall have serious secondary effects as well – droughts have resulted and in some areas traditional agricultural techniques are no longer as effective as before, for example elders in Ecuador say they no longer know when to plant because the rains do not come as expected.

Most communities report an increase in the frequency and intensity of extreme events, ranging from devastating tsunamis to stronger winds and storms. When extreme events occur, they are associated with loss of life and property, destruction of infrastructure and large losses to the economy. The increasing violence of cyclones and typhoon-force winds is particularly devastating to island and coastal communities. For example, cyclone and storm surges have caused massive landslides and soil erosion, and destroyed crops and even forests in the Chittagong

Hill Tracts in Bangladesh; and 90% of the human structures on Pukapuka Island were destroyed in 2005 by five cyclones that hit the Cook Islands in five weeks.

Extreme weather events highlight the importance of indigenous weather prediction knowledge, as timely warning of impending events is one of the best strategies for mitigating the negative impacts of such events. In December 2004, the sea gypsies from the Surin Island were saved from the tsunami that devastated Thailand by their elders' knowledge to read the sea. (Ironically, this community was later relocated to a non-traditional inland location, where the ancestral skills and knowledge, which previously served them so well, must now be replaced by a new way of life.)

Unpredictable weather is also reported in many areas as more extreme variation in year-to-year weather patterns, with some years being unusually dry, some rainier than usual, or stormier. This has resulted in many indigenous calendars (systems that rely on local traditional knowledge of marker days, seasons, and certain activities tied to seasonal cycles) becoming off-balance and less reliable at a time when they are more necessary than ever.

Small island communities and other low-lying indigenous inhabitants all report devastating impacts of rising sea levels, ranging from sea water contamination of fresh water wells and loss of agricultural and food crops, to accelerated erosion from wave activities, frequent storm surges, and landslides causing destruction and land loss in indigenous communities. Accelerated loss of mangroves due to rising sea levels have an additional impact when combined with the increases in extreme events, as it is these mangrove forests that traditionally have provided settlements with protection from waves and storms. The future looks so bleak for these populations that many islands have begun processes for voluntary relocation to other countries of most of their populations that will be implemented within the next 10 years.

TRADITIONAL KNOWLEDGE

Traditional Knowledge (TK) refers to the knowledge, innovations and practices of Indigenous Peoples. This knowledge is critical to maintaining indigenous cultures and values. Traditional knowledge is also the foundation of much of our modern science and continues to provide a significant and valuable source of inputs, pharmaceuticals, botanical medicine and cosmetic and personal care products. Recent developments have created significant new avenues for unlocking the potential of traditional knowledge to help modern society address significant challenges such as those that arise from the impacts of climate change – both directly and in cross-cutting areas that range from water management, sustainable agriculture, disaster management, improving the delivery of health services, to new pathways for sustainable development for poor indigenous and local communities. Despite the fact that Indigenous Peoples have very different individual circumstances and the specific impacts of climate change on a country depend on the climate it experiences as well as its geographical, social, cultural, economic and political situations, there are issues affected by climate change which apply across countries and regions, and traditional knowledge has the potential to assist in addressing all of these vulnerabilities.

The urgent need to respond to the pressures of climate change has put a premium on the generation, interpretation and use of information in decision-making within communities, regions, countries and globally, yet traditional knowledge is still rapidly disappearing. Most of the world's 6000 linguistic groups are indigenous and form the basis

for traditional knowledge, yet 90% of these languages are expected to disappear by 2020. Many of the remaining indigenous languages are predicted to be lost in the next couple of decades. Gaps in human development, inadequate economic opportunities for Indigenous Peoples, education systems that do not respect its value or undermine traditional cultures, inadequate land rights, insufficient support for indigenous people, and a lack of respect for traditional knowledge as a knowledge system are among the factors causing this decline. However, there is a growing awareness of the importance of traditional knowledge, as, for example, the Intergovernmental Panel on Climate Change has identified traditional and local knowledge as an important missing element in its previous assessments and a focus of its work for its next assessment process.

When referring to traditional knowledge, we are not talking about outdated knowledge, but rather critical knowledge that is used by Indigenous Peoples in their everyday lives. While current warming trends are unprecedented, many indigenous groups recognise that environmental and climatic change are not in themselves new phenomena, and they historically have extensive experience of responding to and successfully negotiating such changes. It is clear from the variety of responses reported in this compendium that Indigenous Peoples are already responding to climate change in creative ways, drawing on their traditional knowledge of the natural resource base and combining this with other technologies to find solutions. Such traditional knowledge is already being successfully tested and integrated with scientific knowledge to provide the best possible knowledge foundation for the future.

In facing the challenges posed by climate change, a large number of communities are reporting renewed interest in traditional knowledge that was being lost, and there are many projects that aim to document indigenous knowledge before it vanishes. Preserving indigenous knowledge is proving essential to the effectiveness of community-level responses to climate change. This is taking place in a variety of different ways, from creating simple dictionaries which capture the climate knowledge inherent in local languages (as in several Russian communities), to the Canadian 'Voices from the Bay' project, which put the ancestral knowledge of the environment from the Indigenous communities of the Hudson Bay bioregion into writing so that it is appropriately transmitted and incorporated into environmental assessments and policies and communicated effectively to scientists, the interested public, and the youth of the participating communities.

Several projects have revitalized traditional soil- and water-conservation methods and cropping systems and re-introduced traditional efficient and low-cost technologies such as traditional water-conservation and harvesting practices, resulting in real improvements in the livelihoods of Indigenous communities. Traditional medicinal systems are also being strengthened and upgraded to respond to health impacts.

Traditional knowledge plays an essential role in forecasting and disaster preparedness. Indigenous communities have developed seasonal weather calendars, in many cases over thousands of years, which are finely tuned to local conditions and natural events. They are the guardians of historical climate data that ranges from temperature, rainfall and the frequency of climatic events, as well as current gatherers of fine-scale information. Their intimate knowledge of plant and animal cycles, which has been gained over thousands of years and passed down from generation to generation gives them the ability to link events in the natural world to a cycle that permits the prediction of seasonal events, and this has been a key element of the survival of indigenous communities.

In some countries, sophisticated indigenous knowledge-sharing programmes have been established for indigenous forecasting abilities, such as the Indigenous Weather Knowledge Website Project in Australia which displays the seasonal weather calendars of Aboriginal people of central and northern Australia and is primarily funded by the Australian Government. Other indigenous forecasting skills and abilities have been captured in case studies, such as predicting rainfall using temperature, plants and animals as indicators by farmers of Burkina Faso; predicting rain and droughts in Gujarat, India; predicting the weather in Russia by watching sea birds and clouds; and use of meteorological indicators and animal behaviour to predict the weather in Sri Lanka.

In addition to providing seasonal forecasts for supporting agricultural production, forecasting also plays a role as an early warning system to provide an opportunity for improved emergency response in vulnerable communities in the case of extreme events. The most common climate-related disasters reported relate to extreme weather events (tsunamis, blizzards, heatwaves, strong winds) and their resulting serious impacts (fires and floods). Many indigenous communities rely on traditional forecasting knowledge to respond to disasters, often based on early warning signs (typically related to the appearance of the sky or sea, and changes in animal behaviour). Common strategies for minimising the impact of natural disasters include maintaining a state of constant preparedness for the disaster; relying on domesticated animals to lead the way to safety; or finding a safe place to wait out the disaster.

A number of environmental assessments concentrate specifically on the impacts of climate change on the environment and societies. Of these, the assessment reports of the Intergovernmental Panel on Climate Change are considered the most authoritative global assessment reports due to the large number of scientists and governments involved, as well as the degree to which they directly influence policy. These assessments incorporate some mention of traditional knowledge, although this can be limited. At the regional level, both Indigenous Peoples and the scientific community hold the Arctic Climate Impact Assessment (ACIA) in high regard, as it is considered to have both a sound scientific basis while also effectively incorporating traditional knowledge in its process.

The integration of both traditional wisdom and scientific method to adapt to climate change impacts offers a path to new partnerships and innovative ways of thinking. Particularly in areas where there is a relatively long history of scientific and indigenous collaboration like the Arctic, there are numerous case studies of indigenous participation in scientific data collection projects. These range from the incorporation of 'hard' forms of technology into traditional activities (such as the Global Positioning Systems (GPS) used by the Inuit to capture information from hunters, which are then combined with scientific measurements to create maps for use by both Indigenous and scientific communities), to the integration of indigenous knowledge when predicting the impact of human activity on biodiversity, as took place in Papua New Guinea by recording Hewa knowledge of birds that would not tolerate habitat alteration or shortened fallow cycles in a way that is useful for conservation purposes.

Other approaches to integration include programs designed to enable Indigenous Peoples to contribute to scientific environmental assessments. The Canadian 'Environmental Assessment and Saskatchewan's First Nations: A Resource Handbook', for example, is intended to provide an overview of environmental assessment and to improve basic understandings of environmental assessment, identify how communities can be involved and where resources can be accessed.

Policy mechanisms that have been identified in climate change projects to enhance, preserve and protect traditional knowledge include: mapping of traditional knowledge (including the right to land ownership and protection of sacred lands); the use of legal instruments to protect traditional knowledge and the intellectual property of Indigenous Peoples; programs to revive traditional knowledge, cultures and languages; the creation of financial and appropriate resources to ensure Indigenous Peoples' knowledge can support adaptation activities; and mechanisms to ensure the respect of traditional knowledge and its communication to the next generation, including transmission of knowledge between the community; education systems that support youth learning; and use of knowledge for climate change adaptation that benefits the global community.

SECTORAL VULNERABILITIES AND ADAPTATION STRATEGIES

Specific vulnerabilities and early effects being reported by Indigenous Peoples include cultural and spiritual impacts; demographic changes, including displacement from their traditional lands and territories; economic impacts and loss of livelihoods; land and natural resource degradation; impacts on food security and food sovereignty; health issues; water shortages; and loss of traditional knowledge. Impacts are felt across all sectors, including agriculture and food security; biodiversity and natural ecosystems; animal husbandry (particularly pastoralist lifestyles); housing, infrastructure and human settlements; forests and natural resources; transport; energy consumption and production; and human rights issues.

In spite of these impacts, Indigenous Peoples also have a variety of successful adaptive and mitigation strategies to share. The majority of these strategies are based in some way on their traditional ecological knowledge, whether they involve modifying existing practices or restructuring their relationships with the environment. Their strategies include application and modification of traditional knowledge; shifting resource bases; altering land use and settlement patterns; blending of traditional knowledge and modern technologies; fire management practices; changes in hunting and gathering periods and crop diversification; management of ecosystem services; awareness raising and education, including use of multimedia and social networks; and policy, planning and strategy development.

Health and safety

Continuing climate change is adversely affecting the most fundamental determinants of health: air, water and food. Indigenous Peoples are often even more vulnerable to health impacts from climatic changes because of their close relationship with the environment, their reliance on the land and sea for subsistence, their typically lower socio-economic status, their social marginalisation and their lack of access to quality health care services. Major health consequences of climate change currently being reported by Indigenous Peoples include impacts on food security; increased morbidity due to direct trauma; increases in disease caused by lifestyle changes and environmental toxins; and altered disease patterns. Other health-related concerns include skin cancer, respiratory illnesses, malnutrition, and spread of infectious diseases.¹⁴

Connections between weather and disease are well established (many disease outbreaks occur during certain seasons or follow unseasonable flood or drought conditions) and increases in climate variability draw a clear focus on the nexus between impacts of climate change on environmental health and corresponding impacts on human health

of Indigenous Peoples. Intense short-term fluctuations in temperature can also seriously affect health – causing heat stress (hyperthermia) or extreme cold (hypothermia) – and documented health impacts from short-term fluctuations include respiratory stress in association with increased temperature extremes that have been reported in communities ranging from northern Aboriginal communities in the Arctic to Indigenous Peoples in the mountains of the Andes.

Changing temperatures and patterns of rainfall are expected to alter the geographical distribution of insect vectors that spread infectious diseases. Climate-sensitive diseases, such as malaria and dengue, are among the largest global killers, and several indigenous communities, particularly following floods, have reported increases in their incidence and range. Of equal concern to many indigenous communities are the increases in cancers and other diseases that seem to be the result of changes to traditional diets (as climate change lowers the availability of traditional foods and medicines), and exposure to environmental toxins (such as those that arise from climate change mitigation activities like uranium mining).

More frequent extreme weather events mean more potential deaths and injuries from direct trauma (such as cyclones, flooding, bushfires). Livelihoods that rely on hunting, fishing and gathering have become more difficult due to unpredictable weather and seasonal changes, with many deaths recorded (such as in the Arctic, where changing sea ice conditions have led to more accidents, with hunters and fishermen falling through the ice).

The agricultural sector is extremely sensitive to climate variability. Rising temperatures and more frequent droughts and floods are compromising food security for many communities. Increases in malnutrition are expected to be especially severe in areas where the populations depend on rain-fed subsistence farming. Food security issues are discussed in more detail below.

In addition to other measurable health impacts of climate change, Indigenous Peoples are also experiencing spiritual distress as their close connection to the land is impacted by changes to their lifestyle and culture. It is important to recall when discussing issues of Indigenous wellbeing that it is not only the biomedical impacts that are important in terms of health outcomes, but also those determinants that are difficult for western models to quantify and to qualify – including the emotional, spiritual and social wellbeing that is so closely linked to cultural integrity, resilience and preservation of identity. Cultural disconnectedness is a contributor to psychological distress and psychiatric disorders. It manifests as physiological and stress-related ill-health – increasing the risk profile for vascular disease, renal and metabolic disorders.¹⁶

Loss of plants and animal species can be of special significance to many Indigenous communities, as in the case of the Australian aboriginals who could no longer access bush bee native honey (sugar bag) needed for cultural education and ceremonial practice following a cyclone on Elko island.

Adaptation options being implemented in the health sector typically rely heavily on the use of traditional knowledge, improved environmental monitoring, and disaster management strategies. Traditional medical knowledge does offer hope in combating the occurrence of certain diseases, and in maintaining human and livestock health, with practical examples including prevention of schistosomiasis (bilharzia) in Mali and Maritania using local plants; and control of ticks in livestock in Ethiopia using traditional methods.

Agriculture and food security

Indigenous agricultural activities are at the heart of many major social issues including food security, land and water use, and sustainable livelihoods. All four components of food security—food availability, food access, food utilisation and food production system stability—are affected by climate, with food availability most closely associated with climate change. Increasingly, Indigenous Peoples are promoting food sovereignty (which includes the right of peoples to define their own food, agriculture, livestock and fisheries systems) as an alternative framework to the narrower concept of food security, which mostly focuses on the technical problem of providing adequate nutrition.¹⁷

Climate change is affecting Indigenous Peoples' food systems in several ways, ranging from direct effects on crop production (for example, changes in precipitation causing drought or flooding, fluctuating temperatures leading to changes in the length of the growing season) to changes in markets, food prices and supply chain infrastructure. In general, crop yields will increase in cold areas where low temperature currently limits crop growth. On the other hand, heat stress on crop and water availability will lead to a decrease in yields in warm environments. Because Indigenous Peoples are often overwhelmingly dependent on the environment for daily living, their communities are among those most adversely affected by climate changes. Furthermore, Indigenous Peoples already count for a disproportionate number of the world's poor and food insecure.

Integrated agricultural systems based on indigenous knowledge and traditional practices provide many examples of sustainable and adaptive systems with potential to survive and mitigate major climatic change. Agricultural adaptation strategies employed by Indigenous Peoples include adjusting crop varieties and planting dates (such as mixed cropping in Burkina Faso or rotational cropping in the Indian Himalayas); relocating crops (Indigenous Peoples in Guyana are moving from their savanna homes to forest areas during droughts and have started planting cassava, their main staple crop, on moist floodplains which are normally too wet for other crops); change of hunting and gathering periods to adapt to changing animal migration patterns; and improvement of agricultural techniques (with many instances reported across Africa and Latin America).

Farmers in the dry tropics are particularly vulnerable since they do not only produce food under these very harsh conditions but also make a living out of farming. Traditional pastoral systems preserve natural ecosystems through extensive ranching and rotational grazing and by using a variety of livestock. The Maasai, for example, distinguish between those plants that are good for increasing milk and those that fatten livestock and improve their condition. This knowledge is particularly important during exceptionally dry years when decisions have to be made by the Maasai about where to graze, which grasses recover faster than others and, based on the availability of resources, what stock should be culled first.

Indigenous communities have remarkable adaptive capacities to survive in inhospitable environments and difficult circumstances. Indigenous adaptive strategies in the agriculture sector typically take advantage of traditional knowledge held by the community to reintroduce indigenous agricultural techniques that may have fallen out of favour, and promote sustainable natural resources management practices. Many indigenous populations also possess a unique knowledge of plant genetic diversity that may be needed to fight plant and animal diseases: they breed animal and plant varieties that cope with stressed environments, and possess the ability to interpret natural phenomena to forecast weather shifts and respond appropriately. Examples include soil conservation techniques (contour ploughing to reduce soil erosion in Grenada; use of the Ankara system in Cameroon to manage soil nutrients); irrigation systems (such as the *waru waru* ancient irrigation

methods in Peru); rehabilitation of degraded crop and pasture land; and better food storage methods (such as burying grain in the sand in Egypt, or storing harvest rice in the attic in the Philippines to keep mice away with rising smoke). Related strategies include disaster management planning and income diversification strategies. Land tenure and land reform are essential elements of the underlying framework to support adaptive activities in this area.

Agricultural opportunities experienced by certain communities as a result of climate change include longer growing seasons in higher latitudes and the availability of new products, such as peaches and maize in Bolivia.

Full participation of Indigenous Peoples is essential in the development of mechanisms for cultural land and water use, and applying traditional practices is necessary for food security and food sovereignty, without putting at risk the ownership of land and other resources held by Indigenous Peoples. The engagement of Indigenous youth, women, and elders in the continuation and transmission of traditions, such as growing traditional foods, hunting, fishing, gathering, and pastoralism, is strongly promoted in response to climate change to ensure the resilience of traditional food practices and cultural values.

Sustainable livelihoods and social systems

Ironically, Indigenous Peoples, whose livelihood activities are most respectful of nature and the environment, suffer immediately, directly and disproportionately from climate change and its consequences. Indigenous livelihood systems, which are closely linked to access to land and natural resources, are often vulnerable to environmental degradation and climate change, especially as many inhabit economically and politically marginal areas in fragile ecosystems in the countries likely to be worst affected by climate change. The livelihood of many indigenous and local communities, in particular, will be adversely affected if climate and associated land-use change lead to losses in biodiversity. These communities are directly dependent on the products and services provided by the terrestrial, coastal and marine ecosystems, which they inhabit. Increased pressure on arable land, decrease in and disappearance of certain species, seasonal climate change in the form of extreme weather events such as tropical storms and long periods of drought means that a number of traditional livelihood activities are increasingly coming under pressure and are at the risk of being unable to sustain livelihoods.

In keeping with the intrinsic linkages between Indigenous Peoples and the land, their traditional occupations are to a large extent adapted to the environment in such a way that core ecosystem functions and core conservation values are relatively well maintained, while livelihoods are supported by the specific indigenous production strategies. Traditional occupations with direct reliance on the environment include pastoralism, shifting cultivation, horticulture, hunting, fishing and gathering.

However, these fragile ecosystems are at risk from climate change. Indigenous Peoples around the globe are reporting species loss or extinction; increasing species range shifts and wildfire risk; and coastal communities report coral mortality from coral bleaching. These ecosystems provide essential services for many local and indigenous communities, including food, fibre, fuel, energy, fodder, medicines, clean water, clean air, flood and storm control, as well as cultural and spiritual values. For example, some 20,000 species are used in traditional medicine, which forms the basis of primary health care for about 80 per cent of the 3 billion people living in developing countries.¹⁸ Goods and services provided by biodiversity have significant economic value, and several Indigenous communities have begun to get involved in payments for ecosystem services, where the market trades some of these goods and services.

Indigenous Peoples' notions of development are typically holistic and hence diverge from mainstream development practice. They aspire to protect and enhance their identity and cultural integrity, together with their land and their right to self-determination. Climate change affects all of the livelihood resources of Indigenous Peoples – the natural resource stock on which people rely for income, food, medicine and protection; physical resources (infrastructure, housing, energy and communications); financial resources (including income from sales of agricultural products); cultural and spiritual values; and human resources (skills, knowledge, capacity and good health important to the pursuit of livelihoods).

Many of the agricultural management activities practiced by Indigenous Peoples (such as conservation tillage, erosion control practices, irrigation) sequester carbon in soils, and may have positive or negative effects on biodiversity, depending on the practice and the context in which they are applied. The use of erosion control practices, which include water conservation structures, can reduce the displacement of soil organic carbon and provide opportunities to increase biodiversity. The use of irrigation can increase crop production, but has the potential to degrade water resources and aquatic ecosystems.

Traditional pastoral systems preserve natural ecosystems through extensive ranching and rotational grazing and by using a variety of livestock. Nomads breed their herds over many generations to make them fit in their often harsh and variable environmental conditions. This has produced many different breeds and contributed to the maintenance of biodiversity in domesticated animals. These breeds have developed traits that are so specific to their natural environment that their genetic stock has become a valuable resource for breeding programs, and the pastoralists themselves carry the information related to appropriate livestock husbandry of these breeds. For example, the pastoral Maasai of East Africa keep cattle, goats and sheep and move their herds throughout the year to optimize the use of rangeland resources for maximum meat and milk production. The Qashqai nomadic communities in Iran play an important role in sustaining food production while at the same time preserving the age-old livestock management practices in drought-prone areas of Iran. Some of the indigenous practices to adapt to climate change impacts such as droughts and reduced availability of rangelands include adjusting timing for migration from summer to winter grounds and prolonging migration routes. In the Sudan, the Rashaidi breed of one-humped camel is locally famous for its hardiness and milk performance.

A diversified resource base is considered a prerequisite for adaptation to climate variability and change. Diversified livelihood systems allow indigenous and traditional communities to draw on various sources of food and income and in doing so, spreading the risks of vulnerability to climate change. As the climate for agriculture is becoming more and more variable and unpredictable, it may become necessary for indigenous and traditional peoples to supplement their subsistence livelihoods with income gathering activities beyond agriculture in order to minimise their susceptibility to hazards. Examples of this in action in indigenous communities include transferring indigenous knowledge of weaving in Bani Suhilah to young women through a series of one to one practical training. In the Khaza village south of Gaza in the Palestinian Authority by using sheep wool wastes to produce art pieces. This reduced greenhouse gas emissions that previously resulted from burning the wool, and provided sustainable income generating activities.

Many adaptive responses to climate-change impacts on livelihoods focus on increasing crop production to secure livelihoods and increased food security. In general, the livelihood-security interventions have progressed from a top-down approach to a more bottom-up, participatory approach. Dispersal of high-yielding agricultural varieties, improved fertilizers, diversification of crops and other modern technologies has been used to augment production. Other activities include diversification of traditional livelihoods strategies and combining these with other strategies in non-traditional sectors (for example through skills improvements and entrepreneurship). In addition, climate change is likely to accelerate out-migration leading Indigenous Peoples to enter into new areas of work and employment in the formal and informal economies, often outside their communities, where they are particularly vulnerable to exploitation, discrimination, forced labour and child labour.

Indigenous and traditional peoples typically rely heavily on social networks. They maintain social and economic ties between different groups of peoples and in many places they still support systems of food and labour sharing including exchange, reciprocity, barter or local markets. However, these networks are at risk. For example, various indigenous communities are coming to rely on members who seasonally migrate or temporarily or permanently work afar to be more resilient to adverse climatic impacts than those whose members are exclusively dwelling within the community itself. Others are forced to leave their traditional lands and lose the places where their culture is rooted, as is happening to the Andean cultures who are forced to farm at higher altitudes to grow their staple crops, and other who must move to urban centres to survive.

The fixed cultural heritage of Indigenous Peoples in marginal lands is also being lost, such as early Inuit dwellings, graves and memorials found along the coasts that are being lost to increased winds, waves and erosion of the shoreline. The most significant threat of all to cultural integrity is that of forced environmental displacement and migration (discussed further below).

Short-term adaptation measures generally relate to implementation of immediate relief and rehabilitation programs in the aftermath of a natural disaster. They also involve proactive measures like evacuation and relocation of a population facing adverse climate conditions, as populations in many of the low-lying Pacific islands have already had to face. Long-term adaptation strategies, on the other hand, are needed to empower the vulnerable sections of the people—those living in the drought prone, flood prone, low lying and coastal areas—to help them develop robust coping mechanisms.

Human settlement, infrastructure and transport

Infrastructure and housing can be extremely vulnerable to climate change as many indigenous people live in environmentally marginal areas that are particularly sensitive to alterations in the physical environment. Indigenous and traditional knowledge, in particular with regard to building materials and construction technologies, has a key role to play in mitigating and adapting to the effects of climate change. Houses built using traditional techniques are usually well adapted to local conditions and climate related hazards, have low impact in terms of GHG emissions, and are low-cost and affordable for most of the population.¹⁹

An important issue regarding human settlement and climate change is related to increasing migration to cities, as climate change can encourage Indigenous Peoples to move out of their traditional lands to urban areas. Cities and local leaders need to be aware of the challenges facing Indigenous Peoples in cities, particularly with regard to their loss of traditional knowledge and their difficulties to access land and housing in urban areas.

In urban areas, houses of marginal peoples are often of very poor quality which heightens the exposure of their occupants to hazards. As global temperatures increase, cities with limited sanitation, and stressed water and waste systems are likely to become hotspots for diseases such as gastroenteritis. Organisations like UN-HABITAT are working to promote Indigenous Peoples' right to adequate housing (i.e. to gain and sustain a safe and secure home and community in which to live in peace and dignity).

Climate change is both affected by, and affects Indigenous housing and settlements, as there are environmental complications in the use of timber for shelter construction and the use of charcoal and firewood for cooking fuel. In Kenya and Zimbabwe low-cost and low-energy building blocks are being made from stabilised soil. Sun-dried, they can be made on or close to the building site, so no energy is used in transport. Another advantage of this adaptation is that the people engaged in production gain a livelihood, and can therefore afford to build decent homes and community buildings.

In the Andes, Indigenous communities have designed adobe houses to protect themselves and their livestock from low temperatures. In Canada, the First Nations Market Housing Fund has been established to allow First Nation families and individuals greater access to market-based housing, including home ownership on reserves. The Fund enables more individuals to own or rent their own homes, while respecting the culture of communal ownership of land.

The Tuareg in northern Africa have established 'fixation sites' to enable them to survive the changes that the spread of the desert and increased population have brought. These fixation sites do not settle people permanently, but build upon a tradition that the Tuareg would spend part of each year camped in a particular place while also enabling communities to develop a social infrastructure and pasture management projects where they can cultivate a secure food supply that is less susceptible to drought. Conversely, in Guyana, Indigenous Peoples are having to adopt a newly nomadic lifestyle, moving to more forested zones in the dry season, and are now planting manioc, their main staple, in alluvial plains where previously it was too moist to plant crops.

Infrastructure is also being damaged by climate change – in the Arctic, melting permafrost affects foundations of buildings and homes and public facilities are being damaged. Increased frequency and intensity of storms has provoked marine and pipeline accidents, leading to higher pollution from oil transportation activities. Small Island States suffer particularly from extreme weather events, coastal erosion, coral bleaching, and major landslides and in many instances this causes heavy loss of life and property. As a result, populations on these islands have suffered extensive infrastructural damage to roads and bridges, agricultural crops, homes, farm-houses, machinery, residential and commercial housing.

Adaptive strategies in these sectors include relocation; redesign of transport vehicles and infrastructure to cope with warming; fortification of seawalls and storm surge barriers; and creation of marshlands/wetlands as buffer against sea level rise and flooding (such as the rehabilitation of coral reefs and mangrove forests).

Managing water, land and other natural resources

Most key impacts on Indigenous Peoples will stem from reduced water availability.²⁰ The problems of unsustainable water and land management and climate change are intricately interwoven – degraded areas, for example, are highly vulnerable to extreme climate events such as drought and flooding, which give rise not only to major economic losses but also to serious health problems. The impacts on biodiversity and natural ecosystems include significant loss of vulnerable coastal and marine ecosystems including wetlands, mangroves, and coral reefs; increasing desertification and loss of biodiversity; and associated impacts on species of cultural significance to Indigenous communities.

Water resources in Indigenous Peoples' lands are being stressed through various impacts of climate change, including changes in rainfall, changes in ground water levels, increasing water demands in warmer climate, and salt-water intrusion with sea level rise. Decreasing water availability in the mid latitudes and semi-arid low latitudes is exposing Indigenous communities in these ecosystems to ever increasing water stress. Changes in precipitation and water flows due to climate change are altering already marginal food production sustainability, and shifting the seasonality of water flows and thus the habitats of many species that many Indigenous people depend on, particularly in mountainous areas. The accelerating and dramatic reduction in the size of glaciers and the great variability in rainfall in the Andean region are already causing a noticeable change in the normal water production cycle. Furthermore, the water produced by the accelerated melting of glaciers is being irreversibly lost due to a lack of retention and storage infrastructure.

Holistic indigenous practices typically take advantage of synergizing integrated water resources management with other sectors water resources management. Various adaptive strategies are being employed in areas that are subject to water stress that build upon traditional indigenous techniques of soil and water conservation, from rainwater harvesting and water storage techniques, to social practices designed to better conserve scarce supplies. For example, char dwellers (temporary alluvial islands made up of sand and layers of silt) in Bangladesh are building mounds and construct their dwellings to minimise damage from floods, and planting catkin reed to protect chars from erosion. Degraded land is rehabilitated using tassa-planting pits in the Tahoua region of Niger, and by using the indigenous Zai method of water harvesting practised by Mossi farmers in Yatenga Province in the northern part of Burkina Faso. The Aymaran indigenous people of Bolivia have adopted traditional practices to collect water in the mountains and pampas by way of constructing qhuthañas. The bethma practice in Sri Lanka promotes the temporary redistribution of lands during drought periods to share water resources.

Changes in land use and land cover both drive climate change and are directly or indirectly affected by it. Land use shift from forest to agricultural land, for example, is continuing particularly in parts of western North America, tropical areas of South and Central America and arable regions in Africa and south and central Asia. However, global warming is in turn leading to changes in land cover. In the Arctic, for example, ice sheets are melting which seriously affects the Earth's surface properties.

Indigenous Peoples have distinct spiritual and material relationship with their lands and territories, and which they consider are inextricably linked to their survival and to the preservation and further development of their knowledge systems and cultures, conservation and sustainable use of biodiversity and ecosystem management. Access to land and security of tenure are therefore crucial to achieving the objectives of poverty reduction, more secure livelihoods for Indigenous Peoples,

and the realisation of their cultural value systems. Many indigenous communities continue to practice traditional land use patterns ranging from individual, family or clan, to communal land use and ownership. For instance, among the Indigenous Peoples in the Cordillera region of the Philippines, it is usual to find residential or home lots as individually owned, terraced rice paddies and tree-lots as clan owned, and forest areas and pasturelands as communal property of the whole community or tribe. Agrarian reform thus needs to address and consider these indigenous concepts of communal land ownership and collective land rights where they exist.

Fire management plays an important role in several Indigenous communities. Controlling bushfires through integrating indigenous knowledge and practices into forest management systems can reduce climate impacts. The West Arnhem Land Fire Abatement Project in Australia builds on customary fire management practices together with modern scientific knowledge to better control the timing and intensity of savanna fires which reduces GHG emissions. This includes cross-cultural planning and assessment, long cross-country bush walks, burning programs (undertaken increasingly by traditional landowners) and fire-mapping technology.

The use of protected areas in mitigating the impacts of climate change can be controversial if it occurs within Indigenous ancestral territories and involves the enforcement of new rules that affect and restrict their livelihoods. In some cases, establishment of protected areas has placed strict controls on indigenous community traditional access to forest and natural resources without providing adequate compensation and viable alternatives. Examples of these types of projects include the Cameroon Biodiversity Conservation and Management (BCM) project and the Reserve for the San Rafael National Park created in Paraguay that was superimposed directly on top of the ancestral lands of the Mby'a Guaraní people without consulting the indigenous communities that pertain to these people and without obtaining their free, prior and informed consent.

However, protected areas can also be used to benefit Indigenous communities, as was demonstrated in Agona Kwanyako in Ghana through a project that documented and applied indigenous knowledge and techniques in natural resource management, and enforced local environmental by-laws to restore, conserve and sustainably manage inland wetlands and traditionally protected forests (sacred groves). The collaborative management agreements implemented by the Orang Rimba indigenous people of Makekal Hulu, Jambi, and the Toro indigenous people of Kulawi, with the national park authorities in the protected forest areas in Bukit Duabelas, Jambi Province, Lore Lindu and Central Sulawesi Province provide another good example.

At the ecosystem level, adaptation activities are being undertaken to reduce the impacts of climate change and buffer their effects. Projects that protect and restore ecosystems, rehabilitate degraded landscapes and sustainably manage natural resources appear to reduce vulnerability and strengthen resilience of local food systems to floods, droughts, rising sea level and extreme weather events.

Information and communication technologies

With agriculture and food security high on development agendas, a wide range of new and innovative instruments and approaches are being used both to raise awareness of the effects of climate change on specific Indigenous groups, and to provide complementary tools that can be integrated with community use of traditional knowledge. Many of these efforts involve investment in the recording of traditional knowledge and the wider use of information and communication tech-

nologies. The responses at national and international level have included a wider and stronger recognition of the value of traditional and local knowledge, and the increasing use of a 'social' web to exchange information, as well as emerging roles for indigenous organisations and institutions to maintain and share information relating to indigenous observations and knowledge.

In the Arctic, for example, geomatics engineers and Inuit hunters have come together to design a new, integrated GPS system that can be easily and affordably mounted on snow machines (snow scooters), the regular mode of travel used by Inuit hunters in Canada who log thousands of kilometres per year. The system automatically logs the location of the snow machine every thirty seconds, providing geo-referenced waypoints that can later be mapped to produce the traveller's routes on a map. In addition to tracking routes, the Igliniit system logs weather conditions (temperature, humidity, pressure, etc.) and the observations of hunters (e.g. animals, sea ice features, hazards, place names) through a customized computer screen that has a user-friendly icon interface. Digital cameras (photo and video) that the hunters carry with them provide visual images at certain waypoints (e.g. photos of dangerous hazards, video of animals). All of the data logged in this system is downloaded in the community and used for the creation of maps. These maps integrate the collected data, showing the routes of individual snow machines, along with the geo-referenced observations of the hunters and weather conditions. GPS mapping technology has recently been introduced to the Congo Basin with a handheld mapping device that has made it possible for the Pygmy communities to communicate to timber companies the specific forest resources that they hold sacred.

A rapidly increasing number of indigenous communities are exploring multi-media avenues to share with the global community the effects of climate change on their ways of life. Democratisation and affordability of media development has encouraged the decentralisation of information production, and horizontal 'people-to-people' communication models are replacing more traditional top-down communication processes. Video is a powerful tool that does not depend on traditional literacy, and it has the power to communicate and transform perceptions globally. Several pieces have been produced by professional videographers who are able to powerfully communicate the impacts and adaptive responses of Indigenous communities around the world (such as the United Nations University climate change videobrief series). A number of participatory video projects have been established where communities are given the tools and techniques to create their own films (as with the Conversations with the Earth project), as well as regional initiatives (such as the Pacific Film Festival), and by private companies, (for example the Land Unlocked documentary which compares impacts of global warming on Indigenous Peoples in Bolivia and northern Canada).

The development of biocultural community protocols by Indigenous Peoples is another mechanism that is gaining in popularity to help communities reposition themselves as the drivers of conservation and sustainable use of biodiversity, and in ways that support their livelihoods and traditional ways of life. The process of developing a biocultural community protocol involves reflection about the inter-connectivity of various aspects of Indigenous Peoples' ways of life (such as between culture, customary laws, community-based natural resources management, and traditional knowledge) and may involve resource mapping, evaluating governance systems and reviewing community development plans. It also involves legal empowerment so community members can better understand the international and national legal regimes that regulate various aspects of their lives. The Raika in India,

for example, used a biocultural community protocol to explain how through their interaction with the environment and generations of selective breeding, they created livestock that are particularly hardy, able to forage and digest rough vegetation, withstand the dry Rajasthani environment and to walk long distances – important attributes in the context of climate change adaptation and food security. By articulating this information in a protocol, communities assert their rights to self-determination and improve their ability to engage with other stakeholders, such as government agencies, researchers and project proponents. These stakeholders are consequently better able to see the community in its entirety, including the extent of their territories and natural resources, their biocultural values and customary laws relating to the management of natural resources, their challenges, and their visions of ways forward.

CLIMATE CHANGE MITIGATION MEASURES

Governments are committed to minimising adverse social, economic and environmental impacts resulting from the implementation of measures taken to mitigate or adapt to climate change impacts. Whilst mitigation measures are essential to prevent further impacts from climate change (which in turn contribute to the vulnerability of Indigenous Peoples), such measures offer both opportunities and concerns to Indigenous communities.

Indigenous Peoples typically use a large proportion of the land surface per head of population. In addition, there is a strong correlation between the location of indigenous territories and the areas with the highest biodiversity and natural resource conservation. As a result, they have the potential to be key players in designing and implementing mitigation measures, such as carbon sequestration, forest protection, renewable energy production, conservation tillage, agroforestry and rehabilitation of degraded crop and pasture land.

Mitigation activities require appropriate institutional structures, and the involvement of Indigenous farmers, forest-dependent people and fishing communities in these activities a tremendous challenge. There is a need to build and strengthen national and local systems to measure, report and verify the reduction of emissions or the sequestration of carbon in soils and biomass, and to manage financing systems in a way that is accessible by Indigenous communities.

Energy

Energy generation worldwide has historically relied on the exploitation of natural resources often found on Indigenous ancestral and tribal territories. These resources have been used with little or no consultation nor benefit and revenue sharing with Indigenous people, and more often than not have been extracted by violent and unjust means, displacing Indigenous populations and destroying local ecosystems. A case study on extractive industries in Papua New Guinea concluded that mining and petroleum industries have polluted rivers and oceans, endangered livelihoods, fragmented communities, caused inflation that has marginalized the Indigenous Populations, and destroyed cultural traditions. Studies have confirmed that there are elevated levels of rare and other cancers among Dene and Cree First Nations and Métis living directly downstream from tar sands extraction, and that the contamination of waters, snow, vegetation, wildlife and fish has grown exponentially in the past five years.

Nuclear power is seen by some as a potentially desirable solution to global warming; however, uranium mining for nuclear power has historically led to devastating environmental and cultural destruction in Indigenous communities. Studies have confirmed that there are elevated levels of rare and other cancers among Dene and Cree First Nations and Métis living directly downstream from tar sands extraction, and that the contamination of waters, snow, vegetation, wildlife and fish has grown exponentially in the past five years. Following significant long-term health effects from radioactive contamination, the Navajo Nation in North America passed a moratorium on uranium mining in its territory and traditional lands in 2005, which was followed by similar moratoria on Hopi and Havasupai lands.

In recent years, there has been a strong shift toward wind, solar and geothermal alternatives for energy generation. This trend toward clean technologies is expected to increase and the potential for renewable energy production on Indigenous and traditional lands is now being investigated. Many Indigenous communities over the world are exploring clean renewable energy sources to power their homes and to bring in jobs. Access to affordable, reliable, clean and modern energy services by these communities not only helps the global atmosphere, but also decreases poverty and provides other benefits such as decreased exposure to air pollution and access to energy that other communities may take for granted, such as lighting, cooking, temperature regulation and communications.

Small-scale renewable energy sources form attractive options for energy security for many Indigenous communities, and may also fulfill economic development needs. Renewable solar energy as a mitigation measure is generally supported by Indigenous Peoples, and is already being adopted particularly by remote communities, where solar power systems can provide a community with a more reliable source of energy while also reducing greenhouse gas emissions. In most instances, such energy systems replace diesel or small petrol generators in communities that are not connected to the electricity grid or to gas pipelines, and are typically supported through external funding, such as the Bushlight programme in northern Australia which is increasing access to sustainable renewable energy services for remote communities of indigenous people. The Bedouin township of Darajat has advertised itself as Israel's first solar village and is using this as a way to attract tourists.

In North America in particular, some indigenous groups are striving to adapt to climate change by focusing on the economic opportunities that it may create. For example, the increased demand for renewable energy using wind power has opened an opportunity to use tribal lands an important resource for wind farms, replacing fossil fuel-derived energy throughout the country. Numerous wind turbines have been established with co-funding from government by Native American tribes, where communities have not only gained a measure of energy independence, but energy is being sold through NativeEnergy to individual green power supporters. Wind power projects have also been used to generate jobs and pay for community-driven projects (such as education or health facilities), such as through Jepirachi Wind Power Project in Colombia, and through job-creation and training as in the Renewable Energy for Sustainable Universal Ecology (RESCUE) project in Kenya.

A small number of indigenous communities are investigating the use of biogas (combustible gas produced from the decomposition of livestock manure) by treating farm waste products, to relieve pressure on surrounding forests for firewood. In Asia, for example, demonstration biogas units have been established in Sri Lanka, and indigenous farmers have been trained in the use of biogas plants in Colombia. A biogas and wind energy project in Kenya seeks to train local artisans, some of whom are Indigenous, to build and maintain wind and biogas plants.

The Indian Himalayan region has a rich ancient tradition for tapping hydro-energy from the hill streams and rivers through the device of traditional watermills (gharats) and initiatives are being taken for upgrading for their revival. However, other hydro-development projects, such as the construction of large dams, have proven detrimental to Indigenous communities, resulting in cultural and environmental destruction, forced migration and resettlement, violence and resource competition, and human rights violations. The Pehuenche community in Chile have been fighting a court battle to ensure their rights are respected following the establishment of large hydroelectric projects in their lands, but flooding has already begun covering much of the Pehuenche's ancestral lands.

Another threat comes from the large-scale monoculture plantations for biofuel (renewable fuel made from renewable resources such as cellulose, corn or plant oils, that can be used to supplement or replace the fossil fuels, including petroleum and diesel, used in transport). Bio-fuels are becoming an integral part of the economic growth strategy of many countries, and have already resulted in further aggressive expropriation of Indigenous Peoples' land and territories. For example, bio-fuel crops such as oil palm plantation and sugar cane are now grown on lands that were once native forests in the tropical areas of Africa, Asia-Pacific, Latin America and the Caribbean. Some of these projects take place on Indigenous Peoples' lands and territories.

These plantations are having a devastating effect on certain communities, for example in Indonesia, where power over forests is being shifted from Indigenous Peoples to benefit logging and plantation industries. The Indonesian non-governmental organisation Sawit Watch reports that at least 400 communities in Indonesia have been affected by land conflicts caused by the expansion of palm oil plantations.²¹ Negative impacts consequent to plantations and logging have included forced evictions; loss of traditional forest-related knowledge, livelihoods and cultures; and denial of rights to lands and resources. These in turn lead to food insecurity and health impacts. Monocropping additionally threatens the biodiversity on which Indigenous Peoples rely to minimise the risk of harvest failure and the destruction of carbon reservoirs like native forests leads to more release of GHGs.

REDD – Reducing Emissions from Deforestation and Forest Degradation

The global carbon market in avoided deforestation seems to be emerging as a favoured mitigation strategy to climate changes. Deforestation accounts for almost 20 % of greenhouse gas emissions and climate change mitigation initiatives such as Reducing Emissions from Deforestation and Degradation (REDD) and avoided deforestation seek to reduce this figure by giving forests a monetary value based on their capacity to store carbon and thus reduce greenhouse gases. "REDD+" goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks. This may eventually lead to developed countries paying developing ones to reduce emissions caused by deforestation and forest degradation. It has been predicted that financial flows for greenhouse gas emission reductions from REDD+ could reach up to USD \$30 billion a year²², which could represent a huge financial opportunity for Indigenous Peoples to be rewarded for preserving their forest lands. However, it could also represent a threat if the issue of their land rights is not properly addressed to recognise their collective and individual rights and their customary laws.

Institutional arrangements that incorporate local knowledge and decentralised decision-making (i.e. greater rule-making autonomy at local level) have been shown to be associated with high carbon storage and livelihood benefits.²³

The global UN-REDD Programme aims to contribute to the development of capacity for implementing REDD and to support the international dialogue for the inclusion of a REDD mechanism in a post-2012 climate regime. Initial activities in nine pilot countries have included monitoring of carbon programmes; consultative processes for engaging Indigenous Peoples and civil society, in the design, implementation and monitoring of REDD processes links to benefits such as biodiversity; and the strengthening the capacity of national institutions to address these issues. Over USD \$40million in funding has been approved for preparation of "REDD readiness" action plans in Bolivia, Democratic Republic of Congo, Indonesia, Panama, Papua New Guinea, Paraguay, Tanzania, Viet Nam and Zambia.

If implemented in a manner consistent with indigenous interests and observing Indigenous Peoples' rights, reduced deforestation programmes could help to protect the biodiversity of plants and animals, help to secure indigenous lands and livelihoods, and provide for the ongoing culture and community of indigenous and forest-dwelling peoples. They have the potential to provide a mechanism to reward Indigenous Peoples and local forest communities for conserving their forests, and place them in a position to benefit from funding and other assistance available through REDD programmes. However, to date actual case studies of this in operation outside of Asia are rare.

Unfortunately as forests are given monetary value under REDD schemes, many Indigenous communities (particularly in countries where their identities are not recognised, land tenure rights are unclear, there is no culture of free, prior and informed consent, and decision-making remains top-down) report new conflicts arising between indigenous and local communities and the state. Improperly implemented REDD mechanisms have the potential to exclude local populations from implementation and benefit-sharing processes, and possibly even expel them from their own territories.

The success of measures to reduce deforestation and forest degradation in developing countries will depend in large measure on the access to sustainable forest and land-use generating sufficient employment and income opportunities for forest dwellers and communities on the agricultural frontier. Policies should include measures to generate such opportunities and to channel incentives to communities which preserve and rehabilitate forests. The International Labour Office has specifically identified that the rights of Indigenous Peoples in the conservation of forests as carbon sinks must be in line with the provisions of ILO Convention 169 concerning Indigenous and Tribal Peoples in Independent Countries.²⁴

Payment for ecosystem services and carbon trading

Market-based mitigation measures such as carbon emissions trading (i.e. trading systems designed to offset carbon emissions from one activity – such as burning fossil fuel to create electricity – with another more efficient or less polluting) is an issue that continues to be debated in the international community. Certain Clean Development Mechanism (CDM) and REDD projects have been identified as causing significant threats to Indigenous Peoples who refused to hand over their territories for the purpose specified in the projects. Others have suffered when, for example, hydro-power plants have flooded their lands (Burma and Thailand), geothermal plants have displaced their sacred sites (Philippines) or nuclear power plants affected their health (North America).

On the other hand, some indigenous communities see potential economic benefits from taking part in carbon trading projects, especially when they have already developed, over thousands of years, sustainable neutral and carbon negative livelihoods. Several indigenous communities have actively participated in setting up schemes to benefit from payment for ecosystem services policies (where they are compensated for undertaking actions that increase the provision of ecosystem services such as water purification, flood mitigation, or carbon sequestration) and carbon trading regimes. As an example, in June 2007, an oil company, ConocoPhillips agreed to pay a group of Indigenous Peoples in northern Australia AUD \$1m a year, for 17 years, to offset 100,000 tons of the refinery's own greenhouse emissions. The group is using traditional fire management practices that have been scientifically shown to reduce greenhouse emissions as compared to naturally occurring wildfires.

In Mexico, the Mexican federal government pays participating forest owners for the benefits of watershed protection and aquifer recharge in areas where commercial forestry is not currently competitive through the Payment for Hydrological Environmental Services Program. The Servicios Ambientales de Oaxaca, A.C. (SAO) is working with residents and local authorities in ten Indigenous Zapotec, Chinantec and Mixe communities in the Oaxaca region of Mexico to improve their capacity to manage natural resources sustainably and to increase their income through offering environmental services such as carbon and water capture and biodiversity conservation. The wet tropics biosequestration project in Australia provides an opportunity for many small landholders in the area to receive payment for ecosystem services. A range of natural resource activities are involved, including afforestation and reforestation, farm forestry, assisted natural regeneration, avoided deforestation, grazing land management, and sustainable agriculture.

The New Zealand Permanent Forest Sink Initiative promotes the establishment of permanent forests on previously unforested Māori land through offering land-owners the opportunity to earn Kyoto Protocol compliant emission units for carbon sequestered in permanent forests. The Ikalahan community in the Philippines have divided their forests into conservation forests, forests where people can get wood for building their houses and where they can gather non-timber forest products and there is another part that is segregated for environmental services which they will consider for carbon trading. They have already signed an agreement to this effect with a middleman, the Mitsubishi Corporation. The CAMPFIRE program in Zimbabwe has facilitated sustainable wildlife production, and reduced the degradation of land by offering a viable alternative to the local farmers.

HUMAN RIGHTS ISSUES

According to the Office of the High Commission on Human Rights, climate change may directly affect universally recognised human rights such as the right to life, food, adequate housing or water. Rights to access information and participate in decision-making are also relevant as States take measures to mitigate the impact of climate change. States have obligations under international human rights law to address disadvantage, threats to human rights and ensure that policies aimed at limiting the effects of climate change are not implemented in ways that discriminate against specific groups.²⁵

All of these factors have a bearing on the situations of Indigenous Peoples. They are among the groups that are most vulnerable to actual and potential detrimental impacts of climate change. They live in the most vulnerable ecosystems so are often the first groups to be impacted by climate change; they are highly dependent on their lands and natural resources for subsistence; and their cultural identity is closely associated with the environment and the lands in which they live. Climate change impacts on traditional forms of agriculture, pastoralism, fishing, hunting and gathering and other subsistence activities as well as affects their access to natural resources including water. Of especial importance to Indigenous Peoples, changes in the physical environment may make traditional ways of life impossible, forcing changes of behaviour and means of supporting livelihoods, with associated effects on mental health and community cohesion.

Displacement and relocation of environmental refugees

While there are a number of factors that displace Indigenous Peoples from their lands and territories, climate change brings about its own specific challenges that demand the attention of the international community to respond to what has been called “displacement”, “forced environmental migration” and the creation of “environmental refugees”. This is the environmental migration of people that is being caused by gradual environmental degradation of their lands, resources and territories; by negative impacts from extractive industries or major development works; by rising sea-levels; or by a sudden and extreme climatic events such as landslides or flooding. In each case, the marginalization of Indigenous Peoples is a key social determinant in worsening the impact of these phenomena.

Sea level rise and extreme weather events related to climate change increase the risk of coastal flooding, and are threatening the habitability of certain Indigenous Peoples to the extent that their entire populations may be displaced. Some of the most vulnerable regions are small island nations such as the Maldives in the Indian Ocean, and the Marshall Islands and Tuvalu in the Pacific Ocean, the Nile delta in Egypt, and the Ganges-Brahmaputra delta in Bangladesh. Many communities have already been displaced due to the effects of climate change, for example melting glaciers (Shaktoolik, Alaska), flooding (Kowanyama, Australia), drought (Maasai, East Africa) and rising sea levels (Polynesia).

Where Indigenous Peoples' survival is dependent on seasonal crops, fishing seasons, and other resources from their biodiverse territories, the impacts of climate change including the destruction of ecology and livelihood has also been a factor in forcing indigenous communities to migrate. Many, because of their intrinsic cultural ties to their lands, opt for temporary or circular migration for work to generate supplementary income; however, as environmental degradation continues, others are faced with permanent migration due to the loss of their territories.

In their host destination, Indigenous Peoples may face double discrimination: as migrants and as Indigenous Peoples. Because of discrimination or isolation already felt by Indigenous Peoples, their need to migrate due to environmental factors may be hampered by limited legal migration options. With limited opportunities to make an informed choice to migrate, or because of sudden displacement by a climatic event, Indigenous Peoples may also be more²⁶ vulnerable to irregular migration such as trafficking and smuggling.

Displacement of Indigenous communities is like to have a negative impact on the ecosystems in which they are living, as it has been recognised that Indigenous and other traditional people are vital and active parts of many ecosystems and their presence may help to enhance the resilience of these ecosystems.²⁷

Land tenure and access rights

Traditional or ancestral land that indigenous and traditional peoples inhabit represents the foundation of their cultures. These peoples have managed and shaped their surroundings over centuries, adapting their livelihoods to very specific local natural, physical and climatic conditions. Many of the ancestral territories in which Indigenous Peoples dwell comprise sacred natural sites represented in the form of mountains, rivers, lakes, caves, single trees or forest groves, coastal waters and entire islands. Indigenous Peoples are tightly connected to their land, not only through their livelihoods but also through spiritual bonds.

All persons have the right to adequate housing, land tenure and living conditions in a secure, healthy and ecologically sound environment. However, in many cases, land tenure and access rights of indigenous communities are not legally recognised. As a consequence, their land and resources are often exploited and encroached by outsiders. With the implementation of projects related to the CDM or REDD, and as a result of the increasing demand for biofuels, there are fears that the land rights of traditional and Indigenous Peoples will be increasingly contested or violated. This insecure situation places further stress on the already challenging situation in which many of these peoples live, and may result in severe implications to their vulnerability and capacity to adapt. For instance, in times of acute climatic crises, some communities adapt by shifting their agricultural activities to more favourable areas. If this traditional way of adaptation to environmental variability is restricted or denied these people might not be able to cope with environmental stresses and be at acute risk. Consequently, it is crucial to protect land tenure and access rights of Indigenous Peoples and to reward them for the goods and services their lands provide. Mount Elgon National Park in eastern Uganda is a case in point. A nonprofit group was established to receive carbon credits for reforesting the park's perimeter, but this resulted in the eviction of the local farmers who once lived just inside the park.

Mobility is another significant issue for many Indigenous communities, particularly in light of the impacts of climate change on communities such as pastoralists. In particular, Indigenous Peoples are at risk in locations where they may be forcibly removed or settled away from their traditional lands and territories. In the case of climate change refugees, appropriate programs and measures are urgently needed to address their rights, status, conditions, and vulnerabilities.

Legal redress

Indigenous Peoples have already started to bring cases before national courts and regional and international human rights bodies claiming violations of human rights related to environmental issues.

In 2001, a precedent-setting ruling of the Inter-American Court of Human Rights stated that 1) the Awas Tingni Indian community in Nicaragua has collective rights to their traditional lands, natural resources, and environment; and 2) the government of Nicaragua must demarcate and title Awas Tingni lands and provide a process for the demarcation of all indigenous lands in Nicaragua. The Court also recognised the importance that the relationship with the land holds for Indigenous Peoples, stating, "Indigenous groups, by the fact of their very existence have the right to live freely in their own territory; the close ties of indigenous people with the land must be recognised and understood as the fundamental basis of their cultures, their spiritual life, their integrity and their economic survival." However, even legal cases such as this are subject to the impacts of climate – Hurricane Felix, a category five hurricane, hit the Atlantic coast of Nicaragua in September 2007, destroying houses, crops and livestock in Awas Tingni. This disaster delayed land titling and diverted attention and resources from the process of transferring land title, which was not completed until December 2008.

In 2005, a group of Inuit in the Canadian and Alaskan Arctic presented a case before the Inter-American Commission on Human Rights seeking compensation for alleged violations of their human rights resulting from climate change caused by greenhouse gas emissions from the United States of America. The petition outlined many current effects of warming in the Arctic, including loss of sea ice (impacting on traditional practices and rendering traditional knowledge unreliable), snowfall changes (contributing to loss of traditional igloo building knowledge and culture), melting permafrost (causing relocation and affecting food security), among others. While the Inter-American Commission ultimately deemed the case inadmissible, its submission served to draw international attention to the threats posed by climate change to Indigenous Peoples.

Economic development

Investing in environmental management and climate change responses that benefit the poor will deliver strong returns in terms of sustained poverty reduction and growth, and vulnerable and excluded groups should be placed at the center of development agenda.²⁸

Lessons from projects involving Indigenous Peoples directly confirms that economic development without respecting the Indigenous Peoples norms, cultures, and traditions is not sustainable. Climate change mitigation and adaptation programs, therefore, must address the social, cultural, and environmental dimensions of development as well as the economic ones. In response to these lessons, strategic shifts in organisations such as The World Bank which emphasise a more proactive approach in their work with Indigenous Peoples are welcomed.²⁹

OBSERVATIONS

There is nothing new about the challenge of living with a variable and changing climate. Indigenous Peoples have millennia of experience in collecting and applying local environmental information to help their communities plan for, and better manage, the risks and impacts of the natural variability and extremes of climate.

What is new is the threat of human-induced climate change, and the need to adapt to the adverse effects of man-made changes in climate. This type of change is much faster, results in broader climate variability, and is being accompanied by a rise in global mean temperature due to increasing greenhouse-gas concentrations in the atmosphere.

As a result of their close relationship with the land, Indigenous Peoples have been observing and reporting the impacts of global warming for several decades. Indigenous Peoples are trying to cope with and adapt to these changes, with varying degrees of success. Their capacity to adapt is dynamic and influenced by a number of factors, ranging from availability of economic and natural resources, recognition of rights and entitlements, strength of institutions and governance, human resources, and access to technology. Multiple stresses such as land degradation and human rights abuses significantly affect Indigenous Peoples' exposure to climate risks and their capacity to adapt.

In the context of climate change research, Indigenous communities are proving an important source of climate history and baseline data, and are already playing a valuable role in providing local scale expertise, in formulating research questions and hypotheses, and monitoring impacts and implementing adaptive responses at the local level. There is a growing appreciation that indigenous traditional knowledge offers information and insight that complements conventional science and environmental observations, as well as providing a holistic understanding of environment, natural resources and culture. This has led to increasing collaborative efforts to document traditional knowledge, and these projects frequently make mention of their contribution to developing adaptation and natural resource management strategies in response to climate change.

The range of projects in this compendium reflects the reality that indigenous cultures are in different stages of development and change, and face different internal and external challenges. From a temporal perspective, most Indigenous Peoples' projects are still primarily responding to current climate variability (although they incorporate learning from past adaptations to historical climates). However, while adaptation to current climate variability can also increase resilience to long-term climate change, Indigenous Peoples will require investment and planning responses that go beyond these short-term responses. Further work is clearly needed to address responses to observed medium and long-term trends in climate, and anticipatory planning in response to model-based scenarios of long-term climate change. Urgent attention is needed in forming long-term adaptation strategies to empower the extremely vulnerable Indigenous communities—those living in the drought prone, flood prone, low lying and coastal areas—to help them continue to develop robust coping mechanisms, and to address forced environmental migration and its associated issues.

Nearly all of the projects that currently specifically address Indigenous Peoples are small in scale. For the most part they consist of small, self-contained agriculture or livestock projects that help defined groups of people (typically small communities) achieve greater livelihood security through the generation of more food or income. They are often implemented or measured within a short time-frame (less than a year) and work with a budget of less than \$10,000. Activities do also exist that are directed at the national or subregional level, with larger funds and over longer periods of time, but in these cases, either indigenous or climate change components are likely to be a secondary aim.

Indigenous community projects typically begin by recording the changes in climate being measured by the communities. Projects are then expanded to examine the impacts – both those of climate change itself and (ironically) also of some of the mitigation measures that countries are putting in place to address climate change at a global level. Documenting and reviving valuable traditional knowledge that is being lost also often forms an integral part of climate-change projects, ranging from the knowledge that is inherent in climate terminology in disappearing languages, to sophisticated indigenous agricultural techniques. More recent projects are focusing on adaptive processes: adaptation to climate change (in its broadest sense) because this is now seen as a community imperative for the coming decades.

Many of the projects that address capacity-building needs have focused on the lack of representation and participation of Indigenous Peoples in various governance structures. These projects have also worked to strengthen indigenous institutions and organisations and build their power to participate in decision-making bodies and in policy development.

Recognition of Indigenous Peoples as custodians of climate information is becoming more prominent at national level, as is integration of indigenous-owned and led activities into national adaptation, development and poverty reduction plans. A participatory approach is followed when integrating such activities successfully, with many projects displaying collaboration between Indigenous communities and non-government organisations, development agencies, and government, although there is a notable paucity of examples of private sector collaboration with Indigenous Peoples in adaptation initiatives. It is worth noting that the few private partnerships that do exist seem to be remarkably successful.

Indigenous communities have been active in organising mechanisms to share and exchange information, while remaining mindful of the need to ensure the protection and recognition of and respect for the intellectual property rights pertaining to their traditional knowledge, innovations, and practices. Balancing carbon storage, biodiversity conservation and Indigenous Peoples' livelihoods and production strategies is another important topic for consideration.

Mitigation initiatives such as REDD have significant potential to cut carbon emissions, but they must secure the recognition and implementation of the human rights of Indigenous Peoples (including security of land tenure and ownership, and recognition of land title according to traditional ways, uses and customary laws) before they are implemented or they pose significant risks for Indigenous communities.

A crucial strategic challenge facing Indigenous Peoples with regard to climate change is to ensure that they are involved as key partners in the development of climate change adaptation mechanisms. Program design and implementation should integrate Indigenous knowledge, and be designed in such a way that they do not undermine customary rights to lands and natural resources. This means that Indigenous Peoples must take a proactive role at the national level in establishing their place as national providers of “climate knowledge”, and to make the case for funding their essential climate response activities so compellingly that they cannot be passed over. And the task for development agencies is to respond to these proposals and plans quickly, inclusively and in a well-coordinated way.

Another important challenge facing Indigenous-led projects is the strong competition they face for funds and resources. Outcomes from many of these climate change projects provide compelling evidence of their success, but like other such initiatives, there is always a risk of the competitive element spreading resources too thinly and non-selectively. “Soft” adaptation measures (like those that make use of traditional indigenous knowledge) can be more difficult to identify, design and gain support for than those that involve hard infrastructure, but they remain vital to the effective implementation of adaptive activities in Indigenous communities, as well as developing and structuring the policy environment and ensuring that the views of Indigenous Peoples are incorporated in larger-scale planning. Local capacity building—building local knowledge and local organisations—is an essential component in reducing the risk climate change poses to local Indigenous communities. A holistic approach, integrating social and natural sciences and Indigenous Peoples’ traditional knowledge in the co-production of solutions, can help face the future challenges of climate change.

On the flip side of the coin, climate change has provided a valuable opportunity for Indigenous Peoples to showcase their knowledge, skills and innovation, and to work towards collective global action to protect sustainable development and reach better outcomes for the environment, human societies and, ultimately the global good of the planet. Indigenous Peoples should seize this opportunity to use existing and new knowledge, and to integrate their concerns into various emerging policy, financial and market instruments.

This compendium is intended as a starting point for understanding the impact of climate change on indigenous and local communities. To develop a greater understanding of the inputs to the climate change debate that can be made by indigenous and local communities, further research is undoubtedly needed; in particular, research that engages indigenous and local communities and is directed at how they are adapting to changing conditions, particularly through the incorporation of their observations and application of their traditional knowledge will continue to be valuable. Comprehensive studies of the economic and cultural costs and benefits of Indigenous Peoples’ adaptation to climate change are currently lacking. Additional opportunities to engage Indigenous Communities more interactively with private sector partners could also be explored.

Climate change research programmes that emphasize the participation and research needs of indigenous and local communities should serve as a model for further research initiatives. It is desirable that any such research be conducted in a way that recognises and continues to support and develop the capacities of indigenous and local communities. Research results need to be communicated back to the indigenous and local communities through culturally and linguistically appropriate means. Indigenous and local communities need to be supported in initiating research, including through the development of networks between indigenous and local communities across vulnerable regions.

Consistent with the typically holistic indigenous worldview, most of the climate change projects implemented by Indigenous Peoples span more than one sector, combining for example ecosystem management with biodiversity conservation and livelihood diversification, or watershed improvements with increased agricultural capacity. However, generic approaches identified through the projects and case studies in this compendium are applicable to a range of impacts and sectors to improve decision-making and delivery of social and economic benefits in the management of climate risks. The lessons learned in the climate change arena are equally applicable to related environmental issues, such as desertification, salinisation and biodiversity loss. These include engaging Indigenous Peoples at the outset of project design; establishing dialogue, understanding and partnership between multiple stakeholders; drawing on and validating local and indigenous knowledge; and encouraging interplay between traditional knowledge, science and policy development.

Indigenous Peoples have made a unanimous call for implementation of their fundamental human rights and status as affirmed in the United Nations Declaration on the Rights of Indigenous Peoples, and made clear that these rights must be fully recognised and implemented in all decision-making processes and activities, including those related to climate change. It is essential that the global community takes the necessary measures to ensure the full and effective participation of Indigenous and local communities in monitoring impacts of climate change, and in formulating and implementing mitigative and adaptive responses to those impacts.

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Note: individual case studies referred to in the introduction are referenced in the body of the Compendium.



ARCTIC

1 ARCTIC REGION | Arctic Climate Impact Assessment – Indigenous Knowledge and Observations of Climate Change in the Arctic

Local observations of impacts, traditional knowledge, policy and planning, beneficial effects

The Arctic Climate Impact Assessment (ACIA) is undertaken by the Arctic Council and the International Arctic Science Committee (IASC), to evaluate and synthesize knowledge on climate variability, climate change, and increased ultraviolet radiation and their consequences. It includes a series of case studies drawn from existing research projects that have been selected to give a sense of the variety of indigenous perspectives on climate change in the Arctic. The case studies are idiosyncratic, reflecting differences in the communities they describe as well as differences in the aims and methods of the studies from which they derive. Some communities, such as those in Greenland that fish for cod, may see benefits from climate change if fish stocks increase, a perspective that may be missing from case studies focusing more on the negative impacts of climate change. The observations and case studies contain some common themes. One such observation is that the weather has become more variable and thus less predictable by traditional means. Social changes, such as less time spent on the land, may influence this observation, but there are climatological implications that merit further study. Individual case studies are presented separately in this document. [Nb: Several case studies addressed in the ACIA are also referenced individually in the Compendium.]

Further information:

Arctic Climate Impact Assessment, particularly Chapter 3: Changing Arctic: Indigenous Perspectives (pp. 61-98) http://www.acia.uaf.edu/PDFs/ACIA_Science_Chapters_Final/ACIA_Cho3_Final.pdf

2 ARCTIC REGION | Traditional Knowledge for Adaptation among Arctic peoples

Adaptation, traditional knowledge, transport, food security

Local knowledge is essential for understanding the effects of climate change on indigenous communities and how, for example, some communities have absorbed change through flexibility in traditional hunting, fishing and gathering practices. The generation and application of this knowledge is evidenced in the ability of Inuit hunters to navigate new travel and hunting routes despite decreasing ice stability and safety; in the ability of many indigenous groups to locate and hunt species such as geese and caribou that have shifted their migration times and routes and to begin to locate and hunt alternative species moving into the region; the ability to detect safe sea ice and weather conditions in an environment with increasingly uncharacteristic weather; or the knowledge and skills required to hunt marine species in open water later in the year under different sea ice conditions.

Although Arctic peoples show great resilience and adaptability, some traditional responses to environmental change have already been compromised by recent socio-political changes. Their ability to cope with substantial climatic change in future, without a fundamental threat to their cultures and lifestyles, cannot be considered as unlimited. The generation and application of traditional knowledge requires active engagement with the environment, close social networks in communities, and respect for and recognition of the value of this form of knowledge and understanding. Current social, economic and cultural trends, in some communities and predominantly among younger generations, towards a more western lifestyle has the potential to erode the cycle of traditional knowledge generation and transfer, and hence its contribution to adaptive capacity.

Further information:

IPCC Fourth Assessment Report, Cross-Chapter Case Study C4.2.3, <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-xccc.pdf>

3 ARCTIC REGION | Reindeer Herders and the Polar View Initiative

Adaptation, precipitation, forecasting, technology transfer, animal husbandry, transport

Polar View offers integrated monitoring and forecasting services in the Polar Regions, as well as mid-latitude areas affected by ice and snow. Polar View uses satellite earth observation data from multiple satellites, in combination with 'ground truth' and sophisticated models and automatic tools, to deliver products that accurately illustrate the characteristics of the ice and snow on any given day. Arctic reindeer herders are facing the challenges of adapting to climate change as a warmer Arctic climate makes it harder for herds to navigate and find food. To help them adapt, the Polar View initiative is providing them with satellite-based snow maps. Snow is of paramount importance for reindeer herding because its quality determines whether reindeer are able to access the pastures that lie beneath it for much of the year. The International Centre for Reindeer Husbandry (ICR) partnered with Polar View to examine how satellite observations could help by gathering information on snow and snow change in a timely and accurate manner for such vast circumpolar regions. Under the Polar View initiative, ICR has been receiving snowmelt maps for Norway and Sweden and snow cover maps for Eurasia. These products could have important consequences for herders' decisions regarding winter pasture quality and potential migration routes. Polar View snow monitoring services are assisting the Association of World Reindeer Herders understand and monitor changing snow conditions. Polar View is supported by the European Space Agency (ESA) and the European Commission (EC) with participation from the Canadian Space Agency.

Further information:

Polar View website, <http://www.polarview.org>; European Space Agency (2009, April 10). Satellite Snow Maps Help Reindeer Herders Adapt To A Changing Arctic. ScienceDaily, <http://www.sciencedaily.com/releases/2009/04/090401102938.htm>

4 ARCTIC REGION | Floe Edge and Lake Ice Monitoring in the Arctic

Adaptation, forecasting, technology transfer, transport, food security, health

The Polar View's Floe Edge Monitoring Service is assisting Inuit communities to adapt their travel and hunting under changing sea ice conditions. Satellite images are delivered over the internet to indigenous communities in Nunavut and the Northwest Territories, and are used by Inuit residents to plan safe and efficient travel by snowmobile or dog sled across the frozen sea.

Further information:

Polar View website, <http://www.polarview.org>; Polar View: Earth Observation Services for Climate Change Adaptation, <http://www.polarview.org/files/PVClimateChange.pdf>

Polar View team members are also working with the Nunavik Research centre to deliver satellite-based monitoring of lake ice distribution and thickness. Large numbers of Arctic char over-winter in the lakes in northern Quebec, migrating to the sea in summer. These fish are a vital winter food resource for the region's Inuit, who travel to lakes on snowmobiles and fish through the ice. Ice conditions have a significant impact on the survival and distribution of char, as well as on people's ability to travel to the good fishing lakes. The goal of this project is to integrate this large-scale view from space with traditional ecological knowledge to improve understanding of the impacts of climate change on critical char habitat and to assist with sustainable management of these important food fisheries.

5 ARCTIC REGION | The Saami Research and Project Database (RÁDJU)

Local observations & impacts, database, local observations

The Saami Research and Project Database (RÁDJU) is held at the Arctic Centre, University of Lapland, and contains information collected between the years 2005-2007 and records on over 200 completed or on-going projects dealing with the Saami people or the Saami areas. The projects in the database were carried out by different institutions and researchers, and represent different disciplines. The database is maintained by the Arctic Indigenous Peoples and Saami Research Office and the Information Service of the Arctic Centre.

Further information:
RÁDJU, <http://arcticcentre.ulapland.fi/radju/radju.aspx>

6 ARCTIC REGION | Community contributions to ecological monitoring

Local observations & impacts, policy & planning

The Arctic Borderlands Ecological Knowledge Co-op is a collaborative alliance of indigenous communities, First Nations, Inuvialuit organisations, co-management boards, government agencies, and university researchers.¹ The geographic focus of the Arctic Borderlands Co-op (ABC) is the U.S.-Canada Arctic Borderlands—a region defined by the range of the internationally migratory Porcupine Caribou Herd and its near-shore environment. The ABC addresses concern for climate change, regional development, and contaminants with the central question, what is changing and why? The ABC has emerged as a model for collaboration in regional ecological monitoring. Local observations on changes in weather, in most respects, mirror the recent findings of science-based research on northern climate change, especially as related to in-creses in summer storm surges and overall drying of taiga and tundra ecosystems. Prompted by Old Crow residents' reports of the drying of Crow Flat, research was conducted by Environment Canada to quantify the percentage of total net loss of surface water and establish the geographical extent of drying. Findings based on analysis of satellite imagery both confirm the perceptions of local experts, and indicate a 5% net loss of surface area of water since 1973.

Further information:
Kofinas, G., Aklavik Arctic Village, Old Crow and F McPherson, 2002. Community contributions to ecological monitoring: knowledge co-production in the US-Canada Arctic borderlands. Pages 54-91 in Krupnik and Jolly The Earth is Faster Now, ARCUS, Fairbanks, http://www.taiga.net/coop/community/earthfaster_kofinas.pdf

7 ARCTIC REGION | Changing climate—walrus—human relationships in the Beringian region

Local observations & impacts, wildlife, food security

This paper presents and evaluates two perspectives on changing climate—walrus—human relationships in the Beringian region, from the viewpoints of marine biology and ecology, and from that of indigenous hunters. Bridging these types of knowledge is vital in order to grasp the complexity of the processes involved and for advancing understanding of sub-arctic marine ecosystems that are currently experiencing rapid ecological and social change. Despite substantial gaps and distinctions, information generated by scientists and indigenous hunters has many similarities. Differences in interpretation are primarily due to scaling and temporal rates of change of knowledge, which could be rectified through more active sharing of expertise and records, enhanced documentation of indigenous observations, more collaborative research, and increased insight from the social sciences.

Further information:
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8 ARCTIC REGION | Sea Ice Knowledge and Use: Assessing Arctic Environmental and Social Change (SIKU)

Local observations & impacts, technology transfer, language, traditional knowledge

Sea Ice Knowledge and Use (SIKU) is one of several IPY 2007-2008 projects aimed at documenting indigenous observations of environmental changes in the polar areas, with its specific focus on sea ice and the use of ice-covered habitats by the residents of the Arctic. As a collaborative international initiative, SIKU brings anthropologists, human geographers, sea ice and climate scientists, marine and ecosystem biologists from the U.S., Canada, Russia, Greenland, and France in partnership with almost two dozen indigenous communities in Alaska, Arctic Canada, the Russian Chukchi Peninsula, and Greenland. The project brings together traditional knowledge, science, and methods from social sciences (e.g. interviews; participatory observation) and physical science (e.g. analysis of remote sensing imagery and meteorological data). Funding is organized as a consortium of local or national initiatives with their respective budgets provided by the national funding agencies.

Further information:
International Polar Year database, http://www.ipy.org/index.php?ipy/detail/sea_ice_knowledge_and_use/; Geomatics and Cartographic Research Centre (GCRC), Carleton University, <http://gcr.ccarleton.ca/siku/>

The Alaska-Chukotkan portion of SIKU, for example, coordinates activities in several Alaskan and Chukotkan communities. Local residents, elders, and community experts are partners in the SIKU research and documentation activities, including daily sea ice and weather observations, collection of local terms for sea ice and weather phenomena, documentation of traditional ecological knowledge related to sea ice and sea ice use from local elders and experienced hunters, search for historical records of sea ice conditions, and the like.

9 ARCTIC REGION | Reindeer Herders Vulnerability Network Study (EALÁT)

Adaptation, animal husbandry, traditional knowledge

EALÁT is a Reindeer Herders Vulnerability Network Study and a project that examines reindeer pastoralism in the light of climate change. EALÁT focuses on the adaptive capacity of reindeer pastoralism to climate variability and change and, in particular, on the integration of reindeer herders' knowledge in the study and analysis of their ability to adapt to environmental variability and change. Reindeer pastoralism, ancient in origin in all its forms, represents models in the sustainable exploitation and management of northern terrestrial ecosystems that is based on generations of experience

Further information:
EALÁT, www.reindeerportal.org, www.reindeerblog.org and www.ealat.org; University of the Arctic, (www.uarctic.org)

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accumulated, conserved, developed and adapted to the climatic and political/economic systems of the north. Reindeer herders' traditional knowledge needs to be documented now before much of their understanding is lost owing to the societal/cultural transformations associated with globalisation. Local competence and capacity building in indigenous societies are major objectives of EALÁT, through local case-based study workshops. EALÁT Information includes workshops organized in reindeer herding societies in the circumpolar areas, including the Saami area, the Yamal Peninsula in Western Siberia, Chukotka in the far-east northern part of Russia, Topolnoe and Khatystyr in the Republic of Sakha (Yakutia). EALÁT is anchored in the University of the Arctic.

One adaptation strategy EALÁT is studying is reindeer castration, a technique commonly used in reindeer husbandry as a tool for herd structure management. Castrates generally calm down female reindeer and calves, making herds easier to control. Due to their larger size, castrates are also more able to easily break through ice layers in the snow, facilitating access to food for females and calves.

10 ARCTIC REGION | Climate change impacts on food security

Adaptation, food security

Inuit communities are currently discussing how to adapt to the impacts of climate change, including potential changes in diet due to food availability and are implementing adaptive responses such as shifts in time and place of harvesting. In some regions such as Labrador, the Inuit have already made adjustments to the times of year during which they travel by land, and some have begun collecting winter wood and other supplies in the spring, instead of the fall, because the fall freeze-up is occurring later and is more dangerous. In addition, Inuit fishers are checking fishnets more frequently and carrying out harvesting activities earlier in the year. Inuit communities are also discussing the idea of community freezers to alleviate concerns of food security, and at the community level, heritage sites are being recommended to provide protection against erosion.

Further information:

Ford, V (2008), Climate Change Challenges Faced by the Inuit, Special report in Development Outreach 2008 report on climate change

11 ARCTIC REGION | Changes to reindeer herding patterns

Adaptation, animal husbandry, food security, land rights

The Saami people and the Saami Parliament are working to prevent climate change. For Saami livelihoods, according to researchers the biggest change is, the increasing precipitation of snow. It is likely there will be changes to vegetation cover also. For Saami reindeer herders, high level of snow causes a great deal of difficulties, because the reindeer cannot excavate food underneath high and crusty snowdrifts. This influences the cultural reindeer herding patterns, and compels the herders to feed the reindeer with extra nutrients during the wintertime. Most of the reindeer herders now must feed their herds. This is perhaps the only possible way to react to climate change for the herders, as vast seasonal migration is no longer possible due to government legislation.

Further information:

Adaptation to Climate Change Fil.Lic. Klemetti Näkkäljärvi, Proceedings of the Joint Seminar of UArctic Rectors' Forum and the Standing Committee of Parliamentarians of the Arctic Region (2008), http://www.uarctic.org/Proceedings_1_8CZ9G.pdf

12 ARCTIC REGION | Arctic Vulnerability Study

Local observations & impacts, animal husbandry, traditional knowledge, culture

In this study, local knowledge is applied to reindeer herding in a changing climate. Climate variability, climate change and the societal/cultural transformations associated with globalisation have been, and continue to be, responsible for major changes in physical environment, the biota and the cultures of the indigenous communities in the Arctic. Little is known about the vulnerability of such systems to change. This interdisciplinary, intercultural study assesses the vulnerability of coupled human-ecological systems in the Arctic to variation and change in key aspects of the natural and human environments and biodiversity. Key projects from the Saami University College and Nordic Saami Institute focuses on reindeer herding in Arctic and sub-Arctic Eurasia. Its approach is holistic, integrating social and natural science and users' understanding in the co-production of knowledge. Reindeer herders' experience and understanding are being documented, analysed and, under their guidance, combined with data in social and natural sciences.

Further information:

CBD Technical Series No. 25: Guidance for Promoting Synergy Among Activities Addressing Biological Diversity, Desertification, Land Degradation and Climate Change, <http://www.cbd.int/doc/publications/cbd-ts-25.pdf>

13 ARCTIC REGION | Connections between Arctic Peoples and their Environment

Local observations & impacts, traditional knowledge, culture

This presentation includes examples of indigenous knowledge and spiritual connections that can contribute greatly to the monitoring of biodiversity, ecosystem services, and the host of social and cultural implications they have. In Savoonga, Alaska, for example, one family resumed the tradition of bowhead whaling after several decades, using knowledge that had been handed down for generations even though no one still living had participated in whaling at their traditional site. It also documents that at times, the spiritual dimension of understanding may seem at odds with scientific understanding. For example, Athabascan people in Alaska have a powerful relationship with the moose. Moose are taken for funeral potlatches, a rare instance of a spiritual practice that is recognized in state law, as people can take moose for potlatches when they need them rather than waiting for the usual hunting season. Athabascans believe that the number of moose in the world is constant, with moose offering themselves to worthy hunters and then coming back again. Scientific counts of moose make little sense in this worldview, because the moose may choose not to be visible to the counters. Discussions about moose abundance, a key "ecosystem service" in one worldview, have a large cultural gap to cross before they can make sense to both groups participating in those discussions.

Further information:

Huntington, Henry (2009), Presentation at UNESCO Climate Change and Arctic Sustainable Development International Experts Meeting, Monte Carlo, 3-6 March 2009, http://www.unesco.org/csi/LINKS/monaco-abstracts/Huntington_abstract_MonacoUNESCOarctic.pdf

14 ARCTIC REGION | Sustaining Arctic Observing Networks (SAON)

Local observations & impacts, technology transfer

SAON is a collective effort of 350 Arctic researchers, representatives of inter-governmental, national and subnational government agencies, representatives of indigenous peoples organizations, and residents of the Arctic. An IPY and Arctic Council project, SAON's work on monitoring and observing across interdisciplinary boundaries has contributed significantly to moving closer to a pan-Arctic observing system. The SAON relies on information and advice from those

Further information:

SAON Portal, www.arcticobserving.org

who use observing data and information, those who operate observing sites, systems and networks, and those who provide data and information management services. Indigenous peoples of the Arctic contribute their traditional knowledge of flora and fauna to scientific research and provide community-based monitoring of the Arctic's living resources.

15 ARCTIC REGION | Community Adaptation and Vulnerability in Arctic Regions (CAVIAR)

Adaptation, culture, health, animal husbandry

CAVIAR is a programme of interdisciplinary research to identify insights essential for the development of adaptive responses to changing conditions in the Arctic. It includes several projects. Research outcomes include a symposium on the health and wellbeing of arctic indigenous peoples that discussed the challenges to health and wellbeing caused by climate and environmental changes and by man-made and natural disasters as well as by increased economic development. For example, persistent chemicals such as polychlorinated biphenyls (PCB) and the insecticide DDT are accumulated in the Arctic and constitute a risk for human health and wellbeing. For example polychlorinated biphenyls and DDT are found in abandoned barrels and substances buried in the ground that get released as permafrost thaws. A project monitoring development of traditional Indigenous land use areas in the Nenets Autonomous Okrug, Northwest Russia is applying natural and social scientific methods to acquire data on physical changes in the tundra as well as traditional occupations in the area (mainly reindeer herding) and aims to produce a GIS database to promote interests of traditional land users.

Further information:

CICERO <http://www.cicero.uio.no/projects/detail.aspx?id=30170&lang=en>; Arctic Social Indicators (Health & Wellbeing) http://www.ipy.org/index.php?ipy/detail/arctic_social_indicators/; MODIL-NAO: Traditional Indigenous Land Use Areas in the Nenets Autonomous Okrug, Northwest Russia (Energy), <http://npolar.no/ipy-nenets/>; International Symposium on the Health and Wellbeing of Arctic Indigenous People (Health & Wellbeing) http://www.ipy.org/index.php?ipy/detail/health_of_arctic_indigenous_people/

16 ARCTIC REGION | Changes in Hunting

Local observations & impacts, food security, health, wildlife, transport

Indigenous peoples in the Arctic region depend on hunting for polar bears, walrus, seals and caribou, herding reindeer, fishing and gathering not only for food to support the local economy, but also as the basis for their cultural and social identity. Some of the concerns facing indigenous peoples in the region include the change in species and availability of traditional food sources, perceived reduction in weather predictions and the safety of traveling in changing ice and weather conditions, posing serious challenges to human health and food security.

Further information:

UNPFII (2007): Climate Change: An Overview, http://www.un.org/esa/socdev/unpfii/en/climate_change.html

17 ARCTIC REGION | Heterogeneity and Resilience of Human-Rangifer Systems

Local observations & impacts, animal husbandry

The goal of this project is to improve understanding of the relative resilience and vulnerability of regional Human-Rangifer Systems to climate change. A Human-Rangifer System is defined here at the regional scale as the set of ecological and social processes underlying the human use of wild Rangifer (caribou). Human-Rangifer Systems have historically provided and continue to provide keystone ecosystem services to indigenous residents, with Rangifers being the most important terrestrial subsistence resource of the Arctic System.

The CircumArctic Rangifer Monitoring and Assessment Network (CARMA) is a group of scientists, managers and community people who have a common interest in the future survival of the northern Rangifer herds. CARMA is primarily focused on the status of most of the large migratory Rangifer herds, incorporating observations from community members, particularly Rangifer hunters. CARMA is pulling together data from a number of herds and, through a cross-herd analysis and synthesis, will be assessing the vulnerabilities of herds to future global change.

Further information:

CARMA (CircumArctic Rangifer Monitoring and Assessment Network), <http://www.carmanetwork.com/>; CAFF 2006. Human-Wild Rangifer Systems. Expert Network Monitoring Plan. Supporting publication to the CAFF Circumpolar Biodiversity Monitoring Program - Framework Document. By CARMA in cooperation with CAFF. CAFF CBMP Report No. 11, CAFF International Secretariat, Akureyri, Iceland, <http://arcticportal.org/uploads/w-/Cy/w-CytGUdXkwE5cLW1D5UuQ/human-wild-rangifer.pdf>

18 ARCTIC REGION | Seeking compensation for violations of human rights

Local observations & impacts, human rights, culture, displacement, awareness raising, policy & planning

In 2005, a group of Inuit in the Canadian and Alaskan Arctic presented a case before the Inter-American Commission on Human Rights seeking compensation for alleged violations of their human rights resulting from climate change caused by greenhouse gas emissions from the United States of America. The petition outlined many current effects of warming in the Arctic, including loss of sea ice (impacting on traditional practices and rendering traditional knowledge unreliable), snowfall changes (contributing to loss of traditional igloo building knowledge and culture), melting permafrost (causing relocation and affecting food security), among others. While the Inter-American Commission ultimately deemed the case inadmissible, its submission served to draw international attention to the threats posed by climate change to indigenous peoples.

Further information:

Inuit Circumpolar Council, <http://inuitcircumpolar.com/files/uploads/icc-files/FINALPetitionICC.pdf>

19 ARCTIC REGION | Indigenous knowledge in Disaster Management (RAIPON)

Adaptation, traditional knowledge, disaster preparedness

This interview-based study was conducted in 2005 by the Russian Association of Indigenous Peoples of the North (RAIPON) in partnership with the Division of Environmental Policy Implementation of the UN Environment Programme (UNEP) and UNEP/GRID-Arendal. The study focused on the indigenous peoples of Nenets Autonomous Okrug (NAO) and Kamchatka. The aim was to document how individuals perceive and manage natural disasters and extreme weather events, including documentation of strategies for early detection of coming events, coping strategies, and perceptions of short and long term impacts of these events on biodiversity.

Strategies described for early warning of natural disasters were mainly those based on observations of conditions and events that are considered to be warning signs. The most common warning signs were related to animal behaviour and to appearance of the sky (clouds, moon, sun, etc). Strategies described for minimising negative impacts of a natural disaster included: maintaining a state of constant preparedness for the disaster; finding a safe place to wait out the disaster; relying on domesticated animals to lead the way to safety; and avoiding and mitigating disasters by regulating the size of reindeer herds and managing the use of pastures.

Further information:

RAIPON, <http://www.raipon.org/ikdm/>

20 **ARCTIC REGION** | Inuit knowledge and Climate Change Multimedia knowledge**Adaptation, local observations & impacts, traditional knowledge, video**

A new cross-platform multi-media documentary by Zacharias Kunuk O.C. and Dr. Ian J. Mauro at Isuma.tv, presents Inuit knowledge collected over centuries regarding land, weather, animals and the impacts of climate change on survival and adaptation. The filmmakers also provide interactive conversations during live weekly webcasts from Igloolik.

Further information:
Isuma.tv, <http://www.isuma.tv/hi/en/inuit-knowledge-and-climate-change>

21 **ARCTIC REGION** | Inuit traditional knowledge incorporated in study of changing Arctic weather persistence**Local observations & impacts, traditional knowledge**

With computer models increasingly unable to forecast weather in the face of unpredictable climate changes, researchers at the University of Colorado turned to Baffin Island Inuit knowledge keepers and their insights about the way wind scatters a cloud, the way ice shifts, and subtle changes in animal behavior to forecast weather.

Previously, reports of unpredictable weather coming in from Arctic communities did not match up with scientific measurements that indicated weather around the world appeared to be growing more persistent with less variation. However, prior studies did not focus directly on the persistence aspect of weather, and this study provided scientific evidence of changes in persistence in weather over the last two decades for Baker Lake, Nunavut, Canada. Hourly data indicate that for local spring, the persistence of temperature has changed dramatically in the last 15 years with some years showing a strong drop in day-to-day persistence in the local spring afternoons, somewhat at odds with changes in persistence on a more global scale.

Further information:
Weatherhead, E, A Gearheard and R.G. Barry. 2010: Changes in weather persistence: Insight from Inuit knowledge. Global Environmental Change doi:10.1016/j.gloenvcha.2010.02.002

22 **EUROPEAN REGION** | BC3 Basque Centre for Climate Change**Adaptation, local observations & impacts, policy & planning**

The BC3 is a Research Centre based in the Basque Country, which aims at contributing to long-term research on the causes and consequences of Climate Change in order to foster the creation of knowledge in this multidisciplinary Science. The research programme includes an arm dealing with developing and supporting research that informs climate policy in the Basque region. The aim is to act as the centre for research on all aspects of climate policy in the Basque Country, drawing on the substantial research that is ongoing in the universities and other research centre in the region. Issues being addressed include more precise assessment of impacts, design of optimal adaptation strategies, policies for mitigation, better measurement of emissions from land use and policies to improve IPCC/GHG inventories for agriculture and land use methodologies in the Basque Country through comparison with other countries.

Further information:
BC3 (Klima Aldaketa Ikergai), http://www.bc3research.org/about_us.html

23 **ALASKA** | Iñupiaq and Environmental observations of the Qikiktagrugmiut in Northwest Alaska**Adaptation, local observations & impacts, traditional knowledge**

The Native Village of Kotzebue, the tribal government of the community, conducted a study to document traditional knowledge of environmental change in their region from the 1950s to the present. The study was conceived, developed, and carried out by members and employees of the tribe. Interviewers used a semi-directive interview to engage elders in conversations about environmental change. The results were compiled in a report, which included a discussion of the implications of the various observations recorded. The documentation of this knowledge will be valuable to future tribal members for historic preservation purposes and comparative analysis. A closer look at the Qikiktagrugmiut understanding of one event and its impacts, such as late freeze-up, can show how they see consequences that are widespread and varied yet still intertwined, so that it is impossible to look at any one thing in isolation. Late freeze-up is one likely consequence of regional climate warming, and hence a relevant example for considering the impacts of climate change. The Arctic Climate Impact Assessment discusses the example of late freeze-up and its impacts ranging from rough ice conditions, more danger from thin ice, and more erosion and flood problems, to better access to spotted seals (*Phoca largha*), caribou, and red foxes (*Vulpes vulpes*).

Further information:
Arctic Climate Impact Assessment (pp. 61-98), <http://www.acia.uaf.edu/pages/scientific.html>; Encyclopedia of the Earth, http://www.eoearth.org/article/Qikiktagrugmiut_climate_change_case_study

24 **ALASKA** | Walrus decline in King Island, Alaska**Local observations & impacts, wildlife, food security, culture, health, transport**

Though walrus are federally protected, Alaska Natives have subsistence rights to hunt them and rely on the meat, skin, intestines and tusks -- for food, clothing and boat coverings, and to carve the ivory jewelry and souvenirs that are a significant source of income. A warming climate around King Island, a steep rocky knoll poking out of the Bering Sea, melts the sea ice more rapidly, thinning the walrus herds and forcing native hunters to travel greater distances to track their prey. As the ice has melted, the window of time in which the hunters can pursue the walrus is much shorter -- about three weeks, compared with two months in better years. Floating chunks of ice and high winds can make traveling in the 16-foot aluminum boats they use for hunting very dangerous. A shorter potential hunting period also forces Natives to take more risks with the weather. In 2008, the King Islanders of Nome did not get a single walrus, meaning they had to do without walrus meat over the winter and had to buy ivory to carve. Walrus need to rest on sea ice no more than 400 feet above the ocean floor so they can dive down to eat shellfish and plants. But sea ice is retreating so far north that the waters are too deep for walrus to feed. This forces them to squeeze onto land, and in the summer of 2007 about 4,000 young walrus were trampled to death by males in the crowded conditions.

Further information:
Lydersen, K (2008) Sea-Ice Melt Imperils Walrus, and Economy Based on Them Washington Post, 28 August 2008, <http://www.washingtonpost.com/wp-dyn/content/article/2008/08/28/AR2008082803489.html>; Sherwnit, B (2008) Walrus in a Warming World, Defenders Magazine Summer 2008, http://www.defenders.org/newsroom/defenders_magazine/summer_2008/walrus_in_a_warming_world.php

25 **ALASKA** | Spruce bark beetles and increased wildfire risk in Alaska**Local observations & impacts, wildfire, pests**

Climate-related changes leave many ecosystems vulnerable to pests and diseases. In the Boreal forest ecosystems of the Northern Hemisphere, one immediate impact of rising temperatures is the influx of bark and spruce beetles causing

Further information:
In: Climate Change and Pacific Rim Indigenous Nations, October 2006. Impacts on Indigenous Peoples by Terry Williams and Preston Hardison, Tulalip Nation Fisheries and Natural Resources Department

further deforestation. The burrowing insects were previously kept under control by cold winter temperatures. Now that the winters are warmer, they have spread out of control, killing millions of acres and entire mountainsides of pine forests from New Mexico, USA to British Columbia, Canada. Warmer winters mean greater survival for many of them, so that pests can build up greater levels of infestation and diseases can infect more people, often with more virulence. Many forests around the Pacific, for example, are being attacked by wood-boring and bark beetles. This leaves the trees valueless for commercial use and highly susceptible to very hot fires that destroy the capacity of the land rather than rejuvenate it. More than 4 million acres of spruce forest in south-central Alaska have sustained heavy mortality caused by spruce bark beetle infestation. A significant portion has occurred within the forests of the Copper River Basin, increasing the risk to local communities of catastrophic wildfire.

26 ALASKA | The Aleutian and Pribilof Islands region in Alaska

Local observations & impacts, infrastructure, extreme weather, wildlife, coastal erosion, policy & planning

The Aleut International Association (AIA) and the Aleutian and Pribilof Islands Association (APIA) prepared a summary of current observations, concerns, and plans related to climate change in their region. The changing climate is having dramatic effects on the security of the village and the local infrastructure. Like many Alaskan coastal communities, Nelson Lagoon has been battling the effects of winter storms for years, most notably by building increasingly strong breakwalls along the shore. The increasing violence of the storms and changing winter sea-ice patterns have exacerbated the problem, reducing sections of a structure they hoped would provide decades of protection to kindling within just a few seasons. This is because their break-wall was designed to brace the shore ice, which would in turn provide the real buffer from winter storm wave action. As the winters have been warmer over the past six years, the buffer provided by the shore ice has been lost, allowing the full force of the waves to surge against the wall and the village. Other climate-related observations include the presence of non-indigenous warm-water fish species and shoreline erosion. The Aleut International Association enables international research and monitoring in the Bering Sea by connecting peoples and governments on both sides of the Bering Sea and by helping the Aleut people address the most vital problems that they face today including climate change.

Further information:

Arctic Climate Impact Assessment (pp. 61-98), <http://www.acia.uaf.edu/pages/scientific.html>

27 ALASKA | Observations from hunters of the Native Village of Gambell, Alaska

Local observations & impacts, wildlife, positive beneficial impacts

According to hunters in the Native Village of Gambell, Alaska, generally the sea ice now arrives later and melts earlier and the floe of multi-year chunks of ice and icebergs that spit out of the Arctic Chukchi region in early Fall into the Bering Sea does not happen anymore. The ice now behaves differently – tending to move in one big mass near the shore without open leads, the larger ice floes ideal for whaling and other hunting do not occur as much with this kind of ice. The weather is more unpredictable with extremes and dangers resulting in accidents and losses of life. The changes in the weather and ice conditions result now in changes in animal behaviour, habit, and migration: during Spring, walrus are now seen spread out individually on small pieces of ice instead of in large herds on larger pieces of ice; some animal migrations now seem to take place at the eastern side of the island instead of in the strait (western side) and northwest of Saint Lawrence Island; the Fall seals are now hunted on a different schedule; it is now hard to get tomcod and blue cod in Winter ice fishing, and all this results in shorter Spring harvest.

The warmer climate so far has also resulted in some positive impacts: the marine mammals hunted appear to be in good health, the bowhead whale continues in good numbers with good population growth, harvesting of whales has occurred in Fall/Winter for several years now, harvesting of all species of salmon now occurs in Summer, the cod previously depleted by commercial fishermen are back in local waters, and berries continue to grow as well as other plants and roots gathered for food.

Further information:

Ministry of the Environment of Finland, Indigenous Peoples and Traditional Knowledge Related to Biological Diversity and Responses to Climate Change in the Arctic Region, www.cbd.int/doc/publications/tk-cc-arctic-en.pdf

28 ALASKA | Reduced walrus hunting in Alaska and changes to boat fabrics

Adaptation, human health, food security

In Alaska, indigenous peoples have begun hunting only once a year instead of twice as a result of changing climatic conditions that impact migration patterns and make sea-ice hunting more dangerous. In order to adapt to this enforced change, communities have constructed cold-storage facilities to meet resulting increased quantities and changing timing of supply. The early melting of sea ice in the spring has also made it more difficult to hunt spring walrus in Alaska. As such, indigenous communities have begun shifting from walrus-skin boats to fabric boats due to the difficulty in finding suitable walrus.

Further information:

Ministry of the Environment of Finland, Indigenous Peoples and Traditional Knowledge Related to Biological Diversity and Responses to Climate Change in the Arctic Region, www.cbd.int/doc/publications/tk-cc-arctic-en.pdf

29 ALASKA | Decreasing caribou herds, seal pups and polar bears

Local observations & impacts, wildlife, food security

The migratory Porcupine Caribou Herd's calving grounds are primarily in a narrow section of the coastal plain in Alaska, a wilderness area with petroleum reserves; thus the herd has become the subject of a high-profile, bitter and protracted dispute regarding its ongoing protection. The Gwich'in people who are strongly connected to the Porcupine Herd believe the calving area in northern Alaska is sacred ground. Increased oil and gas exploration and preparations for pipeline development are taking place on the winter range of the herd in the Canadian side of the region. Temperatures are measurably warming in this area already, and the extent of permanent sea-ice is decreasing. Changes in snow conditions in the Arctic Borderlands may now be contributing to the observed decline in population of the Porcupine caribou herd. Travel for the caribou is also getting harder because warmer temperatures in the spring are causing rivers and lakes to break-up earlier.

The Tuktu and Nogak Project collected Inuit observations on the Bathurst Caribou Herd. Inuit Elders in the Bathurst Inlet area in Nunavut have reported how warmer weather in the 1990s affected the Bathurst Caribou Herd. The elders believed that the Bathurst caribou shifted their migration routes to avoid rivers full of rushing water and chunks of ice.

Further information:

Keep It Simple and Be Relevant: The First Ten Years of the Arctic Borderlands Ecological Knowledge Co-op, <http://www.millenniumassessment.org/documents/bridging/bridging.10.pdf>; West Kitikmeot / Slave Study, http://www.enr.gov.nt.ca/_live/documents/documentManagerUpload/West_Kitikmeot_Slave_Study_2007_Update.pdf; ACIA, pp61-98 <http://www.acia.uaf.edu/pages/scientific.html>

The elders also noted that more caribou were drowning as the caribou fell through ice that was thinner than usual. Traditional knowledge has also documented major climatic change at Holman, on the west coast of Victoria Island. There, it was normally safe to travel on sea ice by mid October, but now this travel is not safe until the end of October. There is less snow pack, and the condition of seal pups and Polar Bears has declined (pups have less time to bask and fatten up on the sea ice and are less available to the bears).

30 ALASKA | Seasonal Ice Zone Observing Network, Barrow (SIZONET)

Local observations & impacts, traditional knowledge, sea-ice, technology transfer

The morphology, stability and duration of seasonal landfast sea ice in Alaska's coastal zone is changing alongside large-scale ice thinning and retreat. Barrow, Alaska is an example of a community that experiences and utilizes a broad range of sea-ice types and conditions. The local population is increasingly forced to adapt to less stable sea ice, loss of multiyear ice and a shorter ice season. One of the primary objectives of SIZONET is to bring together geophysical methods of monitoring and studying Alaska's coastal and landfast sea ice with local Iñupiat observations and understanding of sea ice. Geophysical datasets, such as coastal radar monitoring of ice stability and movement, SAR satellite imagery, on-ice and air-borne thickness measurements and detailed monitoring of ice formation and evolution, are being interpreted alongside a program of regular, undirected observations by Iñupiat sea-ice experts and interviews with whalers working in communities of Barrow and Wales, Alaska. During two significant landfast ice breakout events off Barrow in spring of 2007, Barrow's subsistence whaling community partook in a successful hunting season observing and responding to these breakout events and their impacts on ice stability. Using local expert knowledge to parse geophysical datasets obtained from the observatory provided deeper insight into different approaches for assessing ice stability, and integrating information on ice growth, origin, morphology, and dynamics, as well as winds, weather, and currents.

Further information:

SIZONET, <http://www.sizonet.org/>; Druckenmiller, M (2009): Toward an integrated coastal sea-ice observatory: System components and a case study at Barrow, Alaska: Cold Regions Science and Technology Volume 36, Issues 2-3, May 2009, Pages 61-72, <http://dx.doi.org/10.1016/j.coldregi.2008.12.003>

31 ALASKA | Wales Inupiaq Sea Ice Dictionary (Kingikmiut)

Local observations & impacts, traditional knowledge, language

In the community of Kingiini, also known as Wales, Alaska, over one hundred terms have been documented in 2007-2008 for the types of sea ice (sigu) and associated phenomena in the local Kingikmiut dialect of the Iñupiaq language. Local climate knowledge is embodied within such terminology. The Kingikmiut 'Sea Ice Dictionary' has been endorsed by the Community of Wales for publication and also for the prospective use in the Wales High School as a part of local cultural and language curriculum.

Further information:

Geomatics and Cartographic Research Centre (GCRC), Carleton University, <https://gcr.ccarleton.ca/confluence/display/ISIUOP/Wales+Inupiaq+Sea+Ice+Dictionary>

32 ALASKA | Alaskan communities falling into the ocean (Shishmaref and Newtok)

Adaptation, local observations & impacts, displacement, coastal erosion

As a result of unprecedented warming trends due to climate change, several indigenous coastal villages in Alaska are actively trying to find out where they could move entire communities, due to erosion caused by the thawing of permafrost and large waves slamming against the west and northern shores of Alaska. More than 80% of Alaskan communities, comprised mostly of indigenous peoples, are identified as vulnerable to either coastal or river erosion. Moreover, melting mountain snow and ice creates rapid water level rise, which in turn wash away large amounts of village riverbanks. This takes large amounts of soil into the rivers, causing riverbeds to rise as eroded soil accumulates on the bottom. Shallow waters are harmful to fish stocks and thus also to indigenous subsistence fishing. In addition to all the immediate problems these changes are causing, they also force indigenous communities to actively consider various relocation possibilities. It will be enormously difficult for many indigenous communities to finance the relocation of entire villages and build up new infrastructure in new settlements without external assistance, in particular economic assistance.

Further information:

Arctic Change, <http://www.arctic.noaa.gov/detect/human-shishmaref.shtml>; Cochran, P. 2007, Alaska natives left out in the cold, Viewpoint, BBC News, 4 January 2007, <http://news.bbc.co.uk/2/hi/science/nature/6230731.stm>; CNN, 'Climate Change' forces Eskimos to abandon village, <http://edition.cnn.com/2009/TECH/science/04/24/climate.change.eskimos/index.html>

For example, the village of Shishmaref, a traditional Inupiat village in the Bering Straits inhabited for 400 years, is facing evacuation. In the past, sea ice would form in the fall, creating a blockade of ice along the shore, which acted as a protective barrier against sea storms. This protective sea ice, which used to be in place by October or November, no longer forms solidly. Its absence allows powerful waves higher storm surges to reach shore where they undercut the banks that are already weakened by an increased melting of permafrost. In July 2002, residents voted to relocate the community. However, numerous problems slowed the process, including reluctance of the state and federal governments to give monetary support for vital infrastructure. In 2008, the community learned that the site chosen for relocation was not suitable due to permafrost issues and had to begin efforts anew. In 2009, the community of the coastal village of Newtok voted to relocate its 340 residents to new homes 9 miles away, up the Ninglick River. The village, home to indigenous Yup'ik Eskimos, is the first of possibly scores of threatened Alaskan communities that could be abandoned. Warming temperatures are melting coastal ice shelves and frozen sub-soils, which act as natural barriers to protect the village against summer deluges from ocean storm surges. The U.S. Army Corps of Engineers has estimated that moving Newtok could cost \$130 million. Twenty-six other Alaskan villages are in immediate danger, with an additional 60 considered under threat in the next decade, according to the corps.

33 ALASKA | National Wildlife Refuges in Alaska and the Central Flyway

Local observations & impacts, wildlife, transport

Indigenous communities on the Aleutian Island chain are concerned about the potential effects of increased shipping traffic in new routes that may become accessible in a more ice-free Arctic Ocean. Previous introductions of non-endemic species to islands have had severe negative effects on nesting Aleutian Canada geese. Birds that breed in Alaska traverse most of the system as they use portions of the Pacific, Central, Mississippi, and Atlantic Flyways during their annual cycle. The ecosystem management mandate of the National Wildlife Refuge (NWR) in this area has been implemented through development of monitoring partnerships that are designed to detect the appearance of invasive species and of contaminants, and initiation of timely prevention/mitigation programs. Indigenous peoples that depend on Interior

Further information:

Julius, S and West, J (2008): Adaptation Options for Climate-Sensitive Ecosystems and Resources, Annex A, http://picaa.sel.uaf.edu/manuscripts/griffith_annexa2008.pdf

Alaska NWRs are concerned about the potential effects of climate-induced lake drying and changing snow conditions on their seasonal access to subsistence resources, and on the availability of waterfowl for subsistence harvest. The refuges have promoted enhanced capacity for projecting possible future conditions, and have educated users regarding observed and expected changes while clarifying conflicting information on the magnitude and extent of observed changes in lake number and area and in snow conditions.

34 ALASKA | Sea Ice and Weather Monitoring

Local observations & impacts, database

Daily ice and weather monitoring in each of the partner communities of Gambell, Wales, Barrow, and Shaktoolik is organized within monthly journals (since late 2006 and/or early 2007), and the majority of records are being incorporated into the database that is part of the SIZONet project at UAF. These daily observations are continuing to provide a 3-year observational record during the International Polar year period.

Further information:

Geomatics and Cartographic Research Centre (GCRC), Carleton University, <https://gcr.c.carleton.ca/confluence/display/ISIUOP/Sea+Ice+and+Weather+Monitoring>

35 CANADA | Adaptation to health impacts of climate change by Inuit Tapiriit Kantami (IPCC)

Adaptation, health, housing

A series of workshops organised by the national Inuit organisation in Canada, Inuit Tapiriit Kantami, documented climate-related changes and impacts, and identified and developed potential adaptation measures for local response. The strong engagement of Inuit community residents will facilitate the successful adoption of the adaptation measures identified, such as using netting and screens on windows and house entrances to prevent bites from mosquitoes and other insects that have become more prevalent.

Further information:

IPCC Fourth Assessment Report, Cross-Chapter Case Study C4.2.4, <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-xccc.pdf>; Inuit Tapiriit Kantami, <http://www.itk.ca/>

36 CANADA | Inuit Sea Ice Use and Occupancy Project (ISIUOP)

Local observations & impacts, traditional knowledge, technology transfer

This project builds on previous sea ice research with several Baffin Island communities. It aims to further document and map local sea ice expertise, including shifts in patterns of sea ice use due to social and/or climatic change. The project includes several smaller subprojects. Mapping Inuit Sea Ice Knowledge and Use (SIKU) in Cape Dorset, Igloodik, and Pangniirtung, and Igliniit in Clyde River focuses on innovative ways of representing Inuit knowledge to develop educational materials that can be used by a variety of audiences, and on evaluating the utility of the Floe Edge Service (satellite imagery of sea ice conditions) in each community. Igliniit is a pilot project to test new Global Positioning System (GPS) technology that can be mounted on a snowmobile and used to track sea ice travel routes, features, changes, wildlife, harvesting areas, etc.

Further information:

Nunavut Arctic College, <http://www.arcticcollege.ca/research/ShowResearch.aspx?Counter=1598>

37 CANADA | Nunavut observations of climate and environmental change

Local observations & impacts, water resources, traditional knowledge, food security, forecasting

In 1995, Shari Fox began a research project with the communities of Iqaluit and Igloodik to help document and communicate Inuit observations and perspectives of climate and environmental change. In 2000, the communities of Qamani'tuaq (Baker Lake) and Kangiqtuqaapik (Clyde River) joined the project. A long-term, multiphase approach has driven the research and the integration of multiple techniques such as interviews, focus groups, videography, and mapping were used to collect, analyze, and communicate information. Close collaboration with individuals and communities has been central to the project. The case study presented here draws on two examples from the project to show how Inuit in Nunavut are observing and experiencing climate and environmental changes and their associated impacts and hazards.

Further information:

Arctic Climate Impact Assessment (pp. 61-98), <http://www.acia.uaf.edu/pages/scientific.html>

The people of Nunavut have reported many observations of environmental change – two examples that appear to be related to climate change are increased weather variability across the region and changing water levels in the Baker Lake area. Other environmental changes are linked to the sun - in some areas, for example, although the overall temperature may not be warmer, elders claim that the heat of the sun is causing small ponds to be warmer than usual or to dry up altogether. In some places, meat hung out to dry seems to get burned by the sun, and caribou skins seem to rip more easily around the neck area, a new condition elders link to skins possibly being burnt or becoming too hot from the sun.

For many elders, increased weather variability and unpredictability also have an emotional and personal impact. For much of their lives they have been able to advise the people around them confidently about when and where to travel, providing weather predictions. As their skills no longer work, some elders are now less confident and feel sadness that their advisory roles have changed. Summer caribou hunting grounds can no longer be reached and there are fewer fish in areas where they are traditionally expected, and when present are often small or skinny. Like many of the environmental changes being experienced in the Arctic, low water levels and subsequent impacts are a relatively recent phenomenon (or have not been experienced in a long time). Coping strategies are focused primarily on the day-to-day. Hunters adjust their travel routes and hunting grounds, looking for caribou in other areas. Residents change fishing areas looking for more abundant and healthier fish populations. While these strategies allow residents to continue day-to-day life, it is unclear what will happen if the water condition persists or worsens. In the community, long-term plans are yet to be developed.

38 CANADA | Maana [Now] video

Local observations & impacts, youth, video

Maana is a humorous short film by Félix Pharand about a young Inuk, acknowledging global warming and its impacts on his community. He realises the carbon heavy footprint of his modern Arctic community intends to drastically reduce the energy consumption of his village.

Further information:

Isuma.tv, <http://www.isuma.tv/hi/en/our-lands/maana-now>

39 **CANADA | Innovative Methods for Sharing Inuit Observations on Climate Change****Local observations & impacts, multimedia**

The International Institute for Sustainable Development (IISD) and the Hunters and Trappers Committee of Sachs Harbour initiated a project to document the effects of climate change in the Arctic and communicate it to Canadian and international audiences. The project team worked in partnership with specialists from five organizations to develop an innovative method for recording and sharing local observations on climate change. The project took place on Banks Island in Canada's High Arctic. The approach, involving Inuvialuit hunters and trappers, combined participatory workshops, semi-structured interviews, community meetings and fieldwork to better understand the extent of local knowledge of climate change. During the year-long initiative, the project team produced a broadcast-quality video and several scientific journal articles to communicate the negative consequences of climate change in the Arctic and to understand the adaptive strategies that local people are using in response.

Further information:

CBD (2008): UNEP/CBD/EM.CC-ILC/1/3, Compilation of Case-Studies on Climate Change and Biodiversity Considerations in the Arctic, <http://www.cbd.int/doc/meetings/tk/emccilc-01/official/emccilc-01-03-en.pdf>; Graham Ashford and Jennifer Castleden (2001): Inuit Observations on Climate Change. Final Report. 27 pp. International Institute for Sustainable Development, www.iisd.org/publications/publication.asp?prno=410

40 **CANADA | Voices from the Bay: Documenting and Communicating Indigenous Ecological Knowledge from the Hudson Bay Bioregion****Local observations & impacts, culture, traditional knowledge, livelihoods, ecosystem management, capacity-building**

The coastal and island communities of Hudson Bay, James Bay, Hudson Strait and Foxe Basin, covering an area of 1,150,995 km, practice the traditional ecological knowledge of the Inuit and Cree peoples, who are indigenous to the Hudson Bay Bioregion of arctic and sub-arctic Canada. Twenty-eight communities previously unidentified on area maps of the bioregion participated in the Hudson Bay Traditional Ecological Knowledge and Management Systems (TEKMS) Study: The study involved 15 Inuit and 13 Cree communities with populations ranging from 250 to 2,500 persons.

Further information:

UNFCCC Database on local coping strategies, Case Study 166, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=166; Voices from the Bay: traditional ecological knowledge of Inuit and Cree in the Hudson Bay bioregion (1998) Published by CARC and the Environmental Committee of Sanikiluaq ISBN: 0-91996-75-2 http://www.carc.org/voices_from_the_bay.php

'Voices from the Bay' originated with the Hudson Bay Traditional Ecological Knowledge and Management Systems (TEKMS) study, which originated in the Inuit community of Sanikiluaq. The aim of the study from the perspective of its indigenous participants was to put their ancestral knowledge of the environment into writing so that it is appropriately transmitted and incorporated into environmental assessments and policies and communicated effectively to scientists, the interested public, and the youth of the participating communities. Thirty communities were identified and invited to participate in the community-led study to document the traditional ecological knowledge of Inuit and Crees living on islands and areas surrounding the Hudson and James Bays. The aim was to inform public policy and environmental decision-making for the Hudson Bay bioregion. Findings on climatic changes, changing current and ice regimes, long-term effects of flow diversions, habitat change and loss, animal population and migration changes, contamination of the Hudson Bay food web, and changing land use patterns were published in "Voices from the Bay".

For example, Cree and Inuit forecast daily weather, predict seasonal characteristics, and adjust to seasonal change using their knowledge of clouds, stars, northern lights, wind, snow ice, currents, and animal behaviour. Of particular importance to the Inuit is the sea ice as different ice conditions determine which sea mammals are present in winter and which areas can support hunting and travel. This strong reliance on sea ice for travelling and hunting is reflected in their knowledge of its processes, characteristics, and annual cycles. Thus Inuit have developed distinct terms to describe different stages of ice development and its associated possibilities. For example, some ice sorts (sikuak) support very good breathing holes for seals, while others (Milutsinik and iktaniq) resulting from freezing snow water are avoided by hunters and animals.

41 **CANADA | Yukon First Nations Climate Change Forum Observations****Local observations & impacts, wildlife, traditional knowledge, water resources**

The Council of Yukon First Nations held a series of workshops in February 2003 to address climate change. At the Elders Climate Change Workshop and the Yukon First Nations Climate Change Forum, elders and community representatives described the changes that they have seen. In the northern Yukon, freezing rains in November have meant that animals cannot eat. Birds that usually migrate south in August and September are now being seen in October and November. In some areas, thawing permafrost has caused the ground to drop and in some cases has made the area smell foul. In more southerly communities, rings around the moon are no longer seen, although they are still visible in the northernmost community. There are increased sightings of new types of insect and an increase in cougar (*Puma concolor*) and mule deer (*Odocoileus hemionus*). People used to be able to predict when it would get colder by looking at tree leaves. It is difficult to do that now. Lakes and streams are drying up, or are becoming choked with weeds, making the water undrinkable. Many animals are changing their distribution and behavior. Bears used to go into their dens in October and November, but are now out until December. One bear was spotted in winter sleeping under a tree but above ground, rather than in a den, which was regarded as an exceptional and unprecedented sighting.

Further information:

ACIA, pp61-98, <http://www.acia.uaf.edu/pages/scientific.html>

42 **CANADA | Inuit Qaumjimatjuqangit, climate and caribou (Nunavut)****Local observations & impacts, animal husbandry**

Inuit observations of climate change have been recently documented for the Kitikmeot region of Nunavut. People have spoken of a changed climate in the 1990s compared with previous decades: increasing temperatures with earlier spring melts and later freeze-ups in autumn have meant periods of longer summer-like conditions, while weather has become variable and unpredictable. This change and variability has had many impacts on caribou. Migration routes and the location of calving grounds have shifted and food sources have sometimes become inaccessible.

Further information:

Thorpe, T., S. Eyegetok, N. Hakongak and the Kitikmeot Elders, 2002. Nowadays it is not the same: Inuit Qaumjimatjuqangit, climate and caribou in the Kitikmeot Region of Nunavut, Canada In: I. Krupnik and D. Jolly (eds.). The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change, pp. 198-239. Arctic Research Consortium of the United States, Fairbanks, Alaska.

43 **CANADA | Sikusilarmiut Place-Name Project****Adaptation, language, traditional knowledge**

The Sikusilarmiut Place-Name Project draws from the expertise of Inuit living in the present-day community of Kinngait, meaning mountains or high hill. Place names and associated routes are vital to many northern communities as they contain important knowledge about Inuit navigation routes, travel safety, food availability, history, and various ecological and sea ice features. Because many Sikusilarmiut place names and routes persist through time they also serve as important spatial and temporal reference points that document climate-sensitive features that can help integrate multiple ways of understanding and identifying environmental change through time. Over 600 place names and approximately 100 routes on six 1:250,000 NTS topographic sheets have been recorded since 2002.

Further information:

Henshaw, A (2006): Pausing Along the Journey: Learning Landscapes, Environmental Change, and Toponymy Amongst the Sikusilarmiut, Arctic ANthor. 43(1):52-66 (2006); Geomatics and Cartographic Research Centre (GCRC), Carleton University, <https://gcr.ccarleton.ca/confluence/display/ISIUIOP/Sikusilarmiut+Place-Name+Project>

44 **CANADA | Arctic Peoples, Culture, Resilience and Caribou (Gwich'in)****Local observations & impacts, traditional knowledge, wildlife**

Hazards associated with climate change being experienced by northern communities include melting sea-ice and increased forest fires. Factors influencing the abilities of individuals, households and communities to respond to these changes include social networks, availability of traditional knowledge and cultural resources, and governance structures. This project involves community-based research on complementary case studies in Nunavut, Yukon and the Northwest Territories.

Further information:

Arctic Peoples Culture, Resilience and Caribou, March/09, <http://www.gwichin.org/reports/acrc-0309.pdf>

45 **CANADA | Inuit Assessing Vulnerability to Sea Ice Change: An example from Igloodik, Nunavut****Local observations & impacts, transport, food security, health, adaptation, traditional knowledge**

The observations of community members and instrumental records indicate changes in sea ice around the Inuit community of Igloodik, in the Canadian territory of Nunavut. This paper characterizes local vulnerability to these changes, identifying who is vulnerable, to what stresses, and why, focusing on local and regional use of sea ice for the harvesting of renewable resources and travel. This analysis is coupled with instrumental and sea ice data that evaluates changing climate/sea ice trends over time, to complement local observations. It demonstrates the relationships between changing sea ice conditions/dynamics and harvesting activities (i.e. dangers and accessibility), with specific emphasis on ringed seal and walrus seasonal hunting, to illustrate current sea ice exposures that hunters are facing. Community members are adapting to such changes, as they have done for generations. However, current adaptive capacity is both enabled, and constrained, by social, cultural, and economic factors that manifest within the modern northern Hamlet. Enabling factors include the ability of hunters to manage or share the risks associated with sea ice travel, as well as through their flexibility in resource use, as facilitated by sophisticated Inuit traditional knowledge and land/navigational skills. Constraining factors include the erosion of land-based knowledge and skills, altered sharing networks, as well as financial and temporal limitations on resource harvesting. The differential ability of community members to balance enabling and constraining factors, in relation to current exposures, comprises their level of vulnerability to sea ice change.

Further information:

Natural Resources Canada Climate Change Research Database, http://adaptation.nrcan.gc.ca/projdb/t68_e.php

46 **CANADA | Education Materials and Mapping Inuit Sea Ice Knowledge and Use (Nunavut)****Local observations & impacts, traditional knowledge, awareness raising, technology transfer**

Building on previous research that characterized the importance of sea ice processes, use, and change around three Nunavut communities, this project focuses on innovative ways of representing previously documented Inuit knowledge of sea ice (e.g. floe edge position, tidal cracks, polynyas, travel routes, dangerous areas, changing ice conditions, safety indicators, and Inuktitut terminology) to develop educational materials that can be used by a variety of audiences. The Floe Edge Service (satellite imagery of sea ice conditions) has also recently been implemented in each community, and the project is working to evaluate how the products are being used, what kinds of useful information the service provides, and how the service could be better tailored to meet community needs.

Further information:

Straight Up North, <http://www.straightupnorth.ca/>

47 **CANADA | Igliniit GPS project (Nunavut)****Local observations & impacts, technology transfer**

In the Igliniit Project, geomatics engineers and Inuit hunters have come together to design a new, integrated GPS system that can be easily and affordably mounted snow machines (snow scooters), the regular mode of travel used by Inuit hunters in Canada who log thousands of kilometres per year. The system automatically logs the location of the snow machine every thirty seconds, providing geo-referenced waypoints that can later be mapped to produce the traveller's routes on a map. In addition to tracking routes, the Igliniit system logs weather conditions (temperature, humidity, pressure, etc.) and the observations of hunters (e.g. animals, sea ice features, hazards, placenames) through a customized computer screen that has a user-friendly icon interface. Digital cameras (photo and video) that the hunters carry with them provide visual images at certain waypoints (e.g. photos of dangerous hazards, video of animals). All of the data logged in this system is downloaded in the community and used for the creation of maps. These maps integrate the collected data, showing the routes of individual snow machines, along with the geo-referenced observations of the hunters and weather conditions. When the maps of different hunters are overlaid, and more maps are accumulated over time, the result is a valuable picture of Inuit-land-sea ice characteristics and use that combines both quantitative data (GPS, meteorological data) and qualitative data (hunters' observations).

Further information:

National Snow and Ice Data Center, http://nsidc.org/research/projects/Gearheard_Igliniit_Project.html

48 **CANADA | Nunavik Communities and Ice: Environmental change and community safety (Kativik)****Local observations & impacts, transport, health**

This project uses both Inuit and scientific knowledge to document the impacts of climate change on winter trail networks that provide access to traditional harvesting grounds and resources in Nunavik. Initial work on related projects has involved interviews conducted by community researchers which were focused on identifying the trail networks currently used at various periods of the year and by which means of transportation.

Further information:

Climate Changes in Northern Quebec, <http://climatechange.krg.ca/>

49 **CANADA** | Impacts on traditional food security in Canadian Inuit communities**Local observations of impacts, food security, wildlife, transport, health, beneficial effects**

Traditional/country foods are critical resources for physical, as well as mental, social and economic health of individuals and communities across the Arctic. Despite this, shifts in traditional/country food consumption have been taking place over the past 15 – 20 years related to a variety of changes in northern ecological, social, political and economic systems. Those related to ecological shifts have been primarily associated with reduced confidence in food safety due to identified threats from environmental contaminants such as mercury and PCBs, and more recently the changes in species availability and accessibility due to shifting climatic conditions. Specifically, climate related changes and variability in the North have been associated with changes in animal, fish and plant population health and distribution, while changes in ice, snow, precipitation regimes, and other environmental factors have the potential to influence human travel and transportation in the North, and thus Inuit access to these wildlife resources. As such, climate change and variability has the potential to influence nutrition and health status among Inuit via impacts on aspects (availability, accessibility and quality) of traditional/country food security.

During Phase I of this project both positive and negative changes in the traditional/country food harvest of five Inuit communities were reported in relation to changes and variability in climatic conditions. It was documented that environmental changes are already having some impacts on both the availability of wildlife species and hunters' access to them in all regions studied (Nunavik and Nunavut). Additionally, during the 2004 Nunavik Regional Inuit Health survey, respondents reported some influence of climate and environmental change on wildlife access and availability in comparison with the same hunting season in previous years. However, the impacts are not homogenous among all hunters and communities and both individuals and households show differential ability to adapt successfully. Factors such as access to economic resources and equipment, experience, and the nature of the adaptive strategy used appear to influence the success of hunter adaptations. Further, through the analyses of harvest and local consumption data in Nunavut it is feasible to relate wildlife harvest data to traditional/country food use at both community and regional levels. Thus, it is possible to begin to model the relationship between climate projections, impacts on key environmental variables influencing availability of wildlife and/or Inuit access to traditional/country food species (e.g. ice conditions), and the level of viable consumption of those species in the community. Phase II of the study (2008-2011) will build on and extend the work Phase I to further understanding of the impacts of climate change and variability on traditional/country food security, and Inuit community health.

Further information:

Food Security, Ice, Climate and Community Health: Climate change impacts on traditional food security in Canadian Inuit communities, http://www.arcticnet.ulaval.ca/index.php?fa=ResearchHome.showThemeProjects&theme=14&project_id=66

50 **CANADA** | Drinking water threats to human health (Nunavik)**Local observations of impacts, health, water resources**

In Nunavik, chlorine-treated water is delivered daily, by tank truck, to the houses, where it is stored in tanks. A large part of the Inuit population continues to depend on an untreated water supply, however. This traditional activity poses certain risks in a region with an abundant presence of migratory animals. Nunavik has also experienced significant climate warming since the beginning of the last decade. The main goal of this study, which took place in 2003 and 2004, was to evaluate drinking habits that may place Nunavik residents at an increased risk of gastroenteric diseases in the context of climate change.

The main climate change impacts reported by Nunavik residents are earlier springs, longer and hotter summers than before (30 to 40 years ago) with less precipitation, colder and shorter winters with less snow, thinner ice covering on lakes and rivers, lower lake levels, decreased river flows, and the drying up of small rivers and small lakes. Nunavik residents have also noticed major shoreline erosion on certain rivers, higher turbidity of running water, and a deterioration of raw water quality. Collection of untreated water is a traditional activity among Inuit, particularly elders, who have spent a large part of their lives outdoors. For most of the people interviewed, gastrointestinal symptoms were usually associated with tap water. When they started having problems with the tap water, they would look for water outdoors. However, they mentioned that in spring, when the ice was starting to break up, the water obtained outdoors tasted different, and cases of diarrhea were more frequent.

Further information:

Drinking water and potential threats to human health in Nunavik: adaptation strategies under climate change conditions, http://www.accessmylibrary.com/coms2/summary_0286-31898940_ITM

51 **CANADA** | Cambridge Bay, Nunavut video**Local observations of impacts, traditional knowledge, multimedia**

From throat singing to break dancing and arctic games, this film is designed to give a vision of what it is like to be a youth in Cambridge Bay, Nunavut. Through their pictures and words, the youth reveal the importance of keeping their culture alive and discuss some of the impacts climate change has already had in their lives.

Further information:

Conversations with the Earth, <http://www.conversationsearth.org/>

52 **FINLAND** | Saami Observations from the communities of Purnumukka, Ochejohka, and Nuorgam (SnowChange)**Local observations of impacts, animal husbandry, extreme events, wildlife, forecasting, traditional knowledge**

This case study comes from a project carried out as part of the SnowChange program organized by the Environmental Engineering Department at Tampere Polytechnic in Finland. The study took place in two locations: the small reindeer herding community of Purnumukka, in central Lapland, and the Saami communities of Nuorgam and Ochejohka (Utsjoki) in the northeast corner of Finland, the only part of the country where Saami represent the majority of the population and involved community interviews and field work. Community observations include seasonal changes and their impact on reindeer herding; increased extreme events; disappearance of birds and insects; changes to the traditional calendar and associated negative impacts on traditional forecasting.

Further information:

Arctic Climate Impact Assessment (pp. 61-98), <http://www.acia.uaf.edu/pages/scientific.html>

53 **FINLAND** | Finnish Environment Institute Research Programme on Biodiversity**Local observations of impacts, biodiversity, wildlife**

The Finnish Environment Institute Research Programme on Biodiversity includes a climate change theme focused on northern environments and their communities and different conservational and management methods that can be used to promote species ability to cope with climate change. The aim of the programme is to analyse the effects of climate and land use changes on species. Studies are based on various climate and land use scenarios. Modeling techniques are used to study the changes in the distribution of target species as well as threats they are facing.

Further information:

CBD (2008): UNEP/CBD/EM.CC-ILC/1/3, Compilation of Case-Studies on Climate Change and Biodiversity Considerations in the Arctic, <http://www.cbd.int/doc/meetings/tk/emccilc-01/official/emccilc-01-03-en.pdf>

54 **GREENLAND** | Sila-Inuk project - A Study of The Impacts of Climate Change in Greenland**Local observations of impacts, wildlife**

This project is a study of the impacts of climate change in Greenland coordinated by the Inuit Circumpolar Council, ICC Greenland and Kalaallit Nunaanni Aalisartut Piniartullu Kattuffiat (KNAPK), and the Association of Fishermen and Hunters in Greenland. Observations from field interviews included "Sila Assallattoq", "the weather has switched", so that it does not appear normal for the season; changing wind patterns; unseasonable weather; changing habits from birds and seals; receding glaciers; and changing tides levels.

Further information:

Inuit Circumpolar Conference, ICC-Greenland and Kalaallit Nunaanni Aalisartut Piniartullu Kattuffiat, The Association of Fishermen and Hunters in Greenland, KNAPK, <http://www.inuit.org/index.asp?lang=eng&num=261>

55 **GREENLAND** | Siku-Inuit-Hila project, "The Dynamics of Human-Sea Ice Relationships: Comparing Changing Environments in Alaska, Nunavut and Greenland"**Local observations of impacts, culture, technology transfer**

The Siku-Inuit-Hila (Sea Ice-People-Weather) project involves Inuit, Inughuit, and Inupiat from Kangiqtuqaapik (Nunavut), Qaanaaq (Greenland), and Utqiagvik (Alaska), respectively, along with academic researchers from several institutions in these three countries. As a collaborative international initiative, SIKU brings anthropologists, human geographers, sea ice and climate scientists, marine and ecosystem biologists from the U.S., Canada, Russia, Greenland, and France in partnership with almost two dozen indigenous communities in Alaska, Arctic Canada, the Russian Chukchi Peninsula, and Greenland. The project brings together traditional knowledge, science, and methods from social sciences (e.g. interviews; participatory observation) and physical science (e.g. analysis of remote sensing imagery and meteorological data). The project relies heavily on fieldwork conducted in each community. Comparisons of sea ice use and changes are the focus of workshops and field excursions. The team intends to also establish ice monitoring stations, which are monitored by local observers to record the ice growth and melt cycle at key locations for each community. Funding is organized as a consortium of local or national initiatives with their respective budgets provided by the national funding agencies.

Further information:

National Snow and Ice Data Center, http://nsidc.org/research/projects/Gearheard_Human_Sea_Ice_Relationships.html; Kielsen, Lene Holm (2009), Presentation at UNESCO Climate Change and Arctic Sustainable Development International Experts Meeting, Monte Carlo, 3-6 March 2009, http://www.unesco.org/csi/LINKS/monaco-abstracts/Holm_abstract_MonacoUNESCOarctic.pdf

56 **GREENLAND** | Ice and Climate Change in Qeqertaq**Adaptation, local observations of impacts, transport, food security, health, wildlife**

A local sea ice knowledge and use documentation project conducted in West Greenland by a French researcher at Meteo France Limoges, aimed at documenting changes in ice conditions and the use of sea ice by the Qeqertarmiut between 1987-1988 and 2008. Changing sea ice conditions have triggered dramatic changes in the use of sea ice by the Qeqertarmiut. The dog-sleds are now used for one or two months only. There is little sea ice fishing and no use of ice-nets; as a result, fewer seals are being caught in wintertime. Many more accidents have occurred involving hunters and fishermen falling through ice. No sassa (whale entrapping events) were observed in recent years, which transforms in less whale meat available to the community. Some hunters and fishermen stopped using dog-sleds altogether or are building lighter sledges to travel on thin sea ice.

Further information:

Geomatics and Cartographic Research Centre (GCRC), Carleton University, <https://gcr.ccarleton.ca/confluence/display/ISIUOP/Ice+and+Climate+Change+in+Qeqertaq>

57 **NORWAY** | Norwegian Arctic Climate Impact Assessment (Nor-ACIA)**Local observations of impacts**

Norway has established the Nor-ACIA secretariat, which is a Norwegian follow-up of the Arctic Climate Impact Assessment (ACIA). The ACIA is an international project of the Arctic Council and the International Arctic Science Committee (IASC) to evaluate and synthesize knowledge on climate variability, climate change, and increased ultraviolet radiation and their consequences. The results of the assessment were released at the ACIA International Scientific Symposium held in Reykjavik in November 2004. The offices of the Nor-ACIA secretariat are within the Norwegian Polar Institute in Tromsø. The Norwegian Polar Institute is Norway's central institution for research, environmental monitoring and mapping of the Polar Regions. Climate research is the area that engages the most researchers at the Norwegian Polar Institute. The Norwegian Polar Institute is investigating these climate changes and understanding the consequences they have for the unique polar environment. Also, within the Biodiversity Programme of the Institute, a major focus is the potential effect of climate change on populations and communities.

Further information:

Norsk oppfølging av, <http://www.noracia.npolar.no/>

58 **NORWAY** | Social implications of oil and gas exploration in Hammerfest**Local observations of impacts, energy, livelihoods, food security, animal husbandry, beneficial effects**

This research addresses the impact of oil and gas activities in the Nenets Autonomous Okrug (NAO) and the town of Hammerfest focusing on the interface of local livelihoods and oil and gas development, in the context of climate change. While oil and gas also represents great opportunities for communities in the north, these case communities are challenged by oil and gas activities in different ways. For the Nenets, central concerns are segmented and diminishing pastures for reindeer and reduced hunting grounds. While new economic activities have brought benefits and opportunities, these may not be equally distributed among and within communities. For Hammerfest, interactions between fisheries and oil and gas activities present new challenges. In both areas, polluted fishing grounds, increased new and unfamiliar economic activities and changes in social structures – in addition to a changing climate – are challenging the opportunities to sustain livelihoods.

Further information:

Hovelsrud, Grete K., Winfried Dallmann and Helene Amundsen, 2008. Arctic oil and gas exploration: Social implications. Arctic Frontiers: Challenges for oil and gas development in the Arctic, 20-25 January 2008, Tromsø. <http://www.cicero.uio.no/media/5858.pdf>

59 **RUSSIA** | Kola observations from the Saami community of Lovozero (SnowChange)**Local observations of impacts, seasonal, animal husbandry, wildlife, forecasting, traditional knowledge**

This case study is drawn from research carried out as part of the SnowChange initiative. For this case study, researchers spoke with elders, reindeer herders, cultural activists, and other local people. Researchers selected from the material gathered in interviews the comments most relevant to the changes local people see in the local ecological and climatic situation. The people interviewed stated that there are many other concerns in addition to climate change, such as the state of Russian society, economic hardship, and lack of resources. But climate change, particularly changes in local weather, has become an increasingly important issue for the reindeer herders and others in Lovozero. Earlier melting and later freezings have disrupted the rhythm of the yearly cycle of herding and slaughtering of reindeer is disrupted and changed the migration patterns of the reindeer. New species of plants have arrived and the number of birds and insects has decreased. The Saami calendar, a system of local traditional knowledge of marker days, seasons, and certain activities tied to seasonal cycles, is off-balance.

Further information:
Arctic Climate Impact Assessment (pp. 61-98), <http://www.acia.uaf.edu/pages/scientific.html>

60 **RUSSIA** | Status and perspectives of the application and use of indigenous knowledge in the Russian Federation**Local observations of impacts, wildlife, traditional knowledge, extreme events, forecasting**

The Russian Federation, from the Kola Peninsula in the north-west to the Chukotka Peninsula in the north east and Primorye in the east, had long been inhabited by indigenous peoples of the North, Siberia and the Far East. The population belonged to forty different ethnic groups, traditionally with a nomadic existence including hunting, fishing, reindeer herding, harvesting of wild plants and the bounties of the sea to sustain families and communities. The majority of the indigenous people had adopted a settled way of life and were continuing with their traditional activities. A federal law had established specific areas for traditional land use and the ways of life of the indigenous peoples of the North, Siberia and Far East. That law recognized that traditional land use areas should be conserved due to their high biological diversity.

Examples of practical use of traditional knowledge included (a) Whale, seal and bird conservation: using indigenous knowledge of the Chukotka to monitor seal and bird behaviour and counting whales with specific observations of ice and snow cover. Changes in ice and snow cover were the main cause of major disasters facing indigenous people, in particular, the reindeer herders; and (b) Forest resources conservation: integration of scientific and indigenous knowledge in assessing land use, biological resources and how they could be used rationally.

Generally, the cycle of occurrence of floods was one in every eight years but the indigenous peoples' region had experienced three floods over a preceding two-year period indicating that the incidence of floods was on the increase with potential serious consequences for the local population and environmental resources. In addition to floods, other disasters such as forest fires, ice-covered ground, storms and earthquakes were also common events. In conclusion, the author indicated that some indigenous people were able to predict storms by observing the behaviour of sea birds, such as sea gulls, the colour of clouds and the direction of the wind.

Further information:
Dordina, Y (2004), RAIPON, In UNEP (2004), Report of the Meeting of Coordinators of the Project on Capacity-Building through Partnership and Information and Communication Technology for Using Indigenous Knowledge for Nature Conservation and Natural Disaster Management in Africa, <http://www.unep.org/depi/PDF/IKmeetingreport.pdf>

61 **RUSSIA** | Monitoring of Development of Traditional Indigenous Land Use Areas in the Nenets Autonomous Okrug, NW Russia**Local observations of impacts, technology transfer, livelihoods**

The collaborative project between a scientific institute (Norwegian Polar Institute) and an indigenous organization (Association of Nenets People "Yasavy") was developed in response to the need of the indigenous population of the Nenets to get an overview of the recent changes in the tundra. While a number of environmental projects are run by other institutions, none of them describe quantitatively the amount and geographical distribution of physical devaluation of tundra grounds and to what extent changes in indigenous livelihoods are due to oil development, or other factors like changes in climate, social conditions, etc. The principal objective of the project is to provide a tool – a GIS database – for the indigenous population of the Nenets Autonomous Okrug to discuss land use issues.

Further information:
Cicero (2008): Monitoring of Development of Traditional Indigenous Land Use Areas in the Nenets Autonomous Okrug, NW Russia, EcoPechora 2008, IPY PROJECT MODIL-NAO, <http://www.cicero.uio.no/media/6229.pdf>

62 **RUSSIA** | Sea Ice Knowledge (Uelen and Sireniki)**Local observations of impacts, language, forecasting, traditional knowledge**

This local knowledge documentation initiative is focused on the community of Uelen (population 800) on the arctic coast of Chukotka, to the north of Bering Strait. It includes daily observation of sea ice and weather conditions; preparation of the illustrated bilingual (Chukchi-Russian) dictionary of local sea ice terms (over 80 local terms have been documented and illustrated); interviews and stories about past sea ice knowledge and use, particularly, on navigation, ice hunting, ice safety, hunters' behavior on the drifting ice; documentation of traditional Uelen Chukchi terms for weather monitoring and forecasting; collection of instrumental records on the changing weather and ice conditions at Uelen for the period 1989-2008; and development of a bilingual Russian-Chukchi school curriculum on local ecological knowledge. Similar initiatives have been taken by other communities, such as the Russian-Yupik 'dictionary' of some 60 traditional terms for sea ice used in the community of Sireniki (Sighinek).

Further information:
Uelen Sea Ice Knowledge Documentation, <https://gcr.ca/leon.ca/confluence/display/ISIUOP/Uelen+Sea+Ice+Knowledge+Documentation>; Sireniki Sea Ice Dictionary, <https://gcr.ca/leon.ca/confluence/display/ISIUOP/Sireniki+Sea+Ice+Dictionary>

63 **RUSSIA** | Community Sea Ice/Weather Observations**Local observations of impacts, wildlife**

In this project, park rangers in the Beringia Natural Park in Provideniya, Russia, supply daily records on ice and weather conditions, local subsistence activities, and on the movement of marine mammals and birds in the area.

Further information:
Park rangers in the "Beringia" Natural (Natural-Ethnic) Park in <http://beringiapark.ru>

64 **RUSSIA** | Indigenous Knowledge in Disaster Management in Arctic Russia**Local observations of impacts, disaster preparedness, traditional knowledge, forecasting, animal husbandry**

This project was based on structured interviews with reindeer herders, hunters, fishers and gatherers in the Nenets and Kamchatka regions of Arctic Russia. Knowledge was documented on extreme weather events such as blizzards and heavy fogs, as well as floods, earthquakes, volcanoes and tsunamis. Project outcomes included a catalogue of the most common disaster types (blizzards, strong winds, floods and icing) and serious impacts (fires), and early warning signs (typically related to animal behaviour and appearance of the sky) as well as common strategies for minimizing the impact of natural disasters (including maintaining a state of constant preparedness for the disaster; finding a safe place to wait out the disaster; relying on domesticated animals to lead the way to safety; and avoiding and mitigating disasters by regulating the size of reindeer herds and managing the use of pastures).

This project was lead by the UNEP Division of Environmental Policy Implementation (DEPI) and implemented by the Russian Association of Indigenous Peoples of the North (RAIPON) and the UNEP Key Polar Centre (who provided results analysis, database and website development).

Further information:
RAIPON survey database:
<http://www.raipon.org/ikdm/>

65 **RUSSIA** | Integrated Ecosystem Approach to Conserve Biodiversity and Minimize Habitat Fragmentation in the Russian Arctic (ECORA)**Adaptation, biodiversity, livelihoods**

ECORA is a project sponsored by the Global Environment Facility (GEF) and was initiated by the Conservation of Arctic Flora and Fauna (CAFF) Working Group of the Arctic Council and the Russian Federation. ECORA is using an integrated ecosystem management (IEM) approach to conserve biodiversity and minimize habitat fragmentation in three selected model areas in the Russian Arctic. The model areas selected for this project are Kolguev Island in Nenets Autonomous Okrug, the Lower Kolyma River Basin in Yakutia (Sakha Republic), and the Beringovsky District in Chukotka Autonomous Okrug. ECORA aims to secure the integrity of these areas, which is currently threatened by pressures such as climate change, while supporting livelihoods of indigenous and local peoples.

Further information:
CBD (2008): UNEP/CBD/EM.CC-ILC/1/3,
Compilation of Case-Studies on Climate Change
and Biodiversity Considerations in the Arctic,
<http://www.cbd.int/doc/meetings/tk/emccilc-01/official/emccilc-01-03-en.pdf>

66 **RUSSIA** | Reindeer herders nomadic school (Nutlendli)**Adaptation, awareness raising, traditional knowledge, livelihoods**

In northern Russia, the Chukchi reindeer-herding community of Nutlendli is facing the melting of permafrost, resulting in the disappearance of lakes and the emergence of new severe floods. In order to survive through the changes that modernity and now climate change are imposing on them and their world, the Nutlendli community has begun providing education to the children of the community by means of a nomadic school. Through such schools, the community is able to build a relationship to the rapid changes of their land while ensuring that their knowledge and traditional livelihoods survive.

Further information:
Ministry of the Environment of Finland,
Indigenous Peoples and Traditional Knowledge
Related to Biological Diversity and Responses to
Climate Change in the Arctic Region, www.cbd.int/doc/publications/tk-cc-arctic-en.pdf

67 **RUSSIA** | Demonstrating sustainable conservation of biological diversity in four protected areas in the Russian Federation's Kamchatka Peninsula**Adaptation, traditional knowledge**

The project is designed to secure the global benefits of preserving biological diversity in all protected areas in the Kamchatka Oblast by demonstrating replicable, sustainable approaches to biodiversity conservation in four existing representative protected areas. It is also expected to promote alternative livelihood pursuits for local communities. This first phase of the project resulted in (a) draft provisions on public councils and local self-governance; and (b) protection of the Bystrinsk and Nalychevo natural parks with the use of traditional environmental knowledge of the indigenous peoples in the north.

Further information:
Kamchatka Biodiversity Conservation,
<http://www.unkam.ru/english/>



AFRICA

68 AFRICA REGION | African indigenous knowledge systems

Adaptation, traditional knowledge, forecasting, agriculture, women, pastoralism, drought, food security

Local communities and farmers in Africa have developed intricate systems of gathering, predicting, interpreting and decision-making in relation to weather. A study in Nigeria, for example, shows that farmers are able to use knowledge of weather systems such as rainfall, thunderstorms, windstorms, harmattan (a dry dusty wind that blows along the north-west coast of Africa) and sunshine to prepare for future weather. Local farmers in several parts of Africa have been known to conserve carbon in soils through the use of zero-tilling practices in cultivation, mulching, and other soil-management techniques. Natural mulches moderate soil temperatures and extremes, suppress diseases and harmful pests, and conserve soil moisture. The widespread use of indigenous plant materials, such as agrochemicals to combat pests that normally attack food crops, has also been reported among small-scale farmers.

Adaptation strategies that are applied by pastoralists in times of drought include the use of emergency fodder, culling of weak livestock for food, and multi-species composition of herds to survive climate extremes. During drought periods, pastoralists and agro-pastoralists change from cattle to sheep and goat husbandry, as the feed requirements of the latter are lower. The pastoralists' nomadic mobility reduces the pressure on low-capacity grazing areas through their cyclic movements from the dry northern areas to the wetter southern areas of the Sahel. African women are particularly known to possess indigenous knowledge that helps to maintain household food security, particularly in times of drought and famine. They often rely on indigenous plants that are more tolerant to droughts and pests, providing a reserve for extended periods of economic hardship. In southern Sudan, for example, women are directly responsible for the selection of all sorghum seeds saved for planting each year. They preserve a spread of seed varieties that will ensure resistance to the range of conditions that may arise in any given growing season and use these to manage changing climatic conditions.

Further information:

IPCC Fourth Assessment Report, Cross-Chapter Case Studies, <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-xccc.pdf>

69 AFRICA REGION | Desert Voices

Local observations & impacts, database, multimedia, desertification

Desert Voices is a collection of stories and testimonies of how climate change affects individual lives in Ethiopia and Sudan. Produced by journalists and compiled and published online, the radio and print testimonies of individuals, produced by journalists, aim to show the long term impact of desertification for the African region. Published for the World Day to Combat Desertification in 2007, the collection looks beyond the environmental impact of desertification and highlights its wide-ranging consequences, from migration in search of employment and increased conflict over resources, to changes in traditions and in women's roles. The personal accounts are narrated in the first person by men and women living in Africa, specifically Sudan and Ethiopia, where climate change has taken a toll on the way people live their lives.

Further information:

Panos London, <http://www.panos.org.uk/?lid=20026>

70 AFRICA REGION | Traditional Knowledge in Education

Adaptation, traditional knowledge

UNESCO, with the support of the Japanese Funds in Trust, recently completed a project engaging indigenous communities from Niger, Kenya and the Central African Republic in a dialogue on the ways in which their cultural heritage and traditional knowledge can be applied to education for a sustainable future, within the framework of the UN Decade of Education for Sustainable Development (2005-2014).

Further information:

UNESCO, http://www.un.org/esa/socdev/unpfii/documents/UNESCO_report_8th_session_en.pdf

71 AFRICA REGION | Soil and water conservation

Adaptation, agriculture

Indigenous soil and water techniques being used in Africa include earth bunds, bench terraces, stone bunds, step terraces, planting pits, micro-basins, contour ridges, mulching, raised-bed cultivation, mounds, strip cultivation, vegetation barriers, drainage ditches, ridge cultivation and basin irrigation. The major crops that are cultivated using these techniques are sorghum, pearl millet, maize and cassava. These cases cover a wide range of agro-climatological zones with annual rainfall varying from less than 200 mm in the Red Sea area of the Sudan to more than 2000 mm in Tanzania, Nigeria and Cameroon. Successful interventions were found to require a conducive policy environment, effective institutional setting, access to a range of participatory methods, and changes in approaches among researchers and development workers.

Further information:

Reij, C et al (1997): *Sustaining the Soil - Indigenous Soil and Water Conservation in Africa*, London: Earthscan Publications Limited.

72 AFRICA REGION | Indigenous Knowledge in Disaster Management in Africa

Adaptation, disaster preparedness, awareness raising, traditional knowledge, forecasting

This Indigenous Knowledge in Disaster Management project was implemented in Kenya, Tanzania, South Africa, and Swaziland, and focused on the use of indigenous knowledge in environmental conservation and natural disaster management and the development of training materials on indigenous knowledge for use in primary, secondary and tertiary education institutions throughout Africa. The study in all four selected countries sought the assistance of local elders and experts in gathering and analyzing data on indigenous knowledge systems. The project was sponsored by UNEP and carried out by the IGAD Climate and Applications Centre (Kenya), the Office of the Disaster Preparedness in Africa at the University of Witwaters (South Africa), the University of Swaziland (Swaziland), and the Tanzania Meteorological Agency (Tanzania).

Further information: Indigenous Knowledge in Disaster Management in Africa, <http://www.unep.org/IK/PDF/IndigenousBooklet.pdf>

73 AFRICA REGION | Malaria in the Sahel region

Local observations & impacts, human health, vector-borne disease, drought

Beyond its role in the continent's already serious disease burden, malaria represents a particular and additional threat in Africa. There are between 300 and 500 million cases of malaria annually in the world each year with a very high proportion of those occurring in Africa – largely among the poor. Malaria causes between 1.5 and 2.7 million deaths, of which more than 90 per cent are children under 5 years of age. There is increasing evidence that climate change is already contributing to the problem. In one highland area of Rwanda, for example, malaria incidence increased by 337 per cent in 1987, and 80 per cent of the increase could be explained by changes in rainfall and temperature. It is expected that small further changes in temperature and precipitation could trigger malaria epidemics at the current limits of the disease both in altitude and latitude.

Global warming will increase the incidence of floods, warming and drought all of which are factors in disease transmission. In addition, flooding – which is likely to increase as the climate changes – could facilitate breeding of mosquitoes, and as a result spread malaria to otherwise dry areas. The Sahel region, which has suffered from drought in the past 30 years, has experienced a reduction in malaria transmission as a result. If flooding does occur, there is a renewed risk of a malaria epidemic. Recent studies also show that it is not just an increase in average temperatures and rainfall that trigger epidemics in areas previously free of malaria, but greater climatic variability can introduce the disease to areas previously free of malaria. Populations within these areas lack immunity and increase the impact of the illness. Climate change will have a dramatic impact not just on the health of vulnerable communities in Africa, but also on the ability of those communities to respond to the changing conditions.

Further information:

Guofa Zhou, et al (2003). 'Association between climate variability and malaria epidemics in the East African highlands', PNAS 101: 2375-2380; published online before print as 10.1073/pnas.0308714100

74 AFRICA REGION | Strengthening biodiversity protection, community resilience and sustainable livelihoods in Africa

Adaptation, biodiversity, livelihoods, policy & planning

The African Biodiversity Network (ABN) was formalised as a network in 2002, and today has an Africa wide reach of 36 organizations in 12 countries. Its purpose is to strengthen legislation, policies and practices that protect biodiversity and enhance sustainable livelihoods in Africa, using an ecosystems approach. The ABN unites groups and individuals committed to finding local and culturally-centred solutions to the growing problems of environmental degradation in Africa. Network members are active in community and biodiversity-related rights, policy and legislation; the protection of sites of ecological and cultural importance; and the revival of bio-cultural knowledge and practices. It is funded by Dutch Biodiversity Fund, Swedbio, European Commission, HIVOS, SDC.

Further information: ABN,

<http://www.africanbiodiversity.org/>

75 AFRICA REGION | Regional partnership for Disaster Risk Reduction on Climate Change, migration and cross-border conflict in pastoral communities (UNOCHA, IOM, UNEP and ISS)

Adaptation, disaster preparedness, conflict, migration

In 2009, UNOCHA, IOM, UNEP and ISS initiated a regional partnership to advocate for disaster risk reduction and preparedness strategies on climate change, cross border mobility and insecurity in pastoralist communities across the Horn of Africa. Several regional Inter-agency assessments were organised as part of partnership.

The objectives of this project include promoting pastoralists' internal and cross-border mobility as a climate change adaptation strategy. The inter-agency assessment undertaken in the Maasai Cluster on the Kenya and Tanzania border highlighted several issues as regards the plight of pastoral communities in a changing climate. Information gathered from community-led consultations and also discussions with government and civil society focal contacts indicated that the 2009 drought was the severest probably in the last 30 years. Similarly the communities also indicated that during this period, they migrated to graze their cattle and also in search of water beyond the boundaries of their districts, even crossing the border into Tanzania and vice versa. Communities mentioned the increased incidences of suicide among the Maasai as a result intensity of the drought, which resulted in most families losing up to 90% of their livestock. Climate change, drought and its impacts in particular seemed to have a major effect on the communal social fabric which to a large extent had become fragmented. The women in particular highlighted their plight with the increased levels of HIV and AIDS in their communities.

Further information: Report of UNEP to UNPFII-9,

<http://www.un.org/esa/socdev/unpfii/documents/UNEP%20report%20to%20PFII%202010.pdf>

76 AFRICA REGION | REDD Opportunities Scoping Exercise (ROSE)

Mitigation, payment for ecosystem services, forests, redd

The Katoomba Ecosystem Services Incubator is an instrument created by the Katoomba Group with the main aim of helping rural communities access payments for ecosystem service (PES) markets, and developing regional capacity in land-use based carbon finance. As part of this process, the Incubator has developed a tool called the REDD Opportunities Scoping Exercise (ROSE). ROSE is essentially a tool to classify and prioritise potential REDD+ sub-national activities, and assess critical constraints to project development, especially those associated with the national legal and institutional framework for carbon finance. The ROSE approach and process was applied in Tanzania, Uganda and Ghana in 2009.

At the national level, ROSE assessments provide a rapid qualitative analysis (based on expert opinion) to identify key emissions abatement opportunities across different forest contexts. At the sub-national level, ROSE is a pre-cursor to the costly process of pre-feasibility and feasibility analysis. In the case of Tanzania, an important REDD project type was miombo woodland under Community Based Forest Management in the Morogoro, Tabora and Manyara Regions, and where charcoal and farming were the main deforestation drivers; and in Ghana a project type was wet evergreen high forest in protection Forest Reserves in the Western Region under threat from tree and food crops, especially cocoa. In the case of Uganda, a further classification, at least for the high forest, was whether it was 'well' or 'low' stocked, e.g., low-stocked tropical high forest under Collaborative Forest Management with illegal logging as the main DD driver.

Further information: The Katoomba Group, <http://www.katoombagroup.org/documents/events/event35/REDDOpportunityScopingExercise-Tanzania.pdf>;

<http://www.katoombagroup.org/documents/events/event31/REDDOpportunityScopingExercise-Uganda.pdf>;

<http://www.katoombagroup.org/documents/events/event36/ROSEghana.pdf>

77 EAST AFRICA | Pastoralism of the Maasai: Optimal utilization of rangelands, including grasses and shrubs

Adaptation, traditional knowledge, pastoralism, animal husbandry

Traditional pastoral systems preserve natural ecosystems through extensive ranching and rotational grazing and by using a variety of livestock. The pastoral Maasai of East Africa keep cattle, goats and sheep and move their herds throughout the year to optimize the utilization of rangeland resources for maximum meat and milk production. The strategy of mobile grazing allows their animals to utilize a wide variety of forage vegetation types that are widely dispersed. This increases seasonal grazing and the carrying capacity of the land. Maasai distinguish between those plants that are good for increasing milk and those that fatten livestock and improve their condition. This knowledge is particularly important during exceptionally dry years when decisions have to be made by the Maasai about where to graze, which grasses recover faster than others and, based on the availability of resources, what stock should be culled first.

Further information: UNFCCC Database on local coping strategies, Case Study 91, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=91; Isaac Sindiga (1994): Indigenous (medical) knowledge of the Maasai. In: IK Monitor Vol. 2(1), <http://web.archive.org/web/20041205113601/www.nuffic.nl/ciran/jikdm/2-1/articles/sindiga.html>; UNESCO, Rangelands Utilization Strategy: utilization of arid and semi-arid rangelands by African pastoralists. UNESCO Best practices on Indigenous Knowledge BP.12, <http://www.unesco.org/most/bpik12.htm>

78 CENTRAL AFRICA | Center for Social Excellence of the Congo Basin Forests

Adaptation, forests, policy & planning, technology

The Congo Basin in Central Africa contains the second largest forest in the world, behind the one in Amazon Basin. It is home to a mainly rural population, estimated to number 29 million people, including approximately 500,000 Pygmies and semi-nomadic peoples grouped into nine communities. These communities are entirely dependent on the forest for their livelihood. It provides them with their habitat, food, medicines and places of worship. The 1.6 million Center for Social Excellence is a Fondation Chirac project to halt tropical deforestation, which has been designed to address issues related to deforestation and its implication for the communities of local and indigenous people who live in the Congo Basin – focusing on improving the understanding and linkages between forestry companies and indigenous communities, thereby encouraging dialogue and sustainable forestry management practices. GPS mapping technology has recently been introduced to the Congo Basin with a handheld mapping device that has made it possible for the Pygmy communities to communicate to timber companies the specific forest resources that they hold sacred.

Further information: Fondation Chirac, <http://www.fondationchirac.eu/en/center-for-social-excellence-of-the-congo-basin-forests>; Afrol News, <http://www.afrol.com/articles/29086>

79 NORTH AFRICA | Drought forces Tuareg desert nomads to settle down in fixation sites

Adaptation, water resources, desertification

For centuries, the Tuareg people have lived as nomads, herding their animals from field to field just south of the Sahara Desert in Mali, near Timbuktu. Rainfall in this semi-arid area is becoming increasingly unpredictable, with changes in timing, frequency and the amount of rainfall. Temperatures are rising gradually. There have been several severe droughts since 1973, causing massive loss of livestock. Climate change is having a major impact on the natural grasslands, resulting in the spread of the desert and the loss of soil fertility. But over the past 40 years, persistent drought has forced the Tuareg to give up their wandering way of life. To survive they have had to start settling in villages and cultivating land to secure a food supply which is less susceptible to drought. The Tuareg diet has changed from one of meat and cheese to one with more grains and vegetables, and they still have a lot to learn about growing crops. Jeunesse En Mission Entraide et Développement (JEMED) has been helping communities to establish 'fixation sites' since 1990 to enable them to survive the changes that the spread of the desert and increased population have brought. These fixation sites do not settle people permanently, but build upon a tradition that the Tuareg would spend part of each year camped in a particular place. They also enable communities to develop a social infrastructure and education, training, health and pasture management projects, while still keeping hold of many of their traditional pastoral ways. There are now 22 fixation sites and each has a management committee elected from the local community. Women and children are increasingly staying at the sites while a portion of the men move with the animals during the rainy season.

Further information: Woodke, J (2008), TILZ, The impact of climate change on nomadic people <http://tilz.tearfund.org/Publications/Footsteps+61-70/Footsteps+70/The+impact+of+climate+change+on+nomadic+people.htm>; Harris, R (2007), NPR, Drought forces desert nomads to settle down, <http://www.npr.org/templates/story/story.php?storyId=11608264>

80 NORTH AFRICA | Effects of Desertification on Arab-Berber Relations

Local observations & impacts, conflict, desertification

As global warming increasingly affects global ecosystems, low-level regional conflicts become more susceptible to escalation. Scientists have seen the Sahara in North Africa expand in recent years at alarming rates as desertification and overgrazing has exacerbated water and wind erosion as well as increased soil salinity. This accelerated degradation is forcing nomadic tribes, such as the Berbers, to become more sedentary and urban, further magnifying the pressure on local resources. Taking into consideration the well-established history of Arab-Berber violent conflict in the region, continued desertification of the Sahara will undoubtedly lead to further and more widespread violence as people come into competition over decreasing arable land and resources. This case study examines these variables with the aim of analyzing the potential for increased conflict among Arab and Berber populations in the Sahara region.

Further information: Phillips, Jon. "Effects of Desertification on Arab-Berber Relations." ICE Case Studies. 9 Mar. 2007. Inventory of Conflict and Environment, <http://eagle1.american.edu/~jp3501a/berber.htm>

81 SOUTHERN AFRICA | Adaptations to climate change amongst natural resource-dependant societies in the developing world: across the Southern African climate gradient (ADAPTIVE)

Adaptation, local observations & impacts, traditional knowledge, agriculture, animal husbandry

The research project 'Adaptations to climate change amongst natural resource-dependant societies in the developing world: across the southern African climate gradient' examines the characteristics of people's responses to recent historical climate variability and change in four locations in southern Africa. Study areas were selected on the basis of exposure to drought and heavy rainfall, and then within South Africa by using the technique of Self Organising Mapping analysis to differentiate detailed trends of climate change since 1950. This allowed changes in climate to be discriminated in terms not simply of general wetting and drying trends, but of detailed changes in the timing, duration and magnitude of rainfall occurrence. Using a range of social science data collection methods, a rich body of data on community and household-level understanding of climate trends, livelihood changes, and relationships of these changes to environmental and other processes was accrued.

Further information: ADAPTIVE, <http://www.geog.ox.ac.uk/research/arid-environments/projects/adaptive/>; David Thomas, Henny Osbahr, Chasca Twyman, Neil Adger and Bruce Hewitson (2005): ADAPTIVE: Adaptations to climate change amongst natural resource-dependant societies in the developing world: across the Southern African climate gradient Tyndall Centre for Climate Change Research Technical Report 35, November 2005, http://www.tyndall.ac.uk/research/theme3/final_reports/t2_31.pdf

Common attributes to the adaptation process were identified across study areas. These attributes not only related to what people actually did in terms of their changing livelihood practices, but also to how adaptation occurred and the routes and process through which successful adaptations were made. In this regard, formal and informal institutions were found to be critical for both transferring knowledge from individuals to communities, and for the development of collective practises that had community-wide benefits. In all areas, the capacity to adapt to further climate changes, if based on adaptations to changes that have already occurred, is high. However, the distribution of the benefits of adaptation within a community is not automatically equitable, since traditions and structures within communities can affect participation and uptake. {Nb: Some of the case studies are listed separately in the compendium.}

82 WEST AFRICA | Baka bear witness to climate change damage video

Local observations & impacts, forests, multimedia

Living in the Central African forests, the Baka hunter-gatherers formed an organization called Okani (meaning “rise up” in Baka) to help train other communities in filming and story-telling techniques. This first film from the Baka People in Eastern Cameroon shows how they are coping with the impacts of climate change and the swift transformations of their habitat. “Trees are bearing less fruit; the soil has lost its moisture,” a Baka hunter-gatherer says in the film. “Baka women love to fish. It’s part of our traditions. But the stream is drying, and fish are dying; the Earth has changed.”

Further information:

UNDP <http://content.undp.org/go/news-room/2009/may/indigenous-groups-bear-witness-to-climate-change-damage-en>; Youtube, ‘Baka People: Facing Change in African Forests’, <http://www.youtube.com/watch?v=AgerTDO4r6M>; Conversations with the Earth, <http://www.conversationsearch.org>

83 WEST AFRICA | Clues from landraces: Positioning local knowledge on plant management of climate uncertainty at the heart of adaptive agricultural strategies

Adaptation, local observations & impacts, agriculture

The “Clues from Landraces” project by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) demonstrated the capital value of specific locally preserved landrace adaptation traits for the definition of sound adaptive strategies in variable climates in Ghana, Mali, and Niger.

Further information:

UNDP <http://content.undp.org/go/news-room/2009/may/indigenous-groups-bear-witness-to-climate-change-damage-en>; Youtube, ‘Baka People: Facing Change in African Forests’, <http://www.youtube.com/watch?v=AgerTDO4r6M>; Conversations with the Earth, <http://www.conversationsearch.org>

84 BURKINA FASO | Zaï, an indigenous water harvesting and soil fertility management practice in Burkina Faso

Adaptation, traditional knowledge, water resources

Zaï is an indigenous method of water harvesting practised by Mossi farmers in Yatenga Province in the northern part of Burkina Faso, in sub-Saharan Africa. The Zaï method of water harvesting is seasonal, practised each year as necessary. The method is used to rehabilitate strongly degraded land known as zi -peepe, which is usually found on relatively flat land on which no crops can be grown. Local knowledge about soil conditions and about the use of organic materials is essential. The practice has been documented in writing, and is discussed on radio programmes for farmers, which are broadcast in local languages. Other community members have progressively integrated a number of indigenous practices into their farms and improved their pastoral systems. A non-governmental organization, Association Internationale des Six, was involved in implementing this project:

Further information:

MOST Register, BP.02, Namwaya Sawadogo: the ecologist of Touroum, Burkina Faso, www.unesco.org/most/bpik2-2.htm and BP.03 Zaï, an indigenous water harvesting and soil fertility management practice in Burkina Faso, <http://www.unesco.org/most/bpik3-2.htm>

85 BURKINA FASO | Mixed cropping in Burkina Faso: mixing long and short growth cycle crops

Adaptation, precipitation, food security, agriculture

Mixed cropping is the growing of two or more plant species in the same field at the same time. Mixed species is often perceived as a viable tool to increase on-farm biodiversity in organic agriculture and is a potentially important component of any sustainable cropping system. Apart from increasing total farm productivity, mixed species cropping can bring many important benefits such as improvement of soil fertility management and suppression of pests and diseases. Mixed cropping also ensures food security by reducing the risk of mass crop failure, due to its different water and nutrient requirements.

In Aribinda, and in most other areas of Burkina Faso with limited precipitation, farmers seek optimal crop yield by growing both long and short growth cycle crops on the same plot, such as millet and sorghum. This practice allows spreading the risk over a large number of varieties and therefore to increase the probability for a successful yield. Millet seeds of various cycles are mixed and sown in the same plot. Harvesting is performed during the staggered ripening period. Combining growing cycles allows these farmers to ensure food security by reducing risks linked to fluctuation in precipitation. This risk reduction strategy, while useful to ensure household food security, is incompatible with the planting of most commercial seeds.

Further information:

UNFCCC Database on local coping strategies, Case Study 99, http://maindb.unfccc.int/public/adaptation/adaptation_casesstudy.pl?id_project=99; Birgitta Rämert, Margi Lennartsson, Gareth Davies (2002), The use of mixed species cropping to manage pests and diseases – theory and practice. In Powell et al. (eds), UK Organic Research 2002: Proceedings of the COR Conference, 26-28th March 2002, Aberystwyth, pp. 207-210. <http://www.organic.aber.ac.uk/library/Mixed%20species%20cropping%20for%20pests%20and%20diseases.pdf>

86 BURKINA FASO | Indigenous forecasting by farmers of Burkina Faso: Predicting rainfall using temperature, plant and animals as indicators

Local observations & impacts, aridity & drought, food security, disaster preparedness, forecasting, traditional knowledge

Farmers in Burkina Faso believe that intense cold (below 15°C) during the dry season (November-January) corresponds to abundant rainfall during the rainy season and that if this cold period begins early or ends late, the rain will do likewise. Intense heat during the hot-dry period (February- April) is believed to predict good rainfall as well. When the sibga begins fruiting and the sabtuluga loses its leaves, the farmers prepare for planting. Farmers plant water-demanding crops where the kankanga, a fig-like tree, grows because it grows where the water table is close to the soil surface.

Observing animals is also a source of forecasting knowledge. Herders believe that when the nests of small quail-like birds (known as koobre in More) hang high on trees, the rains will be heavy, while low hanging nests predicts scarce rainfall. Women predict the farming season based on their observations of bugvare, black insects of the Orthoptera variety that dig concave nests in rubbish heaps outside compounds. After the first rains, larvae emerge and fill the nests with dirt. If the bugvare fill their nests to the brim with dirt, a good farming season is expected. As climate change occurs, these traditional forecasting indicators are changing. Locals have to continue their observations and adjust their predictions accordingly to ensure that correct coping mechanisms will be applied.

Further information:

UNFCCC Database on local coping strategies, Case Study 105, http://maindb.unfccc.int/public/adaptation/adaptation_casesstudy.pl?id_project=105; Carla Roncoli, Keith Ingram, Paul Kirshen, and Christine Jost (2001), Burkina Faso: Integrating indigenous and scientific rainfall forecasting. In IK Notes Vol.39, <http://www.worldbank.org/afri/ik/iknt39.pdf>

87 CAMEROON/CONGO | The Baka Pygmies and Bambendzele develop new fishing methods, and meningitis outbreaks are linked to climate change

Adaptation, local observations & impacts, forests, wildfire, food security, precipitation, drought, health

The Baka Pygmies of South East Cameroon and the Bambendzele of Congo have had to develop new fishing and hunting methods to adapt to the decrease in precipitation and increase forest fires. Rainfall has become less regular and harder to predict. Women who normally catch fish in barriers built in small streams in the dry season are often unable to achieve traditional fish catches as flood patterns of the rivers are changing. Fire has occurred in forest areas where it has not been observed in the past. The el Niño years of 1983, 1987 and 1997 all coincided with droughts in the forest zone and fires occurred in forests that had not previously burned in the living memory of these peoples. Crop failures occur when early or dry season rains provoke the germination of seeds, but dry periods in the traditionally wet months cause the seedlings to die. In West Africa deforestation linked at least in part to climate change has led to outbreaks of diseases in areas where they had not earlier caused problems. In parts of the Upper Guinea savannas of Ghana and neighbouring countries meningitis outbreaks amongst rural people have been linked to climate change.

Further information:

International Union for Conservation of Nature (2008). Indigenous and Traditional Peoples and Climate Change. http://cmsdata.iucn.org/downloads/indigenous_peoples_climate_change.pdf

88 CAMEROON | Baka of Cameroon participatory video

Local observations & impacts, food security, traditional knowledge, forests, multimedia

This video was made by the Baka hunter-gatherers near Bertoua, Easter Cameroon, to record the impacts of climate change on their community. Their film shows examples of the harsh consequences drought has on fishing and harvest. Young people reflect on the necessity to learn from the elders, preserve traditions and protect the forest as it is strongly tied to the Baka's identity.

Further information:

Conversations with the Earth, <http://www.conversationearth.org/>

89 CAMEROON | Promotion and preservation of indigenous ethno-veterinary practices among the Mbororos

Adaptation, animal husbandry, traditional knowledge

This project was carried out by the Society for the Protection of Animal Life and the Environment (SPAEL) to promote preservation of indigenous ethno-veterinary practices among Mbororo nomadic herders of Wum (Upkwa) in the north-western provinces of Cameroon. The project addresses issues such as the marginalization of the Mbororo, poverty, poor animal health and low livestock productivity. The project aims at facilitating the transfer of traditional ethno-veterinary skills and practices. It supports the documentation, assessment and promotion of local health traditions and the conservation and sustainable use of medicinal plants.

Further information:

IFAD IPAF Grants 2008, <http://www.ifad.org/english/indigenous/grants/projects/regions/index.htm>

90 CAMEROON | Ankara system in Cameroon: Gathering and burning organic matter

Adaptation, floods, food security, agriculture, traditional knowledge

Farmers of the Ndop plain in Cameroon have a traditional method for maintaining and increasing soil fertility and increasing crop production on small portions of flooded lands. They produce and apply green manure to approximately 30-60 kg of nitrogen per hectare. They use the ankara system, which consists of gathering and burying organic matter in ridges followed by burning which increases the potash and phosphorous content in the soil. Applying organic matter is paramount in enhancing bacterial activity, which ensures high soil fertility. Organic matter is broken down to carbon dioxide, ash, and other residues. This provides carbonic acid in the soil water, and the solvent effect of this acidified water on calcium, potassium, magnesium, phosphates, and other minerals in rock form is many hundreds of times greater than that of rain water. At the same time the complex constituents of the organic matter are simplified, and nitrogen in the ammonia is released and converted into the nitrate form. Cover crops are grown to suppress weeds in fallow lands. To benefit from the rich flooded zones farmers manage multiple crop cycles per year, cash crops before and after rice cultivation. To maintain mineral plant nutrients, farmers apply weathered volcanic sediments. The flooded areas can also be used for fishing.

Further information:

UNFCCC Database on local coping strategies, Case Study 95, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=95

91 CAMEROON | Cameroon Biodiversity Conservation and Management Project

Local observations & impacts, forests, land rights, livelihoods, protected areas, negative effects

Establishment of protected areas places strict controls on indigenous community access to forest and natural resources. Projects restrict the Indigenous Peoples' traditional use of forest resources without providing adequate compensation and viable alternatives. Restrictions imposed on their customary resource use were unjust, as Indigenous Peoples consider their traditional livelihood activities sustainable. One of the most delicate and frustrating issues for Indigenous Peoples is the establishment of protected areas within their ancestral territories and the enforcement of new rules that affect and restrict their livelihoods.

The Cameroon Biodiversity Conservation and Management (BCM) project was initiated with funding from the GEF, with contributions from the Government of Cameroon and several European governments. The BCM project aimed to consolidate and upgrade the management of protected areas in Cameroon, and this included the identification of core conservation zones and external boundaries of the six Priority Project Sites. Campo Ma'an was one of the Priority Sites. In 1999, Campo Ma'an Reserve became a national park, and in 2000 the government of Cameroon demarcated the area as part of an environmental offset to mitigate the impacts from the Chad-Cameroon oil-pipeline project. Indigenous Bagyeli lands used for traditional hunting and gathering were affected since they overlapped with the new national park. The Chad-Cameroon oil pipeline project went to the inspection panel of the WB. The Bagyeli people claimed that they were never adequately consulted about the establishment of this park, the pipeline project, or the new management plan. As a result of these complaints, a more detailed Indigenous People Development Plan was prepared to protect the indigenous communities. The new program promoted the participation of local population and stakeholders in biodiversity conservation at all sites and supported the creation of numerous community-based organizations and non-government organisations; it also created sustainable management plans for protected areas, which included production of non-timber forest products (e.g., beekeeping, Prunus bark, and giant snails).

Further information:

WORLD BANK (2008): Sobrevila, Claudia. The Role of Indigenous Peoples in Biodiversity Conservation. Friends of the Earth in Working Group on Climate Change and Development, 2005. Africa - Up In Smoke? <http://www.ied.org/pubs/display.php?a=95601IED>

92 DEMOCRATIC REPUBLIC OF THE CONGO | The Impacts of the Carbon Sinks of the Ibi-Batéké Project on the Indigenous Pygmies of the DRC

Local observations @ impacts, mitigation, forests

This case study examines one of the flexible mechanisms of the Kyoto Protocol: the Clean Development Mechanism (CDM) and its impacts on Indigenous Peoples in the DRC. The CDM is intended to allow Annex I Parties (developed countries and those with transitional economies) to lower the costs of reducing greenhouse gas emissions while supporting lasting development projects in economically poorer countries (specifically all those not included in Annex I). The project which is the subject of this case study is the Carbon Sinks of Ibi-Batéké (CSI-B), conceived of by Novacel, a Congolese organization created in 1984. This project includes forestation of 3,000 to 8,000 hectares of the Batéké plateau, with plans to increase the scope to millions of hectares in the future. The Biocarbon Fund of the World Bank will finance the project, up to USD 10 million, beginning in 2007. This research notes that up to this point in the project there has been no involvement of the Pygmy Indigenous Peoples, nor any apparent will to involve them. Indigenous Peoples' rights, experiences, and cultural and spiritual traditions are being ignored. Nothing to ensure the Pygmy's preliminary consent, which was mandated within the framework of the project, has been done since consultation began.

Further information:

Sinafasi Makelo Adrien (2006), The Impacts of the Carbon Sinks of the Ibi-Batéké Project on the Indigenous Pygmies of the Democratic Republic of the Congo, International Alliance of Indigenous and Tribal Peoples of Tropical Forests, http://www.international-alliance.org/cop12_unfccc.htm

93 EGYPT | Food storage methods to protect food from pests

Adaptation, pests, agriculture, food security, traditional knowledge

For farmers in Mut, Egypt, rodents are the most serious pests followed by Sus (red or black insects, e.g. beetles). Many of the traditional indigenous storage technologies are excellent for helping to prevent or control pest infestation. One of the most efficacious storage methods involves burying grain in the sand. The grain's moisture content is reduced by the sand and solar heat which eliminates some insect pests and inhibits the movement of others. Unfortunately, change is affecting the farmers' ability to use these traditional methods - in Mut, for example, winds have caused the sand dunes to shift so that sand is no longer available near the houses, and the sand has become saturated with water from increased irrigation.

Many indigenous practices have been replaced by newly introduced methods of control following the introduction of new approaches to pest management, including the free distribution of pesticides. According to some farmers, these changes have made pest problems worse and created environmental problems as well. However, farmers are finding ways to pick and choose from both traditional and introduced methods

Further information:

UNFCCC adaptation case study, Project 128, http://maindb.unfccc.int/public/adaptation/adaptation_casesstudy.pl?id_project=128; Anne M. Parrish (1994): Indigenous post-harvest knowledge in an Egyptian oasis. In: *IK Monitor* Vol. 2 (1), <http://www.iss.nl/ikdm/IKDM/IKDM/2-1/articles/parrish.html>

94 ETHIOPIA | Farmer to Farmer Learning in a Changing Climate video

Adaptation, agriculture, multimedia

The Netherlands Red Cross reports on new techniques for helping farmers in Ethiopia adapt to Climate Change. Participatory video and peer-to-peer teaching has sped up the process of information transfer between populations and communities and increases the credibility of critical messages about adaptation practices. In this video, Ethiopian farmers share with each other new techniques helping with adaptation to climate change.

Further information:

International Federation of Red Cross and Red Crescent Societies, <http://www.ifrc.org/what/disasters/climate-change/index.asp>; Youtube video, <http://www.youtube.com/watch?v=UKKoodHmPlk&feature=Playlist&p=73D398F50E67A1B6&index=13>

95 ETHIOPIA | National Dialogue on Climate Change and Food Security

Adaptation, traditional knowledge, awareness raising

The World Food Programme (Egypt) has partnered with government and civil society actors to influence thinking about climate change, hunger and malnutrition, and advocate for anticipatory adaptation measures in support of the most vulnerable communities. The project included an element focusing specifically on gathering information on indigenous knowledge and coping/adaptation mechanisms. Generally, the focus of global food security and climate change discussions has centred on the risks associated with limited food availability resulting from declining food production. Through enhancing awareness and dialogue, the project has promoted anticipatory adaptation measures to ensure food security and improved collaboration between Government and civil society organizations. However, climate change poses a wider range of food-access challenges in relation to hunger and malnutrition for vulnerable communities and their livelihoods, and this complexity must still be addressed.

Further information:

Addressing the Humanitarian Challenges of Climate Change: Regional and National Perspectives, Case Studies on Climate Change Adaptation – IASC Regional and National Consultations May-June, 2009, http://www.preventionweb.net/files/12842_IASC-climate12669031111.pdf

96 ETHIOPIA | Daldals - building checkdams to trap silt and water

Adaptation, drought, water resources, adaptation

Daldals were developed by the Irob in northern Tigray in Ethiopia where the landscape is very rugged and stony, with steep slopes and deep narrow valleys carved out of the plateau by flash floods. Over four decades, the Irob developed site-appropriate methods to capture soil and water for cropping. They built a series of checkdams in the seasonal water-courses and raised and lengthened the walls every year. In this way, they created step-like terraces that are now about 8 m wide and up to 10 m high, with about 20 m between dams. Not only has new farmland been created where there had been only rock before, but well-filtered water can now be collected from the foot of the lowest dam during most of the year. Although building and maintaining the dams and cropping in the small pockets is very labour-intensive, it ensures the livelihood of the Irob in the rugged area.

Further information:

UNESCO, Daldal - dams to trap silt and water. An Irob innovation in northern Ethiopia, UNESCO Best Practices on IK. Database on local coping strategies, Case Study 88, http://maindb.unfccc.int/public/adaptation/adaptation_casesstudy.pl?id_project=88

97 ETHIOPIA | From cattle to crops for the Boran

Local observations @ impacts, desertification, drought, food security, culture, livelihoods

In Ethiopia, pastoralist communities such as the Boran account for 12 per cent of the country's population. Their communities cover over 60 per cent of the country's land area. Until quite recently, pastoral life in Ethiopia was not considered a lifestyle but a problem. There were (and at times still are) disputes and clashes for grazing land. Pastoralists remained a marginalised group, given little recognition and attention by successive governments and often seen as 'second class' citizens.

Further information:

Panos London, <http://www.panos.org.uk/?lid=19809>; <http://www.panos.org.uk/?lid=19810>

Ethiopia's Boran people once enjoyed a diet of milk and butter supplied by their plentiful herds of cattle. Now they are planting crops to survive. It is not that the Boran are hungry or thirsty. In fact, they are tilling their land and living off the food they produce. But being forced to till the land is not a part of Boran tradition - in the past their whole diet was based on livestock and animal products; they believe they are being forced to grow crops for food today because the Creator became angry, not with the Boran themselves, but with the Land. The succession of droughts and lack of rainfall have had a severe impact on the Boran community. Quite what triggered these changes is hard for people to understand. For many, this is 'the work of God'. Others draw a connection between the lack of trees and the lack of water. The nearby water sources have dried up. Every morning, women set out on a five-hour walk to fetch water for their families. Thirst has become a constant companion for people in the district.

During severe drought, large numbers of Boran cattle have died due to lack of pasture. Research conducted by Panos Ethiopia in 2002 shows that animal mortality rates reached up to 80 per cent in the worst years of drought. According to one study, there was a 37 per cent drop from an average of 92 cattle per household in the Boran areas in 1980-1981 to 58 head of cattle per household in 1996. Since then many more cattle have perished. A succession of droughts and severe lack of rain led to a steady decline in livestock. Boran people have found themselves in a position where their traditional lifestyle has to change dramatically to survive, and are forced to shift from rearing cattle to growing crops. The Boran now find themselves working the fields more and more but their unease is still very much in evidence. Each time they are about to hoe the ground, they plead with the Creator and let him know they were forced to do so because they had to put something into their bellies. The Boran believe that there is only one way to free them from what they consider a life of misery and to bring back those meat-and-milk days: the Creator and the Land should reconcile as husband and wife.

98 ETHIOPIA | Early warning systems

Adaptation, disaster preparedness

IFAD is supporting the Pastoral Community Development Project in Ethiopia to promote and facilitate participatory programming, implementation and monitoring, by strengthening the institutional capacity of indigenous social organizations. The establishment of early warning systems and disaster preparedness plans will also improve the resilience and ability of beneficiaries to cope with external shocks and reduce the impact of drought and famine which will indirectly contribute to increasing adaptation to climate change.

Further information:

UNPFII, 2009. Information received from the United Nations System and Other Intergovernmental Organisations. E/C.19/2009/3/Add.3

99 GABON | Natural Resources Management Development and Policy Loan

Local observations & impacts, planning, forests

The Indigenous Peoples Development Plan (IPDP) prepared by the Gabon Forest and Environmental Sector Program (also called Natural Resources Management Development and Policy loan) is potentially a good example of indigenous support in the Africa region. The project is currently under implementation. The Babongo, Bakoya, Baka, Barimba, Bagama, Bakouyi, and Akoa—the "pygmies"—were identified as Indigenous Peoples affected by the project. Indigenous Peoples are depending on forests and forest resources within the following national parks: Minkebe, Ivindo, Akanda, Pangara, Waka, Birougou, Lopé, Plateau Batéké, and Moukalaba-Doudou (the final three will be supported by the GEF project). The main actors of the IPDP are MEFEPEN, CNPN/ANPN, national and international non-government organisations working on Indigenous Peoples issues in Gabon, the associations of the Indigenous People, and the Babongo, Bakoya, Baka, Barimba, Bagama, Bakouyi, and Akoa themselves.

Further information:

WORLD BANK (2008): Sobrevila, Claudia. The Role of Indigenous Peoples in Biodiversity Conservation

100 GHANA | Community Sustainable Management Of Ayensu Wetlands And Traditionally Protected Lands For Biodiversity Conservation In Agona Kwanyako

Adaptation, wetlands, traditional knowledge, natural resource management, protected areas, biodiversity

This integrated biodiversity conservation project sought to restore, conserve and sustainably manage inland wetlands and the traditionally protected forests (Sacred Groves) in Agona Kwanyako. The project documented and applied indigenous knowledge and techniques in natural resource management, and enforced local environmental by-laws to protect the biggest inland wetland in the area. Implemented by Together Rural Development Solidarity and led by the Chief of the community who formed a Natural Resource Management Committee to help manage the Ayensu Wetlands, with a grant from the Global Environment Facility (GEF).

Further information:

GEF Small Grants Programme, GHA/04/069: http://sgp.undp.org/web/projects/7538/community_sustainable_management_of_ayensu_wetlands_and_traditionally_protected_lands_for_biodiversi.html

101 GHANA | Community-Based Integrated Bushfire Management and Biodiversity Conservation in the Jaman District

Adaptation, traditional knowledge, fire management

This project aims to control bushfires through integrating indigenous knowledge and practices into the forest management systems for the Dwenem Awaso and Twuekro Dwenem-Awaso traditional areas in the Jaman District, Ghana. 100 ha of off-reserved forest management was dedicated as community resource management area (CREMA), and community stakeholders were identified to form the Collaborative Forest Management Groups to undertake fire management, forest protection and resource management.

Further information:

GEF Small Grants Programme GHA/04/074: http://sgp.undp.org/web/projects/8003/community_based_integrated_bushfire_management_and_biodiversity_conservation_in_the_jaman_district.html

102 GUINEA | Valorisation of positive local knowledge and practices

Local observations & impacts, traditional knowledge, biodiversity

This project, overseen by the Conseil National de l'Environnement (CNE), looks at zones characterized by a marked degradation of the ecosystems and their resources following inappropriate human activities, including acidification in Boké, draining of ponds in Kouroussa, and desertification in Koundara and Beyla. The ecosystems and their resources are of an major importance for the Guinean populations which depend on it still directly for satisfaction on their fundamental needs: food, habitat, health care, clothing, construction materials, fuels and incomes. The local communities have long

Further information:

Guinea NAPA Project Profile (Project #3). http://unfccc.int/files/adaptation/napas/application/pdf/16_guinee_pp.pdf

implemented traditional management practices of stock management which have enabled them to live in perfect harmony with the environment. However, some of these positive practices are in the process of disappearing under modern pressures. This project involves identifying and valuing this knowledge and to identify traditional practices that assist in adaptation to specific climate changes, and to integrate traditional knowledge into biodiversity conservation strategies.

103 ISRAEL | Solar Bedouin Village

Adaptation, energy, tourism

The Bedouin township of Darajat (also spelled Dirgat) is being advertised as Israel's first solar village. Most residents have solar water heaters and electric systems, the school is powered by wind and sun, and students learn hands-on about alternative energy by reading the power meters in their classrooms. The village also boasts a solar mosque. The village also offers a total Arabic-immersion language and culture course in which participants learn how they earn their livelihood; watch them play traditional musical instruments, bake bread in outdoor ovens, dress their brides for a wedding and produce handmade jewelry.

Further information:

Cheslow, D (2009): Immersion Arabic Course in First Solar Bedouin Village in Israel, <http://www.greenprophet.com/2009/06/24/9845/arabic-course-negev-darajat/>

104 KENYA/ZIMBABWE | Low-energy building materials: soil stabilised blocks

Adaptation, housing, traditional knowledge

There are many examples of African solutions to the energy crisis that need support. In Kenya and Zimbabwe low-cost and low-energy building blocks are being made from stabilised soil. Sun-dried, they can be made on or close to the building site, so no energy is used in transport. The other advantage is that the people engaged in production gain a livelihood, and can afford to build decent homes and community buildings. The technology is simple. Soil dug on-site, if suitable, is mixed with a small amount of cement. People are trained in soil-testing techniques to determine the best mix. Water is added and the mixture is placed in block press. The bricks require cement, which often has to be imported, so there is an external energy input cost. However, the bricks offer an alternative to locally made baked-earth bricks, which are fired over 2–3 days in kilns burning fuelwood; this local industry has contributed to deforestation and is inefficient in energy use. The approach has helped to provide legal affordable housing in low-income neighbourhoods because the stabilised soil blocks compete favourably on cost with commercially made clay bricks. The technology uses little water, and produces no waste.

Further information:

Working Group on Climate Change and Development, 2005. Africa - Up In Smoke? <http://www.ied.org/pubs/display.php?o=9560IIED>

105 KENYA | Sengwar mapping project

Local observations & impacts, traditional knowledge, adaptation

ERMIS Africa conducted a series of participatory mapping exercises with mountain-forest based indigenous peoples in Kenya from 2006 through 2008. The mapping project in Kenya involved three indigenous peoples who are all historically and until recently hunter-gatherers, partially absorbed by dominant pastoralist or agricultural peoples. The three communities include the Ogiek of the Mau Forest and Escarpment, the Sengwer of the Cherangany Hills Indigenous Forests (both Nilotic language speakers) and the Yaku of the Mukogodo Forest. The mapping exercise revealed a number of impacts from changes in climate, including drying of rivers, lack of snow, scarcity of food, and changes in rainfall patterns and harvesting seasons. The mapping also proved to be a valuable tool to improve community awareness of the role of traditional knowledge in adaptation and mitigation of climate change, as part of a broader approach to sustainable development. Adaptive responses put in place included the use of indigenous seeds, strengthening traditional economies, creative use of agricultural biodiversity and rehabilitation of damaged landscapes.

Further information:

Julius Muchemi et al 2010: Kenya case study: participatory 3-dimensional modeling. IAPAD, http://www.iapad.org/publications/ppgis/Pages%20from%20Windhoek_English_Second_Edition_Web.pdf

106 KENYA | Malaria control in agriculture

Adaptation, health, agriculture

A study of the links between malaria and agriculture that included participation and input from a farming community in Mwea division, Kenya facilitated identification of opportunities for long-term malaria control in irrigated rice-growing areas through the integration of agroecosystem practices aimed at sustaining livestock systems within a broader strategy for rural development.

Further information:

IPCC Fourth Assessment Report, Cross-Chapter Case Study C4.2.4, <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-xccc.pdf>, Mutero, C.M., C. Kabutha, V. Kimani, L. Kabuage, G. Gitau, J. Ssenyonga, J. Githure, L. Muthami, A. Kaida, L. Musyoka, E. Kiarie and M. Oganda, 2004: A transdisciplinary perspective on the links between malaria and agroecosystems in Kenya. *Acta Trop.*, 89, 171–186.

107 KENYA | Rehabilitation and protection of Kireita Forest

Adaptation, forests

This project was carried out by the Kireita Forest and Wildlife Conservation Association (KFWCA) for the Lari Community of the Kiambu District to rehabilitate Kireita Forest. It forms the foundation of a long-term programme of jointly managing the Kireita forest ecosystem. The project aims to promote the rehabilitation and sustainable management of the Kireita forest. The small grant enabled local people to replant 30 hectares of degraded woodland with indigenous tree species. The project worked through groups of forest users. It successfully regenerated large areas of woodland, increased incomes from the sale of indigenous tree seedlings, honey and other forest resources, and raised awareness among the indigenous community of the importance of sustainable forest management. During the project, the number of forest user groups doubled.

Further information:

IFAD IPAF Grant 2007, <http://www.ifad.org/english/indigenous/grants/projects/regions/index.htm>

108 KENYA | Knowledge for the young generation video

Local observations & impacts, multimedia, drought

In this video, the Maasai community in the Rift Valley of Kenya documents the difficulties children, women, men and animals experience because of the water shortage, the ways they found to cope and the alternative livelihoods they envisage for the future. The film shares testimonies from the group and their family and friends as visual evidence of the impacts of the extreme drought.

Further information:

Eng'eno Eishoi Ng'ejuk, Conversations with the Earth, www.conversationearth.org

109 **KENYA** | The drying of the Tana Delta**Local observations & impacts, traditional knowledge loss, flooding, soil erosion**

In August 2007, the Tana River changed its course due to massive siltation caused by high soil erosion from the Tana River catchments. The situation was worsened by the tremendous reduction of water in the river due to reduced water in tributaries and high evaporation rates as global temperatures rise. At risk are the subsistence farmers from the Boni, Bajuni, Wakone and Wasanya people and the fishers from the Malakote minority communities who depend on river waters for irrigation and fishing, respectively. The indigenous groups in the Tana Delta have relied upon their traditional knowledge to unveil the catastrophes in their surroundings. But due to the unpredictability of local climatic conditions, such as planting and flooding seasons, coupled with lack of scientific knowledge, this knowledge seems inadequate. This said, it is nonetheless crucial to their psychological, social-economical and ecological survival.

Further information:

Geoffrey M. Riungu and Joan Otengo, Frontlines Forum, 13 June 2009, <http://www.climatefrontlines.org/en-GB/node/206>

110 **KENYA** | Biogas and Wind Renewable Energy Project (RESCUE)**Adaptation, energy, beneficial effects**

Renewable Energy for Sustainable Universal Ecology (RESCUE) seeks to develop local solutions to energy poverty, particularly through the use of wind and biogas energy. It seeks to train local artisans, some of whom are Indigenous, to build and maintain wind and biogas plants. In 2006 and 2007, RESCUE established a network comprising different groups working in the renewable energy sector in Kenya. Together with two partner members from Finland and support from the Finnish government, the network has launched a two-year pilot project to support the building of combined wind turbines and biogas units in Kenya. The project will run for over two years with a budget of 39,000 Euro.

Further information:

Shalin, <http://www.shalinry.org/>

111 **KENYA** | Mount Kenya East Pilot Project for Natural Resources Management**Adaptation, local observations & impacts, resource management**

Mount Kenya is the second highest mountain in Africa. Its massive forest is home to a wide range of animals and plants. The mountain's vast underground lakes and network of rivers supply water to millions of people in surrounding rural areas and in the city of Nairobi. Glacier retreat is already causing problems for the local environment. Melting snow once fed the rivers and kept the catchment humid, while moderating the dry season. But now, as a result of earlier and shorter snow-melts, there is less water for the rivers and springs and the land is becoming drier and less productive. In the forest, there are more fires and a lower rate of vegetation regeneration. Wild animals are migrating downstream in search of water and food, worsening the human-wildlife conflict. Farmers in the region are finding that the decline in water availability, poor crops and less forage is having a consistently negative impact on their food security, income, employment and health. With climate change already having an impact in the region, and projected to have an even greater impact in coming years, the IFAD-supported Mount Kenya East Pilot Project for Natural Resources Management is working on improving adaptation while ensuring that the impact of climate change will not be exacerbated by ecosystem degradation, unsustainable use of natural resources and population pressure.

Further information:

MKEPP, <http://www.mkepp.or.ke/>

The project, which started in 2004, is strengthening the resilience of natural and farming systems to short term climate variability and reducing vulnerability to current climatic risks. It supports adaptation through a range of activities including reforestation, improved water resources management and appropriate agricultural practices. The most effective results came from projects that introduced better water-supply infrastructure, rehabilitated degraded lands and hilltops, and protected river banks through planting and agroforestry. Thanks to these efforts, vegetation and tree cover have been increasing. In the upper catchment, forest rehabilitation and protection have led to stable water levels in a number of rivers and reduced siltation in some areas. In the middle catchment, springs and streams are dry for a shorter period. In the lower catchment, where there are no perennial rivers, improved infrastructure – such as water harvesting tanks – have enabled farmers to cope more easily with rainfall shortages. The government of Kenya and IFAD are supporting communities by helping them form water users' associations along the main rivers flowing from the mountain. Members of the associations plant trees and vegetative ground cover to protect riverbeds and natural springs, and monitor the pollution levels of the rivers. In the long run, the aim is to have community institutions that are fully aware of their responsibility to preserve their natural resources while generating enough income to sustain themselves. The GEF is funding a complementary project in Mount Kenya that is working to enhance the equitable use of natural resources in the project area, with special emphasis on two protected areas – Mt. Kenya National Park and Mt. Kenya National Reserve – and their buffer zones. The project intends to contribute to climate change mitigation by conserving carbon stocks in forests and enhancing carbon sequestration, while also maintaining biodiversity.

112 **KENYA** | Intergovernmental Authority on Development Climate Prediction and Application Centre (ICPAC)**Local observations & impacts, disaster preparedness, traditional knowledge use**

The Intergovernmental Authority on Development Climate Prediction and Application Centre (ICPAC) has identified the application of good traditional practices in environmental management, monitoring prediction and early warning. examples include (a) Fish resources conservation including traditional indigenous knowledge of fish breeding periods and places, behaviour of fish-eagles enabling fishermen to know the movements of schools of tilapia and other types of fish, types of winds and their direction allowing fishermen to determine whether fish had changed their direction and the depths of water in which they could be found, the behaviour of different kinds of fish requiring different fishing gear, in order that fish nutrients could be maintained during all seasons; (b) Land use conservation: shifting cultivation was a traditional practice in which land was never overused nor cultivated repeatedly, season after season and year after year; but was left to rest and plant cover was restored to enable it to accumulate vegetable manure. The practice of mixed crop cultivation enabled leguminous crops to restore nitrogen in the soil for other food plants. Knowledge of when to expect long and short rain seasons allowed farmers to plan which crop was suited to a particular season and traditional indigenous knowledge terminologies of types of soil and their reaction to water facilitated the planting of appropriate

Further information:

Ocholla Ayayo, A (2004), University of Nairobi, In UNEP (2004), Report of the Meeting of Coordinators of the Project on Capacity-Building through Partnership and Information and Communication Technology for Using Indigenous Knowledge for Nature Conservation and Natural Disaster Management in Africa, <http://www.unep.org/depj/PDF/IKmeetingreport.pdf>

for each type of soil; (c) Biodiversity conservation: knowledge that local birds socialized in local trees and bushes and that once those trees and bushes were cleared, the birds would migrate leaving the local community without ecological indicators of the natural environment.

Disaster management practices identified include (i) Wind patterns: traditional indigenous knowledge of storm routes and wind patterns enabled people to design their disaster management practices in advance by constructing appropriate shelters, wind break structures, walls, and homestead fences. Preparedness for hydrological disasters was crucial, including traditional indigenous common sense, understanding of wind patterns and their level and intensity, which enabled people to plan their daily economic and social activities with foresight; (ii) Cloud and rain patterns: knowledge of local rain corridors made it possible for people to prepare for storms; knowledge of the cloud colour that might carry hailstones enabled people to take cover; knowledge of thunderclaps, clouds and winds taught them to expect storm and lightning; knowledge that prolonged drought was followed by storm, thunder and lightning during the first few rains enabled them to prepare for and expect a disaster; knowledge that changes in birds' cries or the onset of their mating period were indicators of seasonal change; knowledge of positions of the local clouds enabled the community to assess changes in cloud movement and take appropriate action; (iii) Animal behaviour: observing the migration of a large swarm of butterflies, for example, was a sign of a pending army worm infestation and famine which meant that people should begin planting potatoes and cassava, as a precaution since those were dry season crops; observing bees migrating in large swarms was an indication of a pending dry season requiring livestock herders to migrate to high or low ground in search of grass and water; animal behaviours were indicators of climatic change, weather change, pending storm, droughts, or seasonal change; and knowledge of snake behaviour when they were thirsty enabled elders to assess the extent of droughts; their presence also reduced the problems of rat infestation.

113 KENYA | Conflict and peace-building with sand dams in northwest Kenya

Local observations of impacts, conflict, water resources, drought, traditional knowledge

The way of life of the Turkana people – nomadic pastoralists who graze huge herds of cattle and other animals on the dry savannah of northwest Kenya – has long been made more precarious by political pressures from outside. Their ability to roam was restricted by arbitrarily imposed colonial borders, and modern governments have not done much to help them. Now powerful forces outside their control increasingly threaten the very survival of the Turkana. Rainfall seems to be failing and this has become a trigger for conflict between the Turkana and their neighbours, even as armed groups from outside, and a flood of automatic weapons, spill over from the long-running conflicts in neighbouring southern Sudan and northern Uganda. Very much in line with models of climate change in Sub-Saharan Africa, droughts in northwest Kenya appear to be becoming longer and more frequent. The Turkana are used to dealing with drought and with food shortages. But because the droughts are more frequent and more prolonged, they have less opportunity to recover from a poor rainy season before the next is upon them. Also, rain is less predictable than it used to be. Even in the longest drought, rains come to some places at some times. They could tell, from natural signs, when rains would come and where they would fall. Now rain, when it comes, may be sudden, violent and unpredictable.

There have always been tensions between the Turkana and other pastoralist groups for access to water and pasture. But these have increased as water sources have dried up and pastures been lost. Because the water table is not being recharged, the wetland areas that the Turkana could traditionally fall back on in times of drought have dwindled. Even the huge Lake Turkana has receded. Territorial disputes have become more common as the lake recedes, taking with it the landscape features that formed traditional boundaries between groups. Many such disputes are settled peacefully, but each time one party or the other is perceived to have broken an agreement, the willingness to trust the next time, and to respect borders, is eroded. Cattle raiding is also linked to drought. Raiding has always been used as a strategy to restock herds during or after a drought. Not surprisingly, prolonged drought and more cattle deaths leads to more raids. And raids lead, in turn, to new cycles of retaliation. As a result of the droughts and growing insecurity, the Turkana have moved from a state in which they are able to cope most of the time, to one in which destitution and vulnerability to famine is a constant danger. During the dry periods they get water for themselves and their livestock by scooping into the sand beds of the dry streams. Water in such sites is usually clean for drinking but finite and quickly depleted. Sand dams are an artificial enhancement of this traditional practice that puts extra water into the sand beds to recharge and store water for use. They're made by building a concrete wall across the channel at specific sites to trap and hold back the sand during flooding; this creates an additional sub-surface water bank for harvesting. With careful siting, the total amount of water available in the sand dams can be considerable.

Sand dam technology has been used successfully in Kenya in Kitui, Machakos and Samburu districts. Other countries with similar dry environments such as Ethiopia and Namibia have also used sand dams. Compared to other water-harvesting techniques, the benefits include provision of clean water for households, control of erosion, and improved water infiltration. Sand dam sites witness plants regrowing which attracts other biological resources and ecosystems threatened by drought. The project is costly in terms of getting people involved and it is labour intensive. But it is also culturally acceptable and has the potential to alleviate the region's water shortages and benefit livelihoods. Constructing sand dams gave ITDG provided the opportunity to help build peace between tribes in conflict over scarce resources. Teams of Samburu and Turkana men and women working together built the dams. A condition of the project was that equal numbers of each tribal group and of men and women, should work together, which helped informal interaction and renewed recognition between the tribes of common problems. The improvement of shallow wells and the desilting of water pans reduced the deaths of both people and livestock. The construction of water troughs at the wells has allowed more animals to be watered, at the same thereby reducing congestion and conflicts from water users. These improvements to existing water resources, coupled with better management, opened up underused rangelands and lead to environmental protection and rising livestock productivity, despite poor rainfall.

Further information:

Working Group on Climate Change and Development, 2005. Africa - Up In Smoke? <http://www.iied.org/pubs/display.php?o=956011ED>

114 KENYA | Indigenous forecasting in Kenya: Using meteorological, animal and plant indicators to predict rain and droughts

Adaptation, traditional knowledge, forecasting, disaster preparedness

Climate variability, and in particular rainfall, has a large influence on the lives of the communities of many people in the traditional setup of Kenya who depend on rain-fed subsistence agriculture for their livelihood. Before the advent of modern scientific methods of forecasting, the traditional communities in Kenya were able to observe the behaviour of some animals, birds, insects and plants and use these to forecast the weather for the coming season. The traditional forecasters are still the major source of weather and climate information for farm management in the rural areas. The Drought Monitoring Center in Nairobi started a project to work with traditional forecasters to determine the indicators used in parts of Kenya and make an attempt to establish their scientific interpretations. It involved studies of Luo, Aba-suba, Abaluya and the Akamba communities. The communities have mastered the traditional indicators, which include plants, animals, insects, birds, stars, the moon, the wind the temperature, clouds and lightning patterns. Resources required indigenous forecasting knowledge and understanding of appropriate coping mechanisms to apply based on predictions. As climate change occurs, these traditional forecasting indicators may change. Locals have to continue their observations and adjust their predictions accordingly to ensure that correct coping mechanisms will be applied.

Further information:

UNFCCC Database on local coping strategies, Case Study 113, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=113; Drought Monitoring Center Nairobi (2004), Traditional indicators used for climate monitoring and prediction by some rural communities in Kenya. A contribution to the harmonization of traditional and modern scientific methods of climate prediction in Kenya. http://www.ogp.noaa.gov/mpe/csi/doc/kenya_indicators.pdf

115 KENYA | Adaptation to Climate Change in Arid and Semi Arid Lands Project

Adaptation, desertification, capacity-building

The objective of the 2009 Adaptation to Climate Change in Arid and Semi Arid Lands (KACCAL) Project is to assist is to enhance the resilience of communities and the sustainability of rural livelihoods threatened by climate change in the arid and semi-arid lands of Kenya. Negative measures include: climate information products, policy and advocacy; climate risk management at district levels; and community driven initiatives for climate resilience. Mitigation measures include: a) climate risk profiling and assessment of adaptive measures to strengthen the monitoring processes and capacity for climate risk management, climate proofing and assessing adaptive strategies and investments at the national level and in selected districts; b) involve the indigenous people representatives in capacity building activities and in District Steering Groups (DSGs); c) the ten percent community contribution should be flexible enough to enable the indigenous peoples to contribute effectively; and d) enhanced capacity of targeted communities to prioritize, develop and implement socially accountable investments at the community level.

Further information:

World Bank Report IPP377, <http://go.worldbank.org/VOUB4E9P5o>

116 KENYA | Sacrifices for rain in Wakesi

Local observations & impacts, traditional knowledge, precipitation

The Nyando river basin in Kenya is traversed by several small streams that flow either into river Nyando or directly into Lake Victoria. Over the years the region has experienced long rains in the months of March - June with very short rain spell in November. This trend has been rather irregular in the recent years with floods occurring in the months of August instead of the months of April. Dry weather periods have increased in length and farm harvest are dwindling. One such community that has experienced this change in climate is Wakesi community. This community traditionally offered sacrifices under trees and the Baobab was quite popular as tree under which offerings to gods for rain was done. In a recent participatory community action plan development carried out by Uhai Lake Forum in collaboration with African Center for Technology studies, the community has revealed the fact that they are increasingly offering sacrifices to gods for rain. They associate the trees with rains. It appears climate change is catalysing worldview practices.

Further information:

Uhai Lake Forum via On the Frontline of Climate Change, <http://www.climatefrontlines.org/en-GB/node/411>

117 MADAGASCAR | Project HEPA: Communication of Indigenous Voices of Southern Madagascar videos

Local observations & impacts, traditional knowledge, multimedia

In 2007 and 2008, Panos London, in collaboration with the Andrew Lees Trust (ALT) and Living Lens, worked with communities from the south of Madagascar to produce a series of films and life stories that show how indigenous people have learned to employ multiple strategies to survive in the face of environmental degradation and a changing climate. The project trained men and women from several communities to record oral testimony interviews and films from their friends, neighbours, and families. It aimed to provide communities with a platform to share their experiences and knowledge and to voice their concerns and priorities for the future. The project's ongoing objective is to ensure that responses to climate change and future development in the region will be informed by indigenous people's experiences, priorities, and reality. This project is funded by the International Fund for Agricultural Development (IFAD).

Further information:

Panos UK, <http://www.panos.org.uk/survivalstrategies>, <http://www.comminit.com/en/node/275757>

Panos London's video "Sorghum: A Crop of our Ancestors" discusses sorghum, a crop of the Antandroy and is part of its people's heritage. It had all but disappeared until recently – replaced by donations of corn during the drought. Lost to most, but never forgotten, sorghum is making a comeback in Androy. Many farmers are eager to rediscover the crop which proves to be very resistant to drought.

118 MADAGASCAR | Andavadoaka and octopus fishing

Adaptation, traditional knowledge, livelihoods, tourism

Economic and environmental factors in Madagascar's village of Andavadoaka were threatening the local octopus population, putting a major strain on the village's traditional source of livelihood. In response, village leaders teamed up with marine conservationists to stabilize the species. Combining traditional knowledge with modern science, the two parties formulated a plan involving seasonal bans on octopus fishing. As a result of this project, the average octopus size and catch has increased steadily. The project is being used as a model in the development of a marine protected area network that incorporates twelve nearby villages. In addition to managing the marine protected area, the community is working to expand eco-tourism activities in order to offer sustainable alternatives to the traditional Andavadoakan livelihood.

Further information:

Equator Prize 2004; http://www.blueventures.org/research_andavadoaka.htm

119 MALAWI | Adaptation to Climate Change by Mphunga Villagers in Malawi video

Adaptation, food security, agriculture, extreme events, multimedia

This is a participatory video project by the Malawian Red Cross Society addressing the effects of climate change on subsistence farmers in Malawi. The Mphunga community is building resilience by adapting community activities in simple ways such as substituting maize crops with rice and replacing chickens with ducks (in a flood ducks float and chicken drown).

Further information:
World Bank Social Development,
<http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSOCIALDEVELOPMENT/0,,contentMDK:21919339~pagePK:210058~piPK:210062~theSitePK:244363,00.html>

120 MALI | Schistosomiasis prevention in Africa: Using Balanite aegyptiaca to decontaminate water

Adaptation, health, traditional knowledge, water resources

Changes in parasite distribution, accompanied by increase in the occurrence of vector- and tick-borne disease, have been identified as a central potential consequence of climate change. Modern medical methods are often too expensive and complicated to be applied in the context of small communities. It may thus be necessary to apply traditional medical methods to combat parasite occurrence and to maintain human and livestock health.

In this case study, Balanites aegyptiaca (a small tree) is used to decontaminate water infected with host snail populations carrying schistosomiasis (also known as Bilharzia or snail fever). There are numerous examples of the use of B. aegyptiaca as a pesticide by Indigenous peoples in these areas, such as the Tuareg in Mali and the Fulani in Mauritania. Extending this knowledge has shown that B. aegyptiaca can be applied in a solution made from the fruits and introduced to the water that needs to be decontaminated.

B. aegyptiaca is a drought-resistant tree found in all dry lands of Africa, in drier regions of Asia and in the Middle East, as well as in some parts of Central and Southern America. It is also known as Ximenia aegyptiaca, desert date, myrobolan, heglig, arraroniyit, baddan, adhto, tiborak, ol-ngoswa or soapberry tree and has well-documented pesticidal properties. The fruits of Balanites aegyptiaca are lethal to schistosome parasite hosts, as well as the two larval stages of the parasite. It is also lethal to water fleas that carry the Guinea worm disease.

Further information:
UNFCCC local coping strategies database,
Project 173: http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=173

121 MOZAMBIQUE | Nwadjahane village, Gaza Province, Mozambique: learning to adapt to change and extreme weather events

Adaptation, livelihoods, conflict, adaptation, economic, beneficial effects

Despite civil war and major floods and drought, Mozambique has emerged in the 21st century as a country of progress and possibilities, a flagship of renewal in Africa. The Adaptive research project set out to investigate how rural people have adapted to these disturbances so that rural communities can be better supported in the face of future changes, especially climate change.

Research focused on the community of Nwadjahane in Gaza Province in southern Mozambique. The village was established in the 1980s following displacement from surrounding areas during the civil war. Over the years, villagers have had to live with political and economic instability, drought, and major flood and storm damage. Despite these difficult circumstances, villagers have developed creative and innovative ways of coping and adapting to this uncertainty and change. Social networks are the links and connections that individuals and households have with family, neighbours and friends. Within Nwadjahane, these have evolved and changed over the last 20 years. A fundamental shift is from paying people with cash in exchange for help with tasks on the farm, to 'traditional' forms of noncash bartering, such as exchanging labour. Villagers explain that this is due to the combined drivers of less cash within the local economy (linked to wider economic processes) and the perceived increase in the number of weather-related disturbances.

Increasingly frequent and severe droughts, floods, and storms have led to either less cash being available from crop sales, or simply the need for more labour to replant or repair damaged crops or farm infrastructure. One of the recognised positive outcomes from this shift is an increased sense of solidarity with neighbours.

Further information:
ADAPTIVE, http://www.geog.ox.ac.uk/research/arid-environments/projects/adaptive/pdfs/8_use_Nwadjahane_village.pdf

122 MOZAMBIQUE | Selecting and storing seeds for flood management in the Xai-Xai District

Adaptation, agriculture, food security, traditional knowledge, flooding

The rural people in Xai-Xai District, Mozambique have developed traditional seed systems which become especially important in times of floods to ensure food security. Following floods, seed flows between lowland and adjacent uplands in flood affected areas are necessary. The physical and social closeness of lowlands and adjacent upland areas allows contact and exchange of seeds and planting materials between the two kinds of agro-ecologies. Such seed exchange is essential especially in years when seeds are lost (e.g. due to drought in uplands or flood in lowlands).

The area has long been exposed to modern varieties and what farmers grow may have originated from commercial seeds. However, since farmers consistently save their own seeds and do some selection, any introduced variety is likely to have been more or less naturalised. When a girl is married her mother may stock her with seeds that she takes with her when she moves to her husband's home. Such customs facilitate some movement of seeds between villages. Following floods, seed flows between lowland and adjacent uplands in flood-affected areas are necessary. The physical and social closeness of lowlands and adjacent upland areas allows contact and exchange of seeds and planting materials between the two kinds of agro-ecologies. Such seed flow may determine to which degree unique lowland-materials could evolve and be maintained. Such seed exchange, directly through farmer-to-farmer contacts, or indirectly through the market, is essential especially in years when seeds are lost (e.g. due to drought in uplands or flood in lowlands).

Further information:
UNFCCC Database on local coping strategies,
Case Study 157: http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=157; Trygve Berg, Fernando Dava and Judite Muchanga (2001), Post-disaster rehabilitation and seed restoration in flood affected areas of Xai-Xai District, Mozambique, FAO. http://www.fao.org/sd/2001/PE0302a_en.htm

123 **MOZAMBIQUE** | Using the landscape to spread risk**Adaptation, food security, agriculture**

Villagers in Nwadjahane farm both the fertile lowlands through irrigation and the higher sandy dryland fields. Increasingly severe floods and droughts over the last two decades have increased demand from households for plots of land in both areas. While the lowland can produce good crops of rice, vegetables and potatoes, these can be destroyed during floods. Highland areas can produce good crops of maize and cassava during flood years. However, during drought years the highlands are less productive and families rely on lowland production. Households with land in just one area have started to develop informal farming associations to lobby those responsible for land allocation. They've successfully managed to gain access to new areas to farm. This is especially important for very poor households as it enables them to share some of the production costs and risks, thus increasing their overall resilience to both droughts and floods. A lesson for development agencies is that external support to these farming systems needs to be careful not to favour one type of farming over another as it is the combination that provides resilience to climatic disruptions. These farming associations have become the focus of innovative and experimental farming practices. By working in groups, villagers are able to spread the risk of new practices and technologies and learn for themselves through trial, error and experimentation. When successful, farmers have been able to take the lessons learnt back to their own individual farms. For example, 45 per cent of those interviewed had changed to more drought-resistant species of rice, maize, cassava and sweet potato at some point during the last six years as a direct result of the information exchange within and beyond the farming associations. The farming associations act as a buffer against initial risk with both poor and wealthy households able to experiment. The associations have also been particularly popular with groups of women, leading to a strengthening of their position within the farming community. With the support of extension officers these types of initiatives can strengthen livelihoods in the face of climate change and make livelihood activities more profitable and secure.

Within the Nwadjahane community, individuals, households, and formal and informal groupings of people are all looking for ways in which they can reduce their vulnerability to disturbances and increase the resiliency of their livelihoods. Some adaptations are driven specifically by experience of extreme climatic events, but many come from a combination of climatic, environmental, economic, political and cultural issues. The study shows that we need to take climate change seriously but that it must be viewed within the everyday context of people's lives. The Mozambique Government has recognised this. It sees the need to support local level attempts to build resilience; national planning strategies are deliberately addressing these issues. Some sectors of agriculture are being encouraged to commercialise at a large scale, while smallholders are being encouraged to participate in local level planning to build the human capacity for livelihood renewal. Thus climate change in Mozambique is not being viewed in isolation; it is being dealt with within the context of wider development issues.

124 **NIGER** | Farmers' perception of vegetation changes**Local observations of impacts, drought, agriculture, food security**

Vegetation changes due to climate and human impact in Sahelian countries are rarely documented at species composition level. The decrease or disappearance of certain plant species reduces vegetation cover and enhances the exposure of soil surfaces to wind and water erosion leading to increased land degradation. Men and women in Niger were asked to note plant species and relate their numerical development to pre-defined observation criteria comparing the present and past. Plant species in decline or that had disappeared were reported more often than species that had increased or were newly introduced. The increasing species that were mentioned were often in use for different purposes and seem to be robust enough and well adapted to the semi-arid environment. But the interviewed farmers also stated the loss of many valuable species that they used for construction and hand tools, consumption, medicine or fodder. Those declining species are of socio-economic importance for individual households and the rural ecology. Men mentioned 18 species that had disappeared. Differences in the perception of men and women could be found. Women seemed to have a better perception for species which had increased or were newly introduced, whereas men perceived more a decrease or disappearance of species. Species composition and spatial distribution data indicate that the parkland ecosystem is significantly shaped by human activities. Indigenous land management favours edible-fruit-yielding taxa from the wetter Sudanian and Guinean vegetation zones over Sahelian species. Rainfall isohyets at the northern range limits of parkland species shifted southwards in the late 20th century, crossing the critical 600-mm mean annual rainfall threshold for Sudanian flora. Relict vegetation and historical records indicate that the Sudanian parkland system extended in the past to near 15° N latitude in middle West Africa, compared with 13.5° N today. The current loss of mesic trees in the Sudano-Sahel zone appears to be driven by the sharp drop in rainfall since the 1960s, which has effectively stranded anthropogenically distributed species beyond their rainfall tolerance limits.

125 **NIGERIA** | Improving tassa planting pits using indigenous soil and water conservation techniques to rehabilitate degraded plateaus in the Tahoua region of Niger**Adaptation, soil conservation, water resources, traditional knowledge**

The programme builds upon indigenous techniques of soil and water conservation, like rows of stones and traditional planting pits to rehabilitate degraded plateaus, and has improved soil and water conservation. Historically, most soil and water conservation (SWC) projects in Niger have been concentrated in the hilly areas of the Tahoua region (450 kilometers east of the capital, Niamey). This region is called the Ader Doutchi Maggia, and has densely populated pockets. Its fertile valleys alternate with badly degraded plateaus. In the past, the valley bottoms (fadama) were flooded regularly, and the floodwaters deposited fertile sediments each time. However, vegetation on the valley slopes is now badly degraded, which means that water rushes down the slopes and causes damage downstream. Large and small gullies have appeared on the slopes and in the valley floors, concentrating and speeding up the runoff. As a result, floodwater rarely spreads out slowly (e'pandage de crue), as it did in the past. Since the early 1960s, several SWC projects have intervened to treat valley slopes and/or plateaus. The most commonly used technique is the construction of contour earth bunds, which are often carpeted with stones to protect them from wind and heavy rainfall. The construction of contour earth

Further information:

David Thomas, Henny Osbahr, Chasca Twyman, Neil Adger and Bruce Hewitson (2005): ADAPTIVE: Adaptations to climate change amongst natural resource-dependant societies in the developing world: across the Southern African climate gradient Tyndall Centre for Climate Change Research Technical Report 35, November 2005

http://www.tyndall.ac.uk/research/themes3/final_reports/t2_31.pdf

Further information:

A Wezel, J Haigis (2000): Farmers' perception of vegetation changes in semi-arid Niger, *Land Degradation & Development*, Volume 11, Issue 6, Date: November/December 2000, Pages: 523-534

<http://www3.interscience.wiley.com/journal/76508542/abstract>

Further information:

UNESCO MOST Best Practices on Indigenous Knowledge Programme, BP.10,

<http://www.unesco.org/most/bpik10.htm>

bunds (fosse's ados) is often combined with subsoiling. Until recently, most SWC projects carried out in this region completely ignored the techniques traditionally used by local farmers to rehabilitate barren, degraded plateaus (Hausa term: fako). This is surprising, since the rows of stones (gandari) are seen everywhere on the plateaus and are conspicuous throughout the entire area. The stones trap sand blown by the winds from the desert (harmattan) and conserve water. The traditional planting pits (tassa) can also be seen, but are not as prevalent in the area. They were used by some villages to rehabilitate degraded land.

The SWC programme in Badaguichiri was funded by the International Fund for Agricultural Development (IFAD) and began in 1988. It limited its activities to the Illela district. The annual rainfall in this area varies greatly, but usually ranges between 250 and 600 mm. In 1989, the project organised a study trip for fifteen farmers, three of whom were women. The group visited the Yatenga region of Burkina Faso, where they learned two important lessons. The first was that farmers in the Yatenga perform SWC on their fields themselves, without a food-for-work arrangement, and the second was that the improved planting pits (zay) used widely and successfully in the Yatenga to rehabilitate degraded land, looked very much like their own traditional planting pits. Upon their return to the Illela district, some of the farmers improved their own tassa pits. They changed the size of the pits (diameter 25 - 40 cm., depth 15 - 30 cm., spacing 80 - 100 cm). They placed the excavated earth down slope to allow runoff water to collect in the pits, and they applied manure to the pits. In 1989, farmers treated three hectares with the improved type of tassa, and since then tassas have been quickly adapted by other farmers.

126 NIGER | Pastoral livelihoods and climate change

Local observations of impacts, food security, multimedia

Pastoralists live in a context of environmental uncertainty and have developed a diverse range of strategies, institutions and networks to exploit this unpredictability and risk to their advantage. Field work in eastern Niger has been completed documenting the differentiated impact of climate change on six different pastoral communities, the strategies they are using to respond and which of these are successful and why. Central to the research is also gaining an understanding of the role of politics and the extent to which Niger's policy environment helps build the resilience of local communities to adapt to climate change and to what degree differences of gender, ethnicity and residence impact on communities' capacities to adapt.

In addition, a film has been produced documenting the economic exploitation of environmental unpredictability by Wodaabe herders in Niger. The film presents in the lives of two families the rationale underpinning their mobility patterns: the harvesting of unstable concentrations of nutrients on the range by carefully built teams of cattle versed in the 'art' of feeding selectively, and the proactive and systematic creation of economic value rather than mere survival.

Further information:

Steve Anderson and Marie Monimart, 2009: Recherche sur les stratégies d'adaptation des groupes pasteurs de la région de Diffa, Niger oriental, IIED, <http://www.iied.org/pubs/pdfs/Go2725.pdf>; "Ngaynaaka: Herding Chaos", IIED, <http://www.iied.org/climate-change/key-issues/drylands/pastoralism-videos>; Diffa, les premiers matins du monde, IIED, <http://www.iied.org/climate-change/key-issues/community-based-adaptation/diffa-morning-light>

127 SUDAN | Breeding livestock in the Sahel: Preserving and improving the one-humped camel

Adaptation, food security, animal husbandry

Nomads breed their herds over many generations to make them fit in their often harsh and variable environmental conditions. This has produced many different breeds and contributed to the maintenance of bio-diversity in domesticated animals. These breeds have developed traits that are so specific to their natural environment that their genetic stock has become a valuable resource for breeding programs. While cryogenic conservation of semen preserves the genetic code, it does not carry the information related to appropriate live-stock husbandry of these breeds. The pastoralists still keep their animals on the very marginal lands of the Sahel. Their way of maintaining their cattle, goats, sheep camels and horses is a blueprint for husbandry practices in areas where other forms of land use can not sustain an ever growing population. Active selection for certain qualities is often limited to the male breeding animals, which are chosen with great discrimination on the basis of their dam's and other female relatives' performance, as well as disposition, conformation, colour and other varying criteria.

The one-humped camel furnishes an excellent example for the various processes involved in the development of indigenous livestock breeds. Animal scientists have expressed the opinion that the camel differentiated very little since its initial domestication and that few distinct breeds exist. However, in the Sudan alone, at least a dozen breeds are known, which are named after groups that keep them. Among them is the Rashaidi breed which is locally famous for its hardiness and milk performance, although animal scientists classified it as a transport breed. The Anafi and Bishareen are typical racing and riding breeds, very popular nowadays for export to the camel racing business in the Gulf States. The heavy Lahaween camel is a good meat producer, whereas Arab is a generic term for large and strong-boned burden camels.

Further information:

UNFCCC Database on local coping strategies, Case Study 90 http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=90
Köhler-Rollefson (1993): Traditional pastoralists as guardians of biological diversity. In: IK Monitor Vol. 1 (3) <http://web.archive.org/web/20041211105339/www.nuffic.nl/ciran/jikdm/1-3/articles/kohler.html>

128 SENEGAL | the Dangers of large-scale mono-cropping

Local observations of impacts, aridity of drought

Senegal's experience of peanut farming has left leaves them more, not less, vulnerable to climate change. Climatic phenomena, such as the drought cycles of the last two decades, have worsened desertification. Vegetation cover has been increasingly degraded and there has been overgrazing. Beginning as long ago as the early 1880s, the French Administration, with the help of armed troops, demanded that farmers grow peanuts for the French vegetable oil industry. Peanut monoculture expanded rapidly after World Wars I and II and boomed again during the 1950s. Peasants needed cash to pay taxes imposed by the French and peanuts were the only source of francs. However, the cash crop also brought unexpected catastrophe. Today, around 40 per cent of Senegal's arable land is used for growing peanuts. Economic dependence on the export crop has led to excessive mono-cropping, soil degradation and forest clear-cutting. The environmental impact of the peanut farming has been comprehensive. Small-scale farmers did not own animals, so manure was unavailable. A fallow period would have allowed nutrients to re-accumulate in the soil, but the people could not

Further information:

Columban Faith and Justice. In Working Group on Climate Change and Development, 2005. Africa - Up In Smoke? <http://www.iied.org/pubs/display.php?o=95601IED>

afford the time. Instead they grew peanuts till the soil was exhausted, then moved to new lands. They chopped down trees, which held topsoil in place and helped absorb infrequent rains. Before the peanut take-over, the roots and stalks of the millet crop used to be left in place, holding down the topsoil. But the peanut, on the other hand, is wrenched from the ground, the soil loosened and clouds of earth swirled away with the dry-season winds.

129 SOUTH AFRICA | Examples of adaptation in Africa

Adaptation, disaster preparedness, adaptation, agriculture, biodiversity, wildlife, animal husbandry, food security

The Office of the Disaster Preparedness in Africa has collected examples of local community adaptation in Africa, including:

- Soil management: shifting cultivation (lucabe) as well as intercropping, agroforestry and establishment of grass strips to promote preservation of soil; traditional use of wood ash for soil fertility maintenance; traditional names for describing soil fertility, for example, sidzakeni for fertile soil and esihlabatsini for sandy soil;
- Biodiversity conservation: agroforestry encouraged conservation of soil, trees and wildlife which promoted biodiversity; establishment of grass strips promoted biodiversity; traditional harvesting of wood barks ensured that the cambium layer of trees was not damaged; revered species were protected by names given to them, for example, *Zizyphus macronata* (umlahbantfu), used only for funerals and never to be found in homes; taboos were associated with plants to protect their abuse for household needs; *Helichrysum odoratissimum* (imphepho) was burnt to purify air as air a freshener;
- Wildlife management: stories of humility and friendliness of some wildlife as a way of protecting weak animals from extinction included, for example, that the chameleon (lunwabu) was a messenger of peace from God that should not be harmed; timing of traditional hunting (July and August) ensured that newborns were not killed as most wildlife gave birth in and after October; totems for clans based on certain animals were a means of protecting wildlife and domestic animals, for example, Dube clan: the zebra, Mayantsi clan: the buffalo; Dlamini clan: the black sheep, Mvubu clan: the hippopotamus, Ngwenya clan: the crocodile;
- Livestock production: use of some plants for fertility and control of parasites; traditional preservation of milk in calabashes for fermentation as emasi; traditional preservation of meat as biltong; sun drying of meat as umncweba; use of pawpaw leaves as a meat tenderizer and burning of leaves of certain plants for cattle to inhale as treatment for some diseases;
- Food storage: preservation of vegetables in dried form (infuso); storage of sweet potatoes in pits as ingungu; storage of maize in dry powdered form;
- Drought and flood disaster management: Prediction of floods from the heights of nests of emahlokoheko birds near rivers; use of moth numbers for drought prediction; position of the sun and the cry of a specific bird (phezukumkono) on trees next to rivers to predict the onset of the rainy season for farming; position of moon crescent to predict rain; presence of certain plant species as an indication of a low water table, for example, *Ascolepis capensis* (umuzi).

Further information:

Office of the Disaster Preparedness in Africa (ODPA) In UNEP (2004), Report of the Meeting of Coordinators of the Project on Capacity-Building through Partnership and Information and Communication Technology for Using Indigenous Knowledge for Nature Conservation and Natural Disaster Management in Africa, <http://www.unep.org/depi/PDF/1kmeetingreport.pdf>

130 SOUTH AFRICA | Mantsie village, NorthWest Province, South Africa: living with regular drought

Local observations of impacts, drought, economic

The community in Mantsie village report that the traditional seven-year drought patterns no longer occur. Instead, they believed seasons to be unpredictable, with frequent mini-droughts, corresponding to the climate records. A need to build resilience to poverty and food insecurity because of drought, poverty, unemployment and a lack of water makes matrilineal ties and neighbourhood support groups important for households in Mantsie. Large households are stronger able to make and maintain these social ties, often through non-cash exchange, giving them a higher adaptive capacity. Informal neighbourhood institutions provide support and advice during times of difficulty, help livelihood specialisation, and offer links for temporary migrant work. While Mantsie has a high ratio of reciprocity and number of active ties, weak solidarity, ineffectual leadership and high levels of crime may reduce the villagers' capacity to adapt to future change.

Further information:

Tyndall Centre for Climate Change, ADAPTIVE (Adaptation to climate change in vulnerable environments) Research Notes #5, Mantsie village, NorthWest Province, South Africa: living with regular drought, http://www.geog.ox.ac.uk/research/arid-environments/projects/adaptive/pdfs/5_use_Mantsie_village.pdf

131 SOUTH AFRICA | Khomele village, Limpopo Province, South Africa: learning to adapt to pervasive drought and changes in the rainy season

Adaptation, aridity of drought

Observed changes to climate include increasing risk of drought; Unpredictable and shorter rainy season; Longer and more intense dry season; risk of occasional intense rainfall events; Drying leads to unproductive soils because 'nutrients are trapped in the clay soils'; Decreasing quality of the rangeland through drought and degradation with more unpalatable grasses. Responses include Reliance on family and friends to provide assistance; Selling of assets, such as smallstock and chickens; Local piece work, petty trade or hawking of goods such as craftwork, clothes, vegetables, fruit, firewood) for cash or gifts in-kind; Applying for government financial support to sustain the livestock business (e.g. compensation for cattle that have perished, subsidised feed for up to 30 head of cattle, sale of cattle at a fixed 75% price); Eating of wild fruits. Khomele's success at cooperation and specialisation is based on high levels of agency (extension service, strong local leadership, women's groups), attention to bettering oneself through education or business, and strong ties with urban areas. In particular, large households have more receive ties, whereas small households resort to temporary migrant work and non-cash exchange mechanisms. The role of associations maintain these social ties by providing access to labour and support networks, resources such as resilient seeds or start-up grants, and advice with new ideas, thus counteracting a dry and unpredictable climate, poverty, poor local markets and food insecurity. Essentially, the community have been able to adapt their situation to get higher returns in a more risky environment. However, this success for some comes at a price for others; the benefits from belonging to a group can also lead to exclusion and

Further information:

Tyndall Centre for Climate Change, ADAPTIVE (Adaptation to climate change in vulnerable environments) Research Notes #6, Khomele village, Limpopo Province, South Africa: learning to adapt to pervasive drought and changes in the rainy season, http://www.geog.ox.ac.uk/research/arid-environments/projects/adaptive/pdfs/6_use_Khomele_village.pdf

inequality (the village has a low ratio of reciprocity, with undercurrents of poor solidarity and jealousy).

132 SOUTH AFRICA | Mcitsheni village, KwaZulu Natal Province, South Africa: adapting to increasing variability and intensity of climatic conditions

Adaptation, food security, livelihoods

More persistent disturbances and change appear to trigger adaptations in livelihoods. These adaptations may have important lessons for dealing with future climate changes. Those identified at Mcitsheni are described below. In examining the process of response, more is understood about the ways people turn support networks or social ties into adaptive strategies, and why these help to explain who is successful. Formation of community horticulture projects to reduce food insecurity (by reducing vulnerability to unpredictable weather). Of the sample, 87% are part of associations formed since 1994. For example, potatoes can compensate for damaged rainfed maize harvests. The projects are popular with women, who are able to build on their strong traditional networks forming groups based on friendship and trust. The most successful projects have smaller groups with larger families, allowing information to flow, trust to develop and members to be able to spend time in the garden. They have established penalties for non-participation. The projects have successfully been used as a way of entering the commercial market in larger towns. The projects have sparked an entrepreneurial culture (women have now been successful in accessing grants to formalise other traditional livelihood activities, such as dressmaking).

Mcitsheni's successful responses to unpredictable climate, poverty, unemployment and food insecurity are a result of high levels of agency (extension service and well-connected individuals within the community), strong ties to urban areas (developed during the apartheid years), and the need to maintain flexible lifestyle choices. Processes of response are maintained by large household sizes and culturally accepted role of strongly gendered strategies. Women's projects have been most successful in developing vegetable projects because they have used their long-established social networks with female-headed households having more ties to urban areas. Despite the success for these groups, the village has a low ratio of reciprocity and the lowest ratio of give to receive ties, suggesting that the community prefers to use social institutions that facilitate links outside the village.

Further information:

Tyndall Centre for Climate Change, ADAPTIVE (Adaptation to climate change in vulnerable environments) Research Notes #7 Mcitsheni village, KwaZulu Natal Province, South Africa: adapting to increasing variability and intensity of climatic conditions, http://www.geog.ox.ac.uk/research/arid-environments/projects/adaptive/pdfs/7_use_Mcitsheni_village.pdf

133 SIERRA LEONE | Protecting the Gola Forests in Sierra Leone through conservation concession

Adaptation, forests, conflict

Deforestation accounts for between 20 and 30 per cent of all greenhouse gas emissions worldwide and has devastating effects on both biodiversity and local communities. The Upper Guinea Forest, which once stretched from Guinea to Ghana, now covers less than one-third of its original area and is highly fragmented into comparatively small areas. Sierra Leone has only one-seventh of its original Upper Guinea Forest remaining, half of which is made up of the 750-square-kilometre Gola Forests in the southeast of the country. The RSPB and the Conservation Society of Sierra Leone (CSSL) developed one example of an innovative approach to natural resource management that balances peoples' livelihoods with sustainability. They formed a long-term partnership with the Sierra Leone Government and seven chiefdoms to protect the Gola Forests. Following the recent conflict in Sierra Leone, there was a concern that commercial logging would resume in the Gola Forests, bringing in much needed but short-term money. Instead, the CSSL and the RSPB have concluded a 'conservation concession' agreement with the Sierra Leone Government under which the forest management rights will be used for conservation rather than logging. Under a logging concession, the Government and local communities would expect incomes from the concession holder through fees and royalties. This potential loss of income has to be compensated for by the new conservation agreement. Income for the Government is fed directly into its Forestry Division to manage and develop the Gola Forests for conservation. Local communities will receive royalties to put into conservation-friendly community development projects. The agreement will also guarantee employment and engagement of communities in the management of the forests. A trust fund will meet these costs in perpetuity.

Further information:

Royal Society for the Protection of Birds (RSPB) in Working Group on Climate Change and Development, 2005. Africa - Up In Smoke? <http://www.iied.org/pubs/display.php?a=956011ED>

134 SUDAN | Blinded by sand, cruelty and hunger in the desert

Local observations & impacts, desertification, aridity & drought

Increasing desertification has robbed Sudan's villages of their pastures and children of their education. Usama Ahmed Al-Iman is one of many who has been forced to drop out of school. "We once had animals who fed us," Usama recalls. "There was agriculture around our village. An abundance of whatever we needed. But as the environment changed, rainfall became scarce, animals died. My mother could no longer support us. I had to help in covering the family's living expenses." "El Ithemrat", he explains, "is affected by the phenomena of desert creep, the advanced form of desertification". People here, he says, now depend on pastoralism because agriculture is no longer an option.

When the desert crept into the village of El Ithemrat in Sudan's Northern Kordofan region, it claimed El Nour Abd Elrasol's wealth, his eyesight and his future. When El Nour grew up, El Ithemrat was surrounded by vegetation and water and there was a wealth of animals: camels, sheep and goats, and the finest cows capable of producing an abundance of milk. Rich fields yielded sesame seeds, groundnuts and vegetables. But things were changing in his home area. Sand dunes moved quietly but steadily towards El Ithemrat, and then they surrounded it, isolating it from other towns and life. The state of North Kordofan was being affected by the phenomenon of desert creep.

After severe droughts in the 1980s and 1990s, El Ithemrat changed beyond recognition. The formerly green village became a pile of earth and sand. Its inhabitants moved to live on top of the sand dunes and animals died because they had nowhere to graze. Life became hell. Poverty crept into the village along with the sand, and families began to migrate to urban areas.

Further information:

Panos London, <http://www.panos.org.uk/?lid=19807>, <http://www.panos.org.uk/?lid=19808>

135 **SUDAN** | Community based rangeland rehabilitation**Adaptation, drought, natural resource management**

The drought-prone Bara province is situated in western Sudan and is mainly composed of desert scrub vegetation and undulating sand dunes. The average rainfall is around 250 mm per year with significant seasonal and inter-annual rainfall variability. The land is becoming increasingly degraded as a result of recurring droughts, cultivation of marginal lands, overstocking of livestock and fuelwood gathering. Since 1992 community based rangeland rehabilitation (CBRR) for carbon sequestration measurements have been implemented in 17 villages in central Bara province. These measurements mainly consisted of the implementation of simple model community-based natural resource management to prevent overexploitation of marginal lands and rehabilitate rangelands and the diversification of local production systems to ensure sustainability of the approach as well as to improve socio-economic conditions. The outcomes of the CBRR project were very successful. Over 700 ha of rangeland were improved. Other achievements of the project included: the establishment of local institutions to coordinate community natural resource management and community development activities, regeneration and stabilization of five km of sand dunes to halt expansion of the desert, construction of windbreaks to protect farms from soil erosion, restocking of livestock by replacing goat herds with more resilient and less damaging sheep, creation of water management sub-committees to better manage wells and the preparation of a drought contingency plan. The main lesson learned was that in order to secure the long-term effectiveness of the achievements of this project it is crucial to build the capacity of the affected communities in order to enable them to cope with climate-induced stresses.

Further information:
IISD, 2003. Sustainable Drylands Management. A Strategy for Securing Water Resources and Adapting to Climate Change. Livelihoods and Climate Change. Information Paper 3. Winnipeg, Canada. www.iisd.org/pdf/2003/env-sec_livelihoods_3.pdf

136 **TANZANIA** | Management of local agro-ecosystems in Kenya and Tanzania**Adaptation, livelihoods**

An investigation of how smallholder farmers at two sites in Kenya and Tanzania cope with climate stress and how constraints and opportunities shape variations in coping strategies between households and over time during a drought. Households where an individual was able to specialize in one favoured activity, such as employment or charcoal burning, in the context of overall diversification by the household, were often less vulnerable than households where each individual is engaged in many activities at low intensity. Many households had limited access to the favoured coping options due to a lack of skill, labour and/or capital. This lack of access was compounded by social relations that led to exclusion of certain groups, especially women, from carrying out favoured activities with sufficient intensity. These households instead carried out a multitude of less favoured and frequently complementary activities, such as collecting indigenous fruit. While characterized by suitability to seasonal environmental variations and low demands on time and cash investments, these strategies often yielded marginal returns. Both the marginalization of local niche products and the commercialization of forest resources exemplify processes leading to differential vulnerability.

Further information:
Eriksen, Siri, Katrina Brown and Mick Kelly, 2005. The dynamics of vulnerability: locating and coping strategies in Kenya and Tanzania. *The Geographical Journal*, 171 (4): pp. 287-305. <http://www.cicero.uio.no/publications/detail.aspx?id=3919&lang=en>

137 **TANZANIA** | Ujamaa Community Resource Trust**Adaptation, land rights, tourism**

Ujamaa Community Resource Trust (UCRT) works with marginalized groups and pastoralists in Northern Tanzania to create land management plans, manage natural resource systems, and explore sustainable income-generation opportunities. A central component of UCRT's work is mobilizing communities to lobby local and national governments for community land rights and resource entitlements. UCRT has helped over 20 villages in northern Tanzania – including the biodiversity-rich areas of the Serengeti and Tarangire – secure land and resource tenure, enhance economic benefits of their ecosystems (mainly through ecotourism), and establish community conserved areas based on indigenous management practices.

Further information:
Equator Initiative Awards 2008, <http://www.equatorinitiative.org/>

138 **TANZANIA** | Indigenous forecasting by the Maasai, predicting weather-related diseases**Local observations & impacts, disaster preparedness, forecasting, traditional knowledge, animal husbandry**

Similarly, pastoralist Maasai practice everyday monitoring of their resource base to determine the trend of range condition and to detect early signs of deterioration. To ensure reliability of evaluation they have developed various sampling and surveying techniques. They observe forage types, quality, quantity and condition as used by livestock and wildlife. Common indicators used are: daily milk yield, animal coat texture and colour, consistence of cow and wildlife dung, and the extend of bush encroachment. None of these indicators is used in isolation, rather a combination of all of them provides the experienced pastoralist with early indications of the condition of the range land and its likely changes. Based on the observations, the herders decide how to manage the situation or to apply coping strategies in case of an impending drought.

Further information:
UNFCCC Database on local coping strategies, Case Study 92, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=92; Maasai Resource Centre for Indigenous Knowledge, Arusha, United Republic of Tanzania

The knowledge of the Maasai is little researched so far. Traditional expertise in astronomy and weather forecasting in combination with conventional agricultural meteorology could enhance local forecasts on harvests and food security. As climate change occurs, these traditional forecasting indicators may change. Locals have to continue their observations and adjust their predictions accordingly to ensure that correct coping mechanisms will be applied.

139 **UGANDA** | Documenting Indigenous Knowledge and Natural Resources**Local observations & impacts, natural resource management, traditional knowledge**

Communities have from time immemorial used indigenous knowledge to cope with climate variability and extreme weather and climate events. During the NAPA (national adaptation programmes of action) process relevant traditional knowledges were encountered and they tended to be area, culture- and subject specific. For example, in Rakai, the Lwanyia, a local shrub is used as antidote to lightning. In Karamoja, initiation of farming following the first rains is sanctioned by the elders after examining the content of ruminant guts and forecasting based on an apparently "indigenous meteorological system". Others include food preservation in Kapchorwa using honey, rain making using a combination

Further information:
Uganda NAPA Project Profile (Project #8), http://unfccc.int/cooperation_support/least_developed_countries_portal/napa_project_database/items/4583.php

of rituals and herbal concoctions, and water purification using Moringa seeds. These traditional practices are of considerable cultural value to communities, although the scientific basis of some of them is doubtful.

To exploit this potential for adaptation to climate change, there is need to document and understand indigenous knowledge and where possible establish their scientific basis. This project by the Ministry of Water, Lands and Environment aims to: document and validate climate related indigenous knowledge for natural resource management; develop and implement community based strategies for effective natural resource management; train communities in integrated natural resource management; promote use of appropriate indigenous knowledge in natural resources management; strengthen collaborative management of natural resources; and identify and promote alternative livelihoods.

140 UGANDA | Eviction of the Benet of Mount Elgon

Local observations & impacts, land rights

A signed agreement between the Forest Absorbing Carbon Dioxide Emission Foundation of the Netherlands and the Uganda Wildlife Authority in 1994 permitted the foundation to plant trees on the 25,000 hectares of Mount Elgon National Park of Uganda. The objective of the project was to create a plantation of eucalyptus trees which would store carbon, to offset the emissions generated by the energy utility companies in the Netherlands. Another Dutch company called GreenSeat also sells sequestered carbon from Mount Elgon to people wanting to offset the emissions caused by their aeroplane flights.

While project coordinators claim that the plantation has improved the lives of the people around the park, the indigenous people themselves (the Benet) say the exact opposite. After Mount Elgon was declared a national park in 1993, the Uganda Wildlife Authority violently forced the residents of Mount Elgon to leave the area and move to caves and mosques in neighbouring villages. Park rangers killed more than 50 people in 2004. In addition, the project took away what little income the people had had from their lands and crops. The villagers are not allowed to graze their cows and goats in the area or to obtain food or important traditional materials from the forest.

The Benet took the Government to court in August 2003 to reclaim their land rights. In October 2005, Justice J. B. Katusi ruled that the Benet people were historical and indigenous inhabitants of the said area which was declared wildlife protected area or national park. He ruled that the Benet be allowed to live on their land and continue farming it. When this story was exposed, the Uganda Wildlife Authority-Forest Absorbing Carbon Dioxide Emission Foundation organization, GreenSeat, and other institutions engaged with the project, including the Forest Stewardship Council, the Société Générale de Surveillance and the clients of GreenSeat (including members of the Dutch Parliament, WWF Netherlands, Amnesty International and Body Shop) rationalized their own actions, claimed ignorance or denied any responsibility.

141 ZIMBABWE | Rural Afforestation Programme

Adaptation, forests, traditional knowledge

In view of the alarming rate of deforestation in Zimbabwe's rural areas, the government has initiated a Rural Afforestation Programme which is now being implemented by state agencies, with the help of national and international non-governmental organizations. The main objective of this programme is to grow trees, mainly gum trees (*Eucalyptus* spp.), to provide communities with a source of fuelwood and with poles for construction. The ultimate aim of the programme is to encourage people to use gum trees for these purposes, to help save the few remaining indigenous forests. The implementation of the programme has been facilitated by the relaying of information and recommendations from government departments and research centres. In addition to these formal knowledge networks, local farmers, in their day-to-day struggle to survive, have established their own informal networks to exchange information on conservation forestry.

Equally important, therefore, are the informal networks which have evolved from the cooperation between and within various state agencies, NGOs, international organizations and groups of farmers. Farmers themselves have also set up informal networks to deal with practical production problems, resulting in multiple and overlapping networks. In the past, programmes have always faced one problem, known as the 'subordination' or 'ignorance' syndrome. There are two sides to this. On the one hand, farmers display ignorance or subordination towards external experts like extensionists. On the other hand, the experts often approach the farmers as though they are naturally ignorant.

Contrary to common belief, indigenous farmers - like technical forestry researchers - are experimenters. For many indigenous cultivators, reducing risk is more important than maximizing production. In order to minimize risk, they develop special strategies, adapt technical recommendations to local conditions, solve specific problems, and test existing technologies or ideas. They internalize, use and adapt externally acquired knowledge to suit local conditions. This participatory approach means involving local people at all stages of the technology development process, including the generation, dissemination and utilization of technology, as well as research planning, implementation and evaluation. The programme is carried out as an interactive model with strong linkages between researchers, extensionists and local farmers, a strong feedback mechanism, and active participation by all actors.

The farmers adapt all kinds of knowledge (including that from external researchers and networks) and use it for their own experiments and environment. In addition to the farmers, there are other sources of indigenous knowledge, including indigenous experts, opinion leaders and village elders. Locally-generated knowledge is disseminated through farmer-to-farmer interaction, usually involving neighbours or friends (*sahwira*), during personal visits, at farmer group or village gatherings, in social clubs and especially at beer meetings.

Further information:

UNPFII, 2008: Information received from Governments E/C.19/2008/5/Add.1; Kevin Smith, et al (2007), *The Carbon-Neutral Myth: Offset Indulgences for your Climate Sins* (Imprinta Hija de J. Prats Bernadas).

Further information:

UNESCO Best Practices on Indigenous Knowledge BP.14, <http://www.unesco.org/most/bpik14.htm>

Adaptation, payment for ecosystem services

The CAMPFIRE program (Communal Area Management Program for indigenous Resources) has been quite successful in involving communal area farmers in wildlife management. This program has facilitated sustainable wildlife production, and reduced the degradation of land by offering a viable alternative to the farmer. It is also important to note that revenue generated by the CAMPFIRE program is ploughed back to the local community and utilized in accordance with community-identified development priorities.

Payments for environmental services (PES) have been distinguished from the more common integrated conservation and development projects on the grounds that PES are direct, more cost-effective, less complex institutionally, and therefore more likely to produce the desired results. Both kinds of schemes aim to achieve similar conservation outcomes, however, and generally function in analogous social, political and economic environments. Given the relative novelty of PES, what lessons can be learnt and applied from earlier initiatives? In this paper, we describe the evolution over the first 12 years (1989–2001) of Zimbabwe's Communal Areas Management Programme for Indigenous Resources (CAMPFIRE), a community-based natural resource management programme in which Rural District Councils, on behalf of communities on communal land, are granted the authority to market access to wildlife in their district to safari operators. These in turn sell hunting and photographic safaris to mostly foreign sport hunters and eco-tourists. The District Councils pay the communities a dividend according to an agreed formula. In practice, there have been some underpayments and frequent delays. During 1989–2001, CAMPFIRE generated over US\$20 million of transfers to the participating communities, 89% of which came from sport hunting. The scale of benefits varied greatly across districts, wards and households. Twelve of the 37 districts with authority to market wildlife produced 97% of all CAMPFIRE revenues, reflecting the variability in wildlife resources and local institutional arrangements. The programme has been widely emulated in southern and eastern Africa. We suggest five main lessons for emerging PES schemes: community-level commercial transactions can seldom be pursued in isolation; non-differentiated payments weaken incentives; start-up costs can be high and may need to be underwritten; competitive bidding can allow service providers to hold on to rents; and schemes must be flexible and adaptive.

Further information:

Peter G.H. Frost, Ivan Bond, 2008: The CAMPFIRE programme in Zimbabwe: Payments for wildlife services; *Ecological Economics*, Volume 65, Issue 4, 1 May 2008, Pages 776-787, doi:10.1016/j.ecolecon.2007.09.018



ASIA

143 ASIAN REGION | Programme for developing mechanisms to reward the upland poor of Asia for environmental services they provide (RUPES)

Adaptation, payment for ecosystem services, forests, water resources, land rights

Poor rural people have the potential to be important players in natural resource management and carbon sequestration. The RUPES project is testing mechanisms that can enable upland communities to share in the local and global benefits that these services provide, thereby enhancing their livelihoods and reducing poverty. RUPES operates in six sites – in the Philippines (Kalahan Reserve & Ancestral Domain and Bakun), Nepal (Kulekhani) and Indonesia (Bungo, Sumberjaya and Singkarak), and has also carried out activities in China and India. Through a partnership with the International Fund for Agricultural Development (IFAD) as a major donor, the World Agroforestry Centre (ICRAF) is coordinating a wide-ranging consortium of research organizations, non-government organizations and national partners interested in contributing and being a part of RUPES. The RUPES project is building working models of best practices for successful environmental transfer agreements adapted to the Asian context. Targeted action research is identifying the environmental services and how can they be measured. It is looking at who the rewards should go to, who will pay the rewards, how and in what form they would be collected, and what amount or form is appropriate.

Further information:
RUPES, <http://rupes.worldagroforestry.org/>

The process of identifying environmental services, valuing them, and facilitating the development of local institutions has led to increased awareness of watershed conservation and better land management in all RUPES sites. RUPES and other initiatives have encouraged poor rural people to adopt improved land and forest management practices. This is especially apparent in Sumberjaya, Indonesia, where the reward mechanism started with coffee agroforestry and has now been extended to include river care. Better environmental practices were shown to have a direct impact on agricultural production, such as improved and higher yields of coffee in Sumberjaya. At Sumberjaya, where land tenure rights have been a longstanding issue, the project helped to resolve conflicts over land and to provide tenure security in return for a commitment from the upland poor to maintain or restore environmental services. Indeed, land tenure has been the main reward mechanism for watershed protection and carbon sequestration projects.

144 BANGLADESH/PHILIPPINES | Low-cost ways to reduce vulnerability: disaster-resistant housing

Adaptation, housing, traditional knowledge

Floods are a normal part of life in much of Bangladesh, and typhoons in the Philippines. Various traditional housing techniques have been formulated to cope with this situation. ITDG worked with communities regularly affected by monsoon floods to develop a design for a flood-resistant house. It used available low-cost materials and local skills, and built on local skills and knowledge. The approach could readily be applied in other countries affected by floods and storms, like Mozambique. Success depends on collaboration between local masons and carpenters and any outside experts. In Bangladesh, an improved attic to be used as living and storage space during times of floods resulted from contributions from the community on how to improve the housing design. Poorer people cannot afford more water-resistant materials like corrugated metal, and have to suffice with thatched roofs, walls of woven grass or palm and bamboo. But, innovative methods can be applied, building on local traditional methods. Weaving, and joining bamboo and timber to form joists, results in a building that can withstand typhoon-force winds through its very flexibility, better than a rigid building of modern materials. Where the floodwater level is not normally too far above normal water level, houses can be built on raised earthen platforms. Planting water-resistant plants and trees such as bamboo and banana next to homesteads helps to protect the houses from erosion. Food, household items and crops are stored on a platform in the main living room. An added benefit is that the structure using woven walls can be designed to be dismantled in the event of a severe flood forecast, and moved for re-erection on a new site or restoration after floodwaters subside.

Further information:
Working Group on Climate Change and Development, 2005. Africa - Up In Smoke? <http://www.ied.org/pubs/display.php?o=956011ED>

145 BANGLADESH | The Taungya project

Adaptation, livelihoods

The Taungya project aims to identify a concrete coping strategy to combat the global climate change that is cost effective, ecofriendly, reliable, and adaptable. It is linked to viable livelihoods that use and manage available natural resources in a sustainable manner. The taungya is a system whereby villagers and sometimes forest plantation workers are given the right to cultivate agricultural crops during the early stages of forest plantation establishment. Cultivation is often allowed to continue until trees shade crops due to canopy closure. During the early stages of forest plantation establishment, intercropping of young trees with food crops is beneficial in terms of tree survival, food crop production, financial income to the peasant farmers and reduction of forest plantation establishment costs.

Further information:
UNDP Regional Centre in Bangkok, <http://regionalcentrebangkok.undp.or.th/practices/governance/ripp/InnovativeProject.html>

146 BANGLADESH | Indigenous forecasting in Maheshkhali, using meteorological indicators and animal behaviour to predict cyclones

Early warning systems, disaster preparedness, traditional knowledge

Maheshkhali Island is situated off the Bay of Bengal coast with an area of approximately 60 square km. Cyclones are the greatest disaster threat of coastal people. Research has revealed that certain indigenous prediction capacity possessed by the local people always helped them to anticipate cyclones and take necessary precautions. The indigenous cyclone prediction is even more important as it was revealed during interviews with the Maheshkhali islanders that they do not understand the modern warning system with its different numerical codes (1-10) and elaboration on wind direction, as explained in the warning bulletins.

Further information:
UNFCCC Database on local coping strategies, Case Study 33, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=33; Md. Shahed Hassan (2000) Indigenous Disaster Management Culture: A Comparative Study Between the Cyclone Affected People of Bangladesh and Japan. ASA 2000 Conference Papers <http://www.asa2000.anthropology.ac.uk/hassan/hassan.html>

Many Maheshkhali islanders say that they can predict occurrences of cyclones. However, these respondents were all belonging to the older generation, i.e. 50 years and above. The indigenous knowledge, particularly the one related to natural calamities, is transmitted through the male line and preserved by the older generation and identifies five major indicators in predicting cyclones: wind direction, temperature and salinity of sea water, colour of clouds, appearance of a rainbow, and abnormal bird behaviour. The indigenous cyclone prediction is even more important as it was revealed during interviews with the Maheshkhali islanders that they do not understand the modern warning system with its different numerical codes (1-10) and elaboration on wind direction, as explained in the warning bulletin

147 BANGLADESH | Floods in the Chittagong Hill Tracts

Food security, observations

In Khagrachari in the Chittagong Hill Tracts (CHT), severe floods took place in 2006 which lasted for 15 days and led to the destruction of houses and thousands of acres of land planted to food and other crops. Thousands of indigenous persons were displaced. Massive floods also occurred in the coastal areas of Bangladesh which has led to freshwater salinization and increased incidents of diseases. Agricultural production of the Santal, Munda and Oraon, indigenous peoples who live in North Bengal, has decreased significantly because of increased precipitation in their territories. The Rakhine are the indigenous peoples who live in the coastal areas who have suffered worst floods because of the rising sea level, which caused coastal and riverbank erosion and the depression of the Sundarbans, one of the best floodplain mangrove forests in the world. More migration from Dhaka and other low-lying coastal areas into the CHT will mean the further minoritization of the indigenous peoples in that region. This will also exacerbate existing conflicts over lands and natural resources between the Bengali people and the Jummas. Rats attacked rice fields and Jhum or swidden farms leaving no food for the people, exacerbated by the disappearance of natural predators like snakes, birds, wild cats, due to deforestation and forest fires brought about by long drought seasons. The rat infestation and drought led to a devastating famine in 2007 resulting in malnutrition of indigenous peoples in the Chittagong Hill Tracts, particularly children under five years of age. Incidents of vector-borne diseases like malaria and dengue fever and increased cases of children going blind because of vitamin A deficiency has been reported by the health authorities. Cyclone and storm surges have caused massive landslides and soil erosion and destroyed crops and even forests.

In spite of the fact that the indigenous peoples in the Chittagong Hill Tracts have lost access to their forests because of government policies, they managed to devise new sustainable forest management practices which are still largely based on their traditional knowledge and practices. They formed Village Common Forests (VCF) under the leadership of the Mouza Headmen and managed by the villagers. The case study done in Monglechan Karbari para showed that from an area of 20 acres the villagers managed to expand the forest to 100 acres. They planted diverse trees which now are crucial for watershed management, biodiversity conservation, source of biomass, and bamboos for construction of houses and temples. Due to the scarcity of water, the Jumma of Bangladesh devised the godha and thagalok systems to hold rainwater and seepage water for irrigation and household use. The godha is a cross dam, made of earth, bamboo and wood, which is constructed between two hills to store water for irrigation. Water from the godha is brought to the fields by using bamboos. The thagalok is a bamboo pitch which courses seepage water from the rocky hill slopes. This water is collected in an earthen pitcher called kum and this is used for drinking purposes. Vegetation on the upper slopes is carefully maintained to ensure that the water is cool and clean.

In Bangladesh, indigenous peoples have adapted over generations to the risks of floods, drought and cyclones. They have raised their homes on mounds above the normal flood levels and they adjust their agricultural patterns to take advantage of flood waters. They breed and grow a wide range of rice varieties and other crops to be planted in accordance with the recession of floods and the length of droughts. They try to take part and use government programmes such as cyclone shelters and shelters from river floods for environmental refugees, coastal embankment projects designed to raise productivity to prevent tidal flooding and salinization of the soil, and flood management schemes and disaster management projects. However, many of these projects hardly reach the indigenous peoples communities, even those who are near coastal areas

148 BANGLADESH | Using Local Knowledge for disaster management

Flooding, disaster preparedness

Bangladesh is one of the most highly disaster-prone countries of the world. Of all disasters, the problem of floods has aggravated most from 1955 to 2004 and became one of the main concerns of people in Bangladesh. Abnormal floods submerge about 60 percent of the land, damage crops and property, disrupt economic activities and result in diseases and loss of life. Participatory rural appraisals, focus group discussions, inter-generational dialogues, semi-structured interviews with local people and key informants in Bangladesh in flood-prone district of Mankiganj showed that indigenous strategies remain the dominant form of response to climate disasters. The frequency of use of different local coping strategies in various flood years is shown in Table 1. It appears that raising the plinth of homes is the most common form of response in terms of improving housing condition, and dietary changes accompanied by reduced food intake and using local methods of dry food storage were the most common strategies to survive in periods of flood. As most people don't own boats, the main form of transport was rafts lashed together with trunks of banana trees. The planting of reeds known as catkins (*Saccharum spontaneum*), an indigenous species well suited to sandy soils, is another local coping strategy to prevent soil erosion. While these methods appear inadequate and primitive, they are still considered the most effective forms of survival by local people.

Local flood coping strategies include improvement of housing conditions (raising the plinth of homes; constructing "manchans" - hanging bamboo platforms inside houses); taking shelter in elevated grounds; selling land; fuel storage; storing dry foods; diet changes and reducing food intake; banana plantation and bamboo propagation to be used as floating platforms and rafts for movements; and growing catkin in sandy lands to prevent erosion.

Further information:

Tebtebba (2009), Report of the Asia Summit on Climate Change and Indigenous Peoples, http://www.tebtebba.org/index.php?option=com_docman&task=doc_download&gid=290&Itemid=27

Further information:

Institute for Global Environmental Strategies, <http://www.iges.or.jp/en/cp/pdf/report8.pdf>

149 **BORNEO** | Climate variations observed by the Dayak and Punan

The Dayak have documented climate variations based on various traditional indicators, including bird species, rising water levels, and traditional medicinal plants. They observed bird species that they had never seen before, they became aware that the level of water in the rivers is higher/lower than usual for the season and that the traditional plants used as medicinal remedies can not be found anymore. Behaviour and migration patterns of birds have traditionally been used to guide hunting and cultivation activities but they no longer provide reliable guidance. One of the remaining hunter-gatherer communities in East Kalimantan is the Punan people. According to the phases of the moon, they decide upon activities such as planting agricultural and tree crops, clearing cultivation areas, hunting etc. But with the changes of climate these lunar signals may no longer coincide with the favourable times for these activities and the Punan may be misled in taking their decisions.

Further information:

International Union for Conservation of Nature (2008). Indigenous and Traditional Peoples and Climate Change. http://cmsdata.iucn.org/downloads/indigenous_peoples_climate_change.pdf; Boedhihartono, A. K. 2004. Dilemme à Malinau, Borneo: Être ou ne pas être un chasseur-cueilleur Punan. PhD thesis, University of Paris 7. France.

150 **BORNEO** | Dayak forbidden forests climate change videobrief**Local observations & impacts, forests, multimedia**

A short video about the effects of climate change on indigenous people living in the forests of Borneo island. Deep in the old growth forests of Borneo, the Setulang Dayak village guards its forest with might. To date, the village's traditional law of Tana Olen (forbidden forest), withstands increasing pressure from encroaching logging industries. Now as rapid development rolls in, the village is trying to secure sustainable and forest-friendly future, including a eco-tourism venture and carbon credits.

Further information:

UNU-TKI Indigenous Perspectives on climate change video series, http://www.unutki.org/default.php?doc_id=120; Vimeo album, <http://www.vimeo.com/album/85004>

151 **BURMA/CHINA/THAILAND** | Hydro-power Dams on Salween Threaten Indigenous Groups**Local observations & impacts, energy**

Thai and Burmese ministries have begun survey work on a series of large hydro-powered dams scheduled for construction in the Salween River basin. The Salween River, known as the Nu River in China and the Thanlwin River in Burma, remains the longest river in all of mainland Southeast Asia that flows freely, uninterrupted by massive dams. A series of five dams is scheduled to be built on the Salween River in a joint Thai-Burmese-Chinese government program. They are expected to generate 10,000 megawatts of electricity, much of which would be delivered to Thailand. Environmental groups say about 10,000 villagers would be displaced by the proposed Hat Gyi dam. More than 10 million people, from 13 ethnic groups, will be affected if the entire series of Salween River dams is completed. The different ethnic minority groups residing in the basin rely mostly on lowland rice paddy farming and upland swidden cultivation and harvesting of non-timber forest products, a lifestyle enabling them to co-exist with the forest for generations. However, often the local people are not able to engage in stable agriculture because of the decades-long civil war for self-determination and the struggle for democratic rule. Areas that are used for seasonal cultivation of crops, as well as important archaeological and cultural sites will be lost. For example, the Salween Dams will completely submerge all of the sacred land, cultural heritage, livelihood, homes, and forests of the Yintalai, a tribe with only approximately 1,000 people remaining in the world.

Further information:

Salween Watch, <http://www.salweenwatch.org/>

152 **CAMBODIA** | Biodiversity and Protected Areas Management**Adaptation, natural resource management**

Another good example of community management plans is from the highlands of northeastern Cambodia, where Bank/GEF financing is supporting the protection and management of Virachey National Park (VNP) in the province of Ratana-kiri. Encompassing 350,000 hectares of forest and mountain habitats, VNP is one of the largest expanses of intact forest left in Cambodia. It also adjoins protected areas in neighboring Laos and Vietnam to form part of a tri-national conservation triangle. The region is home to numerous ethnic minorities who have lived in the project area for many generations but moved settlements many times during the political strife and warfare that ravaged the region during the Vietnam War and subsequent Khmer Rouge regime. These communities are now settled along the rivers at the edge of the park. Park staff and the indigenous Brou, Kravet, and Krueng communities are working together to articulate and implement long-term community resource management plans in lands that overlap park boundaries. These plans will assist the communities to assert their rights against large-scale timber interests, which are moving into the region.

Further information:

WORLD BANK (2008): Sobrevila, Claudia. The Role of Indigenous Peoples in Biodiversity Conservation + WB Project database

153 **CHINA** | Gansu and Xinjiang Pastoral Development Project**Adaptation, natural resource management, wetlands**

The objective of the Gansu and Xinjiang Pastoral Development Project is to sustain the natural resources and improve the lives and livelihoods of herders and farmers in the project areas in China. The main targeted beneficiaries in both Gansu and Xinjiang are ethnic minority semi-sedentary herders (sedentary in winter, nomadic during summer) and farmers belonging to the Dongxiang, Hui, Kazakh, Mongol, Sala, Uyghur, and Yugu ethnic groups. During project preparation, extensive social assessments were carried out in both Gansu and Xinjiang by Chinese social scientists. Participatory Rapid Appraisals involved focus group discussions, village-wide meetings, household case studies, and householder interviews. In order to "stream-line" beneficiary participation during implementation, innovative Beneficiary Participation Manuals (BPM) were prepared. The purpose of the BPMs is to formalize and describe in detail the consultation and participation process with affected groups. As such, they define a strategy for allowing stakeholders to influence the decisions and resources that affect them. By 2007, project beneficiaries were found in 359 villages of the 24 project counties/cities. In addition, 2,107 households chosen utilizing the selection criteria benefited from the project directly; of these, 358 households were Han nationality, 756 Kazaks, 659 Uyghurs, 212 Mongols, Hui 69, and Kerkez 53. The project supported the rehabilitation of an important wetland site in Suzhou district where herders voluntarily imposed a grazing ban on 44 percent of the 20,000 mu degraded land. A monitoring system was put in place and showed that the project resulted in improvement in biomass and ground cover in the grazing areas compared with the grazed area.

Further information:

WORLD BANK (2008): Sobrevila, Claudia. The Role of Indigenous Peoples in Biodiversity Conservation

154 CHINA | Ecological restoration of degraded watershed on the upper reaches of the Minjiang River; Integration of Qiang ethno-botanical knowledge and practices into a reforestation project

Adaptation, water resources, forests, traditional knowledge

The Qiang people mainly inhabit the valleys of the Minjiang River (a main branch of the Yangtze) in Sichuan Province. This region is important for its mountain forests, which are a major source of water for the Yangtze. What takes place in these mountain ecosystems has far-reaching effects on the areas downstream. Large-scale deforestation and population growth over the last four decades have resulted in serious degradation in this area. In just four decades, it is estimated that the forests have shrunk from 40 per cent of the land area to 10 per cent. This has caused a loss of biodiversity.

Since the 1980s the government of China, recognizing the need for ecological restoration, has funded a programme entitled "Construction of a Protective Forest System on the Upper Reaches of the Yangtze River". Productive land, including newly cultivated fields, some of them on steep slopes, has been forcibly set aside for protection and reforestation. From the beginning, the project to rehabilitate this watershed has incorporated indigenous knowledge of the Qiang people. Their knowledge of medicinal plants has played an important role in the conservation of biodiversity, and Qiang practices of forest management and home-gardening have been integrated into the project. Because the collection and cultivation of plants for herbal medicines were an important source of income for the Qiang people, the cultivation of these plants was integrated into the project to plant trees. This helped to guarantee the participation of local farmers in ecological conservation, which in turn increased the economic return from the reforestation investment.

At present trees are being planted in terraces: i.e. horizontal bands of original vegetation (shrubs and grasses) are alternated with bands that are planted with tree seedlings. Indigenous species are preserved in the bands of original vegetation, which also prevent soil erosion. In the area where the Qiang live, the collection of wild medicinal plants is a traditional source of income. Some of the plants are used locally, but most are sold. Because of this market, Qiang farmers cleared fields for cultivating the plants on a large scale in addition to growing them in their home gardens. This indigenous agroforestry model means that the people know exactly which plants to cultivate and how--was incorporated into the national projects. This not only maintains local traditions of forestry management but also promotes the participation of local people in conservation projects.

Further information:

UNESCO Best Practices on Indigenous Knowledge BP.15, <http://www.unesco.org/most/bpik15.htm>

155 CHINA | Center for Biodiversity and Indigenous Knowledge (CBIK)

Local observations & impacts, traditional knowledge, awareness raising

The CBIK project seeks to generate innovative ways of nurturing intercultural dialogue among people of varying cultures, languages, and knowledge systems in Southwest China. It aims to enhance understanding of multi-stakeholders on biodiversity resources, traditional livelihoods and indigenous knowledge systems and increase the livelihood diversity and security of local ethnic nationalities in the context of climate change.

Further information:

UNDP-RIPP, <http://regionalfocentrebangkok.undp.or.th/practices/governance/frpp/InnovativeProject.html>

156 CHINA/LAOS/MEXICO | IFAD Income diversification Summary

Adaptation, income diversification

IFAD has learned that indigenous peoples can increase their incomes by diversifying their sources of food and income. This can involve crop diversification, agricultural productivity enhancement, microfinance, supporting micro-enterprises, and alternative income generation opportunities like ecotourism and processing of medicinal products. For instance, crop diversification into tea, coffee, cash-crop trees, organic farming, and horticultural production has served to increase household incomes by up to 43% among minorities in mountain areas of China. Research and development for the production and marketing of high-value non-timber forest products has led to similar results in Laos. Support for indigenous women micro-entrepreneurs has proved a very effective way not only to support women's economic empowerment but also to increase household incomes in many countries in Latin America and Asia. With its focus on marginalized groups, particularly indigenous peoples, the promotion of nature-based tourism in Mexico (Sustainable Development Project for Rural and Indigenous Communities of the Semi-Arid North-West) reduces the dependence on agricultural-based products, promoting a shift to off-farm activities and improving the natural resource base and environmental services.

Further information:

UNPFII, 2009. Information received from the United Nations System and Other Intergovernmental Organisations. E/C.19/2009/3/Add.3

157 EAST TIMOR | Experiences of climate change in East Timor

Local observations & impacts, water resources

The local communities that live in East Timor report the disappearance of spring water, changing planting seasons, extreme flooding, landslides, and other environmental changes. A prominent leader amongst the indigenous women in Tutuala, the most eastern part of East Timor, reports that ten years ago people in her village collected water from a nearby spring, but that today the water has disappeared. Fetching water is normally the task of women and children so this increases the workload of women in the village who now have to walk more than two kilometres to collect water.

Further information:

Working Group on Climate Change and Development, 2007. Asia and the Pacific - Up In Smoke? <http://www.iied.org/pubs/display.php?o=100201IED>

158 EURASIA | Neverending Unfolding Lifeworld of Peoples of the Bear

Local observations & impacts, animal husbandry, traditional knowledge, awareness raising

In this inquiry the research question focuses on local knowledge in the context of climate change. The Evenki of Southern Sakha-Yakutia practice nomadic reindeer herding. The first case explores oral histories and shamanism from the area. The second case traces songs and spirituality of Juhana Kainulainen, one of the rune singers of the region as well as contemporary ice and weather knowledge of nuotta-seine fishermen of North Karelia, Finland. Continued seining (a type of fishing) renews ice place names and experience-based knowledge. The last case assesses oral histories and shamanic tundra life in Northeastern Sakha-Yakutia. While climate change causes the continuous permafrost to alter the landscape the Indigenous communities of Nutendli and Turvaargin have taken advantages of changes in Post-Soviet Russia. They

Further information:

SnowChange, http://www.snowchange.org/web/index.php?option=com_content&task=view&id=35&Itemid=2

are neotraditional Indigenous societies practicing unbroken nomadic reindeer herding. In Nutendli the local knowledge is renewed by a nomadic school (see separate entry for this project under Russia).

159 HIMALAYAS/CHINA | Livelihoods Improvement

Adaptation, energy, livelihoods

IFAD is supporting reforestation in the Livelihoods Improvement Project in the Himalayas with a focus on gender inequalities and indigenous households. Over the years, the largely self-sufficient survival system of Himalayan mountain communities has been seriously weakened. This has led to an accentuation of poverty conditions in mountain areas and, as a consequence, the degradation of natural resources, particularly land and forests. The project uses available natural resources more productively through appropriate "small scale interventions" and participatory rural appraisals for poverty mapping, and identification of self-targeted activities and intensive sensitization programmes. It also aims to create community owned organization from the villages level upwards, and gradually transfer project ownership and management to these institutions after suitably building the capacities enabling them to perform role.

Further information:

UNPFII, 2009. Information received from the United Nations System and Other Intergovernmental Organisations. E/C.19/2009/3/Add.3; Shri Bhuvneshwari Mahila Ashram, http://www.sbmahimalaya.org/projects_ifad.htm

160 INDIA | Building the capacity of indigenous peoples to cope, adapt or mitigate the effects of climate change on their livelihoods and environments

Adaptation, traditional knowledge, policy & planning

This project is being implemented by the Centre for Development Action (CDA). It seeks to address Indigenous Peoples' vulnerability to the effects of climate change and environmental degradation, particularly in the Sundargarh district in Orissa, involving the Kisans Kharias and Bihors. The project builds on the beneficiaries' traditional knowledge in coping and mitigating the effects of climate change. Adaptation and mitigation strategies are being developed and disseminated by the communities for purposes of information and lobbying on decision-making processes related to climate change.

Further information:

IFAD <http://www.ifad.org/english/indigenous/grants/projects/regions/asia.htm>

161 INDIA | Carbon Sinks, Carbon Trade, the Clean Development Mechanism, and the Indigenous Peoples of the North-East Region of India

Local observations & impacts, forests, traditional knowledge

This case study relates the impacts of climate change as experienced by the Indigenous Peoples of North-East India, describing radical differences in their ancient life patterns. They see these changes as having been imposed or instigated by forces beyond their control and consent. These may be perceived shifts in the natural order (such as changes in weather patterns and biodiversity) or policies instituted (such as granting migrants and settlers of different ethnic groups access to Indigenous Peoples' lands).

Further information:

Anna Pinto (2006), The India Case Study: Carbon Sinks, Carbon Trade, the Clean Development Mechanism, and the Indigenous Peoples of the North-East Region of India, International Alliance of Indigenous and Tribal Peoples of Tropical Forests, <http://www.international-alliance.org/documents/Climate%20Change%20-%20India.pdf>

162 INDIA | Study on tribal knowledge and climate change

Adaptation, traditional knowledge, livelihoods

The Ministry of Tribal Affairs is conducting a study on climate change and its possible impact on tribals to equip the community members with necessary skills and mechanism to cope with the adverse effects of green house emissions. The study will seek to identify bioindicators which could help tribals recognise and anticipate climate change, as well as traditional mechanisms and methodologies applied by the tribals to cope with climate change. It aims to consolidate the existing knowledge of tribals to adapt to climate change and identify areas for project interventions.

Further information:

<http://www.hindu.com/thehindu/holnus/002200906141051.htm>

163. INDIA | Indigenous technology knowledge for watershed management in upper north-west Himalayas

Adaptation, water resources agriculture, forecasting, traditional knowledge

Weather is certainly the most important factor determining the success or the failure of agricultural enterprises, the main source of livelihood in the western Himalayas. In all, weather accounts for approximately 75% of the annual loss in farm production. However, crop losses can be reduced substantially by making appropriate adjustments in cropping practices. Timely and accurate weather forecasts can provide planning guidelines regarding the crops best suited to the anticipated climatic conditions. Weather forecasts for agriculture can be grouped into short-range (up to 48 hours), medium-range (3-10 days) and long-range (one week to the entire season). Each plays an important role in farm operations and planning agricultural activities. Although there are meteorological services and information is disseminated to the region, farmers still apply weather predictions based on observations of various natural, cultural, and social phenomena.

Further information:

L.R. Verma (1998): Indigenous technology knowledge for watershed management in upper north-west Himalayas of India. PWMTA Field Document No. 15, Kathmandu: FAO, <http://www.fao.org/docrep/X5672E/X5672e00.htm>

164. INDIA | Balancing agriculture and fisheries through sluice gates: Khazans in Goa, India

Adaptation, agriculture, traditional knowledge

Khazans are traditionally community managed integrated agriculture-aquaculture ecosystems found in Goa, India. These are reclaimed marshy mangrove swamps using a system of dykes, canals, and sluice gates. The Khazan technology is based on the principle of a tidal clock and salinity regulation. In Goa, agriculture is the main source of livelihood for the local community, followed by traditional aquaculture. The three components - agricultural fields, fisheries, and sluice gates - are interdependent and need to be conserved as one Khazan ecosystem.

Further information:

UNFCCC Database on local coping strategies, Case Study 159, http://maindb.unfccc.int/public/adaptation/adaptation_casesstudy.pl?id_project=159; TERII, INTEREST - Interactions between Environment, Society and Technology. Three case studies using different ecosystems: Traditional Aquaculture - Goa, Agriculture - Karnataka, Bamboo forests - Haryana. The Energy and Resources Institute, <http://www.teriin.org/teri-wr/projects/interestaqua.pdf>

165 INDIA | Crop processing practices in Tamil Nadu, India: Threshing, winnowing, cleaning, and drying for dryland crops

Adaptation, drought & aridity, water resources, agriculture, drylands, traditional knowledge

Dryland agriculture in Tamil Nadu is faced with two problems: climatic instability and low productivity. One important aspect of dryland agriculture is the fact that production is seasonal, which means that grains must be stored for long periods by traders, procurement agencies and consumers. The women farmers of Tamil Nadu have developed various post-harvest practices over the years for better processing of food grains and their storage. While post-harvest practices vary according to the specific crop, it commonly includes threshing, winnowing, cleaning, and drying. In dryland agriculture, an important aspect of post-harvest operations is the need to ensure that the produce is kept free from rot, pests, and rodents. Given the low productivity of the system as a whole, it is important to see that the produce which is ultimately obtained is edible and palatable.

Some 19 indigenous post-harvest practices are used by all the dry land farmers in the villages, irrespective of caste and class. According to the farm women, these practices were handed down from generation to generation, usually by word of mouth. They were perceived to be economically feasible and user-friendly. The indigenous post-harvest tools that the women used were made by local artisans, using low-cost resources that were locally available, and they were easy to repair and to maintain.

166 INDIA | Cropping practices in the Indian Himalayas: Rotational cropping and seed selection in cold deserts

Adaptation, precipitation, food security, agriculture

The cold deserts of the Indian Himalayas are characterized by fast-blowing winds that erode the immature sandy soils and extreme variations in daily and seasonal temperatures. There is erratic precipitation during spring and summer, which marks a short growing seasons (2-5 months). Farmers have developed a number of cropping practices to adapt to the harsh conditions, including:

- Crop rotation: If irrigation is available, paddy cultivation is alternated with wheat cultivation. If irrigation is not available, wheat or barley rotates with maize and/or mash. However, in cold reaches where paddy cannot be grown and two regular crops are not practicable, cultivation of wheat, barley, or masur is followed by a fallow period during the winter. Millet and maize or buckwheat are planted in the following year. Usually maize is followed by wheat; buckwheat or mash is followed by wheat after maize. Crop rotation helps in maintaining soil productivity. Leguminous crops fix nitrogen. Intercropping maize, wheat, barley and millets conserves soil due to their different root systems which extract nutrients from different layers of the soil. This also helps in crop diversification and control of any soil- or crop residue-borne diseases/insect pests. The practice of keeping lands fallow preserves and restores soil fertility.
- Seed selection: Seeds for future cultivation are collected from selected plots manifesting vigour, early maturity, disease resistance, and higher productivity. After three to four years, the seed source is shifted to other villages without diluting the selection criteria. This practice of collecting seeds from different villages after every three to four years is a check against inbreeding which otherwise may induce low productivity.

167 INDIA | Indigenous forecasting in India using meteorological indicators, plant features and animal behaviour

Adaptation, agriculture, food security, traditional knowledge, forecasting

Weather is the most important factor determining the success or the failure of agricultural enterprises, the main source of livelihood in the western Himalayas. In all, weather accounts for approximately 75% of the annual loss in farm production. However, crop losses can be reduced substantially by making appropriate adjustments in cropping practices. Timely and accurate weather forecasts can provide planning guidelines regarding the crops best suited to the anticipated climatic conditions. Although there are meteorological services and information is disseminated to the region, farmers still apply weather predictions based on observations of various natural, cultural, and social phenomena. For example, an accumulation of clouds in the southeast direction in a layered form, accompanied by winds blowing from the south, indicates that there will be rain within a day or two. When grey clouds descend below the hill-tops, rain is assured.

Gujarat in India is a drought-prone, predominantly dryland region. Agricultural drought has been a regular feature there since the 1970s. The monsoon season extends from June to September and is characterized by erratic rainfall. The farmers of the region assign a lot of importance to accurate predictions of the monsoon's onset since they base their cropping-pattern decisions on these predictions. Although the Department of Meteorology makes monsoon predictions, they are not very helpful to farmers in making choices related to cropping pattern as they are short-range, i.e. for a period of three days ahead only and long-term predictions are for India as whole. Consequently farmers rely mainly on indigenous meteorological beliefs and knowledge to make local predictions, including:

Researchers from Gujarat Agricultural University have evaluated eight indigenous forecasting beliefs between 1990 to 1998. For each year, the data was tabulated and analysed on the basis of Bhadli's criteria. Based on the findings the researchers concluded that many of the beliefs are reliable indicators of monsoon. The study has helped to restore the people's confidence in their own traditional knowledge and skills. As climate change occurs, these traditional forecasting indicators may change. Locals have to continue their observations and adjust their predictions accordingly to ensure that correct coping mechanisms will be applied.

Further information:

UNFCCC Database on local coping strategies, Case Study 23, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=23
S. Parvathi, K. Chandrakandan and C. Karthikeyan (2000): Women and dryland post-harvesting practices in Tamil Nadu, India. In: IK Monitor Vol. 8(1)

Further information:

UNFCCC Database on local coping strategies, Case Study 52, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=52
L.R. Verma (1998): Indigenous technology knowledge for watershed management in upper north-west Himalayas of India PWMTA Field Document No. 15, Kathmandu: FAO <http://www.fao.org/docrep/X5672E/X5672e00.htm>

Further information:

UNFCCC Database on local coping strategies, Case Study 46, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=46;
L.R. Verma (1998): Indigenous technology knowledge for watershed management in upper north-west Himalayas of India PWMTA Field Document No. 15, Kathmandu: FAO <http://www.fao.org/docrep/X5672E/X5672e00.htm>;
UNFCCC Database on local coping strategies, Case Study 49, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=49;
Parshotambhai R. Kanani, Validation of Traditional Meteorological Principles in Saurashtra, India <http://www.maweb.org/documents/bridging/papers/kanani.pr.pdf>

168 **INDIA** | strengthening sustainable livelihoods for biodiversity conservation in Sundarbans**Adaptation, biodiversity, livelihoods**

UNDP India supports a number of projects located in indigenous/tribal areas. A recently completed project, on strengthening sustainable livelihoods for biodiversity conservation in Sundarbans, focused on sustainable development and biodiversity conservation for the Sundarbans ecosystem. A related project, on conservation and sustainable use of the Gulf of Mannar biosphere reserve's coastal biodiversity, aims to demonstrate the modalities for integrating biodiversity conservation, sustainable coastal zone management and the livelihoods of local communities, including indigenous/tribal peoples. More information from UNDP India includes the following reports: "Land rights and ownership in Orissa"; "Paharias: the struggle of a tribe for recognition"; and "Enclosing forests: towards protection of habitat".

Further information:
UNDP India, <http://www.undp.org.in>

169 **INDIA** | Manual for Restoration and Retrofitting of Rural Structures in Kashmir**Adaptation, traditional knowledge, disaster preparedness**

The UNESCO Regional Office in New Delhi produced a field guide manual on repair and retrofitting of earthquake damaged structures in Kashmir, North India, utilizing traditional knowledge systems of construction. The manual was a joint initiative with UNDP and Government of India and was advocated by UNESCO in various scientific forums.

Further information:
National Centre for Peoples' Action in Disaster Preparedness, http://www.ncdpindia.org/Kashmir_Unesco_Manual.htm

170 **INDIA** | Carbon forestry projects in India**Local observations of impacts, forests, conflict**

A review of several joint forest management projects in India found that some had led to increased conflict due to income disparities among communities, conflict over forest areas that were open for harvest, indiscriminate fining, and curtailment of customary land use and tenure practices.⁵⁹ A joint forest management project in Madhya Pradesh left a legacy of disempowerment among the Adivasi (indigenous people) and community-level divisions.

Joint forest management is supposed to provide a system for forest protection and sustainable use through the establishment of village forest protection committees, through which Government and development aid funds are channelled. Joint forest management was designed partly to ensure that forest-dependent peoples gain benefits from protecting forests. In 2001, Community Forests International (CFI) carried out two feasibility studies in Madhya Pradesh and Andhra Pradesh to examine systems that could compensate communities for carbon sequestration and storage resulting from forest regeneration using the mechanism of joint forest management. CFI concluded that the joint forest management projects had improved the standard of living of the Adivasi and their relationship with the Forest Department, while regenerating forests.

However, subsequent interviews by activists in Madhya Pradesh found that the Adivasi communities in the Harda Forest Division were not even aware of the CFI feasibility project, and that they did not know of the concept of carbon forestry. The wealth of local and written information exposing the problems with joint forest management in Madhya Pradesh was not cited in studies undertaken for the CFI feasibility project. The CFI conclusions did not consider the views and perspectives of the range of social groups and rights holders who had expressed large-scale opposition to the existence of village forest protection committees and rejected them as a basis for forestry-related schemes in Madhya Pradesh. Activists and Adivasi leaders in India fear that the impacts of implementing carbon forestry would pose a great threat to indigenous communities.

Further information:
UNPFII, 2008: Information received from Governments E/C.19/2008/5/Add.1; Village Forest Protection Committees in Madhya Pradesh: an update and critical evaluation by Emily Caruso of the Forest Peoples Programme and Anurag Modi, Shramik Adivasi Sangathan, October 2004; The Clean Development Mechanism: Issues for Adivasi Peoples in India, 12 (2005); Sarin, et al., 2003, the summary report of Jan Sunwai (public hearing) on forest rights at the village of Indpura, Harda District, 26 May 2001.

171 **INDIA** | Restoring farm biodiversity to cope with climate variability and droughts in Medak, India**Adaptation, biodiversity, agriculture**

A millet that grows on dew and sorghum that can survive on very little water – these are not genetically modified organisms (GMOs) but traditional crops used by farmers in Medak (Andhra Pradesh). For many women these crops, which they have been growing on their small farms for centuries, have been the difference between starvation and survival. Over the last six years, poor women of lower castes have expanded their seedbanks of local crop varieties and now supply seeds to others in their villages. Many of these traditional crops are rare as they have been replaced by higher yielding varieties and irrigated sugarcane. During periods of severe drought, however, these crop varieties carry a much greater risk. Maintaining crop-biodiversity for local small-scale farmers is an important strategy for drought relief that targets the most vulnerable.

Further information:
International Union for Conservation of Nature (2008). Indigenous and Traditional Peoples and Climate Change. http://cmsdata.iucn.org/downloads/indigenous_peoples_climate_change.pdf. From Menon, M. 2002. The crops of truth. Wasteland News, May-July 2002: 53-55.

172 **INDIA** | Naga Women's Union, Manipur (NWUM)**Local observations of impacts, information sharing, women, traditional knowledge**

The Naga Women's Union (NWUM) project is raising awareness on environmental issues among the Naga community, and reinvigorating indigenous peoples' survival systems by harnessing both modern and traditional methods in dealing with environmental issues including climate change.

Further information:
UNDP Bangkok, <http://regionalcentrebangkok.undp.or.th/practices/governance/ripp/InnovativeProject.html>

173 **INDIA** | Indigenous women in the villages of Khuti District in Jharkand, India**Adaptation, income diversification, water resources, women**

Asian indigenous women are much more vulnerable to climate change impacts because they are often the subsistence producers and are heavily reliant on the quality and quantity of natural resources. They are the main caregivers, water and food providers and yet they have the least access to land, education and health facilities, technologies and agricultural technical assistance and inputs, and disaster relief services, infrastructure development and credit assistance. Many of them suffer from discrimination in their own indigenous societies, in the dominant society and in the labour market.

Further information:
Tebtebba (2009), Report of the Asia Summit on Climate Change and Indigenous Peoples, http://www.tebtebba.org/index.php?option=com_docman&task=doc_download&gid=290&Itemid=27

The Himalayan glaciers are the lifeline for around two billion people in Nepal, India, China and the Mekong region who rely on glacier-dependent rivers such as the Ganges, Brahmaputra, Indus, Mekong, Yellow and Yangtze Rivers. They face acute and long-term shortages of water because of the melting of the glaciers and the vanishing snowpeaks. This deglaciation has also induced floods downstream due to the surge of water into the rivers and consequently prolonged droughts because of decreased river flows and water supply. India's northern region will experience more floods in the coming years because of changing stream flow patterns in the Himalayan rivers. The floods caused by the change of course of Kosi River in Bihar affected close to three million people, many of whom are indigenous peoples.

Climate change has adversely affected the livelihoods of indigenous women in the villages of Khuti District in Jharkand, India. This is the production and sale of lac, a natural polymer (resin) produced by an insect called kerr (Kerria lacca). Lac, which is used to polish fruits to maintain their freshness and for handicrafts, is a second source of income for the women next to paddy rice production. The production has gone down in the past three to four years because of the extreme cold (4-10 degrees Celsius), lack of sunlight and increased frost.

174 INDIA | Raika Bio-cultural Community Protocol

Local observations & impacts, traditional knowledge, animal husbandry

The Raika are an indigenous pastoral community who live in Rajasthan, North West India. In collaboration with the South Africa based NGO Natural Justice and LPPS (Lokhit Pashu-Palak Sansthan), they have produced a written record of their traditional knowledge on managing livestock breeds and their environment, and a bio-cultural community protocol that sets out their biocultural values and explains how they have developed and preserved unique breeds of livestock and traditional knowledge associated with them, and how their pastoral lifestyle has developed the co-evolved ecosystem of Rajasthan's forests which they have traditionally conserved and sustainably used. It explains how through their interaction with the forests, gauchar and oran, and through selective breeding for generations they have created breeds that are particularly hardy, able to forage and digest rough vegetation, withstand the dry Rajasthani environment and to walk long distances - important attributes in the context of climate change adaptation and food security.

Further information:

FAO Domestic Animal Diversity Information System, <http://dad-training.fao.org/cgi-bin/getblob.cgi?sid=b5c072b255a647dfo3cbde5ae18c2d1a,748>

175 INDIA | Development of a new crop calendar

Adaptation, agriculture, food security

In Uttar Pradesh, in the foothills of the Himalayas, communities are experiencing an increasing frequency of flash floods; dry spells during floods; changes in flood timing (longer, delayed or early); increased duration and area of waterlogging; and changes in time, volume, and pattern of rainfall. Adaptation to climate change required the development of a new crop calendar: crops that are fast-maturing, flood-tolerant and with soil-rehabilitating characteristics are planted according to the calendar. The selection of new varieties by farmers and participatory plant breeding are supporting adaptation to changing production environments.

Further information:

PAR Climate Change Project, 2010: The use of agrobiodiversity by indigenous and traditional agricultural communities in adapting to climate change, http://www.agrobiodiversityplatform.org/blog/wp-content/uploads/2010/05/PAR-Synthesis-low_FINAL.pdf

176 INDIA | Vulnerability & Adaptation Experiences from Rajasthan & Andhra Pradesh

Adaptation, traditional knowledge, adaptation, water management, food security

The Swiss Agency for Development and Cooperation initiated the Vulnerability Assessment and Enhancing Adaptive Capacity to Climate Change programme in the semi-arid regions of India to examine in 2005. The states of Rajasthan and Andhra Pradesh were selected and various proactive adaptive solutions were adopted through a blend of traditional wisdom and modern science. A broad range of measures were piloted to help poor communities reduce climate vulnerability of their water and land resources, and their agriculture and livestock-based livelihoods. Opportunities identified for up-scaling these measures included integration into policies, plans and programmes at various levels. Priority interventions included water conservation (reinforcing traditional methods with modern knowledge, such as gravity flow management) and promoting fodder security (through sustainable management of common property resources).

Further information:

Anna Bruderle and Othmar Schwank, 2009: Climate Change: Vulnerability & Adaptation Experiences from Rajasthan & Andhra Pradesh, <http://indiaenvironmentportal.org.in/node/310115>

177 INDONESIA | New pests in Northern Lombok, Sulawesi

Local observations & impacts, pests, soil erosion, health

There are new species of insects invading indigenous communities after long bouts of drought. Unusual insect behavioral patterns are taking place causing massive destruction of crops. Locust invasions and plagues in Indonesia, for example, have increased in occurrence and intensity. After the 1950s this occurred once in 20 years. In the 1990s this happened once in five years and at present it is happening every two years, attested to deforestation and landscape alterations taking place due to logging, monocrop plantations and worsening forest fires due to prolonged droughts. The changes in land cover and the quality of the top soil provided suitable conditions for the locust to lay eggs and for hatching. In Indonesia, the haze from rampant burning of forests to convert these to oil palm plantations for increased production of biofuels led to high incidence of respiratory diseases not only in the areas where burning is taking place but even in many places in Malaysia, Singapore, Indonesia, Brunei and Thailand. Clove production, a major source of cash for the indigenous peoples of Lombok in Indonesia, dropped by 40 per cent in 2007 due to temperature rise. Pest resurgence has also led to a decrease in cacao and banana production in Indonesia.

Further information:

Tebtelba (2009), Report of the Asia Summit on Climate Change and Indigenous Peoples, http://www.tebtelba.org/index.php?option=com_docman&task=doc_download&gid=290&Itemid=27

178 INDONESIA | Rehabilitating coral reefs in Serangan in Denpasar, Bali

Adaptation, payment for ecosystem services, forests

Indonesia has 50,000 square kilometers of coral reefs but many of these are deteriorating because of "bleaching" due to the warming of the seas. The indigenous peoples in Serangan are rehabilitating their coral reefs and mangrove forests and how they are generating cash from these. They managed to plant 15,000 pieces of corals from 22 indigenous species from coral colonies in various parts of Indonesia. The indigenous peoples of a village called Les stopped doing cyanide and dynamite fishing so they can rehabilitate their coral ecosystems. They now have managed to bring back ornamental fish which feed on these corals. This is managed by a collective of 90 families who are exporting to nine countries in

Further information:

Tebtelba (2009), Report of the Asia Summit on Climate Change and Indigenous Peoples, http://www.tebtelba.org/index.php?option=com_docman&task=doc_download&gid=290&Itemid=27

Asia, Europe and the United States. The Serangan project is buying some of the fish from Les and they package these together with their corals and also export these. According to the project coordinator of the project, with the economic crisis, they are getting more orders as people who cannot travel anymore opt to buy the corals and fishes and put these in their aquariums. This project was initially supported via the UNDP GEF-Small Grants program.

179 INDONESIA | Aliansi Masyarakat Adat Nusantara (AMAN)

Adaptation, traditional knowledge, tourism, livelihoods

Aliansi Masyarakat Adat Nusantara (AMAN) believes in increasing the economic value of bamboo through innovative practices. A Torajan tradition that forbade the use of discarded ceremonial bamboos is being reviewed through a consultation process (Kombongan) to see how it can be a source of income for the indigenous communities, especially the women. The project aims to rehabilitate and conserve the bamboo forest in Toraya's indigenous territory through community-based management; establish bamboo briquette and souvenir production as an alternative livelihood for the indigenous peoples, and strengthen women's economic empowerment.

Further information:

UNDP-RIPP <http://regionalcentrebangkok.undp.or.th/practices/governance/ripp/InnovativeProject.html>

180 INDONESIA | Development of Ecological and Cultural Tourism in Indigenous Communities in South Nias

Adaptation, livelihoods, tourism

UNESCO supports indigenous communities in developing tourism projects that contribute to their socio-economic development while respecting their cultures, values and environment. This project supported training and capacity-building for indigenous communities on tourism issues, facilitated the elaboration of a code of conduct for local guides and tourists, and advised on the development of financial plans and strategies for local businesses as well as on the establishment of networks among local stakeholders. The "Development of Heritage Tourism in East Nusa Tenggara, Indonesia: Contributing to the Millennium Development Goals" project followed a similar approach.

Further information:

UNESCO, http://www.un.org/esa/socdev/unpfi/documents/UNESCO_report_8th_session_en.pdf

181 INDONESIA | Strengthening Community Based Disaster Preparedness in Indonesia and Empowerment of customary environmental management in Siberut Biosphere Reserve

Adaptation, disaster preparedness, traditional knowledge

In the Siberut Island Biosphere Reserve in Indonesia, two activities were implemented in partnership with indigenous communities: "Strengthening Community Based Disaster Preparedness in Indonesia" with support from the United Nations International Strategy for Disaster Reduction (UN-ISDR) to help reduce the vulnerability of indigenous communities to natural disasters, primarily earthquakes and tsunamis, through an integrated, community-based approach, combining indigenous and scientific knowledge systems; and "Empowerment of customary environmental management in Siberut Biosphere Reserve" to strengthen participation of indigenous communities in sustaining natural resources management in Siberut Biosphere Reserve.

Further information:

UNESCO, http://www.un.org/esa/socdev/unpfi/documents/UNESCO_report_8th_session_en.pdf

182 INDONESIA | Orang Rimba indigenous people of Makekal Hulu, Jambi, and the Toro indigenous people of Kulawi

Adaptation, natural resource management

Through the GEF-Small Grants Programme, support was provided to the Orang Rimba indigenous people of Makekal Hulu, Jambi, and the Toro indigenous people of Kulawi, to implement collaborative management agreements with the national park authorities in the protected forest areas in Bukit Duabelas, Jambi Province, Lore Lindu and Central Sulawesi Province. Toro is an indigenous community neighborhood within the Lore Lindu National Park, in Central Sulawesi. To address threats to the forests, the community created Tondong Ngata, a forest ranger troop. Their duties are to uphold the indigenous law as it applies to the protected forest based on indigenous regulations. The national park management acknowledges Toro indigenous law but many policy dialogs were needed especially with the local government, the forest authority and neighboring hamlets/villagers to achieve this recognition. In addition to information dissemination towards the international community, the Ngata Toro Indigenous Institution published a book on local herbal medicines book printing, and trained the youth group to film their own traditional wisdom, especially on sustainable natural resource management.

Further information:

GEF Small Grants Programme Indonesia. Community's Contribution to Develop Sustainable Future. <http://www.sgp-indonesia.org/downloads/Community%27s%20Contribution%20to%20Develop%20Sustainable%20Future.pdf>

The Orang Rimba have a concept of forest garden for sustainable use zone, Hompongon, as a means to protect their last remaining forest and to support their livelihood. The Hompongon or living fence is planted with food crops and rubber to preserve the subsistence economy and semi-nomad way of living. A solar panel was also provided by GEF to support the learning process at night without disturbing the children's day-time productivity as Orang Rimba and their forest monitoring activities.

183 INDONESIA | The Indonesian Community-based Marine Management Foundation (PLKL) – Adaptation to climate change

Adaptation, natural resource management, income diversification

PLKL supports communities in Papua, West Papua, and the Moluccan Islands in administering their marine resources through traditional tenure management systems, known as sasi. The foundation has been successful at creating community-based marine management areas that conserve local biodiversity, increase resource abundance, and improve incomes. PLKL has supported over 20 communities in the creation of community-based marine management areas and is serving as a model for replication through regional site visits and networking programs. Through targeted training and technical support, community-based management in the region has resulted in population growth among endemic species central to local ecosystems and livelihoods.

Further information:

Equator Initiative Awards 2008, <http://www.equatorinitiative.org/>

184 **INDONESIA** | Customary Iban Community**Local observations & impacts, pests, forests, REDD**

This study examines the social and institutional practices of a sedentary Iban sub-tribe in the upstream part of the Kapuas system in governing their life. In 2008, the Sungai Utik community acquired a formal, recognition of their institutional capacity to live at the center of one of the most complex ecosystems that is the tropical rainforest of Kalimantan. The Indonesian Eco-label Institute provided the community logging practice of the Sungai Utik Ibans its “seal of ecological appropriateness”. The Sungai Utik life-space is part of the bigger climatic zone just north of the Equator that has been predicted to experience higher precipitation over the course of climate change in this century, particularly in comparison with the last three decades of the last century. It means that the community should learn to adapt to a transformed rainy season—the duration of which and the timing of its start and ending are also subject to change—for the crucial nugal (planting) rituals.

This community also reports impacts from climate change mitigation measures. Throughout the first decades of the second half of the last Century, the locust explosion occurred once in about twenty years. In the 1990s the span shrank to once in five years, then once in two years. In an attempt to identify the underlying processes of such a recurring plague, a chronospatial mapping discovered the key role of change in the topsoil and land cover—which appeared to follow the land preparatory stage for oil palm planting.

Further information:

Sangkoyo, H. (2009). Life Beyond Carbon: The Exemplary Contribution of the Self-Determined Societies of the Indonesian Archipelago In Resolving the Planetary Social-Ecological Crisis Without Carbon Trading – The Case of the Customary Iban Community (TKI-CC:2). UNU Traditional Knowledge Initiative/Tebtebba, Climate Change and Indigenous Peoples – Country Case Studies on Local Mitigation and Adaptation Measures Series, http://www.unutki.org/default.php?doc_id=166

185 **IRAN** | Drought the Death of Life video**Local observations & impacts, drought, multimedia**

Drought: the death of life is a 5 minute video by the Centre for Sustainable Development and Environment (CENESTA), discussing the role of customary institutions in coping with climate change between previously fertile lands in Iran suffering the effects of drought.

Further information:

CENESTA; Youtube video, <http://www.youtube.com/watch?v=V5ZKR4oaKZQ>

186 **IRAN** | Pastoralism of the Qashqai communities and managing livestock in droughts (CENESTA)**Adaptation, drought, land degradation, natural resource management, traditional knowledge, animal husbandry**

More than 90 percent of Iran's surface is arid or semi-arid land and pastoral communities have always played an important role in food production by developing creative and sustainable systems for the use of scarce natural resources. Although migrating pastoralists number only about 2% of the entire population, they satisfy about one quarter of the country's livestock needs. The Qashqai nomadic communities play an important role in sustaining this important food sector while at the same time preserving the age-old livestock management practices in drought-prone areas of Iran. Some of the indigenous practice to cope with droughts and reduced availability of rangelands include adjusting timing for migration from summer to winter grounds and prolonging migration routes.

Some of the indigenous practices employed to cope with droughts and reduced availability of rangelands include: adjusting timing for migration from summer to winter grounds; prolonging migration routes; loaning of sheep and other requirement from better off families to the worst hit families; buying and sharing of fodder; and transporting water to wintering grounds.

Further information:

UNFCCC Database on local coping strategies, Case Study 151, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=151; CENESTA (2004), The role of Qashqai nomadic communities in reducing vulnerability to recurrent drought and sustainable livelihoods development in Iran. Prepared for FAO by the Centre for Sustainable Development, Iran, <http://www.cenesta.org/projects/Pastoralism/Local%20communities%20and%20drought%20-%20Qashqai%20case%20study-Feb%202024.pdf>

187 **KYRGYZ REPUBLIC** | Changes of natural and cultural landscapes and adaptation to them**Adaptation, natural resource management**

The Public Fund “Ak Terek” is based in Bishkek, Kyrgyz Republic project, “Changes of natural and cultural landscapes and adaptation to them” focuses on landscape conservation and adaptation practices and currently being implemented in several communities of Naryn Province with future expansion to Issyk-Kul Province of Kyrgyz Republic. The Christensen Fund grant for this program is for action-based research to enhance adaptability to environmental and climate change among pastoralists and to support their cultural connections to their land in the high altitude grasslands (jailoos) of the Tien Shan Mountains.

Further information:

The Christensen Fund, <http://www.christensenfund.org/page.asp?id=56>

188 **LAO PDR** | District Upland Development and Conservation Project**Adaptation, livelihoods, biodiversity**

The Lao PDR District Upland Development and Conservation Project exemplifies how community livelihood initiatives can be well supported. The development objective of the project was to improve the livelihoods of local communities while conserving the biodiversity of a high-priority protected area through the adoption of more-intensified agricultural practices by farmers in the pilot areas. The communities involved are recognized as the poorest in the country, and the conservation of biodiversity is intimately linked with the welfare of these communities. The project is located within a National Biodiversity Conservation Area (NBCA) that is considered to be of great significance for global biodiversity. This area also contains significant cultural diversity; that is, the area consists of around 5,000 people of various ethnic groups living in 32 villages speaking 28 languages in four major language families. Most of them face severe poverty, expanding populations, and deterioration of their resource base.

The main response to their situation has been to further reliance on forest products, expand swidden agriculture, and collect wildlife and forest products for cash income. The expansion of swidden and increasing demand on the natural resources was compromising the biodiversity of the NBCA. The NBCA addressed by the project covers three sub-watersheds (zones) of the Nam Theun watershed area, with the 32 villages inhabited by several indigenous ethnic minority groups. The project design chose 3 pilot villages for the Agriculture Support component, one from each watershed; 15 villages for the Social Support component; and 6 villages for the Conservation Support and Awareness component. These villages are remote, lying between one and two-and-a-half days of travel (by boat and walking) from the district town of Nakai.

Further information:

WORLD BANK (2008): Sobrevilla, Claudia. The Role of Indigenous Peoples in Biodiversity Conservation, World Bank Project Po59305, <http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&ProjectId=Po59305>

The project supported ethnic groups through the following activities: Establishment of six Village Conservation Monitoring Units (VCMUs) (doubling the project target) that are now equipped and trained for patrolling and monitoring of wildlife and human impacts on the NBCA. Each VCMU consisted of six villagers. Construction, staffing, furnishing, and supplying of six schools in the target area. To solve the problem of maintaining teachers from the public sector in such remote areas, the project arranged training for 17 young villagers chosen by the villages. Training of six district nurses sent to the three pilot village dispensaries. The volunteer training for village health workers (VHW) and traditional birth attendants (TBA) was successfully organized in several sessions by the provincial and district medical staff. Training of 28 VHWs and 22 TBAs. In general, those volunteers met the villagers' satisfaction in the improvement of health conditions. Establishment of 15 village medical kits that were kept reasonably replenished (57 percent of the target of 60 percent). Training on data collection was also proposed for project monitoring and evaluation purposes but was not systematically followed up on by the health authorities. Improvement of wet rice cultivation, leading to a doubling of the annual rice cropping area. Improvement of home gardens, increasing the area of settled vegetable and fruit tree gardens and stabilizing the areas cultivated in second-choice staple foods (maize and cassava). Involvement of 150 out of 160 households (94 percent) in the three pilot villages in demonstrations of different types.

189 LAO PDR | Community Knowledge Support Association (CKSA)

Adaptation, natural resource management, traditional knowledge, agriculture

The CKSA project aims to support the conservation of the ethnic and cultural diversity of upland communities in Borikhamxay province. The pilot will document traditional seed and plant reservation in the country's poorest community and their response to climate change; identify good practices of ecological and sustainable development, and strengthen traditional knowledge systems of seed preservation.

Further information:
UNDP Bangkok,
<http://regionalcentrebangkok.undp.or.th/practices/governance/ripp/InnovativeProject.html>

190 LEBANON | Resource tenure through Al Hima

Local observations & impacts, natural resource management, traditional knowledge

The Hima is a traditional system of resource tenure that has been practiced for more than 1400 years in the Arabian Peninsula. This digital book brings back recognition for the positive contributions that traditional knowledge and ingenious approaches of this region had brought and can still give to development and conservation. The book presents these traditional approaches as a tool that existed and can still exist to advance the conservation and poverty paradigms and to meet upcoming challenges related to conflicts and climate change, as the concept of Hima emphasises is closely linked to resilience. The authors outline how the most successful revival attempts to date have taken place in Lebanon where the Hima efforts aim to complement conservation efforts not to replace them. Various other regional advances are discussed in countries including Iran and Indonesia.

Further information:
IUCN (2007) K. Hala; A. Serhal; O. Llewlyn,
Al Hima: a way of life. International Union for
Conservation of Nature and Natural Resources
(World Conservation Union), 2007
http://cmsdata.iucn.org/downloads/al_hima.pdf

191 MONGOLIA | Adaptation Strategies for Pastoral Communities of Mongolia's Central Mountainous Region

Adaptation, local observations & impacts, animal husbandry

Historically, traditional pastoral networks emerged in drylands with scarce natural resources, subsequently evolving to increase human adaptive capacity in coping with climate variability and extreme climatic events such as drought and zud, a winter condition that can prove devastating for livestock. A large geographical landscape was critical in order to offset climate variability, as traditional pastoral networks used certain landscapes primarily for forage and water. There was thus a strong coupling between traditional pastoral groups and the landscapes they used. Traditional pastoral communities and their cultural landscapes, consisting of four seasonal land types in addition to reserve areas, otor pastures and haylands, provides a prime example of a coupled social-ecological system or human-environmental system. His research aims to investigate change and transformation of open pastoral social-ecological systems and develop climate change adaptation options for pastoral communities with participation of herders, local and national governmental officers and scientists.

Further information:
India Environment Portal, <http://www.indiaenvironmentportal.org.in/files/Climate%20Change%20Adaptation.pdf>

Migration from the rural areas to the big cities of the central area started to increase in mid-1990s. The migration from the rural areas was a result of environmental change, following summer droughts and intensifying after the 1999-2002 zuds. The herders who had lost their livestock during these disastrous climatic events were forced to leave the area and can be referred to as environmental refugees. Water and foraging sources are becoming depleted due to climate change in central Mongolia and the depletion has been amplified due to increasing land use intensity. Herders complain that goats further ecosystem degradation because they dig out the roots of young plants in the spring. Plant species composition is shifting with a decreasing number of edible plant species. Climate change adaptation options for cultural landscape restoration suggested in participatory community workshops included the introduction of community based conservation and sustainable use of natural resources, the addition and protection of water points for additional pastureland, the agreement between neighbouring sums for communal use of otor and reserve pastures, and the enlargement of administrative-territorial units, for instance, by combining several sums into one unit in order to restore cultural landscapes. For pastoral communities living in the riparian zones, diversification of the economy and intensification of the livestock industry through ecotourism and farming, the prevention of riparian ecosystems from degradation and desertification and taking animals to otor pastureland during the summer period were suggested options.

192 MONGOLIA | Combating Desertification and Sustainable Grassland Management in Mongolia

Adaptation, desertification

The majority of the rural population in Mongolia is herders and depends heavily on pasturelands and derives their food sustenance and cash income almost entirely from their animals. Thus degradation of pasturelands directly impacts the livelihoods of herders and to fight poverty means improving the management of pasturelands. Various projects which aim to establish sustainable rangeland management and improve herders' livelihood are being conducted in Mongolia, including the "Fodder Production Program" by the Mongolian government, "Sustainable Grassland Management" by United Nations Development Programme (UNDP), "Master Plan Study for the improvement of agro-pastoral system to counter zud disaster" by Japan International Cooperation Agency (JICA), and "Climate Change and Adaptive Capacity Development: Combating Desertification and Sustainable Grassland Management in Govi Region, Mongolia" by the Ministry of the Environment of Japan. Many of these projects have a focus on the prospect of sustainable rangeland management in the Gobi region in Mongolia. The objectives of these programmes support implementation of long-term strategy for disaster risk management, and assist in adapting to climate change that adversely affects sustainable development of the country, especially those in rural environments.

Further information:

Waseda University Global Institute for Asian Regional Integration, Combating Desertification and Sustainable Grassland Management in Govi Region, Mongolia http://www.waseda-giari.jp/eng/events/PHPSESS_ID=d92d711be9c6c9c139251ce80cde674; UNDP, Strengthening the Disaster Mitigation and management System in Mongolia, <http://www.undp.mn/snm-slmc.html>

193 MALAYSIA/INDONESIA | Oil-palm plantations evict Indigenous Peoples from their traditional lands

Local observations @ impacts, land rights, mitigation

The Intergovernmental Panel on Climate Change has identified the production of second-generation biofuels, to be used in place of fossil fuels, as another way of mitigating climate change. A special report, which included an analysis of some of the problems related to the production of biofuels (in particular, oil palm), was presented at the sixth session of the Forum. That report highlighted how indigenous peoples in Malaysia and Indonesia have been affected by the aggressive expansion of oil palm plantations. It has been used by the Aliansi Masyarakat, Adat Nusantara, a national federation of indigenous peoples' organizations in Indonesia, and other organizations as an annex to their submission to the Committee on the Elimination of Racial Discrimination. Subsequently, the CERD recommended to the Indonesian Government to review the law which pushed for expansion of oil palm plantations and to ensure that the rights of indigenous peoples are respected. As a result of all these actions, the Government has put on hold the plans for expansion.

Further information:

UNPFII, 2008: Information received from Governments E/C.19/2008/5/Add.1; <http://news.mongabay.com/2007/0516-indigenous.html> (15 May 2007); The Economist, "The End of Cheap Food" (6 December 2007).

The production of biofuels provides both opportunities and challenges. Given the proclivity for agricultural production among many indigenous peoples, biofuels could potentially provide great economic opportunities. However, the production of biofuels can offset potential gains in GHG emissions when forests are cleared for the production of crops such as sugar cane and soya in Argentina and Brazil or palm oil in South-East Asia. The clearing of forests for production can also lead to the violation of the land rights of indigenous peoples, as can be seen in Indonesia and Malaysia.

194 MALAYSIA | Dayak-Bidayuh-Jagoi village of Duyoh in Sarawak

Local observations @ impacts, livelihoods, food security

Traditional livelihoods and other economic activities of indigenous peoples are also adversely impacted by climate change. In Malaysia, for example, rubber tapping has been a source of cash for many indigenous peoples in Sarawak and Sabah. Latex is tapped when the leaves of the rubber tree are shed around August and September. With the changes in weather, leaves shed as early as January and thus there is less latex gathered which means less income. Other fruit trees like durian and engkabang (also known as ilipe nut) are indigenous species in Sarawak and these are sources of cash and food. Bumper crop harvests from these trees have decreased significantly because of weather changes.

Further information:

Rubis, J (2009). "Understanding the Interactions between Global Climate Change and Traditional Lifestyle Initiatives of the Indigenous Peoples of Malaysia: A Bidayuh-Jagoi Case Study (TKI-CC:1)". UNU Traditional Knowledge Initiative/Tebeba, Climate Change and Indigenous Peoples – Country Case Studies on Local Mitigation and Adaptation Measures Series, http://www.unutki.org/default.php?doc_id=166

195 MYANMAR | Jatropha plantations in Chin State

Local observations @ impacts, land rights, human rights

In Myanmar, the government has pushed for jatropha plantations in Chin State. Forced labour was used to establish these plantations. The Army was brought in to confiscate indigenous lands, and there has been a loss of income for the people because they were forced to buy jatropha seedlings to plant. Fines are imposed as punishment for non-compliance, taking away what little cash people have.

Further information:

Tebeba (2009), Report of the Asia Summit on Climate Change and Indigenous Peoples, http://www.tebeba.org/index.php?option=com_docman&task=doc_download&gid=290&Itemid=27

196 MYANMAR/THAILAND | Traditional Knowledge that Saved the Sea Gypsies

Adaptation, traditional knowledge, disaster risk management

On December 26 2004, several elders from the Moken tribe, a small community of sea gypsies from the Surin islands Marine National Park off the coast of Phang-Nga Province, Thailand, noticed that the sea was churned up and moving in an unusual way. They raised the alarm and most of the inhabitants rush to take refuge further inland. When they return, the village has been entirely swept away by La Boon, as the Moken call the tsunami that devastated the region. Their boats and houses mounted on piles have been reduced to a heap of wood and debris. But while Thailand mourns more than 5,000 victims, the Moken community was spared. The elders' knowledge of the sea saved their lives.

However, the Moken are now rebuilding their village, using bamboo and leaves woven together, in a non-traditional location inland, as dictated by the local government authorities. They have settled in a forest, further from the sea, and therefore a presumably safer but certainly not more advantageous site. The new village is less sanitary and has poor ventilation and a cramped design. Of most concern, the visibility of the Moken's natural environment, the sea, is substantially reduced. The influence of the outside world is growing all the time. Since the national park authorities forbade them from catching certain species such as the sea cucumber and some shellfish that they used to sell, the Moken have been deprived of one of their sources of income. A number of them have already abandoned fishing to work as diving guides for tourists or garbage collectors.

Further information:

http://portal.unesco.org/science/en/ev.php-URL_ID=4579&URL_DO=DO_TOPIC&URL_SECTION=201.html; Soimart Rungmanee and Irwin Cruz, 2005: The Knowledge that Saved the Sea Gypsies. A World of SCIENCE, Vol. 3, No. 2, April-June 2005, http://portal.unesco.org/science/en/files/4527/11158120231Sea_gypsies.pdf/Sea_gypsies.pdf

197 **NEPAL** | Melting glaciers in Sagarmatha**Local observations & impacts, traditional knowledge, disaster risk management**

The melting of glaciers around the world is affecting the appearance of sites inscribed for their outstanding beauty and destroying the habitat of rare wildlife species such as the snow leopard, in the Sagarmatha National Park, Nepal. These changes could also have disastrous effects on human lives with flooding resulting from glacial lake outbursts threatening human settlements. The establishment of monitoring and early warning systems and the artificial draining of glacial lakes are recommended to help avoid disasters.

Many of the features that constitute the outstanding universal values of the Sagarmatha National Park are the result of, or linked to, past climate variability. Up until the end of the Little Ice Age, snow accumulated in the Sagarmatha National Park, inciting the formation of glaciers. The action of these glaciers contributed to the geological features of the Park, since, as ancient rivers of compressed snow, they crept through and shaped the landscape. It is now feared that the Himalayan glaciers are rapidly retreating because of climate change. Despite these changes in the environment, people will continue to reside in the Park and the interaction of the human race with nature will continue. The Little Ice Age cooling maintained humanity's well-being to a minimum. The warming may bring the reverse effects. Population growth, settlement expansion and encroachment are likely to become a major management challenge. The integrity of the indigenous Sherpa People's culture will erode further under growing external influences.

Further information:
UNPFII, 2009. Information received from the United Nations System and Other Intergovernmental Organisations. E/C.19/2009/3/Add.3

198 **NEPAL** | Association of Nepal Kirat Kulung Language and Cultural Development (ANKKLCD)**Adaptation, income diversification**

The Association of Nepal Kirat Kulung Language and Cultural Development (ANKKLCD) works on socioeconomic development and linguistic and cultural development of the Kulung community, a forest dependent community. The pilot project focuses on Allo, the Himalayan Giant Nettle (*Girardinia Diversifoli*) as a source of income, especially for the Kulung women; however it is being depleted through forest degradation. The main goal of the project is to contribute towards the survival of indigenous peoples by increasing the capacity of the indigenous people in Allo cultivation and production, and supporting marketing networks for economic empowerment.

Further information:
UNDP-RIPP, <http://regionalcentrebangkok.undp.org.th/practices/governance/ripp/InnovativeProject.html>

199 **NEPAL** | The Upper Mustang Biodiversity Project**Adaptation, biodiversity, culture**

This project seeks to conserve the unique and globally significant biological and cultural resources in one of the most remote corners of the globe. The project has linked GEF-supported biodiversity conservation initiatives with the preservation of indigenous culture and provision of basic human needs. The project has focused on improving rangeland management, restoring cultural heritage, and developing local sustainable tourism to conserve the unique mountain biodiversity of Upper Mustang. Weakening of indigenous cultural and religious organizations and the authority of local institutions poses a major threat to the biodiversity in the area. High rainfall intensity and droughts have become common phenomena that are having severe effects on the crops and harvest.

Further information:
Forestry Nepal, <http://www.forestrynepal.org/project/44>; International Union for Conservation of Nature (2008). Indigenous and Traditional Peoples and Climate Change. http://cmsdata.iucn.org/downloads/indigenous_peoples_climate_change.pdf

200 **NEPAL** | Landslides isolate communities**Local observations & impacts, health, food security, pests, livelihoods**

Nepalese communities report several disasters in the form of landslides which have further isolated many indigenous communities as paths and roads are destroyed. It was observed that the phenomenal decrease of available water adversely affected crop production and the changes in the agricultural patterns and quality of agricultural crops. Peas and rhododendron are flowering much earlier and the apples are less sweet than they used to be. There are unknown insects invading the high mountain communities, because of increased temperatures, causing diseases that were not there before. Tourism, which is a main source of livelihood for many indigenous peoples, has decreased in recent years because of the accidents caused by avalanches and landslides.

Further information:
Tebtebba (2009). Report of the Asia Summit on Climate Change and Indigenous Peoples, http://www.tebtebba.org/index.php?option=com_docman&task=doc_download&gid=290&Itemid=27

200 **NEPAL** | Livelihoods in Koshi Tappu Wetlands**Adaptation, local observations & impacts, biodiversity, traditional knowledge, agriculture**

Koshi Tappu Wildlife Reserve, an IBA and Ramsar site, lies on the floodplain of Sapta Koshi River in south-eastern lowland Nepal. Unusual rainfall patterns have caused fluctuations in water levels, including a longer dry season that has led to water bodies drying up. This has resulted in the depletion of habitat of waterbirds and fishes, and of the natural resource base (fish, molluscs and water for crops) that sustains many of the poorest people. Invasive plant species have thrived in the drier conditions, resulting in further loss of biodiversity. The wetland reed *Typha* (used for mat weaving and fuel) has decreased due to the intense drying out of wetlands. The response has been to use manure as an alternative fuel source, meaning that it is no longer available as crop fertiliser. Working with local communities, Bird Conservation Nepal (BirdLife in Nepal), has implemented a project integrating biodiversity conservation with livelihoods, which addresses immediate climate impacts and helps build resilience and adaptive capacity for the future. Activities include promotion of bio-fuel production (briquettes made from wetland invaders such as *Iponea* and *Laneria*), and fertiliser production from the invasive water hyacinth *Eichhornia*. Clearing invasive plants to use in these products helps maintain and strengthen the wetland ecosystem. Community mobilisation and training has created new opportunities for indigenous people, and promoted the transfer of local knowledge from one community group to another.

Further information:
Birdlife International, 2010: Partners with nature: How healthy ecosystems are helping the world's most vulnerable adapt to climate change. http://www.birdlife.org/climate_change/pdfs/Ecosystemsandadaptation.pdf

202 PALESTINIAN AUTHORITY | Use of sheep wool wastes to produce art pieces

Adaptation, traditional knowledge, culture, income diversification, livelihoods

This demonstration and capacity building project involved transferring indigenous knowledge of weaving in Bani Suhilah to young women through a series of one to one practical training. In the Khaza village south of Gaza, women used to burn sheep wool twice a year after shaving the sheep. The project reduced GHG emissions previously resulting from burning the wool, and provided sustainable income generating activities through applying indigenous weaving techniques to reuse the wool to make useful and marketable handicrafts.

Implementation: Bait Al Mostaqbal Association/Khan Younis-Gaza, GEF Grant of USD\$19,803.00.

Further information:

GEF Small Grants Programme PAL/03/39: http://sgp.undp.org/web/projects/6470/utilization_of_sheep_wool_wastes_to_produce_art_pieces.html

203 PHILIPPINES | Increasing the resilience of tropical hillside communities

Adaptation, forests, ecosystems

In the Philippines, the Camalandaan Agroforest Farmers Association, a community-based land and resource management organization, have undertaken tree planting and forest protection to reduce sudden onrushes of water (during the rainy season) and depletion of water reserves (during the dry season).

Further information:

Equator Initiative, 2008: Camalandaan Agroforest Farmers Association – Philippines, http://equatorinitiative.org/index.php?option=com_content&view=article&id=530&Itemid=531&dx=86

204 PHILIPPINES | Ikalahan community - Forest title in Imugan, Nueva Vizcaya

Adaptation, payment for ecosystem services, forests, natural resource management

Indigenous peoples use various modern methods to ensure better control over their forests. In the case of the Ikalahan of Nueva Vizcaya in the Philippines, they used the Community Forestry Stewardship Act (CFSA) to assert their claim over their forests as early as 1974. When the Philippine Indigenous Peoples' Rights Act was passed in 1997, they moved towards having this converted into a Certificate of Ancestral Domain Title (CADT) which they recently achieved.

In terms of mitigating and adapting to climate change, the Ikalahan continue to do their traditional and innovative agroforestry management systems which includes the use of gen-gen (organic fertilizers), day-og, pangomis (inter-cropping and fallow periods) and gaik (firelines). They devised their own Forest Improvement Technology (FIT). They run a food processing unit where they sell harvested fruits from their production forests to generate cash for their basic needs. The community members are encouraged and supported to continue their organic farming methods. They use traditional pesticides such as panawel and other plants. They also practice mutual labor exchange called amuyo and bataris in order to finish their agricultural work in time without paying cash for labour. The Ikalahans have a sophisticated system of forest management where they delineated the forests into different functions. They divided the forests into conservation forests, forests where people can get wood for building their houses and where they can gather non-timber forest products. There is another part that is segregated for environmental services which they will consider for carbon trading. They have recently signed an agreement with a middleman, Mitsubishi Corporation to this end.

Further information:

Abayao, L. et al (2009) Climate Change and Indigenous Peoples in the Philippines: The Calamian Tagbanua and the Ikalahan views and actions on Climate Change (TKI-CC:3)". UNU Traditional Knowledge Initiative/ Tebtebba, Climate Change and Indigenous Peoples – Country Case Studies on Local Mitigation and Adaptation Measures Series, http://www.unutki.org/default.php?doc_id=166

205 PHILIPPINES | Coastal bleaching and the community of the Tagbanua in Coron, Palawan

Local observations & impacts, natural resource management, food security, traditional knowledge

Indigenous peoples who live in low-lying coastal areas are also very much affected by climate change and unsustainable practices such as cyanide fishing, harbor dredging, coral mining, deforestation, coastal development, agricultural runoffs, pollution from mining operations and careless divers. All these have led to a devastating loss of corals across the world and in Asia. The Philippines has one of the longest coastlines in the world covering 32,400 kilometers. About 70 per cent of the country's municipalities share the coast and there are approximately 50 million people living in the Philippine coastal areas that are at risk from the impacts of extreme climatic changes manifested in sea level changes and degradation of coastal and marine ecosystems, to name a few. These include indigenous peoples, among them, the Calamian Tagbanua.

A case study was done in the villages of Banuang Daan and Cabugao of Coron Island in Palawan. These form part of the ancestral domain of the Calamian Tagbanua, seafaring people whose lives revolve around the aawuyuk (lakes), talu (corals), teeb surublien or teeb sorableyen (ancestral waters), leyang (caves) and geba (forest). According to them, the rise in temperature of the sea, along with the pollution and destruction of coral reefs, has lowered their daily fish catch from 30 kilograms a few years back to five kilograms today. Coral bleaching has been observed and their capacity to fish has also decreased because they cannot stay long in the sea lest they get heat strokes. They mainly practice subsistence fishing using bamboos, fishing hooks and spears as their tools. They also maintain strict rules which regulate the amount of fish taken and they have delineated sacred areas called panyaan, where no one is allowed to catch fish.

The Tagbanua of Coron were the first indigenous peoples in the Philippines who secured a Certificate of Ancestral Domain Title (CADT) over their ancestral land and waters. This struggle has taken many years since the early 1960s and they have used existing national laws to stake their ancestral land claims. The security of tenure over their lands and waters has strengthened the possibilities and actions they are taking to mitigate and adapt to climate change. Forest resources, both mangrove forests and tropical rainforests, are communally owned and are governed by strict customary laws, e.g., prohibition of cutting trees near streams, springs, wells and the coast, fishing not allowed in parts of the sea delineated as sacred waters, etc. The Tagbanua recognize the value of their water-sheds and thus regulate the use of the forests. They protect the mangrove forests that form part of their ecosystem. The Tagbanua's efforts to rehabilitate the coral reefs and mangrove forests have brought back fish species which disappeared due to overfishing. While they have developed a very sophisticated Ancestral Domain Sustainable Development and Protection Plan (ADSDPP), there is a lack of financial support for this to be implemented.

Further information:

Abayao, L. et al (2009) Climate Change and Indigenous Peoples in the Philippines: The Calamian Tagbanua and the Ikalahan views and actions on Climate Change (TKI-CC:3)". UNU Traditional Knowledge Initiative/ Tebtebba, Climate Change and Indigenous Peoples – Country Case Studies on Local Mitigation and Adaptation Measures Series, http://www.unutki.org/default.php?doc_id=166

206 PHILIPPINES | Environmental impacts of community-based forest management in the Philippines

Adaptation, disaster preparedness

Community-based forest management (CBFM) is a major strategy in managing forest lands in the Philippines. Forest and land management activities implemented in CBFM project sites include management of tropical forests (enrichment planting, timber stand improvement or TSI and limited harvesting), rehabilitation of degraded lands (reforestation, assisted natural regeneration (ANR)) and agroforestry. The environmental effects of CBFM and its technologies are largely positive. CBFM has led to the conservation of natural forests and the associated biodiversity. The planting of trees in farms and landscapes has led to soil and water conservation, carbon sequestration and biomass production. The example of the Ikalahan indigenous people in Northern Luzon is discussed, where local communities have organised themselves to protect the natural forest and its rich biodiversity resources, among other activities.

Further information:
Rodel D. Lasco and Juan M. Pulhin (2005): Environmental impacts of community-based forest management in the Philippines International Journal of Environment and Sustainable Development, Volume 5, Number 1, 16 January 2006, pp. 46-56(11), <http://www.worldagroforestrycentre.org/Sea/Publications/files/journal/Aoz18-05.PDF>

207 PHILIPPINES | Montañosa Research and Development Center, Inc (MRDC)

Adaptation, natural resource management, income diversification

The Montañosa Research and Development Center (MRDC) project aims to strengthen indigenous natural resource management systems in the Cordillera; increase household income through the development of sustainable resource-based enterprises such as honey production under the indigenous Lapat system; and provide a space for skills development in cooperative enterprises.

Further information:
UNDP-RIPP, <http://regionalcentrebangkok.undp.or.th/practices/governance/ripp/InnovativeProject.html>

208 PHILIPPINES | Cold spells in the Cordillera

Local observations & impacts, food security

The Cordillera mountain region in the Philippines has lately experienced cold spells seriously damaging the economy of indigenous and local highland farmers. Low temperatures have seriously hit agriculture, which is the main source for subsistence and livelihood for indigenous communities in the Cordillera, in December 2006 and January 2007. Low temperatures and frost damaged crops, such as potato, cabbage, carrots, radish and peas. The region also faced some other climate related problems in 2006: during the summer months, from March to May, the Cordillera was hit by drought and was hit by typhoons in July to November 2006. This had serious negative impact on the indigenous communities, as agriculture is vital for their economy and subsistence. It also has an impact on other parts of the country, as the vegetable production in the Cordillera also supplies the vegetable demand from other parts of the country. As a result of the shortage of highland vegetables, vegetable prices have soared. Continued climate-related problems of this sort can potentially have severe consequences for the food security of these communities, as well as for their cash economy. These uncertainties have forced farmers to consider various options for adaptation, including building of greenhouses in order to protect their crops from future cold spells.

Further information:
CBD (2007) : UNEP/CBD/WG8J/5/INF/18, Report on Indigenous and Local Communities Highly Vulnerable to Climate Change Inter Alia of the Arctic, Small Island States and High Altitudes, with a Focus on Causes And Solutions, <http://www.cbd.int/doc/meetings/tk/wg8j-05/information/wg8j-05-inf-18-en.pdf>

209 PHILIPPINES | Solidarity in the Cordillera region video

Local observations & impacts, forests, land rights, multimedia

Indigenous communities from the Cordillera region record the impacts of large-scale mining and deforestation on their environment. Their film also shows their fears regarding climate change, and consequently a strong will to strengthen their solidarity and assert their rights to their land and its resources.

Further information:
Conversations with the Earth, <http://www.conversationearth.org/>

210 RUSSIA | Rediscovering Altai's human-nature relationships videobrief

Local observations & impacts, culture, mountains, traditional knowledge

Slava Cheltuev, is a Telengit community leader and shaman from the Russian Altai's high altitude Kosh Agach district. Whilst traversing Altai's sacred lands, he reflects on our 21st century world and stresses the importance of reviving vital traditional knowledge - age-old wisdom that instruct the respectful and harmonious relationship between local environment and human behaviour.

Further information:
UNU-TKI Indigenous Perspectives on climate change video series, http://www.unutki.org/default.php?doc_id=120; Vimeo album, <http://www.vimeo.com/album/85004>

211 SRI LANKA | Indigenous forecasting in Sri Lanka: Farmers use meteorological indicators and animal behaviour to predict the weather

Local observations & impacts, agriculture, food security, disaster risk management, traditional knowledge, forecasting

Traditional farmers' short-range weather forecasts are essentially based on personal experiences, instincts, and visual indicators such as humidity and heat. A cold night with mist and dew is considered to be a sign of impending dry weather, while hot and warm days signal rainy evenings. Farmers observe the sky and the movement of clouds to predict the weather. A red sky at sunrise and sunset is considered to be a warning for rainless days ahead.

Further information:
: UNFCCC Database on local coping strategies, Case Study 31, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=31; SLARCIK, Sri Lanka Resource Centre for Indigenous Knowledge, University of Sri Jayewardenapura, Geography Unit

Animal behaviour is also used to predict weather changes. When frogs and toads make a peculiar, sharp sound or when bees remain inside their hives, rain is expected. Restless buffaloes or cats that make unusual noises are believed to indicate impending harsh conditions such as cyclone. Farmers commonly expect a break in the weather pattern on the night before the monthly full moon.

212 SRI LANKA | Promoting the use of traditional knowledge of local dairy farming and use of alternative energies

Adaptation, traditional knowledge, energy

The Community Oriented Resource Exchange established 20 demonstration biogas units and 100 cowsheds for selected farmers of the area, formed a network of 200 farmers with specific knowledge on traditional dairy farming, and printed a booklet on the subject for distribution. The project mainly concentrated on the promotion of the use of renewable energies, establishing an information exchange unit, and undertaking a survey on the knowledge and practices of traditional local dairy farming methods. Promotion of traditional cattle rearing helps develop farming activities, provide additional income to the farmers and promote the use of organic fertilizer in sustainable farming. Biogas was made available for cooking purposes. The farmers directly involved in the project (300 farmers) reported that they have now been able to use traditional indigenous medicine for cow diseases by themselves, saving the time and money spent on modern practitioners and modern medicine.

Further information:

UNDP Small Grant Program, SRL/04/05, http://sgp.undp.org/web/projects/422/promote_the_use_of_traditional_knowledge_of_local_dairy_farming_and_use_of_alternative_energies_by_c.html

213 SRI LANKA | The bethma practice: promoting the temporary redistribution of lands during drought periods

Adaptation, traditional knowledge, water resources

Bethma is a practice that temporarily redistributes plots of land among shareholders (being paddy landowners) in part of the command area of a tank (reservoir) during drought periods. It is an old indigenous methodology, still practiced in some areas in Sri Lanka, which aims to provide opportunities for farmers to cultivate during drought situations when there is some water in the reservoirs, but not sufficient for cultivation of the entire command area. Local Farmer Organizations (and sometimes local government organizations) drew upon their past experience with bethma, especially regarding the water level at which bethma can be carried out, to revitalise this old practice. By adapting the water resource management system, it has improved the yield from the paddies. The primary initiators of the project were leaders of the Farmer Organization or the traditional irrigation headmen (the 'velvidane').

Further information:

UNESCO Best Practices on Indigenous Knowledge BP.21, <http://www.unesco.org/most/bpik21.htm>

214 TAJIKISTAN/AFGHANISTAN | Linking custodians of indigenous knowledge through Cornell University

Adaptation, awareness raising

This project is being implemented by Cornell University to enable custodians of indigenous knowledge of agro-biodiversity, pastoralism and medicinal herbs in Badakhshan and Wakhan of Tajikistan and Afghanistan to forge links with scientists and NGOs to enhance resilience in the face of climate and other change in these mountain areas.

Further information:

The Christensen Fund, <http://www.christensenfund.org/page.asp?id=72>

215 TAJIKISTAN | Energy for the Pamir Mountains videobrief

Local observations & impacts, energy

In this short video, highland people in the Pamir Mountains struggle to fuel their lives on the roof of the world.

Further information:

UNU-TKI Indigenous Perspectives on climate change video series, http://www.unutki.org/default.php?doc_id=120; Vimeo album, <http://www.vimeo.com/album/85004>

216 THAILAND | Water Buffalo Conservation for Community

Adaptation, energy, traditional knowledge

This Integrated Farming Management Group project is located in a village with 312 families of which 253 earn their living as farmers. Before 1982, there were approximately 1,000 water buffaloes in used for agricultural land of about 300 ha. After 1982 there emerged the too large-commercial scale plantation of a non-indigenous species cassava prompting almost all farmers to sell their buffaloes for small tractors. The patterns of buffaloes use were obsolete. The use of diesel oil for tractors replace and the application of chemical substance in agriculture prevailed. These new practices have adversely affected the environment and their livelihoods, and contribute to climate change. Water buffaloes are now preferred to small tractors, since this beast of burden will reduce fuel consumption and provide manure which will subsequently reduce the expense and green house gas emission.

Further information:

UNDP THA-00-G06, http://sgp.undp.org/web/projects/3409/water_buffalo_conservation_for_community.html

217 THAILAND | International Alliance of Indigenous and Tribal Peoples of the Tropical Forests Foundation (IAITPTF)

Adaptation, income diversification, traditional knowledge, women

The International Alliance of Indigenous and Tribal Peoples of the Tropical Forests Foundation (IAITPTF) project aims to demonstrate the linkage between indigenous women, income generation projects and climate change adaptation and mitigation. It will support indigenous women traditional knowledge and skills preservation by building capacity in the innovative production, design and marketing of their products as well as preserving relevant trees and plants required in the production process. The project will also strengthen networking and strategic partnerships of indigenous women.

Further information:

UNDP-RIPP, <http://regionalcentrebangkok.undp.or.th/practices/governance/ripp/InnovativeProject.html>

218 THAILAND | Integrated community development programme in Mae Hong Son Province

Adaptation, food security, income diversification, disaster preparedness

UNDP Thailand launched a new project in 2008 in the remote highland province of Mae Hong Son in Northern Thailand to specifically improve the lives of vulnerable women and men, a majority of whom belong to indigenous and highland ethnic peoples. The project has three interrelated components focusing on: enhancing food security and increasing agricultural and non-agricultural income generation opportunities; developing an inclusive and responsive public service to improve service delivery; and developing management and technical skills for natural disaster risk management and environmental activities, including environmentally friendly enterprises.

Further information:

UNDP, http://www.undp.or.th/resources/documents/ProjectBrief_MHS_004.pdf

219 **VIET NAM** | Stabilizing water resources

Adaptation, water resources

Several community-based adaptation projects in Viet Nam are working towards stabilizing water resources for agricultural purposes in Muong communities, which are facing increasingly erratic rainfall and hydrological regimes.

Further information:
UNDP, http://www.undp.org/partners/civil_society/publications/indigenous/IP_Fast_Facts_English_May_2009.pdf

220 **VIET NAM** | Kep A Village, Minh Son Commune, Bac Me District in Ha Giang Province

Local observations & impacts, health, disaster preparedness

In Ha Giang Province in Viet Nam irregular rainfall, unusual flooding and unpredictable whirlwinds and storms have led to long weeks of floods which submerged lands and crops and drowned livestock, destroyed infrastructures and disturbed socio-cultural activities such as community feasts and rituals. Aside from the loss of crops and livestock leading to food insecurity, there have been high incidences of epidemics amongst humans and animals.

Further information:
Phan Viet, C. (2009) Vietnam: Kep A Village (TKI-CC:6)". UNU Traditional Knowledge Initiative/Tebtebba, Climate Change and Indigenous Peoples – Country Case Studies on Local Mitigation and Adaptation Measures Series, http://www.unutki.org/default.php?doc_id=166

221 **VIET NAM** | In Pu Mat National Park

Adaptation, natural resource management, livelihoods, capacity-building

UNESCO is working with the local management board of the In Pu Mat National Park to develop guidelines for community participation in sustainable management and livelihood development. The project builds capacities of the site managers to better involve the local communities in the management of the site and to assist them in identifying and developing sustainable livelihood opportunities in the face of climate change.

Further information:
UNESCO, <http://www.unesco.org/mabdb/br/brdir/directory/biores.asp?mode=all&code=VIE+06>



LATIN AMERICA AND THE CARIBBEAN

222 LATIN AMERICA/CARIBBEAN | Indigenous Women's Groups in Disaster Risk Reduction

Adaptation, disaster preparedness

Community women leaders from Latin America and the Caribbean explained and debated the approaches they have devised to recover or reduce their vulnerability to damage from natural disaster, environmental degradation and climate change. Immediate response, recovery, and reconstruction practices included running community kitchens & emergency food distribution programs and distributing emergency supplies; disseminating information on entitlements and other government programs (via community radio and public meetings); and taking the lead on constructing affordable disaster resistant housing. Community-led preparedness and resilience building practices were also discussed, where women undertake risk and asset mapping and surveys, raise community awareness of the issues and lead in establishing community contingency plans, and community vulnerability to disaster is reduced via: rain water harvesting, reinforcing river embankments, promoting food security through organic agriculture and systematic crop rotation, safeguarding indigenous seeds, scaling up community tools and seed banks in indigenous communities, and community monitoring of environmental changes.

Further information:

GROOTS International, The Role and Power of Grassroots and Indigenous Women's Groups in Disaster Risk Reduction, ProVENTion Consortium Pre-Forum Workshop, 12-14 March 2008, Antigua, Guatemala, http://www.proventionconsortium.org/themes/default/pdfs/Forum08/Antigua_exec_summary.pdf

223 CENTRAL AMERICA | Regional Indigenous Ecosystem Management Project

Adaptation, biodiversity, natural resource management, livelihood, capacity-building

The global objective of the project is to achieve effective biodiversity conservation in Central America - Guatemala, Belize, Honduras, El Salvador, Nicaragua, Costa Rica, and Panama - by strengthening the capacity of indigenous communities to protect, and manage their natural and cultural resources, and, by recuperating and promoting their cultural values, and sustainable traditional land use practices, thereby preventing further land degradation that threatens environmental services, livelihoods, and economic well-being, as well as conserving the region's high, biodiversity resources.

Further information:

WORLD BANK (2008): Sobrevila, Claudia. The Role of Indigenous Peoples in Biodiversity Conservation; World Bank P075219, <http://web.worldbank.org/external/projects/main?Projectid=P075219@theSitePK=40941@pagePK=64283627@menPK=228424@piPK=73230>

The project has a strong focus on biodiversity conservation, institutional strengthening, and cultural preservation. The project was originally designed to work in 10 biodiversity priority areas that were selected following strict selection criteria to ensure that biodiversity impacts are significant. Under the project, indigenous communities are setting aside two types of conservation areas: Community Conservation Areas (CCA) and Areas of Cultural Use (ACU). In the CCAs, communities commit themselves to preserving biodiversity and make an agreement with all surrounding communities that these areas are not to be degraded or utilized except for conservation and limited tourism. In the ACUs, the extraction and utilization of biodiversity is done according to ancestral customs. These areas can preserve sacred sites and areas traditionally used by their ancestors.

At the design stage, the project set aside 135,000 hectares for targeted flora and fauna conservation and water resource protection through the CCAs and 45,000 hectares for improved agro-ecological productivity through the ACUs. The results of the mid-term review showed that 193 indigenous and rural communities participated in the conservation and agro-ecological productivity systems. Community organizations were strengthened; farmers received technical assistance in agro-ecological systems management without the use of agro-chemicals; and training in biodiversity conservation and ecotourism was provided.

224 SOUTH AMERICA | Comunicado de Prensa Mapuche

Local observations @ impacts, traditional knowledge, biodiversity, food security

The Mapuche have noticed changes in temperatures, increased flooding and weather unpredictability. These changes have had a direct impact on the subsistence agriculture (due to salinity of land), water quality, and loss in biodiversity.

Further information:

Comunidad Pillan Mahuiza, <http://qollasuyu.indymedia.org/es/2004/12/1309.shtml>

225 SOUTH AMERICA | Adaptation capacity of the South American highlands' Pre-Colombian communities

Adaptation, traditional knowledge, water resources

The subsistence of indigenous civilisations in the Americas relied on the resources cropped under the prevailing climate conditions around their settlements. In the highlands of today's Latin America, one of the most critical limitations affecting development is the irregular distribution of water. This situation is the result of the particularities of the atmospheric processes and extremes, the rapid runoff in the deep valleys, and the changing soil conditions. In large areas, human activities depended on seasonal rainfall.

Further information:

IPCC Fourth Assessment Report, Chapter 13: Cross-Chapter Case Studies C4.2.1, <http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-xccc.pdf>

Under such limitations, from today's Mexico to northern Chile and Argentina, the pre-Colombian civilisations developed the necessary capacity to adapt to the local environmental conditions. Today, the problem of achieving the necessary balance between water availability and demand is practically the same, although the scale might be different. Such capacity involved their ability to solve some hydraulic problems and foresee climate variations and seasonal rain periods. On the engineering side, their developments included rainwater cropping, filtration and storage; the construction of surface and underground irrigation channels, including devices to measure the quantity of water stored. They also were able to interconnect river basins from the Pacific and Atlantic watersheds, in the Cumbe valley and in Cajamarca. Other capacities were developed to foresee climate variations and seasonal rain periods, to organise their sowing schedules and to programme their yields. They also acquired the capacity to forecast climate variations, such as those from El

Niño, enabling the most convenient and opportune organisation of their foodstuff production. In short, they developed pioneering efforts to adapt to adverse local conditions and define sustainable development paths. Today, under the vagaries of weather and climate, exacerbated by the increasing greenhouse effect and the rapid retreat of the glaciers, these adaptation measures are being revisited. Comisión Económica para América Latina y el Caribe (ECLAC)'s procedures for the management of sustainable development, when considering the need to manage the extreme climate conditions in the highlands, refer back to the pre-Colombian irrigation strategies and the need to educate and train present community members on the knowledge and technical abilities of their ancestors.

226 AMAZON REGION | Droughts and fires in the Amazon

Local observations of impacts, forests, drought

In the Amazon, the effects of climate change include deforestation and forest fragmentation and consequently, more carbon is released into the atmosphere exacerbating and creating further changes. Droughts in 2005 resulted in fires in the western Amazon region and this is likely to occur again as rainforest is replaced by savannas thus, having a huge effect of the livelihoods of the indigenous peoples in the region.

Further information:

UNPFII (2007): Climate Change: An Overview, http://www.un.org/esa/socdev/unpfii/en/climate_change.html

227 AMAZON REGION | Transamazônica Highway, Smallholders and REDD

Adaptation, forests, REDD, agriculture

The Amazon Fund aims to raise donations for non-reimbursable investments in actions to prevent, monitor and combat deforestation and to promote the conservation and sustainable use of forests in the Amazon. Amazon Environmental Research Institute (IPAM) and Fundação Viver, Produzir e Preservar (Foundation for life, Environmental Protection and Food Production, FVPP) submitted a first pilot project of REDD for smallholders living in areas of expansion of agricultural frontier in the Amazon. The project aims to stop deforestation in the productive areas of 350 families of smallholders through allowing the implementation of Familiar Production Units Using Plans, designed with the goal of replacing conventional land use practices (such as slash-and-burn activities and extensive pasture) by sustainable ones (agroforestry systems, adoption of techniques to increase the productivity in opened areas, fire management, etc). In 10 years, the project should reduce the emission of approximately 3.1 million tons of CO₂.

Further information:

Amazon Fund, <http://www.fundoamazonia.gov.br>; IPAM, <http://www.ipam.org.br>; FVPP, <http://www.fvpp.org.br>

228 AMAZON REGION | Tropical Forest Protection in the Northwest Amazon

Adaptation, forests, biodiversity, land rights, policy and planning

CANOA (Consolidation and Alliance in the Northwest Amazon) is working in support of the rights of indigenous peoples and conservation of the environment in the northwest Amazon Basin, linking indigenous organizations and other actors in border areas shared by Colombia, Venezuela and Brazil. Since 2002 the CANOA initiative has been coordinating trans-border activities, responding to the threats of climate change through the conservation of biological and cultural diversity in a corridor of indigenous territories and protected areas that cover 100 million hectares in the Northwest Amazon. Funded by the European Commission.

Further information:

COAMA, <http://www.coama.org.co>; GAIA Amazonas, <http://www.gaiaamazonas.org>

229 ANDES | Climate change impacts in the Andes and adobe houses to protect from low temperatures

Local observations of impacts, traditional knowledge

The Coordinadora Andina de Organizaciones Indígenas represents Indigenous Peoples throughout the Andean region. They have documented increased temperatures during the dry season throughout the region leading to the loss of biodiversity and decreased food security. During the winters, CAOI has documented record low temperatures that are affecting the health, alpaca, and food production in the Andes. Indigenous peoples have designed adobe houses to protect themselves and their livestock from low temperatures.

Further information:

Coordinadora Andina de Organizaciones Indígenas (CAOI), <http://www.minkandia.org/>

230 ANDES | Millennium Ecosystem Assessment – Vilcanota Sub-Region

Local observations of impacts, biological diversity, water resources, food security

This assessment is undertaken by the International Center of Traditional Knowledge, Ecology, and Policies (CICTEP), which is a project of the Asociación ANDES, a community-based Quechua-Aymara organization working on conservation and livelihoods promotion in the Andes region. The main objective of this assessment is to assess the state of the ecosystem in the Vilcanota sub-region of the Peruvian Andes. Ecosystem services being assessed include cultural services (spirituality); provisioning services (water, food); supporting services (soil, primary production) and agrobiodiversity.

Further information:

Millennium Assessment, <http://www.millenniumassessment.org/en/SGA.Peru.aspx>

231 ANDES | Vulnerability and health impacts in the Andes

Local observations of impacts, health, animal husbandry

The organization Practical Action documents that freak cold spells, falling to -30 °C, have caused death of children and severe illness in indigenous communities in Peru in recent winters. For instance, in 2003 around 13,000 people suffered severe hypothermia, bronchitis and pneumonia. Indigenous communities were also faced with enormous loss of animals. Reportedly around 50-70% of their alpacas perished and many more were left exhausted and prone to disease. Such extreme conditions threaten the very existence of many of these indigenous communities. Loss of sheep and alpacas have created unprecedented problems as far as clothing is concerned, as the heightened levels of sheep and alpaca mortality leave less material for clothing, insulation and bedding. Indigenous Peoples have also noticed a decrease in biodiversity and a decreased agricultural season. Increased precipitation causes flooding endangering Indigenous homes and livelihoods. Increased respiratory illnesses due to climatic changes have also been documented.

Further information:

Practical Action, 2007, Surviving the Frieaje; Freak freeze conditions in Peru, http://practicalaction.org/?id=climatechange_frieaje; Pueblos Indígenas y Cambio Climático: Declaración Qollasuyo sobre Cambio Climático: <http://www.ecoalimenta.com/es/viewer.php?IDN=3057>

LATIN AMERICA AND THE CARIBBEAN

232 ANDES | Deglaciation and Indigenous Health in the Andes

Local observations of impacts, health, water resources, extreme weather events

The Andean region accounts for 95% of the world's tropical glaciers, covering an area estimated at 2500 km² today. 71% of them are located in Peru, 22% in Bolivia, Ecuador 4% and 3% in Colombia. Warming in high mountain regions generates a significant reduction or disappearance of snow and ice surfaces. In general, the health of indigenous peoples in the Andean region, especially those living in mountain ecosystems, is affected by the occurrence of natural phenomena attributed to climate change, such as cold, frost, drought and rainfall. Particularly in the high Andean areas of Peru, frost and snow is not only affecting agriculture and livestock, but also people's health because it increases the risk of acute respiratory infections like bronchitis and pneumonia. Acute respiratory infections have been identified as a leading cause of death in the high Andean zones, as well as acute diarrhoeal diseases in the lower areas.

Indigenous peoples living in areas of glaciers are affected by various hazards during the rainy season (landslides, flooding of lakes, and earthquakes). The risks are increased with the rains. Communities are concerned that the loss of the glaciers during the last decades might reduce the availability of water for irrigation and power generation by reducing the flow of rivers, and even for human consumption. In Bolivia, January and March 2007 had record flood levels in Santa Cruz, Cochabamba, La Paz, Tarija, Potosí, Chuquisaca, Oruro, Beni and Pando. Landslides and flooding of rivers caused by heavy rains were accompanied by hail and cold that affected mainly the areas of the highlands and valleys – the areas that house the majority of the indigenous population. In Ecuador, heavy rains from January to March caused floods in coastal provinces (Esmeraldas, Manabí, Guayas, El Oro and Los Ríos) and Sierra (Canar, Chimborazo, Cotopaxi, Bolívar, Azuay) affecting the population (500 thousand affected), infrastructure (roads, bridges and water supply) and agriculture (102 hectares damaged).

The Indians believe that climate change is evidence of a "malaise" of the "Pachamama" as a result of the irrational exploitation of natural resources and pollution of global industries. For decades these communities have warned that climate change is confirmation of the breakdown of the harmonious relationship between people and Mother Earth, endangering the future of humanity as a whole. The Andean indigenous peoples claim that they have survived because they were able to "resist and control" the climate of high mountains and therefore their knowledge could be of great importance to adapt to climate change in the following decades.

Further information:

El Cambio Climático y Efectos sobre los Pueblos Indígenas de Los Andes: Luis Vittor <http://www.comunit.com/es/node/269289/37>; Coordinadora de las Organizaciones Indígenas de la Cuenca Amazónica www.coica.org.ec; <http://www.etniasdecolombia.org/actualidadetnica/detalle.asp?cid=6557>

233 CARIBBEAN | Caribbean Community Climate Change Centre

Local observations of impacts, capacity-building, policy and planning

The Mainstreaming Adaptation to Climate Change (MACC) project is being implemented by the World Bank, with funding of USD \$5 million from GEF. The executing agency is the CARICOM Secretariat located in Georgetown, Guyana. In-kind participants include the Government of Canada and the Government of the United States of America through the National Oceanic and Atmospheric Administration (NOAA).

The project's main objective is to mainstream climate change adaptation strategies into the sustainable development agendas of the Small Island and low-lying states of CARICOM. MACC will adopt a learning-by-doing approach to capacity building, consolidating the achievements of CPACC and ACCC. It will build on the progress achieved in these past projects by furthering institutional capacity, strengthening the knowledge base, and deepening awareness and participation. The participating countries are: Antigua and Barbuda, the Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Saint Lucia, St. Kitts and Nevis, St. Vincent and the Grenadines, and Trinidad and Tobago.

Further information:

CARICOM, <http://caricom.org/jsp/projects/macc%20project/macc.jsp?menu=projects>; Caribbean Community Climate Change Centre, <http://www.caribbeanclimate.bz/>

234 CARIBBEAN | Caribbean Renewable Energy Development Programme (CREDP)

Adaptation, energy

The Caribbean Renewable Energy Development Programme (CREDP) is an initiative of the Energy Ministers of CARICOM region established to change the market environment for Renewable Energy in the Region. The project methodology centres on initialising and accompanying processes of change within political and institutional procedure, and in providing technical and economic expertise so as to encourage the climate of investment in renewable energy in the Caribbean. The project's scope of performance covers the provision of specialist consultancy to the national governments and political organisations within the region on questions of energy strategy and the required framework conditions for renewable energy; giving support to the electric utilities and other investors with regard to the planning and implementation of concrete RE and EE projects; and finally, through an institutional strengthening of the Caribbean Community Secretariat (CARICOM/CCS) and the Caribbean Association of Electric Utilities (CARILEC). The project is in alignment with the concept laid down in the Development Cooperation with Indigenous Peoples in Latin America and the Caribbean and its core precepts (the fight against poverty, protecting the environment and its natural resources, modernisation of the state and community).

Further information:

CARICOM, <http://www.caricom.org/>

235 BOLIVIA | Indigenous Bolivian Amazon REDD Program

Mitigation, forests, ecosystems

The Indigenous REDD Program in the Bolivian Amazon is a pilot endeavor in the southwestern Amazon developed by the Fundación Amigos de la Naturaleza (FAN), the Confederation of Indigenous Peoples of Bolivia (CIDOB) and the Central Indigenous Council of Bolivia's Amazon Region (CIRABO). It involves the Municipalities of Guayaramerín, Riberalta, Gonzalo Moreno, San Pedro, Villa Nueva and San Lorenzo. REDD Amazonia is an innovative effort that promotes the mitigation of climate change and the sustainable use of timber and non-timber forest resources in order to improve the living conditions of indigenous communities and other inhabitants of the Bolivian Amazon. The five components

Further information:

Indigenous Bolivian Amazon REDD Program, <http://www.reddamazonia.com>

of the program are to establish a social pact; quantify emissions reductions; improve forest governance; provide added value for sustainable forest resource use; and monitor, report and verify emissions and reductions.

236 **BOLIVIA** | Mitigating Climate Change through Water Management

Mitigation, water management, biodiversity, adaptation

In Bolivia, the project for Strengthening Indigenous Peoples' Organizations to Mitigate Climate Change through Water Management aims to strengthen the capacity of indigenous peoples in water management, biodiversity conservation and climate change response strategies. The project builds on the social, cultural, economic and political understanding about water of the Aymara and Uru Murato people living in the La Paz and Oruru districts. It focuses on valuing indigenous peoples' knowledge about water and strengthening their participation in decision-making processes and policy formulation.

In India, the Centre for Development Action is supporting tribal peoples' communities to strengthen their capacity to cope with, adapt to and mitigate the effects of climate change in order to improve their livelihoods and environments. The project builds on tribal peoples' traditional knowledge about soil conservation techniques, drought-resistant crops and land and water management. It also supports their own initiatives to develop strategies and practices to adapt and mitigate the effects of climate change.

Further information:

IFAD, 2010: International Day of the World's Indigenous Peoples, <http://www.ifad.org/media/events/2010/indigenous/index.htm>

237 **BELIZE** | Belize Community Managed Sarstoon-Temash Conservation Project

Adaptation, natural resource management, biodiversity, livelihoods, land rights

The Community Managed Sarstoon Temash Conservation Project (COMSTEC) in Belize was originated by five indigenous communities (four Q'eqchi' Maya groups and one Garifuna) to preserve their ancestral lands, which included the Sarstoon Temash conservation area in the Sarstoon Temash region. The International Fund for Agricultural Development and the World Bank have supported this project since 2002 and funding has resulted in the establishment of the Sarstoon Temash Institute for Indigenous Management (SATIIM), a formally registered NGO. This project has supported the gathering of comprehensive baseline data on flora, fauna, soils and geology, hydrology, socioeconomic situation, and indigenous traditional knowledge. Participatory conservation community mapping identified 4,026 hectares of coastal marine protected areas within the buffer zone that the indigenous communities claimed as ancestral lands. The Sarstoon Temash Marine Management Area was established in May 2005 through arrangements with the Belize Fisheries Department. It encompasses 4,026 square kilometers of coastal waters adjacent to the national park and is managed by SATIIM in conjunction with coastal communities. A Co-management Agreement was signed with the government. Five Village Resource Centers have been established, and 38 kilometers of trails, 15 bridges, and four visitation areas have been constructed for eco-ethno-tourism.

Further information:

WORLD BANK (2008): Sobrevila, Claudia. The Role of Indigenous Peoples in Biodiversity Conservation; World Bank Project Po78216, <http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=Po78216>

One of the foremost success stories of this project is that the empowerment of the indigenous communities to own and manage their lands bolstered their ability to fight an oil extraction claim within their territory. SATIIM brought this case to the Supreme Court in May 2006, challenging the legality of the permission granted to the oil company by the Forestry Department. This action resulted in an injunction on oil exploration in the Park until a judicial review was complete. On September 27, 2006, the judicial review found that the permission granting the oil company entry into the National Park was illegal because no Environmental Impact Assessment (EIA) was prepared. The permission was then revoked and an EIA was required. Also facilitating sustainable resource use by communities, the COMSTEC project has affected three sectors: Indigenous subsistence systems where the use of non-timber forest products in the protected area is now legally permitted and monitored Indigenous agro-forestry sector where organic cacao production and sales through the Toledo Cacao Growers Association has been expanded and is being marketed in Europe through a fair trade agreement Eco- and ethno-tourism sector, which has been strengthened through investments in infrastructure, training, and marketing, thus expanding visitation to the Sarstoon-Temash National Park and buffer zone communities. Additionally, 100 Maya and Garifuna students and 95 farmers were trained; 135 indigenous villagers regularly participate in park management activities.

238 **BOLIVIA** | Ancestral irrigation system to protect against floods

Adaptation, traditional knowledge, extreme weather events

Poor farmers in the heart of Bolivia's Amazon are being encouraged to embrace the increasing annual floods by using a centuries-old irrigation system for their crops. The system is based on building "camellones" - raised earth platforms of anything up to 2m high, surrounded by canals. Constructed above the height of flood waters, the camellones can protect seeds and crops from being washed away. The water in the canals provide irrigation and nutrients during the dry season. Pre-Columbian cultures in Beni from about 1000BC to AD1400 used a similar system. During the rainy season, large expanses of land in Beni are under water for several months - except for the raised areas.

Further information:

Bolivia: Reviving ancient indigenous knowledge, Oxfam, <http://www.oxfam.org/en/campaigns/climatechange/bolivia-reviving-ancient-indigenous-knowledge>

When the water recedes into the tributaries that run into the Amazon, it takes nutrients with it leaving a sandy brown soil in which it is difficult to grow crops. But in the camellones project, the water left by the floods is harnessed to bring fertility to the soil and irrigation during times of drought. In short, from being victims of the floods, poor people could become masters by turning the excess water to their advantage. The project is supported by Oxfam and the Kenneth Lee Foundation.

239 **BOLIVIA** | De-glaciation of Mount Illimani and new crops

Local observations & impacts, water resources

The glaciers on Illimani are estimated to have been there for thousands of years. However, in early 2009, the Paris-based Development Research Institute (IRD) estimated that the glaciers in the Cordillera Real mountain range in Bolivia, of which Illimani forms a part, had lost more than 40% of their volume between 1975 and 2006.

Aymara Indians living in Khapi, perched high up in the Bolivian Andes, are watching Illimani with increasing alarm. They depend on it for part of their water supply - both to drink and to irrigate their small, terraced parcels of land; and the water from Illimani plays a crucial role in the life and religious beliefs of the community. Every September, they carry out a ritual, involving offerings called Waxt'a in Aymara. This includes the sacrifice of a llama and other offerings like coca leaves, alcohol and cigarettes to Illimani. Villagers are also concerned about the changing climate. They say there is no longer any predictability about when the rains come, compared to the past, they are sure that there is less rain, and that the weather is getting hotter. One positive aspect of the warmer temperatures is that some of them can now grow peaches and maize where previously they could not.

Further information:

Bolivia's Indians feel the heat, James Painter, BBC News, 29 July 2009, <http://news.bbc.co.uk/2/hi/americas/8172981.stm>

240 **BOLIVIA** | Fortification of indigenous organizations for climate change mitigation through use and management of water resources

Adaptation, water resources, biodiversity, policy & planning

This project by Consejo Regional del Departamento de La Paz (CONAMAQ) is based on the social, cultural, economic and political cosmivision on water of the Aymara and Uru Murato people living in the La Paz and Oruru districts, and it aims to strengthen the capacity of indigenous peoples in water management, biodiversity conservation and climate change response strategies. The project focuses on valuing indigenous peoples' knowledge on water and strengthening their participation in decision-making processes and policy formulation.

Further information:

IFAD Projects 2008, Fortalecimiento de las organizaciones indígenas: para la mitigación en el cambio climático a través de la gestión y el uso del agua, <http://www.ifad.org/english/indigenous/grants/projects/regions/lac.htm>

241 **BOLIVIA** | Sustainable Water Resources Management through the Recuperation of Traditional Knowledge in the Bolivian Andes

Adaptation, traditional knowledge, water management

This proposal by Grupo de Voluntariado Civil (GVC), La Paz, Bolivia, aims to establish best practices in water management along the full length of the Suches River, from Alpaca grazing grounds at 4,800 meters to the shores of the Lake Titicaca. The project is unique in its mix of traditional farming techniques, culture and modern approach to sustainable use of natural resources. The project seeks to restore the Andean vision of equilibrium between man and the environment through the development of economic activities and social tradition. Archaeological evidence shows that pre-Columbian indigenous populations developed techniques adapted to the physical conditions of their environment, with sukakollos in the areas prone to flooding and taqanas on hillsides, and designed systems of irrigation, rotation, combined cultivation and genetic selection of plant varieties. These techniques allowed them to reduce the effects of the Andean climate and achieve abundant harvests. The landscape of the Suches River watershed allows for the reintroduction of sukakollos and taqanas and their subsequent use for intensive farming.

Further information:

Swiss Re, <http://www.swissre.com/pws/about%20us/corp.%20responsibility/corporate%20citizenship/water/winners%20of%20the%20international%20resource%20award%20for%20sustainable%20watershed%20management%202005.html>

242 **BRAZIL** | Surui Carbon Finance and the Protection of Indigenous Peoples' Forests

Mitigation, forests, payment for ecosystem services

The Surui Indians of the Brazilian Amazon made contact with the outside world for the first time only 40 years ago. This contact inaugurated a period of settlement, road construction and disease that decimated their population and their ancestral lands. Now the Surui are working with Forest Trends, the Katoomba Group, Amazon Conservation Team and other partners to wed sophisticated mapping technology and global carbon finance to protect their culture and forests. By supporting processes of local consultation and planning, mapping, technical carbon assessments and links to markets, the Katoomba Incubator and partners propose to catalyze carbon finance for the protection of over 240,000 hectares of native forest and the support of a sustainable future for the Surui. After reviewing the Surui rights for carbon sequestration through reforestation in their lands researchers concluded they have carbon ownership rights and that the economic benefits from payments for carbon credits deriving from CDM or Voluntary Market forest projects belong to the Surui.

Further information:

Katoomba Group, <http://www.katoombagroup.org/incubator>

243 **BRAZIL** | Inhibition of Amazon Deforestation and Fire by Parks and Indigenous Lands

Mitigation, forests, protected areas

In this study published in Conservation Biology, researchers showed that many indigenous lands prevent deforestation completely even though there are high rates of forest destruction directly outside their borders. Indigenous lands occupy one-fifth of the Brazilian Amazon—five times the area under protection in parks—and in a compelling statement for the value of the protections indigenous peoples give to forests, the researchers claim that indigenous lands are the most important barrier to deforestation in the Amazon.

Further information:

D Nepstad et al, 2006: Inhibition of Amazon Deforestation and Fire by Parks and Indigenous Lands, Conservation Biology, 2006 Feb;20(1):65-73.

The authors used satellite-based maps of land cover and fire occurrence in the Brazilian Amazon to compare the performance of large (>10,000 ha) uninhabited (parks) and inhabited (indigenous lands, extractive reserves, and national forests) reserves. Reserves significantly reduced both deforestation and fire. Deforestation was 1.7 (extractive reserves) to 20 (parks) times higher along the outside versus the inside of the reserve perimeters and fire occurrence was 4 (indigenous lands) to 9 (national forests) times higher. Uninhabited reserves tended to be located away from areas of high deforestation and burning rates. In contrast, indigenous lands were often created in response to frontier expansion, and many prevented deforestation completely despite high rates of deforestation along their boundaries. The inhibitory effect of indigenous lands on deforestation was strong after centuries of contact with the national society and was not correlated with indigenous population density.

244 **BRAZIL | Indigenous Lands Project (PPTAL)****Adaptation, land rights**

The Brazil Indigenous Lands Project (PPTAL) supported the conservation of natural resources in indigenous areas and the well-being of Indigenous Peoples through regularization of indigenous lands in the Legal Amazon. It has been an innovative effort to improve technical quality and increase indigenous participation and control in the processes of regularizing, protecting and managing their lands. Satellite maps clearly show that the area of the Amazon covered by indigenous lands represents one of the largest remaining reserves of essentially intact tropical forest. According to climate models of climate-tipping points in the Amazon Basin resulting from deforestation, it is this sustainable core of protected areas in the Amazon that buffers against potential climate-tipping points and protects the drier ecosystems of the basin.

Further information:

B. L. Turner II, Protecting the Amazon with Protected Areas, *PNAS* June 30, 2009 vol. 106 no. 26 10582-10586 <http://www.pnas.org/content/106/26/10582.abstract>; WORLD BANK (2008): Sobrevila, Claudia. The Role of Indigenous Peoples in Biodiversity Conservation

245 **BRAZIL | Agro-extractive Cooperative/Cooperativa Agro-extrativista Yawanawa (COOPYAWA)****Adaptation, land rights, livelihood diversification**

Established in 2003, the Cooperativa Agro-extrativista Yawanawa (COOPYAWA) is a representative body of the Yawanawa indigenous people of Acre State. The group endeavors to create income-generation opportunities for its members through the conservation and promotion of the Yawanawa people and one of their native agricultural products: urucum. When the national government stopped purchasing rubber from the Yawanawa in 1992 – previously their central source of income – the group came together to explore other sustainable forms of income generation. The Yawanawa turned to urucum, a local plant extract used in cosmetics. In 2003, the group signed an agreement with Aveda Corporation to market urucum-based cosmetics using the Yawanawa name and equitably share profits. COOPYAWA distributes benefits across the Yawanawa tribes and, through an international advocacy campaign, successfully lobbied to have their tribal territory increased from 92,000 to 187,000 hectares.

Further information:

Equator Initiative Awards 2008, <http://www.equatorinitiative.org/>

246 **BRAZIL | Frutasã, Industry and Trade Export Ltd****Adaptation, agriculture, livelihood diversification**

Frutasã is a joint conservation-business partnership venture owned by a local indigenous association and an NGO. Frutasã is creating income for indigenous populations (the Timbira people) and small farmers through the sustainable extraction, marketing, and sales of native fruit pulps from the threatened Cerrado region of Brazil. The sustainable use of native fruits is helping stop the Cerrado from being completely converted to pasture and soy plantations as the income generated for the traditional populations living in the area provides an alternative to giving in to the pressure of the expanding agricultural frontier and subsequent deforestation. In addition to generating income for over 300 families in the region, Frutasã has supervised the creation of a 160,000 hectare national park, and routinely lobbies the government for environmental public policies and rights for the local community.

Further information:

Equator Prize 2006, http://www.equatorinitiative.org/index.php?option=com_content&view=article&id=510%3Afrutasã&catid=106%3Aequator-prize-winners-2006&Itemid=541&lang=en; GEF Small grants programme BRA/04/15, http://sgp.undp.org/web/projects/7778/increasing_fruit_production_and_processing_at_frutasã_#227__apoio_para_umentar_o_volume_da_produ%C3%A7ã_#2.html

247 **BRAZIL | Amazon Culture Withers as Food Dries Up****Local observations & impacts, food security**

For centuries, fish from jungle lakes and rivers have been a staple of the Kamayurá diet, the Xingu National Park tribe's primary source of protein. But deforestation and, some scientists contend, global climate change are making the Amazon region drier and hotter, decimating fish stocks in this area and imperiling the Kamayurá's very existence. Like other small indigenous cultures around the world with little money or capacity to move, they are struggling to adapt to the changes. Chief Kotok, who like all of the Kamayurá people goes by only one name, said that men could now fish all night without a bite in streams where fish used to be abundant; they safely swim in lakes previously teeming with piranhas. Chief Kotok, who like all of the Kamayurá people goes by only one name, said that men can now fish all night without a bite in streams where fish used to be abundant; they safely swim in lakes previously teeming with piranhas.

Further information:

Elizabeth Rosenthal, 25 July 2007, New York Times As Trees Fall in the Amazon, Fears that Tribes Won't Be Heard, http://www.nytimes.com/2009/07/25/science/earth/25tribe.html?pagewanted=1&_r=1&sq=kamayurã&st=cse&scp=2; An ancient society faces new change in Brazil slide show: <http://www.nytimes.com/interactive/2009/07/25/science/earth/20090725-kamayurã-audio/index.html?scp=5&sq=kamayurã&st=cse>

248 **BOLIVIA | Adapting to increasing aridity and changing hydrology around Lake Titicaca****Adaptation, water resources**

Project development activities are planned in the predominantly indigenous region surrounding Lake Titicaca, leading to a portfolio of projects focusing on adaptation to increasing aridity and changing hydrology in the Bolivian Altiplano.

Further information:

UNDP, www.undp-adaptation.org/project/cba

249 **BOLIVIA | Qhuthañas in Bolivia: Collecting and storing rainwater in small dams (qhuthañas)****Adaptation, drought, agriculture, water resources, food security, traditional knowledge**

The Aymaran indigenous people of Bolivia have adopted traditional practices to collect water in the mountains and pampas by way of constructing qhuthañas. In Bolivia, droughts affect—at varying levels—at least 40% of its territory. To prevent and mitigate disasters caused by droughts, the Aymaras build small dams (called qhuthañas in the native language). These dams collect and store rain water from various places such as mountains and pampas. Water stored in qhuthañas represents a valuable resource for both people and domestic and wild animals, because it allows them to drink water during periods of drought. In addition, these 'mirrors' or 'bodies of water' serve as thermo-regulators of humidity related to the environment and diffuse the damaging rays of sunlight which cause skin cancer.

Further information:

UNFCCC Database on local coping strategies, Case Study 92, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=137; Félix Gutiérrez Matta (2003), Aymaran Rainwater Harvesting, In: ISDR Turning the tide on disasters towards sustainable development, 2003 World Disaster Reduction Campaign.

250 **COLOMBIA | Consolidation of the Amazon (COAMA) Programme****Adaptation, forests, biodiversity, land rights**

The COAMA (Consolidation of the Amazon) programme was initiated in 1989, to secure indigenous territorial rights and the conservation of vast areas of tropical forest in the Colombian Amazon, to build the capacity of local indigenous people to assume local governance, and to strengthen resilience to withstand external pressures and adapt to climate instabilities. COAMA empowers the local indigenous people to preserve the forest and biodiversity and encourages

Further information:

COAMA, <http://www.coama.org.co>; GAIA Amazonas, <http://www.gaiaamazonas.org>

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policy-makers to develop alternative natural resource management systems based on indigenous knowledge. It builds capacity at the community level through providing access to professionals and technicians in different disciplines, and works at the national and international level to increase understanding, awareness and political willingness. Fundación Gaia Amazonas in Colombia provides a Secretariat for the COAMA programme; The Gaia Foundation, UK, is co-founder and European counterpart. Funders include the European Commission, SIDA, Sigrid Rausing Trust, Austrian Government (through Global2000), DANIDA, Dutch Embassy, Novib-Oxfam, IUCN-Netherlands Committee.

251 COLOMBIA | Integration of ecosystems and adaptation to climate change in the Colombian Massif

Adaptation, water resources, natural resource management

The Colombian Massif area has been identified as Colombia's Water Sponge, home to 65 water areas from which the country's largest rivers originate: Magdalena, Cauca, Patía, Caquetá, Putumayo and Saldaña, all key affluents for the country's agricultural development and which supply around 70% of the Colombian population. The region is home to seven indigenous ethnic groups with a population equivalent to 27% of the national indigenous population, located in just 1.7% of the country's territory. This project is developing pilot adaptation measures in the Colombian massif aimed at strengthening the sustainable practices of indigenous communities and other rural inhabitants. It is also working to integrate environmental issues within the national development agenda, with an emphasis on reducing vulnerability.

Further information:

MDG Achievement Fund, <http://sdnhq.undp.org/opas/en/proposals/suitable/256>, Program Conjunto Integración de Ecosistemas y Adaptación al Cambio Climático en el Macizo Colombiano, <http://www.cambioclimaticomacizo.org>, Enamorate de TU Planeta, <http://www.enamorate-detuplaneta.org>

252 COLOMBIA | Conservation and Sustainable Development of the Mataven Forest

Adaptation, biodiversity, land rights, livelihoods

In the Mataven project in Colombia, 16 indigenous communities lead the land planning process to establish a conservation area extension to their already demarcated indigenous territory. This project has assisted six different ethnic groups—the Piapoco, Piaroa, Cubeo, Sikuani, Curripaco, and Puinave in the Mataven Forest—to map natural resources, demarcate their lands, produce and market crafts, and strengthen their organizations.

Further information:

World Bank (2008): Sobreviva, Claudia. The Role of Indigenous Peoples in Biodiversity Conservation

253 COLOMBIA | Jepirachi wind power project in Colombia

Adaptation, energy

The Guajira region on the north-east Atlantic coast of Colombia is one of the poorest on the South American continent, with high levels of disease and illiteracy and, prior to this project, it had no permanent access to water or reliable access to electricity. The Government of Colombia has given the Wayuu, the indigenous people of the area, legal rights to their traditional lands. A windswept, arid, coastal region, Guajira is an ideal location for wind generation. The Jepirachi wind power project, established by the World Bank through its Prototype Carbon Fund (A partnership between 17 companies and six Governments, and managed by the World Bank, the PCF became operational in April 2000. As the first carbon fund, its mission is to pioneer the market for project-based greenhouse gas emission reductions while promoting sustainable development and offering a learning-by-doing opportunity to its stakeholders. The Fund has a total capital of \$180 million (www.carbonfinance.org). with the utility company Empresas Públicas de Medellín and support from the Ministries of Mines and Energy, became operational in February 2004. The project aims to build 15 windmills, which will provide emission reductions of 1.2 million tonnes of CO₂ over 21 years.=

Further information:

Andrew Simms and Hannah Reid (2006) Up in Smoke? Latin America and the Caribbean, <http://www.iied.org/pubs/display.php?o=1001711ED>; Prototype Carbon Fund (2003) Clean Development Mechanism Project Design Document. Colombia: Jepirachi Wind Power Project. 8 September 2003; World Bank, <http://carbonfinance.org/pcf/router.cfm?Page=Projects&ProjectID=3119>

The World Bank asserts that the Jepirachi wind power project also contributes to the sustainable development of Colombia. The demonstration of the potential of wind-based energy generation at the commercial level is expected to bring investment into the country. The non-hydraulic energy contributed by the project to the national grid is critical for Colombia, as it enhances the reliability of the grid in the wake of the power shortages, severe drought and forced rationing of the 1990s. Finally, the project will contribute to the development of the host indigenous community by financing a series of community-driven projects designed in consultation with the project sponsor. The features of the social plan include training to facilitate direct and indirect job creation; the provision of a water desalination plant fed by wind power; the provision of water storage depots; the rehabilitation of the cemetery; and the provision of health and educational facilities. The project has employed almost 150 indigenous individuals during its construction.

254 COLOMBIA | San Andrés de Sotavento clean development mechanism project

Adaptation, forests, payment for ecosystem services

In the northern tropics of Colombia, the indigenous peoples of San Andrés de Sotavento are partners in a project with the Environmental corporation of the Sinu and San Jorge Rivers, the Colombian National Agricultural Research Organization and the International Center for Tropical Agriculture. This clean development mechanism project aims to regenerate degraded tropical savanna by establishing silvopastoral systems and reforested areas over 2,600 hectares. This will yield increased income and profits for landowners and a healthier ecosystem. The BioCarbon Fund acts as the broker for carbon trading and certifies the carbon emission reductions.

Further information:

UNPFII, 2008: Information received from Governments E/C.19/2008/5/Add.1; CGIAR, http://www.ciat.cgiar.org/epmr_ciat/pdf/poster_45_epmr07.pdf

255 ECUADOR | Adaptation with Waorani and Timpoca communities

Adaptation, forests, livelihoods

This GEF funded project collaborates with the Waorani and Timpoca communities to create a sustainable management plan of raising palms and frogs to earn income. Waorani territory is located within the Yasuní National Park. Traditionally the Waorani were nomadic, but customs changed when oil companies began extractive activities in the park (in 1993). This enforced sedentary lifestyle has led to intensive hunting concentrated in a small area, the gradual loss of the quality of life.

Further information:

UNDP Small Grants Program, <http://sgp.undp.org/print.cfm?module=Projects&page=ShowProject&ProjectID=8626>

Due to the increasing demand of natural forest products of the forest, the project involved raising palms used in the creation of purses and hammocks, as well as raising the young of poisonous frogs that are attractive for tourism. These activities are designed to conserve the park's biodiversity and genetic resources, while allowing its inhabitants to obtain economic income.

256 ECUADOR | Sustainable and Effective Practices under Guidelines for Land Use, Land-Use Change, and Forestry

Adaptation, forests, traditional knowledge

This case study examines Pastaza Province, located in the central Ecuadorian Amazon, which is ninety-five percent tropical rain forest (including land where Indigenous Peoples continue to practice their traditional cultures and live in harmony with nature). Indigenous communities in this region have developed alternative economic initiatives that reinforce and strengthen traditional knowledge. In order to face new threats to their rights and territories, these Indigenous Peoples have created strong alliances both among themselves and with local and foreign civil society organizations. Above all, the protection and sustainable use and management of tropical rain forests enhances international efforts to mitigate the effects of the changing global climate.

Ninety-five percent of the forest in Pastaza Province has been preserved because of the lifeways of the Indigenous Peoples inhabiting the area.³² Using traditional knowledge to manage the forests has resulted in the perpetuation and nurture of these wooded areas, partly because there is no exchange between the economies of Indigenous and nearby non-Indigenous communities; this, in turn, strengthens Indigenous communities' cultures and traditional practices. These efforts involve preventing deforestation, thereby reducing the percentage of emissions caused by deforestation, and allowing forests to persist and naturally capture carbon.

257 ECUADOR | Biodiversity Conservation in Pastaza Project

Adaptation, natural resource management, livelihoods, capacity-building

The Ecuador Biodiversity Conservation in Pastaza Project was designed to improve the sustainable use of biodiversity through the creation and implementation of community management plans in three Quichua communities located in the southeastern Amazon region of Ecuador. The communities designed management plans that assessed the key biological resources in a 250,000-hectare area spanning the community territories of Yana Yacu, Nina Amaran, and Lorocach. The plans included three principal components: a proposal for community zoning based on ancestral criteria of land use, a proposal of Community Standards for the sustainable management of the principal biological resources of the territory, and a proposal for projects to recuperate the quality of life of the families in the three communities. Criteria utilized in developing the management plans included the existence of ancestral spaces, the validity of community regulations oriented toward the conservation of the principal threatened species of fauna and sacred places, and the ancestral forms of administration of community justice. In the Ecuador project, participating community families consider that they have improved their local economy. The project increased productivity of their crops and established microprojects with species of short-cycle crops. The resulting surplus from the production (particularly from the short-cycle crops) allowed the community to have a seed bank for future crops and to trade or exchange for corn, peanuts, or other managed vegetable species (at small scales). The project allowed indigenous farmers to plant 40 hectares of organic cacao in the buffer zone. The Ecuador Biodiversity Conservation in Pastaza Project implemented a community-level capacity-building program that helped develop skills for the sustainable management and conservation of the ecosystems and biodiversity of the indigenous territories of Pastaza. The program emphasized participatory diagnostic methodologies, design of management plans, management of biodiversity, socio-environmental monitoring, and evaluation of the indigenous territories and their management plans.

258 GUATEMALA | Landslides and soil erosion

Adaptation, disaster preparedness

UNDP has several community-based adaptation projects under development in Kiché and Mam communities, focusing on reducing the increasing risks of landslides and soil erosion in the highland agro ecosystems.

259 COLOMBIA | Association of Indigenous Producers and Farmers of Riosucio, Caldas (ASPROINCA)

Adaptation, food security, energy

Based in the northern Caldas region of Colombia, Asociación de Productores Indígenas y Campesinos de Riosucio Caldas (ASPROINCA) is a community-based organization that works with close to 400 indigenous farming families to diversify their agricultural production in an environmentally responsible manner. A key objective of the association is breaking local dependence on coffee production. The association has been successful at working with local farmers to: increase food security; institute sustainable agricultural practices; integrate composting; and recuperate native varieties of beans, maize, panelera cane, and fodder plants. An innovation of the association has been training farmers to harness biogas, thereby relieving pressure on surrounding forests for firewood.

260 ECUADOR | Pastaza Forestry Case Study

Adaptation, traditional knowledge, forests

It is evident that land-use change can have unfortunate consequences on traditional forest management systems; therefore, giving Indigenous Peoples incentives to strengthen their systems can be beneficial for the entire country. In some cases, the techniques of participatory community mapping coupled with current technology determine how resources are used. This, in turn, has led to territorial organization, zoning, and the development of future plans for the Amazo-

Further information:

Johnson Hugo Cerda Shiguango (2006), The Ecuador Case Study: Sustainable and Effective Practices under Guidelines for Land Use, Land-Use Change, and Forestry, International Alliance of Indigenous and Tribal Peoples of Tropical Forests, http://www.international-alliance.org/cop12_unfccc.htm

Further information:

WORLD BANK (2008): Sobrevila, Claudia. The Role of Indigenous Peoples in Biodiversity Conservation; World Bank Project Po57034, <http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&Projectid=Po57034>

Further information:

UNDP, <http://www.undp-adaptation.org/project/cba>

Further information:

Equator Initiative Awards 2008, <http://www.equatorinitiative.org/>

Further information:

Further information: <http://www.international-alliance.org/documents/Climate%20Change%20-%20Ecuador.pdf>

Johnson Hugo Cerda Shiguango (2006) The Ecuador Case Study: Sustainable and Effective Practices under Guidelines for Land Use, Land-Use Change, and Forestry. A case study commissioned by the International Alliance of Indigenous and Tribal Peoples of Tropical Forests.

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nian nationalities. One focus of this case study is Pastaza Province, located in the central Ecuadorian Amazon, which is ninety-five percent tropical rain forest (including land where Indigenous Peoples continue to practice their traditional cultures and live in harmony with nature). Indigenous communities in this region have developed alternative economic initiatives that reinforce and strengthen traditional knowledge. In order to face new threats to their rights and territories, these Indigenous Peoples have created strong alliances both among themselves and with local and foreign civil society organizations. Above all, the protection and sustainable use and management of tropical rain forests enhances international efforts to mitigate the effects of the changing global climate.

261 ECUADOR | Ecuador's Big Melt

Local observations of impacts, water resources

Glaciers in Ecuador are also shrinking rapidly due to global warming. The ice surface on the volcano Cotopaxi reduced by 31 per cent between 1976 and 1997, and the glacier has shrunk from 21.2 km² to 14.6 km², according to a report by the French Institute for Development (IRD) and the Ecuadorian Instituto Nacional de Meteorología e Hidrología (INAMHI). Over the next 10 to 20 years the country will lose at least four of its eight most important glaciers. The phenomenon is linked to the growth of arid areas and soil loss and desertification, as well as native ecosystem loss, the disappearance of species, and loss of agricultural land. All this puts the country's ability to feed itself at risk and has a special impact on Andean indigenous culture by forcing indigenous people to migrate. A warming climate forces people to farm at higher altitudes to grow their staple crops, adding to deforestation. This in turn undermines water sources and leads to soil erosion. And there is also a cultural impact.

The displacement of millenary Andean cultures to higher lands means the loss of the places where their culture is rooted, putting its survival at risk. The native communities of the Imbakucha Basin in Otavalo, Ecuador, already feel the impact of climate change. Unexpected frosts and long drought periods affect all farming activities. The older generation say they no longer know when to sow because the rains do not come as expected. Migration offers one way out but represents a cultural nemesis and the human and social price to pay is high. The same is true for other communities living in areas between 2,500 and 3,500 metres above sea level, who depend on rain for cultivation. Coastal communities are also affected. Carbon sequestration through forest growth is said to mitigate global warming, but where plantation monocultures of exotic plants replace the fragile ecosystems of the páramos, the sequestration benefits are questionable. Helped by weak legislation in Ecuador, these plantations make it easier and cheaper for high-polluting rich countries to offset their greenhouse gases emissions in developing countries rather than at home. But not all the costs are being counted: the plantations negatively affect the hydrological cycle and also reduce the amount of land available for the indigenous population. Not only is the climate changing, so, too, are the lives of the indigenous population and farming communities.

Further information:

Andrew Simms and Hannah Reid (2006) *Up in Smoke? Latin America and the Caribbean*, [http://www.iied.org/pubs/display.php?o=1001711EDmms and Hannah Reid \(2006\) Up in Smoke? Lati](http://www.iied.org/pubs/display.php?o=1001711EDmms%20and%20Hannah%20Reid%20(2006)%20Up%20in%20Smoke%20Lati)

262 ECUADOR | Union of Farming and Indigenous Organizations of Cotacachi (UNORCAC)

Adaptation, agriculture, biodiversity, food security, capacity-building

UNORCAC is an organization of 3,225 Quichua families that is dedicated to improving the quality of life of indigenous Ecuadorians. The group focuses its work on the conservation of agricultural biodiversity, the reintroduction and maintenance of traditional cultural practices, and comprehensive community participation. Unión de Organizaciones Campesinas e Indígenas de Cotacachi (UNORCAC) focuses on local capacity building in three areas: apiculture, ethno-tourism, and high-value crops (in particular, blackberries). A critical achievement of the organization has been the reintroduction of traditional crops and medicinal plants, a process of cultural renewal that has also resulted in the valuation of over 130 native plant species. Local incomes have risen dramatically and community members now grow more than half of their own food.

Further information:

Equator Initiative Awards 2008, <http://www.equatorinitiative.org/>; UNORCAC, <http://www.unorcac.org>

263 ECUADOR | Federation for Ecuadorian Community Tourism (FEPTCE)

Adaptation, livelihoods, tourism, biodiversity

A partnership of sixty community-based initiatives composed of indigenous peoples, afro-Ecuadorians, and farmers, Federación Plurinacional de Turismo Comunitario del Ecuador (FEPTCE) focuses on encouraging eco-friendly tourism. Since FEPTCE's establishment in 2002, participating communities have experienced an increased quality of life, gaining access to health services and education, increased employment, and public interest in biodiversity and agriculture. Communities have invested in reforestation and the protection of native flora and fauna, successfully protecting 25,000 hectares in order to use the region's biodiversity as a marketing tool to promote tourism. Conserving biodiversity has permitted the FEPTCE communities to diversify their economy, leading to added income and an improved standard of living.

Further information:

Equator Initiative Awards 2004, <http://www.equatorinitiative.org/>; Turismo Comunitario, <http://www.turismocomunitario.ec>

264 ECUADOR | Yasuni-ITT Proposal

Adaptation, payments for ecosystem services, energy

The Yasuni Park is located in the Ecuadorian Amazon region in the provinces of Orellana and Pastaza. It covers an area of 6,100 square kilometres and is one of the most bio diverse regions in the world. The park is home to the indigenous Waorani people, of which three clans live in voluntary isolation (Taromenane, Tagaeri and Oñamenane). Yasuni is on the frontline in the battle to protect the Amazon rainforest and prevent further deforestation, which accounts for between 20 percent and 25 percent of global greenhouse gas emissions. Climate change is already threatening the rainforest, raising temperatures, disrupting rainfall patterns, causing droughts and increased forest fires.

Further information:

Yasuni Green Gold Campaign, <http://www.yasuniorengold.org/>; Live Yasuni, <http://www.liveyasuni.org/>

Yasuni contains Ecuador's largest oil reserves, the 900 million barrel Ishpingo-Tambococha-Tiputini (ITT) oilfields. ITT oil is a heavy crude oil which is difficult to extract and produces 4 barrels of water for each barrel of oil. This formation

water is typically re-injected into the ground, with associated impacts to pristine ecosystems, particularly watersheds. The foreseen impacts of any extractive activity in the park include deforestation and its associated impacts on climate change, destruction of social structures and extinction of cultures. The Yasuni-ITT proposal looks for an alternative for the oil exploitation of the ITT oil block. In compensation, the Ecuadorian government seeks the contribution of the national and international communities to implement this expensive national decision. Its goal is to obtain 50% of the income it would gain from exploiting the oil block. Among the options for revenue substitution that share parity with ITT's value are debt relief or direct compensation in exchange for carbon credits. In exchange for keeping the crude oil in the ground, the Ecuadorian government has asked for compensation of \$350 million a year for 10 years. It has signaled its willingness to consider placing the funds in a financial trust that could be structured to include international co-administration. These funds would be allocated towards environmental and social development programs, helping Ecuador move towards a sustainable economy while preserving the rainforest, and recognizing the rights of the Waorani and other indigenous communities in Yasuni.

265 GRENADA | Contour ploughing to reduce soil erosion

Adaptation, disaster preparedness, agriculture, food security, traditional knowledge

Natural disasters and most recently recurrent severe hurricane seasons that appear to be linked to climate change have seriously destabilized the socio-economic fabric of Grenada. The agricultural sector, to which the island's economic fortunes are historically linked, is particularly vulnerable and has been greatly damaged by natural hazards. The island's vulnerability is further aggravated by its mountainous terrain. One of the local agricultural practices used to prevent and mitigate the negative consequences of hazards is contour ploughing. Crop row ridges are built by tilling and/or planting on the contour, creating hundreds of small dams. These ridges or dams slow water flow and increase infiltration which reduces erosion.

Contour ploughing is a soil conservation technology that is practiced throughout Grenada to mitigate the negative consequences of natural disasters on soil quality and composition. It is performed by following the natural contours when tilling the soil, planting and cultivating. Best practiced on slopes between 15-20 degrees, it is a very cost effective and sustainable practice when properly planned and applied. Contour ploughing prevents and mitigates the impacts of floods, storms and landslides in the cropping sub sector by reducing soil erosion up to 50%, controlling runoff water, and increasing moisture infiltration and retention thus enhancing soil quality and resilience.

Further information:

UNFCCC Database on local coping strategies, Case Study 184: http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=184; Contour ploughing in Grenada in FAO's TECA (Technology for Agriculture) database; Grenada Ministry of Agriculture, 2004, Assessment of damages resulting from Hurricane Ivan. OECS, 2004, Grenada – Macro-socio-economic assessment of the damages caused by Hurricane Ivan

266 GUATEMALA | Sierra de Las Minas Water Fund

Adaptation, water resources, payment for ecosystem services

The Motagua-Polochic System, located along Guatemala's Atlantic Coast, is one of the most biodiverse regions within the Mesoamerican Biological Corridor. Among the protected areas located here is the Sierra de las Minas Biosphere Reserve (SMBR), considered as Guatemala's most precious jewel within the national protected areas system. These rivers also flow downwards towards the Polochic river valley, on the SMBR montane tributaries support the Q'eqchi', Poqomchi' and Achi' Mayan indigenous groups. Water resources here are essential to support mostly subsistence-based agriculture and some coffee, cardamom and fruit production for export.

The SMBR Water Fund is a World Wildlife Fund (WWF) initiative to finance responsible water management. It promotes activities upstream that are expected to increase recharge and decrease erosion and support major users (industry) to increase their water use efficiency and reduce the impacts of their effluents. Savings are to be invested in the fund and channelled upstream to protect the buffer zone of the SMBR. The project was driven by an interest in increasing financial support to the Biosphere Reserve to protect the biological integrity of the reserve, and its hydrological functions, particularly in terms of water delivery, as local water users have in recent years noted a fall in water quality and quantity, particularly during the dry season that appears to be linked to climate change.

This Payments for Environmental Services (PES) scheme represents the heart of a much broader initiative that takes into account several other project components including integrated river basin management, efficient irrigation systems, scientific research development, clean production, strengthening local water management and governance capacities and undertaking environmental education and awareness-raising among target groups. The approach taken so far has been to try and buy the land in the core area of the SMBR. The goal of the present PES initiative is to promote shade coffee and sustainable agriculture (soil conservation measures and low use of fertilizers) by channelling funds to the farmers living in the reserve's buffer areas: large private farmers and forest owners (coffee, cattle), indigenous community forest owners (subsistence production of corn, beans, coffee); and cooperatives (coffee, sugar and vegetables). On the provider side, the projects financed by the water fund include (such as the production of environmentally friendly organic coffee) could improve income for farmers and benefit indigenous communities diversifying their income sources.

Further information:

http://www.watershedmarkets.org/documents/Guatemala_Sierra_Minis.pdf

WWF. 2005. The Water Fund Model Motagua-Polochic System, Guatemala- A Novel environmental Payment Scheme with the Private Sector. <http://www.wwfca.org/php/proyectos/agua/fondoo1eng.php>

267 GUYANA | Adopting a nomadic lifestyle and crop changes

Adaptation, agriculture, displacement

Indigenous peoples in the Central, South American and Caribbean regions are shifting their agricultural activities and their settlements to new locations that are less susceptible to adverse climate conditions. For example, indigenous peoples in Guyana are moving from their savannah homes to forest areas during droughts and have started planting cassava, their main staple crop, on moist floodplains which are normally too wet for other crops.

Further information:

UNPFII (2007): Climate Change: An Overview, http://www.un.org/esa/socdev/unpfii/en/climate_change.html

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268 GUYANA | National Protected Areas System (gNPAS) Project

Local observations & impacts, land rights, energy

Since 1994 the government of Guyana has been seeking international support to establish a system of protected areas. It was in this context that the Guyana National Protected Areas System (GNPAS) project was initially conceived as a component of a World Bank/IDB Natural Resources Management Project. Guyana's National Strategy for the Establishment a Protected Areas System was being conceived within a country that had no national legislation to protect Indigenous Peoples' rights. These concerns were raised by Indigenous Peoples. To address those concerns, the Bank conditioned its approval of GNPAS on the passage of an Ameridian Law that would protect the Indigenous Peoples of Guyana. After several years of negotiating the language of this law, the Bank decided to pull out of the GNPAS because the Ameridian Law had not reached a level of satisfaction compared to other standards in the region.

Further information:

Further information: WORLD BANK (2008): Sobrevilla, Claudia. *The Role of Indigenous Peoples in Biodiversity Conservation*

269 HONDURAS | Using traditional techniques to protect watersheds

Adaptation, water resources, traditional knowledge

In the remote village of Guarita in Honduras, traditional techniques have become the starting point for climate change adaptation. The village was one of the few places in the region that successfully avoided the worst destruction from Hurricane Mitch in 1998. The traditional Quezungal farming methods that are practiced by the local villagers protected the upper catchment and only 10% of crops were lost. Traditional farming in this area involves planting crops under trees whose roots anchor the soil, pruning vegetation to provide nutrients to the soil and conserve soil water, and terracing to reduce soil erosion. On the other hand, methods that are taught at agricultural colleges and then applied to the surrounding areas are damaging as they are more suited for the plains rather than farmland in hill terrain. The traditional Quezungal method avoids widespread slash and burn techniques and also improves soil fertility. The success in the village is being actively promoted by the Government of Honduras in collaboration with the UN Food and Agricultural Organisation.

Further information:

International Union for Conservation of Nature (2008). *Indigenous and Traditional Peoples and Climate Change*. http://cmsdata.iucn.org/downloads/indigenous_peoples_climate_change.pdf. From Bergkamp, G., Orlando, B., and Burton, I. 2003. *Change – Adaptation of water resources management to climate change*. IUCN, Gland from Gunson, P. 1998. 'Honduran Villagers Survived Mitch with a Method as old as the Hills.' *The Gardian*. January 23. <http://data.iucn.org/dbtw-wpd/edocs/2003-004.pdf>

270 HONDURAS | CDiversified plant varieties

Adaptation, agriculture, biodiversity

In Honduras, farmers organized community-based agricultural research teams, to diversify their plant genetic resources and develop hardier plant varieties that grow well on their soils. Responding to the higher occurrence of hurricanes, farmers were able to produce improved maize varieties through a participatory breeding process that are shorter and capable of withstanding the physical trauma brought by the hurricanes, with a higher yield and yet are still adapted to high-altitude conditions. The selection process was accompanied by a conservation effort, as the seeds of the selected species are stored in a community seed bank, assuring availability of healthy and resistant plants.

Further information:

PAR Climate Change Project (2010): *The use of agrobiodiversity by indigenous and traditional agricultural communities in adapting to climate change*. http://www.agrobiodiversityplatform.org/blog/wp-content/uploads/2010/05/PAR-Synthesis_low_FINAL.pdf

271 HONDURAS | Community water resource management in Ibans Lagoon, La Mosquitia, Honduras

Adaptation, water resources, natural resource management

Ibans Lagoon is located within the Río Plátano Man and Biosphere Reserve (RPMBR) in the Mosquitia area of north-eastern Honduras. The reserve covers an area of over 8,300 km². It has been recognised as a World Heritage Site since 1982 due to its exceptional diversity of marine and terrestrial ecosystems that include coastal wetlands, tropical broadleaf forests, and areas of pine savannah. The reserve is home to three indigenous groups – Miskito, Pech and Tawahka – as well as members of the Garifuna ethnic group and Ladinos from other parts of Honduras. Most people live on the coast or along the major rivers where they farm, hunt, fish, and gather useful products from the forest, including firewood, timber for building houses and canoes, and medicinal plants. The reserve's coastal wetlands consist of a series of lagoons, canals and swamps. Ibans is the second-largest lagoon in the reserve. It covers approximately 64 km² and becomes brackish during the drier times of the year. Several Miskito communities are located on the thin strip of land between the lagoon and the sea, sharing the lagoon and its associated ecosystems, including the forests of the water catchment area. Rapid population growth and the immigration of landless farmers from other parts of Honduras into the zone are putting pressure on the area's natural resources leading to deforestation, over-fishing, over-hunting, erosion, sedimentation, and soil and water pollution. Climate change is adding to these pressures. One of the most pressing concerns for the communities is the erosion of the narrow coastal strip caused by the waves from both the lagoon and the sea, particularly during bad weather. This is exacerbated because much of the shore vegetation – including mangroves – has been removed for firewood, to create space to build houses, for boat landings, and to provide access to the lagoon for bathing and washing clothes. The older people tell of when they used to have a house or land in areas now covered by water. During Tropical Storm Michelle in 2000, in some parts of the village of Cocobila several metres of land were lost with the result that at the narrowest point there are now fewer than 100m between the lagoon and the sea. As this is an area frequently affected by tropical storms, and sometimes hurricanes – notably Hurricane Mitch in 1998 – the high rate of erosion increases the risk of flooding in the villages and therefore damage to infrastructure and housing. Also during Michelle, along the coast towards Palacios, the main river that drains the lagoon broke through the sand bar into the sea in an uninhabited area where much of the vegetation had been removed. As a result, the salinity of the lagoon has increased because salt water now makes its way up river during high tides or when the river is low. Although the effect on fish stocks and the general lagoon ecosystem has not been monitored, this is likely to cause substantial changes.

Further information:

Tearfund partner MOPAWI (Mosquitia Pawisa) in Andrew Simms and Hannah Reid (2006) *Up in Smoke? Latin America and the Caribbean*, <http://www.iiied.org/pubs/display.php?o=1001711ED>

In extreme environmental conditions, such as those expected under climate change, locally adapted food crops are invaluable in producing sufficient food for survival. The conservation and development of local agricultural biodiversity is crucial in the face of climate change. In the high Andes of Peru and Bolivia, local potatoes, or papas, and alpacas provide the basis for survival in inhospitable conditions. Communities living at altitudes above 3800m get help from the UK-based group Practical Action to commercialise native potatoes as niche products in local markets. The approach has been to set up a revolving fund for native potato seeds and seeders for local production. This is complemented by a local

system to provide technical assistance. Technical leaders, or Kamayoq, are chosen by the community to receive training. A direct relationship was found between local well-being and the level of biodiversity in two important areas. Higher levels of biodiversity reduced the risks from insect attacks and climate change. And being able to provide a greater range of dishes at meal times gave both status and social recognition. In higher lands, conserving biodiversity is a particularly important survival strategy. Yet, development that promotes agricultural modernisation reliant upon high inputs and monoculture approaches, has led to the loss of biodiversity. New participative methods are needed to reevaluate appropriate technologies, and to value the culture that has produced such a diversity of potato varieties.

272 NICARAGUA | Deforestation and deteriorating conditions for the Miskito

Local observations of impacts, traditional knowledge, water resources

Miskito Indians make up the majority of Nicaragua's 85,000-strong indigenous population. They live in Nicaragua's western territories and subsist on crops that are planted on a few hectares of land and food hunted from the jungle and rivers. Isolated from modern farming techniques and crippled by poverty after years of economic neglect and discrimination, the Miskito are already being severely affected by changes in climate. Floods occur in the summer followed by drought in the winter, so planting season is completely out of sync with the traditional rhythms of the Miskito culture. During the rainy season the Rio Coco usually flows but recently the river has been extremely low. The normal mode of transportation is by boat so basic supplies such as salt and drinking water can no longer reach the villages as there is also a lack of roads in the area. In addition the low volume of water means that pollution becomes concentrated and people are more susceptible to cholera and tuberculosis. Massive deforestation is occurring in the area, an estimated 50% of rainforest has been logged in the last 50 years, which is also believed to be a contributing factor to the deterioration of river flows in the region. There is now a ban on deforestation, but there is no effective policing resulting in commercial logging operations pushing deeper into the forest. Oxfam have aided by installing weather monitoring stations along the banks of the Rio Coco to help Nicaragua's indigenous peoples deal with the impact that increasingly unpredictable weather patterns are having on their way of life. However, the long-term ability of the Miskitos to adapt is looking increasingly uncertain. Further efforts are needed beyond traditional knowledge and skills to adapt to the ever increasing change in climate.

Further information:

International Union for Conservation of Nature (2008). Indigenous and Traditional Peoples and Climate Change. http://cmsdata.iucn.org/downloads/indigenous_peoples_climate_change.pdf. From Kelly, A. 2007. Hope dries up for Nicaragua's Miskito. Guardian Unlimited. <http://environment.guardian.co.uk/climatechange/story/0,,2090053,00.html>, Accessed June 11, 2007

273 NICARAGUA | Awas Tingni case

Local observations of impacts, land rights

The Awas Tingni case in Nicaragua paved the way for recognising indigenous peoples' rights based on land occupancy and relationship to the land. On 31 August 2001, the Inter-American Court of Human Rights handed down a judgment on The Case of the Mayagna (Sumo) Awas Tingni Community v. Nicaragua. The judgment put an end to a long-standing contentious case between the Awas Tingni Community and the State of Nicaragua concerning the group's communal property rights over its ancestral lands, and at the same time set a very important precedent for the protection of indigenous rights both in Nicaragua and in the international system. The Court ordered Nicaragua to compensate the Community for the violation of human rights by demarcating and titling the contested territory within a period of 15 months. Setting an important precedent for the protection of indigenous rights in the international system, the Court stated that indigenous territorial rights are not based on the existence of a formal title granted by the State, but on "actual possession" by communities, rooted in their own "customary law, values, customs and mores." The Court also recognized the importance that the relationship with the land holds for indigenous peoples, stating, "Indigenous groups, by the fact of their very existence have the right to live freely in their own territory; the close ties of indigenous people with the land must be recognized and understood as the fundamental basis of their cultures, their spiritual life, their integrity and their economic survival."

Further information:

Indian Law Resource Centre, 'Nicaragua / Awas Tingni Community', http://www.indianlaw.org/en/projects/past_projects/nicaragua; Danaida (2008) Technical Note: Linkages between Biodiversity Management, Indigenous Peoples Rights and the Emerging Consequences of Climate Change; Rainforest Foundation US 'Our work in Nicaragua', <http://www.rainforestfoundation.org/?q=en/node/83>

The progress of this legal case has itself been impacted by climate change. For example, in September 2007 when Hurricane Felix, a category five hurricane, hit the Atlantic coast of Nicaragua. Almost all of the houses in Awas Tingni were destroyed, crops were devastated and animals were killed. Even more than a year later, there were no healthy large trees in the area. The Awas Tingni community quickly mobilized after Hurricane Felix to rebuild their community's infrastructure. However, the disaster delayed land titling and diverted national attention from the process.

274 PANAMA | Recovery of the traditional knowledge of the Kunas women of Panama

Adaptation, traditional knowledge, food security

The Recuperación del conocimiento tradicional de las mujeres Kunas de Panama proposal has been designed by the Kuna IPO Fundación para la Promoción del Conocimiento Indígena (FPCI) on demand and in collaboration with 6 indigenous communities in the Comarca Kuna Yala (Panama) and the indigenous women network Red de Mujeres Indígenas sobre Biodiversidad. The project addresses: 1) the risk of extinction of traditional knowledge both related to agricultural biodiversity and typical handicraft techniques; 2) the loss of native seeds and cultivations that is weakening indigenous families food security. Strong emphasis is placed on empowerment of women. The project is aimed at recovering indigenous knowledge through the strengthening of women's key roles in maintaining and transmitting it to new generations.

Further information:

IFAD, <http://www.ifad.org/english/indigenous/grants/projects/regions/lac.htm>

275 PANAMA | Native Species Reforestation, Panama

Adaptation, payment for ecosystem services

The CO2OLUSA/Futuro Forestal project is seeking to create certified emissions credits for both regulatory and voluntary markets through sustainable reforestation in Panama. The project involves emissions reductions through: 1) sustainably managed commercial timber plantations; 2) reforestation in areas that will eventually be passed on to local communities who will be in charge of managing and protecting them to ensure the permanency of carbon storage; and 3) the protec-

Further information:

The Climate, Community & Biodiversity Alliance, <http://www.climate-standards.org/projects/index.html>

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tion of existing secondary forest areas that are part of the land that Futuro Forestal acquires for the implementation of its reforestation services. While the project is not being undertaken on Indigenous-owned land, it is employing a number of Indigenous people. In particular, its Las Lajas operation is close to the NgobeBugle Indigenous reserve and approximately 60% of the workers at this operation belong to the NgobeBugle Indigenous group.

276 PANAMA | Panama-Atlantic Mesoamerican Biological Corridor Project

Adaptation, biodiversity, capacity building, land rights

The Panama-Atlantic Mesoamerican Biological Corridor Project provides an example of how the embracing of indigenous lands is central to achieving a country's overall conservation vision. This project integrated indigenous groups as major participants in all components of the project and treated indigenous comarcas, or territories, as important foci for conservation action. At the outset, the project signed formal agreements with indigenous communities guaranteeing their participation in planning and implementation of the Mesoamerican Biological Corridor in their comarcas. Capacity-building activities specifically targeted indigenous communities, and two-thirds of the community leaders who received training on environmental legislation, the biological corridor, and participation and organization were indigenous. The project supported meetings of the General and Regional Indigenous Congresses, as well as meetings to discuss the protection of indigenous territories and the resolution of land tenure conflicts between indigenous communities and settlers. Indigenous communities were supported on 15 exchanges with communities inside and outside Panama to build capacity for sustainable development subprojects. Finally, indigenous communities accounted for 75 percent of the 100 alternative livelihoods subprojects financed by the project, at a total cost of almost US\$2 million.

The Mesoamerican Biological Corridor project had substantial institutional development impact. The project supported the establishment of a new comarca for the Naso Teribe territory, which overlapped with an important protected area, and was subsequently taken under consideration by the national Congress. With project support, volunteer patrols were created in some territories, and action plans were written for areas where indigenous territories overlap with protected areas. Also, protected-areas management was better integrated with comarca management through the opening of regional offices of the national protected-areas management agency in the Kuna Yala and Ngobe-Bugle comarcas. The project also supported a more visible and active role for indigenous authorities at the national level by financing the preparation of a proposal for the establishment of the National Council for Indigenous Development. The Council would provide the mechanism for Indigenous Peoples to be directly involved in defining their own development strategy and to be included in the national government's social agenda. However, indigenous representatives have complained that they have not yet been effectively involved in the elaboration of this new project.

277 PANAMA | Kuna Yala Conversations with Mother Earth video

Local observations & impacts, biodiversity, sea-level rise, youth, multimedia

Kuna Indians used participatory video in their struggle to conserve their forests, which are their main source of food and medicine. As their traditional island territories are threatened by rising sea levels, they use their film to ask indigenous youth to reconnect with agriculture and invite industrial countries to cooperate in the conservation of biodiversity.

278 PANAMA | Integration of Climate Change Adaptation and Mitigation Measures in the Management of Natural Resources in Four Priority Watersheds

Adaptation, water resources, payment for ecosystem services

This UNDP, FAO, UNEP, PAHO/WHO and GEF-SGP joint programme will promote the implementation of climate change adaptation and mitigation measures in vulnerable populations through sustainable land management and optimal water use, particularly in the agricultural and forestry sectors. The overall aim of the programme is to build the capacity to adapt to, and mitigate climate change in order to contribute to environmental sustainability and poverty reduction in four priority watersheds in Panama: Tuirá and Chucunaque in Darién, Tabasara in the Ngobe Buglé Territory and La Villa in Arco Seco. These watersheds are situated in three geographical areas: Arco Seco (part of the provinces of Coclé, Veraguas, Herrera and Los Santos), the Ngobe Buglé Territory and Darién province. The Ngobe Buglé Territory and Darién Province have large populations composed mainly of indigenous people with poverty levels of 99% and 68%, respectively. This will be achieved through the development of an Adaptation and Mitigation Strategy and a Pilot Climate Monitoring System, improvement of local management of land and water resources, and increased access to sources of funding, thus contributing to climate change adaptation and mitigation. The financial sustainability of these efforts will be achieved by introducing payment for environmental services projects.

279 PARAGUAY | Protection of Wildlife Areas of Paraguay

Local observations & impacts, land rights

The objective of this project is the conservation of the biological diversity in Paraguay, especially in four protected wildlife areas. As part of the project, the Reserve for the San Rafael National Park was created by an Executive decree in 1992 within the Itapúa and Caazapa Departments. The entire area of the Reserve for the Park was superimposed directly on top of the ancestral lands of the Mby'a Guaraní people without consulting the indigenous communities that pertain to these people and without obtaining their free, prior and informed consent. This was done despite the fact that the Paraguayan State recognizes that these lands are the ancestral lands of the Mby'a Guaraní people.

Further information:

WORLD BANK (2008): Sobrevila, Claudia. The Role of Indigenous Peoples in Biodiversity Conservation; World Bank document 2005/01/23, http://www-wds.worldbank.org/external/default/main?pagePK=64193027&ipPK=64187937&theSitePK=523679&menuPK=64187510&searchMenuPK=64187283&siteName=WDS&entityID=000160016_20060123133712; Onel Masardule, Foundation for the Protection of Traditional Knowledge – FPCI, Panama, August 2006, quoted in Griffiths, T (2006), The Global Environment Study and its Local Benefits Study: A Critique, Forest Peoples Programme, UK www.forestpeoples.org

Further information:

Conversations with the Earth, <http://www.conversationearth.org/>

Further information:

UNDP MDGF-1747, <http://sdnhq.undp.org/opas/en/proposals/suitable/244>

Further information:

Association of Indigenous Communities of Itapúa (ACIDI), the Coordinating Committee for Indigenous Peoples Self-Determination (CAPI) of the Republic of Paraguay; Forest Peoples Program, http://www.forestpeoples.org/documents/ifa_igo/gef/gef-paraguay_ip_rights_let_novo7_eng.shtml

280 PERU | Indigenous Andean Irrigation System

Adaptation, water management, traditional knowledge

As the Himalayan glaciers disappear, extreme glacial melt, seismic activity and extreme weather events are already affecting the region's rivers, lakes, wetlands and coasts. There is a distinctive way of managing water that exists in many communities in the Andes today, a locally-derived tradition that may once have prevailed widely and that is a highly effective means of managing a scarce and fluctuating resource. One such system is in the Peruvian Andes, a peasant village where irrigation and water management are handled in an unusual way. The village principles of social organization create a situation of equity and transparency which provides people with a strong incentive to obey the rules and conserve water. By doing so, they are directly maximizing the frequency of irrigation, a benefit that is the same for everyone using a given source of water. The system is argued to be a highly effective and sustainable way of dealing with a scarce and fluctuating resource.

Further information:

Paul Trawick, 2001: Successfully Governing the Commons: Principles of Social Organization in an Andean Irrigation System. *Human Ecology*, Vol. 29, No. 1, 2001.

281 PERU | Indigenous Management of Protected Areas in the Peruvian Amazon

Adaptation, biodiversity, natural resource management

The Indigenous Management of Protected Areas in the Peruvian Amazon Project aims to increase the sustainability of biodiversity conservation by involving indigenous communities in the management of new and existing protected areas. This form of participatory protected-area conservation was a new experience for the main implementers of this project: the park agency (National Institute of Natural Resources, INRENA) and the government of Peru. This project helped to change the prevailing conservation paradigm of establishing national parks and sanctuaries that prohibit human occupation and uses and enriched INRENA's capacity to collaborate with Indigenous Peoples in protected areas and resulted from combining traditional knowledge of Indigenous Peoples with modern conservation techniques.

Further information:

WORLD BANK (2008): Sobrevilla, Claudia. The Role of Indigenous Peoples in Biodiversity Conservation; World Bank Project database, <http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=228424&contentFed=yes&ProjectId=Po65200>

282 PERU | Effects of climate change in the Peruvian Andes video

Local observations & impacts, traditional knowledge, multimedia

Through this participatory video film, three indigenous communities of the Peruvian Andes show the perceptible impacts of climate change on their environment. Diverse members of the community discuss and agree on the importance of reviving and celebrating their traditional rituals to respect Mother Earth.

Further information:

Conversations with the Earth, <http://www.conversationsearth.org/>

283 PERU | Waru waru ancient irrigation and drainage system

Adaptation, agriculture, food security, traditional knowledge

The waru waru restoration project began in 1991 in the southern Andean department of Puno, Peru. The aim was to recover a technology, invented by the Tiahuanaco culture, that fell into disuse around 1100 AD. Archaeological excavations of raised fields demonstrated that farmers began constructing them by 1000 BC. Waru waru or raised field agriculture makes it possible to bring into production the low-lying, floodprone, poorly drained lands found all over the Altiplano. The project involved the restoration of earthworks that are central to the technology. The shallow canals, when filled with water, ensure a microclimate that acts as a buffer against nighttime frosts and provides moisture during droughts and drainage during the rainy season. The canals also act as barriers to keep out crawling insect pests. The waru waru system provides peasant farmers with greater harvest security and reduces the risks associated with frosts and drought.

Further information:

UNESCO, Waru Waru, a cultivation and irrigation system used in flood-prone areas of the Altiplano, UNESCO Best practices on Indigenous Knowledge BP-II.19, <http://www.unesco.org/most/bpik19-2.htm>; Clark Erikson (2003), Agricultural Landscapes as World Heritage: Raised Field Agriculture in Bolivia and Peru. In *Managing Change: Sustainable approaches to the conservation of the built environment*. Edited by Jeanne-Marie Teutonico and Frank Matero, Getty Conservation Institute, Los Angeles, pp.181-204 <http://ccat.sas.upenn.edu/fishweir/articles/EriksonGetty1.pdf>

284 PERU | Traditional planting of potatoes protects against unseasonal frost

Adaptation, agriculture, food security

Potato is particularly vulnerable to global warming due to its narrow production "window": it needs mean daily temperatures of 18-20°C and night-time temperatures less than 15°C. Fluctuation outside the range of 10-30°C significantly inhibits tuber growth: this is what devastated potato crops in the Andean highlands of Peru in 2007, when a freak frost arrived in mid-February. During this planting season only those potatoes planted in the traditional way survived the unprecedented extreme frost temperature.

Further information:

FAO Newsroom, Indigenous peoples threatened by climate change, 8 August 2008, <http://www.fao.org/newsroom/en/news/2008/1000906/index.html>

285 PERU | Marketing Strengthening and Livelihood Diversification in the Southern Highlands (Sierra Sur) Project

Adaptation, livelihood diversification

The native people of the high Andes (altiplano) have always had to contend with an inhospitable environment. High winds, sparse ground cover, frozen water and extreme temperature variations are the norm. As a result of climate change, these temperature variations have become even more pronounced, with oscillations of -8°C to 25°C in a single day, compared with -1°C to 21°C 50 years ago. Water shortage as a result of climate change has also become a significant problem in the region. Rainfall is less frequent and less abundant. Some glaciers have melted completely, leaving large areas without water. As a result, the green cover has been disappearing, and there is less forage for animals. The IFAD-supported Marketing Strengthening and Livelihood Diversification in the Southern Highlands (Sierra Sur) Project, is working directly with more than 21,000 families over an area of almost 78,000 km² to help them become more resilient to the impact of climate change and improve their management of natural resources. Water from rain and melting ice is being trapped in pits so it can be used for irrigation. Project participants are diversifying their crops and are now cultivating maize, beans, cereals, potatoes and oregano in terraces, separated by stone walls, on the mountain slopes. The stone walls break the wind and trap soil and water to prevent runoff. The stones also act as heat reservoirs, soaking up warmth from the sun during the day and releasing it slowly, which helps control freezing during the cold mountain nights.

Further information:

IFAD, <http://www.ifad.org/gbdocs/eb/98/e/EB-2009-98-R-38.pdf>

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Project participants are also involved in tree planting initiatives to help restore the area's green cover. The trees serve as wind breaks and help regulate the temperature. They are a source of fuelwood and their roots help stabilize the soil on the slopes. Families taking part in the project have also been protecting themselves from lower temperatures by improving their homes. They are building double walls to help absorb solar heat and adopting fuel-efficient stoves instead of cooking over open fires. Because their homes are no longer filled with irritating smoke, people are able to remain comfortably indoors for longer periods. As a result of the project, the local population is better fed, and livestock is thriving. The improvements in natural resource management have led to new business initiatives. With more cattle, for example, people are able to make yoghurt and cheese to sell to other communities. Thanks to the more efficient stoves, families participating in the programme are saving 2.6 tonnes of fuel per year – the equivalent of 32 hectares of forest saved per family each year. And with fewer trees being felled, greenhouse gas emissions from deforestation have been reduced. The project, which began in 2005, is due to run through 2011.

286 PERU | Recovery of traditional knowledge on biodiversity for food and medicine Quechuas and Ashanika communities

Adaptation, traditional knowledge, capacity-building

In the context of an advanced national legal framework on the protection of indigenous intellectual property rights related to traditional knowledge on biological resources (Ley 27811, Perú), this proposal aims at giving Quechua and Ashanika communities and organizations (FECMA and CECONSEC), the necessary skills and capacities to make use of the existing law to recover and protect their traditional knowledge and intellectual property rights. The foreseen project activities are: 1) capacity-building workshops on: traditional knowledge recovering and registering, national and international laws on intellectual property rights; 2) to recover traditional knowledge on biological resources (plants for food consumption and medical use), through interviews to communities elders; 3) to realize a photographic register and video documentation; 4) to publish a book on the experience realized; 5) to carry out the necessary legal procedures with the designated national institution (INDECOPI) to obtain legal protection of their intellectual property rights.

Further information:

IFAD, Recuperación del conocimiento tradicional sobre biodiversidad alimentaria y medicinal en comunidades quechuas y ashánikas del Perú, <http://www.ifad.org/english/indigenous/grants/projects/regions/lac.htm>

287 PERU | Forecasting El Niño influence on Andean rainfall and crop yield with the Pleiades

Adaptation, traditional knowledge, forecasting

Farmers in drought-prone regions of Andean South America have historically made observations of changes in the apparent brightness of stars in the Pleiades around the time of the southern winter solstice in order to forecast interannual variations in summer rainfall and in autumn harvests. They moderate the effect of reduced rainfall by adjusting the planting dates of potatoes, their most important crop. Scientific analysis of data on cloud cover and water vapour from satellite imagery, agronomic data from the Andean altiplano and an index of El Niño variability has shown that poor visibility of the Pleiades in June—caused by an increase in subvisual high cirrus clouds—is indicative of an El Niño year, which is usually linked to reduced rainfall during the growing season several months later.

Further information:

Orlove, B.S., J.C.H. Chiang and M.A. Cane, 2000: Forecasting Andean rainfall and crop yield from the influence of El Niño on Pleiades visibility. *Nature*, 403, 68-71. <http://www.nature.com/nature/journal/v403/n6765/abs/403068a0.html>

288 PERU | Farmers help each other where government support is missing

Adaptation, culture

For many communities living over 3,500 metres above sea level the most common crops are maize, potatoes and beans. Many families also have one or two head of cattle, some sheep and a number of guinea pigs (a food staple in the Andes). These communities are poorly served by government agricultural support, so-called 'extension services'. Training farmer-to-farmer 'extension agents' has become a focus of Practical Action's work. Locally the agents are known as Kamayoq, a name associated with the Inca empire in the 16th century. A Kamayoq school was established in 1996. The course covers identification and treatment of pest and diseases for crops and livestock; improved irrigation; and breeding and rearing of guinea pigs. Since the school opened, over 140 Kamayoq have been trained, one in five of whom are women. The trainees' mother tongue is Quechua.

Further information:

Andrew Simms and Hannah Reid (2006) Up in Smoke? Latin America and the Caribbean, <http://www.iied.org/pubs/display.php?o=1001711ED>

The Kamayoq help local smallholder farmers with both their plants and animals and they are paid in cash or in kind. Farmers can afford to pay because of the assistance they get, which raises production and sales. It is the farmers' willingness to pay that makes the Kamayoq model so interesting. Apart from the initial cost of training, it is, in effect, an unsubsidised farmer-to-farmer service. The Kamayoq also help farmers to adapt through experimentation to changing environmental, social and economic circumstances. Good examples of this process of joint problem solving include the treatment of a fungal disease of maize; the control of mildew on onions; and the discovery of a natural medicine to treat *Fasciola hepatica*, a parasitic disease of animals. Some specific results of working with the Kamayoq model include: Farm households who have adopted improved guinea pig breeding techniques, now raise bigger and heavier animals for their own consumption, as well as for sale. Technical advice that farmers have received on irrigation, improved pasture, and treatment of animal diseases has led to increases in milk production of up to 50 per cent.

289 PERU | Artisans Association of Arbolsol and Huaca de Barro of the Morrope District

Adaptation, agriculture, biodiversity, women

Founded by local women in 2003, the Asociación de Artesanas de Arbolsol y Huaca de Barro del distrito de Mórrope has worked to recover traditional methods of cotton production that are environmentally responsible and to create positive socio-economic change in the region. The association oversees the planting and harvesting of native cotton varieties using only pesticides from natural sources. In addition to cotton production, the association has been active in managing water resources. Traditional colours of native cotton have been recovered, water resources have been cleaned as a result of better management, and organic cotton is produced for local markets. The group, which began as a women's organization, has now expanded to include the whole community

Further information:

Equator Initiative Awards 2008, <http://www.equatorinitiative.org/>

290 **PERU** | Association for the Integrated Development and Research (AIDER)**Adaptation, forests, natural resource management**

Working in partnership with 14 indigenous communities, the Asociación para la Investigación y el Desarrollo Integral (AIDER) has developed a community-based forest management plan for the Ucayali region in the Peruvian Amazon rainforest. The community-led conservation area covers 150,000 hectares of rainforest, a critical habitat for 21 species listed as endangered by the Peruvian government due to illegal extraction, hunting, and harmful commercial activities. Characterized by its participative, intercultural, and gender-balanced approach, AIDER strengthens the capacity of local communities to manage their natural heritage in a sustainable manner.

Further information:
Equator Prize 2004,
<http://www.equatorinitiative.org/>;
AIDER, www.aider.com.pe

291 **VENEZUELA** | Venezuela Expanding Partnerships for the National Parks System**Adaptation, natural resource management**

Life plans are guided by the elders of the communities and follow two steps. The first step is to search for unity and reach a common identity as a people. The second step is to have an agreed understanding of the quality and living conditions they want to achieve or maintain as a people during the next seven generations, at a minimum. During this process of building a common identity, communities organize themselves around a clear Life Plan, apply a common methodology, and define a spiritual common thread to guide the people from generation to generation. A good example of an indigenous community's life plan was prepared for the "Pemons" of Canaima National Park through the Venezuela—Expanding Partnerships for the National Parks System Project. The objective of this project is to implement a co-management model that guarantees the sustainable management of Canaima National Park through an alliance between Indigenous Peoples, private sector institutions, and government agencies.

Further information:
WORLD BANK (2008): Sobrevila, Claudia.
The Role of Indigenous Peoples in Biodiversity
Conservation

With funding from the GEF, this project provided an opportunity to fulfill the aspiration of Indigenous Peoples to participate in the park's management—an aspect considered fundamental to the project's success. The Indigenous Life Plan, originally written in Spanish and entitled Plan de Vida de los Pueblos Indígenas de 8 Sectores de la Federación de indígenas del Estado Bolívar (FIEB—Federation of Indigenous Peoples in Bolívar State) was elaborated through a highly participatory process involving all interested indigenous groups residing in the eight local sectors governed by the FIEB. Initial consultations began in 2004, culminating in the final drafting of the Life Plan in early 2006. Both the FIEB and the World Bank provided consultants throughout the entire process to facilitate the community consultations, meetings, and drafting of the document. As part of the Life Plan, an Inter-Institutional Agreement between the Venezuela Park Service, the Electric Corporation of Venezuela, and FIEB was signed and constitutes one of the most innovative agreements between Indigenous Peoples and private and government sectors. As per the request of the Venezuelan government, the project was transferred to UNDP, through which it is currently being implemented.

292 **VENEZUELA** | Orinoco Delta Warao Support Programme**Adaptation, health, traditional knowledge, natural resource management**

The Orinoco Delta Warao Support Programme in Venezuela, has been designed based on Venezuela's national policy, institutional and legal framework, as well as the UNDRIP and international norms that recognize the rights of indigenous peoples. This project can be considered as a model for designing projects with indigenous peoples in IFAD. Based on a holistic approach, this project has been tailored on the identity and culture of the Warao people living in poverty in the Orinoco Delta. Demand-driven initiatives focus on integrated public health projects, including reproductive health and traditional medicine; food security and ecologically and culturally appropriate economic activities; social infrastructure and communications; natural resource and land management; strengthening of community-based organizations, including women's organizations and cooperatives; technical, managerial and administrative capacity-building; bilingual education and basic literacy training for adults; and promotion of culture and folklore.

Further information:
IFAD, <http://operations.ifad.org/web/ifad/operations/country/project/tags/venezuela/1404/project%20overview>



NORTH AMERICA

293 NORTH AMERICA REGION | Summary of observations

Local observations of impacts, food security, health, transport

Indigenous Nations and Peoples around North America are experiencing the impacts of climate change in their communities and traditional lands. These include the disappearance of traditional subsistence foods, including wild game, fish, berries, wild plants and traditional food crops and plant medicines. Water levels are rising in coastal areas. Inland water tables, lakes, streams, rivers and springs are diminishing. Arctic sea ice is rapidly disappearing. New diseases affect the food chain and human health.

Indigenous Peoples in Manitoba, Canada also reported that winter roads are accessible for much shorter periods of the year. These roads are used to bring food, fuel, building materials, and other essential goods in a cost-effective method to the local communities. This diminishing access raises costs of essential survival goods for these remote communities. Other Indigenous Peoples report that forests in their areas are dying due to recent infestations of insects. Wild animals held sacred by many Indigenous Peoples, such as polar bears, are disappearing. Other communities report that their lakes and springs are drying up.

Further information:

UNPFII, 2008: E-C_19_2008_CRP4: Report of the North America Region Preparatory Meeting for the UNPFII Seventh Session http://www.un.org/esa/socdev/unpfii/documents/E-C_19_2008_CRP4.pdf

294 NORTH AMERICA REGION | Tribal Campus Climate Challenge

Adaptation, energy, youth

The Tribal Campus Climate Challenge is a project created in partnership with the Energy Action Coalitions Campus Climate Challenge to leverage the power of young people to organize on college campuses and high schools across the US and Canada to organize and promote renewable energy and emission reductions strategies on campuses in both the USA and Canada. Over 600 colleges and universities that have signed on to take part in the Campus Climate Challenge, with 22 of those being tribal college and high school groups.

Further information:

Indigenous Environmental Network, <http://www.ienearth.org/tccc.html>

295 CANADA | Impacts on traditional foods in Manitoba

Local observations of impacts, traditional knowledge, food security, pests, forests

Many First Nations within the boreal region of Canada continue to harvest economically and culturally important traditional foods and medicines. In 2006-2007, the Center for Indigenous Environmental Resources (CIER) partnered with a Manitoba First Nation to increase understanding of how climate change is affecting the quantity and location of traditional foods and medicines in the boreal region of Canada.

The study focused on three species commonly found and used in Black River First Nation territory: conifer trees, berry plants, and moose - species that have beneficial spiritual, cultural, health and nutritional qualities for community members. Participants of the study discussed climate change impacts and shared observations of how climate change is affecting these species in Black River First Nation. Participants also shared possible adaptation strategies to deal with the impacts of climate change on these species.

Community members noticed climate changes including milder winters, less snow, drier summers and more unpredictable weather. Impacts on traditional foods and medicines included greater occurrence of berries drying up before coming to fruit, and spruce budworm infestations affecting conifer trees. Adaptation strategies under consideration include building shade structures for berry plants, controlling spruce budworm by increasing populations of budworm predators such as bird populations, changes to plant harvesting locations and times, adjustments to hunting activities, and sharing and exchanging traditional foods.

Further information:

Center for Indigenous Environmental Resources, 2007. Climate Change Impacts on Abundance and Distribution of Traditional Foods and Medicines: Effects on a First Nation and Their Capacity to Adapt, <http://www.cier.ca/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=1296>

296 CANADA | Drinking Water Safety and Source Water Protection in Alberta and Saskatchewan

Local observations of impacts, water resources

Climate change is exacerbating current water issues in First Nations communities. Projects in Driftpile Cree Nation, Alberta, and Yellow Quill First Nation, Saskatchewan, had both reported climate-related water quality problems in their communities.

Driftpile Cree Nation is located in the boreal ecoregion, approximately 300 kilometres northwest of Edmonton, Alberta. The community has had difficulties with water quality since May 2005, when a drinking water advisory was enacted due to unacceptable turbidity levels. The Nation worked diligently for a year and established a new water treatment system. Another one of their projects involves developing a First Nation's handbook on source water protection.

Yellowquill First Nation is also located in the boreal ecoregion, approximately eight kilometres east of Rose Valley, Saskatchewan. The community was under water advisories from 1995-2004. In order to ratify the problem, the community changed the source from a creek to an area of higher flow and ground water sources, as well as establishing a new water treatment system.

Further information:

Climate Change and First Nations South of 60: Impacts, Adaptation, and Priorities, <http://www.cier.ca/information-and-resources/publications-and-products.aspx?id=1178>

297 **CANADA | Signals from the Forest Video****Local observations & impacts, multimedia, forests**

This 16-minute video documents the observations of a changing environment from the perspective of six First Nations individuals living in the northern boreal forests of Canada. The observations documented are consistent with expected climate change impacts. The individuals who participated in the video come from four distinct cultures from the Yukon to Quebec, and provide the perspectives of men, women, Elders and youth. Signals was created by First Nations for First Nations and helps to fill the need for educational resources that are culturally appropriate and relevant. Furthermore, it presented participants an opportunity to share their Indigenous knowledge with a wider audience.

Further information:

Signals From the Forest: First Nations Observations of Climate Change Video, <http://www.cier.ca/information-and-resources/publications-and-products.aspx?id=430>

298 **CANADA | Emergency preparedness in Seabird Island, British Columbia****Adaptation, disaster preparedness**

Extreme weather events such as storms (wind, ice, thunder, and snow), floods, and droughts are starting to occur more intensely and more often than has occurred in the past. Emergency preparedness can help First Nations meet these challenges. This is especially true for increased frequency and severity of both extreme weather events and forest fires. Seabird Island First Nation, British Columbia, utilized emergency preparedness to meet challenges posed by increased flooding.

Further information:

Climate Change and First Nations South of 60: Impacts, Adaptation, and Priorities, <http://www.cier.ca/information-and-resources/publications-and-products.aspx?id=178>

Seabird Island First Nation is located in the Coastal ecoregion, approximately 20 kilometres northeast of Chilliwack, British Columbia. The First Nation created an emergency preparedness plan for their community, with flooding identified as the largest concern. Climate change has the potential to intensify spring floods as larger snow packs accumulate over winter, due to changes in precipitation. These snow packs also melt faster in the spring. Part of the Seabird Island plan includes educating community members on what they need to do in the case of a flood. Six emergency response pamphlets are available for download on the Seabird Island website to assist in this process. The band has tasked the Seabird Fire Department with distributing this information to the membership. There are also infrastructure procedures outlined in the plan that include shutting off the hydro and gas lines if flooding is imminent. In these cases, the membership will need access to alternative drinking water or means of preparing food, and the plan includes these alternatives. An evacuation plan is also included.

299 **CANADA | Walpole Island First Nation evaluation of Climate Change Impacts and Adaptation Options****Local observations & impacts, agriculture, wildlife, health**

Climate change observations recorded by the Walpole Island First Nations community include the necessity to replant agricultural fields due to the high moisture levels in the soil, preventing germination of the seeds; decreases in ice and snow accumulation; waterfowl have shifted their food sources as decreasing water levels have opened up new sources; composition of fish species in Lake St Claire has changed as a result of changes to water temperature; decreased water levels have led to an increased number of boating accidents; and more fishermen go through the ice in the winter; increased incidence of grass fires due to dry conditions mean children with asthma have to remain indoors due to poor air quality; increased mosquito populations contribute to health problems, such as an outbreak of West Nile Virus in a neighbouring town.

Further information:

Natural Resources Canada Climate Change Research Database, http://adaptation.nrcan.gc.ca/projdb/pdf/184_e.pdf

300 **CANADA | Access to Territory and Resources in Northern Quebec and Nunavik****Local observations & impacts, health**

The Nunavik region is made up of fourteen (14) local communities that are accessible only by plane (year-round) or boat (during the summer months). The Naskapi community of Kawawachikamach is located inland, just south of the Nunavik border and is linked by road to the community of Schefferville, itself accessible by train to a community on the Lower North Shore of the St-Lawrence. None of these communities are linked to each other or to the rest of the province by a road network. The winter trail networks are therefore particularly significant since they connect the communities and allow residents to travel to other villages in addition to providing access to harvesting grounds. The Kativik Regional Government (KRG) and the communities of Kangiqsualujuaq, Kangiqsujuaq, Umiujaq, Kawawachikamach, Ivujivik and Akulivik have developed an ice-monitoring program based on weekly fieldwork and interviews. Snow and ice characteristics are measured at strategic locations along the trail networks. Interviews with ice experts are conducted to obtain more detailed descriptions of ice, snow and general weather conditions along the trail networks. Weekly ice trail information is displayed and updated regularly on a website.

Further information:

Climate Change in Northern Quebec and Nunavik: Access to Territory and Resources, Silaup Aistjpalianinga Project, <http://climatechange.krg.ca/>

This program is part of the larger research project called "Climate Change in Northern Québec: Access to Land and Resources". Information gathered during the ice-monitoring program will be used in conjunction with predictions from regional climatic scenarios developed by the Ouranos Consortium. The goal is to help identify the specific conditions under which ice becomes safe for travel and predict the potential changes that might occur along the trail networks within Nunavik as well as the implications of these changes on the existence of "safe" ice as viewed from a human health and safety perspective.

301 **CANADA | First Nations – Impacts on Winter Roads and Lake/River Ice Conditions in Manitoba****Adaptation, local observations & impacts, transport**

First Nations in northern Manitoba are particularly susceptible to the impacts of climate change due to their geographic location in the middle of the continent at relatively high latitude. Many of these First Nations are dependent upon cold weather and reliable ice, winter road, and trail conditions in order to maintain their physical, social/cultural, and economic way of life. This study was carried out by the Centre for Indigenous Environmental Resources (CIER).

Further information:

Natural Resources Canada Climate Change Research Database, Summary A1255: Climate Change Impacts on Winter Roads and Lake/River Ice Conditions – Effects on First Nations Communities in Northern, Central and Eastern Manitoba and the Capacity to Adapt, http://adaptation.nrcan.gc.ca/projdb/pdf/187b_e.pdf

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Community members and external organizations described changes in weather (in winter, spring, summer, and fall), water and ice conditions, and winter roads and access trails. Although gradual in nature, many of the changes were described as being most profound in the last ten years. Changes were attributed to a variety of factors, with warming climatic conditions (i.e. climate change) being predominant amongst them. Community members also described significant impacts of these changes on many aspects of their daily lives, including social/cultural activities, personal health and safety, financial, and community operations, including: Reliability of winter roads; Personal safety on winter roads; Winter road failure and emergency preparedness; Personal safety on trails and frozen water bodies; Decreased participation in sustenance activities; Personal health concerns; High cost of living; Decreased participation in social/recreational activities; and, Hindrance of community operations and economic development.

Community members and external organizations described a number of strategies (and associated barriers to and drivers of action) for addressing the impacts of climate change on their daily lives. These include moving winter roads off-ice (e.g. since 1997 government bodies and First Nation construction companies have moved ~600km of winter road off ice and onto land); developing alternative winter road routes (new routes are being developed into communities to replace specific routes that are a concern in face of climate change, such as a new road from Norway House into the Island Lake communities in 2005/06); installing bridges; expediting open dates of winter roads (e.g. some First Nation construction companies use light-weight vehicles to pack and strengthen the initial ice that is forming early in the season and thicken thin ice by repeatedly flooding the surface with water).

302 CANADA | Identifying the impacts of climate change and capacity for adaptation in two Saskatchewan First Nations communities

Adaptation, local observations & impacts, traditional knowledge

Two community case studies were undertaken with attention given to the integrated and interconnected impacts of climate change across various sectors. A holistic framework was used that emphasizes the interconnections between the social, cultural and natural systems. The purpose of the research was to assess the future impacts of climate change and the capacity for two First Nation communities in Saskatchewan to respond and adapt to those impacts. Both communities of James Smith and Shoal Lake are situated in the southern boreal forest and historically depended on the regional ecological community of plants and animals for their economic and survival needs.

The Elders of James Smith and Shoal Lake said that the ancestors had forewarned their people about the unfolding of environmental and socio-cultural changes. On the environmental front, analysis of the Elders' statements indicates that similar climatic events had happened to both communities. Both communities experienced alternative periods of flood and drought outside the variation considered normal in their territories. The Elders, however, were not unfamiliar with climatic variations and trusted that the flux was an expression of natural patterns and events that the people had to synchronize with. They spoke of strong philosophies and attitudes that had certainly helped to maintain their communities' equilibrium in the past. On the personal level, the cultural promotion of traditional knowledge creates aware individuals and at the collective level, social responsibility promoted communal unity. The systemic philosophies and attitudes of the communities allowed them degrees of manoeuvrability as they negotiated changes taking place around them. The Elders from both communities believe that their people have also shown inherent resilience in light of the changes they have experienced in their histories. Both communities have largely recuperated from the impacts experienced from perturbations such as climatic fluctuations and loss of traditional forests. Developing foresight through traditional means of knowing enhances the capacity to predict how nature will ultimately unfold.

Overall, the Elders identify issues that constrain their communities' abilities to plan for and adapt to climate change. The James Smith Cree recognize their complicity in the causes of climate change by their adoption of contemporary lifestyles. Cultural continuity in both communities is a concern and Elders place strong emphasis that such continuity is vital for the future of their youth. Both communities also experienced increases in diabetes and other forms of ill health, which they attribute to the shift of diets from natural foods to contemporary forms of processed foods. At this juncture, there is urgent need to link Elders with the youth as a way to ensure that cultural knowledge is transmitted.

303 CANADA | Assembly of First Nations Climate Change Program

Adaptation, policy & planning, outreach, energy

The Assembly of First Nations is beginning to undertake work on climate change impacts and adaptations. Research activities are focusing on research, education and awareness-raising. Other program activities include building capacity, supporting integration and addressing issues of jurisdiction. It supports First Nations climate change, renewable energy and energy efficient projects, activities and research at the national, regional and community level; and facilitates increased response of First Nations communities to climate change.

Further information:
Assembly of First Nations,
<http://www.afn.ca/article.asp?id=743>

304 CANADA | ANCAP Energy Pathfinders, First Nations View and Resources Kit (CIER)

Adaptation, transport

The Aboriginal and Northern Community Action Program (ANCAP) developed the following strategies to maximize the chances for successful adaptation to climate change: formalized awareness and communications strategies crucial to obtaining community buy-in; development of adaptation management frameworks for the North; impacts and adaptation partnerships with Aboriginal and northern organizations; and, conducting research and analysis on impacts and adaptation. Projects included the ANCAP Energy Pathfinders (in which individuals were trained to build a network to provide expansive assistance and advice to the communities in their regions), First Nations View (the impact of climate change on ice, winter roads and access trails), and the Climate Change and Energy Resources for Aboriginal and Northern Communities (CC&E) Kit of resources (to provide information needed to become better informed on issues related to climate change including technical and non-technical resources).

Further information:
Centre for Indigenous Environmental Resources (2007), 'Reflections on Success – A Sustainable Future in a Changing Climate',
<http://www.ainc-inac.gc.ca/enr/clc/cen/pubs/ros/ros-eng.pdf>

Ultimately, the First Nations View study identified seven tangible, overarching strategies crucial to helping First Nations reliant on winter-roads to adapt to the impacts of climate change: Developing Climate Change Action Plans; Increase Security of Winter Roads; Develop a Communication Strategy; Increase Social / Cultural / Recreational Opportunities; Increase Consumption of Local Foods; Enhance Community Safety; and Increase Funding Opportunities for Community Operations.

305 CANADA | Land Unlocked Film

Local observations & impacts, multimedia

A 48-minute documentary that explores cultural, social, and economic impacts on First Nations communities in the Yukon and northern Canada and draws a parallel with the impacts of global warming on Aboriginals in Bolivia. Broadcast on the Aboriginal Peoples Television Network (APTN). Implemented by a private company (Northscape Productions); funded by CIDA for approx CND\$67,000.

Further information:
Northscape Productions, <http://www.northscape.info/projects.html>; <http://www.acdi-cida.gc.ca/cidaweb/cpo.nsf/vLUWebProjEn/F473A340E817F852571FE00692F8C?OpenDocument>

306 CANADA | Weather Report Film

Local observations & impacts, multimedia

Two one-hour television documentaries and a feature film, "Weather Report" explores the dramatically evolving impact and social implications of climate change. Travelling through North America (including Canada's Arctic), Haiti, Kenya, India, and China, the film explores how the battle against climate change is implicated in the larger battle for global justice. This takes form through the introduction of a range of complex and passionate characters, from an Inuit hunter to a climate negotiator, which puts a human face on the climate crisis, developing intimate portraits of the people and communities who are on the front line of climate impacts and climate politics. The CBC Television show "The Nature of Things" is the broadcaster for the television version. Implemented by a private company (Sienna Films Productions); funded by CIDA for approx CND\$155,000.

Further information:
Sienna Film Productions, <http://www.cbc.ca/natureofthings/weatherreport.html>; <http://www.acdi-cida.gc.ca/cidaweb/cpo.nsf/vLUWebProjEn/A775573EDB6878A852571FE00692B0A?OpenDocument>

307 CANADA | Decrease in wild salmon

Local observations & impacts, food security, wildlife

A specific example of the impact caused by climate change and global warming is the alarming decrease in the wild salmon runs, upon which many Indigenous Peoples of North America's coastal areas depend for their traditional means of subsistence. For example, the Upper Fraser Fisheries Conservation Alliance in British Columbia recently released a study of sockeye salmon runs in the upper Fraser River. The report showed 700,000 fish returned in the early Stuart run in 1993, but those numbers fell to 100,000 by 2005. Scientists involved in the study reported that climate change is a significant contributing factor, with the temperature of the Fraser River increasing by about half a degree over the past 50 years. As well, millions of acres of forest lands in British Columbia have been destroyed by mountain pine beetle with direct, immediate and serious impacts on the safety and well-being of Indigenous Peoples, communities and entire ecosystems, including salmon spawning and rearing streams and migration routes. The Haida Nation in British Columbia are attempting to protect the traditional biological diversity of the wild salmon in their area and to oppose the introduction of farmed salmon which undermines the integrity of the wild salmon stock.

Further information:
Report of the North America Region Preparatory Meeting for the United Nations Permanent Forum on Indigenous Issues Seventh Session, E/C.19/2008/CRP. 4, http://www.un.org/esa/socdev/unpfii/documents/E_C_19_2008_CRP4.pdf

308 CANADA | Climate Change, Health and Vulnerability in Canadian Northern Aboriginal Communities

Local observations & impacts, health

The Climate Change and Health in Nunavik and Labrador: What We Know from Science and Inuit Knowledge project was conducted in the communities of Kuujuaq, Nunavik (Québec), and Nain, Nunatsiavut (Labrador). The project was conducted to establish a baseline understanding of the relationship between environmental changes observed in the communities and the potential impacts of these changes on health, as perceived by participants and reported in the health sciences literature. This analysis of the collective base of information identified a series of potential direct and indirect health impacts associated with climatic changes. Participants in the two regions identified changes in climatic conditions over the past 10 years not previously experienced or reported in the region. Some changes were identified as having a direct impact on the health of individuals. Respiratory stress was reported among elderly participants and those with decreased respiratory health in association with an increase in summer temperature extremes that now exceed 30°C in both regions. The reported increase in uncharacteristic weather patterns and storm events had significant impacts on travel and hunting/ fishing safety. The project was initiated by members of regional Aboriginal (Inuit) agencies in charge of local environmental health issues in cooperation with Laval University, Québec, Canada.

Further information:
Climate Change, Health and Vulnerability in Canadian Northern Aboriginal Communities Christopher Furgal and Jacinthe Seguin Environmental Health Perspectives Vol 114 , No 12, December 2006

309 CANADA | First Nations Market Housing Fund

Adaptation, housing

The aim of this project is to increase the amount of affordable and suitable housing while building capacity to ensure effective management and control by First Nation communities. The First Nations Market Housing Fund is intended to allow First Nation families and individuals greater access to market-based housing, including home ownership on reserves. The Fund is intended to build on best practices demonstrated by First Nations themselves to help families and individuals living on reserve lands and on settlement lands to enable more individuals to own or rent their own homes, while respecting the culture of communal ownership of land. The Canadian Government has made CND\$300M available through the fund.

References:
First Nations Market Housing Fund Web Site: <http://www.fnmhf.ca/english/index.html>

310 CANADA | A resource handbook for Environmental Assessment and Saskatchewan's First Nations

Local observations & impacts, capacity-building

'Environmental Assessment and Saskatchewan's First Nations: A Resource Handbook' is intended to provide an overview on environmental assessment and be a helpful resource for communities. The document was developed based on

Further information:
Environmental Assessment and Saskatchewan's First Nations: A Resource Handbook: http://www.iisd.org/pdf/2008/environmental_assessment_sask.pdf

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needs identified by community leaders and resource personnel. The goal of the resource handbook is to improve basic understandings of environmental assessment, identify how communities can be involved and where resources can be accessed. The International Institute for Sustainable Development (IISD) was contracted by the Prince Albert Model Forest (PAMF) to develop the handbook. IISD consulted with the PAMF Aboriginal Caucus prior to the development of the manual to assess current environmental assessment capacity needs and interests.

311 CANADA | Beaufort Sea Project for Climate Change: Impact and Adaptation to Climate Change for Fish and Marine Mammals in the Canadian Beaufort Sea

Local observations of impacts, wildlife, food security

Canada is completing a study on the vulnerabilities and potential adaptations to climate change for marine fish and marine mammals in the Canadian Beaufort Sea including an additional study on the potential impacts of climate change on key ringed seal habitat variables. Ringed seals are the major food of polar bears, and are important species for traditional and subsistence hunting. Based on existing scientific research for environmental impacts in the Canadian Beaufort Sea, this Project examines climate change and impacts on fish and marine mammals in the Canadian Beaufort Sea region, subsistence uses by the Inuvialuit, and the management of these species by the Fisheries Joint Management Committee and other government agencies and departments. Funding for this project comes from the Climate Change Adaptation Fund, the Fisheries Joint Management Committee, the Arctic Institute of North America, and the University of Calgary's Department of Geography. This research is implemented by consultants and biological and GIS specialists, in cooperation with the Fisheries Joint Management Committee, Inuvialuit and government organizations, research scientists and academic institutes, and interested parties.

Further information:
CBD (2008): UNEP/CBD/EM/CC-ILC/1/3, Compilation of Case-Studies on Climate Change and Biodiversity Considerations in the Arctic, <http://www.cbd.int/doc/meetings/tk/emccilc-01/official/emccilc-01-03-en.pdf>;

312 CANADA | Blue Ecology and Climate change: Interweaving cultural perspectives on water, an Indigenous Case study

Local observations of impacts, water resources

This case study proposes that we re-examine climate change from a Blue Ecology or "water first" angle. The case study proposes the acknowledgement of water's central functional and spiritual roles in our world and urges us to apply both Indigenous and science-based understanding as we develop collaborative climate change mitigation strategies. A 'Blue Ecology' water cycle is to be interwoven with Western science's hydrological cycle and the author offers recommendations for hydrologists and water managers to implement Blue Ecology.

Further information:
The Role of Hydrology in Water Resources Management (Proceedings of a symposium held on the Island of Capri, Italy, October 2008). IAHS Publ. 327.2009

313 CANADA | Pine beetles destroy forests in British Columbia

Local observations of impacts, pests, food security, wildlife

In the Canadian provinces of British Columbia and Alberta, where Indigenous Peoples continue to depend on hunting, fishing and gathering in the forest ecosystems, the influx of tree pests fueled by warmer temperatures is very severe. British Columbia has lost 33 million acres of lodge pole pine forest. Forests are cut down before they can be killed by the insects, and forest fires unprecedented in size and number burn through the acres of dead trees. Millions of acres of forest lands in British Columbia have been destroyed by mountain pine beetle with direct, immediate and serious impacts on the safety and well-being of Indigenous Peoples, communities and entire ecosystems, including salmon spawning and rearing streams and migration routes.

In: Conference Room Paper (CRP) 4, Report of the North America Region Preparatory Meeting for the United Nations Permanent Forum on Indigenous Issues Seventh Session (UNPFII7), http://www.un.org/esa/socdev/unpfii/documents/E_C_19_2008_CRP4.pdf

314 CANADA | Canadian Indigenous Tar Sands Campaign

Local observations of impacts, energy, health

Tar sands or extra heavy oil, are a type of bitumen deposit, found in extremely large quantities in Alberta. The production of bitumen and synthetic crude oil emits more greenhouse gas (GHG) than the production of conventional crude oil, and has been identified as the largest contributor to GHG emissions growth in Canada, as it accounts for 40 million tonnes of CO₂ emissions per year. The process of extracting oil from tar sands is extremely resource-intensive; it requires large amounts of energy for heating, mining, and pumping and uses 2.5 to 4 times the amount of water required for conventional crude oil extraction. Greenhouse gas emissions from tar sands production are three times those of conventional crude oil.

Further information:
Indigenous Environmental Network, <http://www.ienearth.org/cits.html>; Poitras, G (2009), 'Canada's Bloody Oil', The Guardian, 24 August 2009, <http://www.guardian.co.uk/commentisfree/2009/aug/24/climate-camp-canada-oil-tar-sands>; Eggertson, L (2009), 'High Cancer Rates Among Fort Chipewyan Residents', CMAJ, 26 February 2009, <http://www.ccmaj.com/cgi/rapidpdf/cmaj.090248v1.pdf>

Dene and Cree First Nations and Métis live close to and in the midst of these tar sand deposits, along the Athabasca River water basin area. These are the communities of Mikisew Cree First Nation and the Athabasca Chipewyan First Nation at Fort Chipewyan, Fort McMurray First Nation, Fort McKay First Nation, and to the south, the Chipewyan Prairie First Nation. The tar sands development around Fort McMurray and Fort McKay is located upstream along the Athabasca River basin. Current tar sands development has completely altered the Athabasca delta and watershed landscape, with deforestation of the boreal forests, open pit mining, de-watering of water systems and watersheds, toxic contamination, disruption of habitat and biodiversity and disruption to the indigenous Dene, Cree and Métis trap-line cultures. Studies have confirmed that there are elevated levels of rare and other cancers among indigenous residents who live directly downstream from the tar sands activity, and that the contamination of waters, snow, vegetation, wildlife and fish has grown exponentially in the past five years. Alberta's tar sands are now the subject of three legal actions by indigenous governments against the government of Alberta for not consulting with its indigenous communities before going ahead with this development.

315 CANADA | First Nations – protected areas, indigenous people and local knowledge in James Bay QC

Local observations of impacts, energy, traditional knowledge, mitigation

The Cree Community of Wemindji in northern Quebec is an aboriginal community whose culture and economy depend in significant measure on their connection to lands and waters. Portions of their traditional territory have been heavily

Further information:
CBD Online Discussion Forum on Article 10(c), <http://www.cbd.int/tk/forum/?threadid=371>

modified by Hydro-Quebec's James Bay (Phase I) hydro-electric development. The community has also had to adjust, in the last thirty years, to proliferating roads, an influx of recreational hunters and fishers from the south, and the imminent prospect of significant mining activity in their territory. In response to large-scale industrial development plans from the urban south, the need for economic diversity and jobs for young people, and a commitment to safeguard hunting, fishing and trapping as a way of life, the community is considering alternative forms of development. One option is the design of terrestrial and marine protected areas in lands integral to the Cree hunting way of life, and relatively rich in subarctic terrestrial and arctic marine species and habitats. A regime of protection that builds on existing Cree institutions for environmental stewardship, and on Cree practices of indigenous ecological knowledge is being developed. Knowledge-sharing, knowledge creation, and cultural and environmental education are central to this vision for enhanced community control

316 MEXICO | Scole'te and carbon sequestration in Chiapas, Mexico

Mitigation, mapping, payment for ecosystem services

Since 1997 the Scole'te project in Chiapas, Mexico, has been actively participating in the voluntary market through carbon sales under the Payment for Environmental Services (PES) scheme. This programme is one of the first initiatives in Latin America that developed a technical/social model for carbon sequestration through forestry and agroforestry systems. Scole'te originated from a collaboration between AMBIO, The Plan Vivo Foundation (both nongovernmental organisations), several farmer organizations, and ECOSUR (El Colegio de la Frontera Sur, research institution). This programme was first implemented in Chiapas and then expanded its operation to Oaxaca, Mexico. A study comparing the carbon content between a set of non-agroforestry and agroforestry prototypes in Chiapas in plots of farmers involved in the Scole'te programme demonstrated that silvopastoral systems, improved fallow, Taungya and coffee systems (especially polyculture-shade coffee and organic coffee) have the potential to sequester carbon via growing trees. Agroforestry systems could also contribute to carbon sequestration and reducing emissions when burning is avoided.

Further information:

Lorena Soto-Pinto et al, 2010: Carbon sequestration through agroforestry in indigenous communities of Chiapas, Mexico. *Agroforestry Systems* DOI 10.1007/s10457-009-9247-5

317 MEXICO | National PSAH Programme

Adaptation, payment for ecosystem services, water resources

Mexico faces both high deforestation and severe water scarcity. The Payment for Hydrological Environmental Services (PSAH) Program was designed to complement other policy responses to the crisis at the interface of these problems. Through the PSAH, the Mexican federal government pays participating forest owners for the benefits of watershed protection and aquifer recharge in areas where commercial forestry is not currently competitive. Funding comes from fees charged to water users, from which nearly US\$18 million are earmarked for payments of environmental services. Applicants are selected according to several criteria that include indicators of the value of water scarcity in the region. This paper describes the process of policy design of the PSAH, the main actors involved in the program, its operating rules, and provides a preliminary evaluation. One of the main findings is that many of the program's payments have been in areas with low deforestation risk. Selection criteria need to be modified to better target the areas where benefits to water users are highest and behavior modification has the least cost, otherwise the program main gains will be distributive, but without bringing a Pareto improvement in overall welfare.

Mexican countrywide PES scheme investing earmarked water use fees into conservation of forest cover in priority areas for enhancement of hydrological resources (PSAH, National Programme for Hydrological Environmental Services). The programme is meant to catalyse the introduction of local schemes based on contributions from local water users that can be financially sustainable in the long term. Interest in curbing deforestation and, at the same time, protect aquifer recharge function of natural forestlands. Water scarcity is a serious problem in Mexico, as two-thirds of its aquifers are being exploited beyond their capacity.

The PSAH scheme provides incentives for forest conservation with a share of revenues from existing water fees. The PSAH programme began with 6 million ha of eligible land. In the first year (2003) from the 900 applications (600,000 ha), 271 were selected (127,000ha). In the following year, 352 new participants (and 180,000ha) were added to the programme. By 2005, the programme included already 477,756ha, covering most states) but mainly concentrated two northern states (Chihuahua and Durango) and two southern (Oaxaca and Chiapas). Including CABSAs, the total land area under the Mexican National PES schemes, by 2005, was already 535,206ha surpassing the 10-year old Costa Rican National Programme, in 2 years alone (2003-2005) and becoming the largest programme in Latin America. For the first year of operation ejidos and indigenous communities holding forestland as common property, accounted for 47% of the contracts and for 93% of the area contracted. The remaining 7% of the area under PES belonged to private landowners (public land is not eligible for the programmes). The largest share of the PSAH payments has been assigned to areas of high or very high marginality (72% of enrolled hectares in 2003 and 83% in 2004).

Further information:

Watershed Markets, http://www.watershedmarkets.org/casestudies/Mexico_National_PSAH_eng.pdf

Alix-Garcia, J., de Janvry, A., Sadoulet, E. and Torres, J.M. (2005) An Assessment of Mexico's Payment for Environmental Services Program. Roles of Agriculture Project Environment Services. Agricultural and Development Economics Division (ESA) Food and Agriculture Organization of the United Nations, <http://are.berkeley.edu/~sadoulet/papers/FAOPESreport.pdf>. Carlos Muñoz-Piña, Alejandro Guevara, Juan Manuel Torres, Josefina Braña, 2008: Paying for the hydrological services of Mexico's forests: Analysis, negotiations and results *Ecological Economics*, Volume 65, Issue 4, 1 May 2008, Pages 725-736. <http://dx.doi.org/10.1016/j.ecolecon.2007.07.031>

318 MEXICO | Capacity Building for Natural Resource Management

Adaptation, traditional knowledge, natural resource management, payment for ecosystem services

The Servicios Ambientales de Oaxaca, A.C. (SAO) is working with residents and local authorities in ten Indigenous Zapotec, Chinantec and Mixe communities in the Oaxaca region of Mexico to improve their capacity to manage natural resources sustainably and to increase their income through offering environmental services such as carbon and water capture and biodiversity conservation. The programme will include community meetings, and training and ongoing technical assistance related to land-use planning, ecosystem mapping and monitoring, and the development of five tree nurseries on communal land.

Further information:

Inter-American Foundation, Grant ME-481, http://www.iaf.gov/grants/awards_year_en.asp?country_id=14&gr_year=2006

319 USA | Global Climate Change Impacts in the United States

Local observations of impacts, water resources

This Global Climate Change Impacts in the United States report summarizes the science of climate change and the impacts of climate change on the United States, now and in the future. It highlights key findings, and impacts by region and sector. For example, the Great Plains region is home to 65 Native American tribes; the people on tribal lands have limited capacities to respond to climate change. Many reservations already face severe problems with water quality and quantity and these problems are likely to be exacerbated by climate change.

Many locations in the United States are already undergoing water stress. Large, unquantified Native American water rights challenge existing uses in the Southwest region. By changing the existing patterns of precipitation and runoff, climate change will add another stress to existing problems. Native Americans who live on established reservations are restricted to reservation boundaries and therefore have limited relocation options. Warming reduces the availability and accessibility of many traditional food sources for Native Alaskans, such as seals that live on ice and caribou whose migration patterns depend on being able to cross frozen rivers and wetlands. These vulnerable people face losing their current livelihoods, their communities, and in some cases, their culture, which depends on traditional ways of collecting and sharing food.

Native cultures in the Southwest are particularly vulnerable to impacts of climate change on water quality and availability. The Great Plains region is home to 65 Native American tribes. Many reservations already face severe problems with water quantity and quality – problems likely to be exacerbated by climate change and other human-induced stresses. Many water settlements between the U.S. Government and Native American tribes have yet to be fully worked out. The Southwest is home to dozens of Native communities whose status as sovereign nations means they hold rights to the water for use on their land. However, the amount of water actually available to each nation is determined through negotiations and litigation. Increasing water demand in the Southwest is driving current negotiations and litigation of tribal water rights. While several nations have legally settled their water rights, many other tribal negotiations are either currently underway or pending. Competing demands from treaty rights, rapid development, and changes in agriculture in the region, exacerbated by years of drought and climate change, have the potential to spark significant conflict over an already over-allocated and dwindling resource.

Further information:
United States Global Change Research Program, <http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf>

320 USA | Native Energy and Climate Program

Adaptation, energy, payment for ecosystem services

The Native Energy and Climate Program is part of the Indigenous Environmental Network, and aims to strengthen and build the capacity and political power of Indigenous Peoples to address the impacts of fossil fuel energy development in Indigenous communities and motivate the creation of sustainable and clean energy and climate policies at all levels of governance. It addresses human rights violations that arise from oil, gas, and mining industries infringing rights to protect traditional lands, treaty rights and the trading of carbon and greenhouse gases, including forest sinks.

Further information:
Indigenous Environmental Network, <http://www.ienearth.org/index.html>

321 USA | the Dene Nation's Denendeh Environmental Working Group

Local observations of impacts, wildlife, traditional knowledge, pests, health, water resources

Dene Nation is a non-profit Aboriginal governmental organization mandated to retain sovereignty by strengthening Dene spiritual beliefs and cultural values in Denendeh, which encompasses five culturally and geographically distinct areas, six language groups, and is home to over 25000 Dene. The Dene have always observed the climate and have stories that speak about the way things were before time and as they are meant to be in the future. Changing climate is indeed being experienced as local changes on the land; however, policies and programs dealing with these changes often have little to do with the needs of the people on the land. Dene Nation decided that the most efficient way of contributing to discussions on climate change was by sharing some of what was gathered during workshops where Dene knowledge could be shared and documented.

Further information:
Dene Nation and Assembly of First Nations NWT website, <http://www.denenation.com>

The Denendeh Environmental Working Group (DEWG) is a non-political forum where Dene and invited guests from government, academia, and nongovernmental organizations can gather to share climate change knowledge and observations. Change is manifest in how animals behave, such as wolves acting unpredictably. Invasive species, such as moose moving further north and buffalo (Bison bison) moving into Monfwi region, are being observed. Birds never before seen and increasing variations in insects are also being noted. A problem identified for trees was increased pine and spruce parasites and diseases. The overall health of trees and their ability to fight disease and withstand the increased frequency of insect infestations is of concern for forests. Ice was unpredictable in places and there were increased instances of people falling through. In the Mackenzie Delta, many channels had changed with some widening, making winter land travel impossible. Groundwater is down in some areas because of increased levels of vegetation, especially willows. Changes in vegetation were not the cause but rather the effect of climate change. Changes in water also lead to increased disease in wildlife. Interconnectedness among all parts of the environment is a feature repeated by elders during the workshops. The links between activities on the land, development impacts, lack of capacity to deal with change, and the overall adaptive ability of Dene cultures are important considerations. For the Dene, it is wrong to separate climate change from human and governance issues. Proceedings of the workshops have been produced which summarize the discussions and outcomes of the meetings. To protect the interests of the Dene, the detailed content of these reports is protected and cannot be reviewed or used without the full, involved, and meaningful consent of the Dene. In addition, Dene Nation has developed a web page summarizing the key findings of the DEWG.

322 USA | Loss of freshwater in Pacific Northwest leads to increase in salmon lesions

Local observations of impacts, water resources, wildlife

For centuries, salmon have been a cultural cornerstone for the Native American tribes of the Pacific Northwest. Thus, any harm to the salmon will necessarily harm those tribes whose identity is inextricably bound to these fish. Several aspects of climate change have been exasperating a serious decline in salmon from a variety of causes, including damming of rivers, pollution, urban development and over fishing. For example, less snow and more rain in the winter months alters natural stream flows, affecting salmon migration from freshwater to the ocean and back. Rising ocean levels have increased shore erosion, damaging coastal habitat, while the timing and extent of fresh water mixing with ocean water in estuaries and along the coast also is degrading salmon coastal habitat, even as rising temperatures bring new predators of salmon to the area, and there is the possibility that with warmer temperatures, the salmon may move away, to more northern areas.

Hydrological changes related to climate change, environmental degradation and land use have caused significant and often unappreciated declines in water supply and quantity. In the Pacific Northwest, glacier-fed rivers and streams have permanently warmed due to the decline in winter snow packs and the retreat of high mountain glaciers. Global warming has meant that these glaciers will not reappear and the fish and wildlife that depend on clear cold water are disappearing. These fish and wildlife are necessary supplements to the diet of North American Northwest tribes and essential to the practice of their tribal cultures. Models by the Tulalip Tribes and Battelle Pacific Northwest, for example, suggest that the level of freshwater lost to the ocean has increased from .6% to 33. This is almost 1/3 of the freshwater that used to get into the groundwater.

Over two months have been lost to warming, so that there is less time for snow to accumulate in the mountains. When spring comes, it happens quickly so that much of the meltwater is released very quickly in large volumes. This process scours and channelizes the streams, which destroys salmon habitat and stirs up sediment and toxic materials. Tribal fishermen in the Pacific Northwest report seeing more salmon with lesions associated with warm-water disease. It also leads to significant water storage loss. This loss can then lead to permanent losses in soil and aquifer storage capacity as the land dries out and natural storage structures collapse. On smaller islands, extremes of drought and rainfall-variability can allow for salt water intrusion into freshwater lenses, destroying freshwater supplies and requiring expensive desalination.

323 USA | Indigenous Permaculture and alternative energies

Adaptation, awareness raising, energy, agriculture, food security

The Environmental Department of Tesuque Pueblo, in association with the Traditional Native American Farmers' Association (TNAFA), initiated an educational program for Pueblos and indigenous peoples in 1997 that focuses on the restoration of ecosystems, the revival of traditional sustainable agriculture, and the ecological design of community infrastructure. The intensive two-week training included theory and practice of ecological land use planning, watershed restoration, home and commercial organic gardening, alternative building design, natural waste treatment systems, soil building, forest gardening, seed collecting and preservation, animal forage systems, native plant lore, and regenerative economics. The course has been expanded to include specific instruction on living with climate change.

Indigenous Permaculture is a cooperative of indigenous groups, including Nahuatl, Lakota, Shuar and Maya, and non-native people. Its mission is to share indigenous farming practices and apply environmentally and culturally-appropriate technology, with the ultimate goal of community food security, in a way that builds capacity within the community. Systems to combat the effects of climate change include water management (such as water catchment and greywater recycling), promotion of traditional farming techniques, and use of renewable energies.

324 USA | Sioux and the Alex Little Soldier Wind Turbine

Adaptation, energy, livelihood diversification

The Alex Little Soldier Wind Turbine was built in the spring of 2003. The turbine is located near the town of Rosebud, on the Rosebud Sioux reservation in south-central South Dakota. Tribal officials see this first turbine as a start of an economic development initiative that will bring a vital industry to the reservation. The wind turbine begins generating electricity when wind speeds exceed 8 mph. The average wind speed at the site is estimated to be 17.9 mph at a 155 feet above ground, and the turbine is expected to produce about 2,400,000 kilowatt hours (kWh) of clean electricity each year, enough to supply about 200 homes.

Its installation marked the end of an eight-year preparation that begun in 1995 when the Rosebud Tribe, the Tribal Utility Commission, and the Rosebud Casino began measuring the wind resources. In 1998, the Tribe applied to the Department of Energy (DOE) for a cooperative grant (50/50) to build a commercial utility turbine. NativeEnergy of Vermont provided approximately 25% of the cost of the Rosebud turbine. Part of the Tribe's success in obtaining the DOE grant was attributed to their having 18 months of wind data. Working closely with the Intertribal Council On Utility Policy (ICUP) and Distributed Generation, Inc., the Rosebud Tribe negotiated the first U.S. Department of Agriculture (USDA) Rural Utilities Service loan to a tribe for a commercial wind energy project.

The Tribe has also negotiated the first tribal sale of the bulk of the "green tags" generated by this turbine to NativeEnergy, which has marketed the tags to thousands of individual green power supporters. The Rosebud turbine installation is the first phase of a long-term plan for multi-megawatt wind development on Indian reservations across the Great Plains, the world's richest wind regime in the world. The two dozen reservations in the northern Great Plains have a combined wind power potential that exceeds 300 gigawatts (the capacity to generate 300,000,000,000 watts at full wind), or about 1/2 of the entire installed electrical generation capacity in the United States.

Further information:

Hanna, Jonathan M. (2007) Native Communities and Climate Change: Protecting Tribal Resources as Part of National Climate Policy, Natural Resources Law Center, University of Colorado; Sachs, 2007. Climate Change, Related Environmental Degradation And Indigenous People, Indigenous Policy, Vol. XVIII, No. 3, Fall 2007, <http://www.indigenouspolicy.org/IPJ-articles.htm#sachs>; Climate Change and Pacific Rim Indigenous Nations, October 2006. Impacts on Indigenous Peoples by Terry Williams and Preston Hardison, Tulalip Nation Fisheries and Natural Resources Department.

Further information:

Indigenous Permaculture, <http://www.indigenous-permaculture.com/>; Louie Hena, Tribal Solutions Dealing With Climate Change - Native American Permaculture Design presentation at the Tribal Lands Climate Conference, 5-6 December 2006, <http://www.tribalclimate.org/Powerpoints/Hena.ppt>

Further information:

NativeEnergy Projects, http://www.nativeenergy.com/pages/alex_little_soldier_wind_turbine/418.php; Wind Powering Native America Case Studies, http://www.windpoweringamerica.gov/na_rosebud.asp; See also: Mandan, Hidatsa and Arikara Nation Demonstration Wind Turbine Project, Toksook Bay Alaska Native Village Wind Turbines, and Kasigluk Alaska Native Village Wind Turbines, http://www.nativeenergy.com/pages/our_carbon_projects/413.php; Kumeyaay Wind Energy Project, <http://www.centredearth.com/documents/KumeyaayWindEnergyProjectCampoKumeyaayNation.pdf>; Sunshine Wind Project (Hopi), <http://www.sunshinewind.com/index.html>; Spirit Lake Sioux Nation Wind Project, <http://www.windpoweringamerica.gov/nativeamericans/sioux.asp>.

NORTH AMERICA

325 USA | Nez Perce Tramway Carbon Sequestration Project

Adaptation, payment for ecosystem services, natural resource management

On parts of the Nez Perce Reservation, land that was cleared for farming in the 19th century is now being returned to forest, to both sell carbon offset credits and provide habitat for wildlife. The Tramway Project, one of the Nez Perce sequestration projects, exemplifies the conversion of agricultural land to forested land. In addition to reducing greenhouse gases by sequestering carbon, projects such as Tramway can provide habitat for deer and other wildlife at the site and cultural preservation activities such as gathering traditional plants for ceremonies and subsistence.

The Nez Perce Tribe - Tramway Carbon Sequestration Project will sequester atmospheric carbon dioxide (CO₂), a principal greenhouse gas, by planting trees on non-stocked agricultural land in north central Idaho that otherwise would not naturally regenerate and would not otherwise be planted. Nursery raised Ponderosa Pine (*Pinus ponderosa*) seedlings will be planted on the site at a 10 foot by 10 foot spacing (436 trees per acre). Ponderosa Pine is a native species in Idaho and historically forms a predominantly single species canopy with an almost savanna like understory. Actions to ensure the success of the afforestation effort include vegetation control, installation of seedling protection materials, and the replanting of dead or damaged seedlings if necessary to meet stocking goals of 300 trees per acre. The Nez Perce Tribe agrees to grow crop trees for a minimum of 80 years and to engage in sound forest management practices that will aid in attaining the maximum potential growth of crop trees.

Management activities include pre-commercial and commercial thinning, and the use of prescribed fire as necessary. These activities will be used to mimic the widely spaced savanna like conditions that protect the stand from lethal crown fires. These open understories of grass and low shrubs are rare in the region due to a century of fire suppression. This approach will be restoring a forest type and structure that is in critically short supply. A majority of the forests in the area are dominated by stands that consist mostly of firs and are declining in vigor due to poor forest health and are now susceptible to large high-intensity and lethal wildfires. The Nez Perce Tribe must meet several criteria to ensure that the Tramway – Agricultural Conversion Carbon Sequestration Project does not plant trees that otherwise would have been planted using other funds. The project area has been cultivated for agricultural production on forest soils for approximately 70+ years. The site will not regenerate naturally and planting tree seedlings is the best option for establishing trees on the site. The total area to be planted is 398.3 acres. Anticipated benefits derived from the above ground biomass of wood alone is estimated at 46,859 metric tons of Carbon or 171,974 metric tons of CO₂ equivalents over the 80 year period. An additional 9,044 metric tons of Carbon or 33,192 metric tons of CO₂ equivalents is anticipated to be sequestered on site as soil Carbon. The approximate total of all Carbon anticipated to be sequestered on site is 55,903 metric tons of Carbon or 205,165 metric tons of CO₂ equivalents over the 80 year period.

Secondary benefits yielded by the project include improved water quality through watershed protection, reduced soil erosion, and restoration of wildlife habitat. Social and cultural benefits include increasing the amount of forested land for gathering and recreational opportunities as well as economic benefits to the Nez Perce Tribe and its members throughout the project life.

Further information:
Idaho Soil Conservation Commission, http://www.scc.idaho.gov/PDF/Carbon%20Sequestration/PowerPointSlideshows/NezPerce_TramwayCSProject.pdf

326 USA | Yaqui Peoples restore food biodiversity

Local observations & impacts, traditional knowledge, food security

Indigenous communities in Rio Yaqui Sonora Mexico and other regions are using the “Cultural Indicators for Food Security, Food Sovereignty and Sustainable Development” finalized at the Second Global Consultation on Right to Food, Food Security and Food Sovereignty for Indigenous Peoples (Bilwi Nicaragua, September 2006) as an effective tool for assessing the impacts of decreasing rainfall on traditional farming activities in their areas, as well as their own traditional knowledge about using seeds (corn, squash and beans) and methods which are resilient in drought conditions.

Further information:
UNPFII, 2008: E-C_19_2008_CRP4: Report of the North America Region Preparatory Meeting for the UNPFII Seventh Session, http://www.un.org/esa/socdev/unpfii/documents/E_C_19_2008_CRP4.pdf

327 USA | Squamish management plans

Adaptation, forests, natural resource management

Advances are being made by the Squamish Nation of British Columbia to assert jurisdiction and take control over their traditional lands, in particular through implementing management plans regarding their forests, waters and traditional game. These advances include permanently safeguarding 50,000 hectares of pristine forestlands called “wild spirit places” and asserting co-management agreements with all 16 provincial parks, significantly reducing de-forestation and environmental degradation in their territories.

Further information:
UNPFII, 2008: E-C_19_2008_CRP4: Report of the North America Region Preparatory Meeting for the UNPFII Seventh Session, http://www.un.org/esa/socdev/unpfii/documents/E_C_19_2008_CRP4.pdf

328 USA | Swinomish Climate Change Initiative

Local observations & impacts, policy & planning

Website about Swinomish Indian Tribal Community's project to assess local impacts, identify vulnerabilities, and prioritize planning areas and actions to address the possible effects of climate change. The ultimate goal is to develop a community action plan that will also be shared as a model to assist other tribal governments and jurisdictions with implementing strategic climate change planning policies and actions within their local communities. In October of 2007 the Swinomish Indian Senate issued a Proclamation directing action to respond to climate change challenges.

Further information:
Swinomish Climate Change Initiative, www.swinomish-nsn.gov/departments/planning/climate_change/climate_main.html

329 USA | Haudenosaunee Environmental Task Force

Local observations & impacts, health, energy

The work of the Haudenosaunee through the long-term effort of the Haudenosaunee Environmental Task Force to study and halt environmental contamination, to call for reparation by those responsible for contamination and, most importantly, restore the health and resiliency of their sacred site, Onondaga Lake through banning the importation of toxins and the declaration of their territories as nuclear free zones.

Further information:
UNPFII, 2008: E-C_19_2008_CRP4: Report of the North America Region Preparatory Meeting for the UNPFII Seventh Session, http://www.un.org/esa/socdev/unpfii/documents/E_C_19_2008_CRP4.pdf

330 **USA | Tribes and Climate Change – Institute for Tribal Environmental Professionals****Local observations of impacts, awareness raising**

Institute for Tribal Environmental Professionals provides information and resources tailored to helping Native people gain a better understanding of climate change and its impacts on their communities. They provide basic climate-change information; profiles of tribes in diverse regions of the U.S., including Alaska, who are coping with climate change impacts; audio files of elders discussing the issue from traditional perspectives; and resources and contacts to develop climate change mitigation and adaptation strategies.

Further information:
Tribes and climate change website,
<http://www4.nau.edu/tribalclimatechange/index.asp>

331 **USA | Crow Canyon Archaeological Center****Local observations of impacts, awareness raising, multimedia**

This collaborative initiative between archeologists and Pueblo Indian farmers and students to assist them understand modern and ancient Anasazi agricultural systems and climate variability produced a variety of educational programs including a video tailored to Native students in the region.

Further information:
The Christensen Fund,
<http://www.christensenfund.org/page.asp?id=72>;
Crow Canyon Archaeological Center,
<http://www.crowcanyon.org>

332 **USA | Indigenous Remote Sensing Collaborative****Local observations of impacts, awareness raising**

The Indigenous Remote Sensing Collaborative (IRSC) is an initiative founded by Indigenous Mapping Network (IMN). The purpose of IRSC is to increase awareness of community remote sensing as a tool for serving the needs of indigenous peoples. Community remote sensing can help indigenous peoples manage and preserve the resources of their local environment. It also presents a means for indigenous peoples, with limited academic and financial resources, to contribute their local environmental knowledge as part of the formal scientific understanding of the Earth (including as a response to climate change). Projects may range from efforts as simple as creating photographic records that formally document local environmental change or as sophisticated as validating satellite imagery to help ensure global environmental analyses accurately reflect the actual environment at local scales.

Further information:
Indigenous Mapping Network,
<http://indigenoumapping.net/imnrscollab.html>



PACIFIC ISLANDS, AUSTRALIA AND NEW ZEALAND

333 PACIFIC ISLANDS | Capacity Building for the Development of Adaptation Measures in Pacific island countries project

Adaptation, Capacity-building

This \$2m Canadian Development Agency (CIDA) initiative is being executed by SPREP. It involves 16 communities in four countries: Cook Islands, Fiji, Samoa and Vanuatu. The project is being implemented by governments and non-government organizations and includes capacity-building in traditional and contemporary ways of adaptation.

Further information:
SPREP, http://www.sprep.org/climate_change/cdbmpic.htm

334 PACIFIC ISLANDS | Pacific Adaptation to Climate Change Project

Adaptation, Capacity-building

This Regional UNDP/GEF Project covers 13 countries and is being implemented by SPREP. One of the few projects globally to access the Special Climate Change Fund of the GEF. The Pacific Adaptation to Climate Change Project Inception Form was approved to secure USD13.125 million of adaptation funding to the region. The objective of the PACC is to enhance the resilience of a number of key development sectors (food production and food security, water resources management, coastal zone, infrastructure etc.) in the Pacific islands to the adverse effects of climate change. This objective will be achieved by focusing on long-term planned adaptation response measures, strategies and policies. To ensure sustainability of the project, regional and national adaptation financing instruments will also be developed. The 13 countries participating are: Cook Islands; Federated States of Micronesia; Fiji; Marshall Islands; Nauru; Niue; Palau; Papua New Guinea; Samoa; Solomon Islands; Tonga; Tuvalu; and Vanuatu. Kiribati currently has a national adaptation project and did not wish to be part of the regional project.

Further information:
SPREP, <http://www.sprep.org/topic/climate.htm>

335 PACIFIC ISLANDS | Pacific Mangrove Loss

Local observations of impacts, natural resource management, biodiversity, livelihoods

There are numerous reports about accelerated loss of mangroves due to rising sea levels, which traditionally have provided settlements with protection from waves and storms; wave energy may be reduced by 75 per cent during a wave's passage through 200 metres of mangrove forest. In accordance to the United Nations Environment Programme, 16 Pacific island states and territories could see over half of their mangroves lost by the end of the century. It is projected that the worst-affected areas include American Samoa, Fiji and Tuvalu. Mangroves are also important nurseries for fish, sources of timber and construction materials for island communities, and provide filter for coastal pollution. Dyes from mangroves are also traditionally harvested in some communities to treat textiles, nets and fish traps. The health of mangroves directly affects the health of local ecosystem. The loss of mangroves has severe impacts on coastal indigenous and local communities due to the important functions mangroves hold. The loss of mangroves will adversely affect many important elements, such as the local biological diversity and ecosystem, fisheries, settlement and habitat safety, pollution, traditional livelihoods, and the availability of construction material.

Further information:
World Watch Institute, 2006, Climate Change Imperils Pacific Ocean Mangroves, <http://www.worldwatch.org/node/4426>

336 PACIFIC ISLANDS | Sharing Community Stories: The Pacific Climate Change Film Project

Local observations of impacts, multimedia

The Pacific Climate Change Film Festival was organized by SPREP and IUCN Oceania Office and held from 23-24 September 2008, Suva Fiji. [Several films from this project have separate entries.]

Further information:
SPREP, http://www.sprep.org/climate_change/filmproject/index.asp

337 PACIFIC ISLANDS | 2009 Pacific Voices Tour

Local observations of impacts, awareness raising, multimedia

The Greenpeace ship, the Esperanza, spent two months in the Cook Islands, Samoa and Vanuatu to document climate change impacts and efforts by climate activists to mitigate impacts. The Arctic Sunrise documented climate change impacts in Greenland.

Several videos released so far include:

- Ulamila – climate activist in the Pacific: Frustrated by the lack of awareness of climate change issues in her region, Ulamila Kurai of the Cook Islands has set up a media network that aims to be a platform for climate impact stories in the Pacific.
- Teava adapting to a changing climate - Teava Iro was born in Rarotonga in the Cook Islands. He remembers that, as a boy, his father would teach him how to fish in the lagoon, where a vibrant coral garden attracted an abundance of colourful fish. Today, it's a different story.
- Climate change impacts on Pukapuka Island - In 2005, Pukapuka and the nearby atoll of Nassau were devastated by Cyclone Percy – the fourth of five cyclones to hit the Cook Islands in five weeks. Only 10 per cent of houses on Pukapuka survived intact.
- A Chilly Warning from the Arctic – Xin Yu (aka "Fish") shares his observations about what he has seen in northwest Greenland and our responsibility to act.

Further information:
Greenpeace Australia Pacific: Climate stories, <http://www.greenpeace.org/australia/resources/videos/climate-change>

338 **PACIFIC ISLANDS** | Training in negotiation**Local observations & impacts, capacity-building**

This FIELD project provided training and capacity-building activities for forty delegates from Pacific Island States to negotiate on behalf of their countries the implementation of the international legal regimes on biodiversity, climate change and trade-related agreements at international negotiating sessions.

Further information:
The Christensen Fund,
<http://www.christensenfund.org/page.asp?id=61>

339 **PACIFIC ISLANDS** | Action research and documentation**Adaptation, disaster preparedness**

IFAD provided a small grant to the Secretariat of the Pacific Community to promote the development and dissemination of appropriate crops and technologies. The results were to be achieved through the valorization of indigenous and atoll technologies through action research and documentation, in order to support agriculture and fisheries. A similar activity will be managed by the Solomon Island Development Trust, which is the recipient of a small grant through IFAD's Indigenous Peoples' Assistance Facility (IPAF). The Babanakira and Kolina indigenous populations will be assisted in improving post crisis resilience by merging valorized traditional with scientific knowledge.

Further information:
UNPFII, 2009. Information received from the United Nations System and Other Intergovernmental Organisations. E/C.19/2009/3/ Add.3

340 **AUSTRALIA** | Sharing Knowledge Project**Adaptation, forecasting, awareness raising**

CSIRO and Climate Change Research Centre, University of New South Wales. This project focuses on the impacts and adaptation strategies for Indigenous Australian communities living in northern Australia. It provides information on climate change projections for regional areas in the north as well as suggested direct and indirect impacts that may occur as a result. Working with Indigenous communities the aim is to encourage a better understanding of climate change impacts on their communities and to determine the best ways to mitigate or reduce these detrimental impacts on their way of life. By acquiring a greater understanding of the traditional environmental knowledge that has accumulated over thousands of years, such knowledge can be integrated with modern environmental and climate science and applied in a broader sense for the wider Australian community.

Further information:
Sharing Knowledge,
<http://www.sharingknowledge.net.au/>

341 **AUSTRALIA** | Impacts of climate change on health of Indigenous Australians**Local observations & impacts, health**

The vulnerability of Australia's Indigenous people living in remote areas to climate change is intensified by the social and economic disadvantage they already experience — the result of factors that include decades of inadequate housing and public services, and culturally inappropriate medical services. In addition, specific cultural ties between Indigenous people's wellbeing and the "health" of their "country" create significant indirect impacts of climate change. It is vital to acknowledge the significance of this situation now, so that anticipatory adaptive policies can be implemented. Such policies should ensure that adequate resources are provided to mitigate some of the worst impacts of climate change on these communities, in a way that encourages community participation in decision-making. Climate change is expected to bring hotter day and night temperatures across northern Australia, where cardiovascular and respiratory diseases are more prevalent and many elderly people have inadequate facilities to cope with increased heat stress. Communicable diseases, such as bacterial diarrhoea, are more common in hot dry conditions and these may increase without extra preventive action. The authors note that one study has predicted an average temperature increase of between 1.0 and 3.5 C by 2050 would result in an increase of up to 18% in diarrhoea case in Alice Springs. Mosquito-borne diseases, such as dengue fever, may present new problems in places such as North Queensland as well. The report notes Aboriginal peoples were also more at risk because of their close ties to traditional lands: "If the community-owned country (land) becomes 'sick' through environmental degradation, climate impacts, or inability of the traditional owners to fulfil cultural obligations through ongoing management and habitation of their land, the people of that land will feel this 'sickness' themselves,"

Further information:
Donna Green, Ursula King and Joe Morrison, 2009: Disproportionate burdens: the multidimensional impacts of climate change on the health of Indigenous Australians in *Medical Journal of Australia* MJA 2009; 190 (1): 4-5
http://www.mja.com.au/public/issues/190_01_050109/gre11091_fm.html
Green, Donna (2008): Climate impacts on the health of remote northern Australian Indigenous communities, *Garnaut Climate Change Review*
[http://www.garnautreview.org.au/CA25734E0016A131fWebObj/03-Clndigenous/\\$File/03-C%20Indigenous.pdf](http://www.garnautreview.org.au/CA25734E0016A131fWebObj/03-Clndigenous/$File/03-C%20Indigenous.pdf)
Green, Donna (2006): Climate Change and Health: Impacts on Remote Indigenous Communities in Northern Australia *Climate Change Impacts and Risk*; CSIRO Marine and Atmospheric Research Paper 012; November 2006
http://web.maths.unsw.edu.au/~donna/g/docs/climateimpacts_health_report.pdf

342 **AUSTRALIA** | Land Management Practices in Australia and carbon offsets**Adaptation, natural resource management, payment for ecosystem services**

This study of six Indigenous Land Corporation properties across Western Australia, Northern Territory, and Queensland looked at land management practices including fire management, reforestation and grazing land management. These practices can sequester carbon or change emissions regimes and the change in carbon stocks or emissions could be sold as offsets. The research found potential greenhouse emissions offsets from fire management on Indigenous lands are worth AUD\$52 million per year to Indigenous communities. This industry could prevent 2.6 million tonnes of carbon entering the atmosphere each year. Indigenous lands account for 54 per cent of all potential emissions reductions from Australia's fire-prone savannas and rangelands, meaning that Indigenous contributions to greenhouse gas abatement are very significant to Australia.

Further information:
Heckbert S, Davies J, Cook G, McIvor J, Bastin G, Liedloff A. 2008. Land management for emissions offsets on Indigenous lands. CSIRO Sustainable Ecosystems: Townsville QLD. 62 pp.
<http://www.csiro.au/files/files/pnpo.pdf>

343 **AUSTRALIA** | Sea level rise in Kowanyama, Cape York videobrief**Local observations & impacts, sea level rise, wetlands, multimedia**

A short video about the effects of climate change on an indigenous community living in a wet savannah zone in Northern Australia. Like other coastal peoples, Aboriginal people living on gulf coastal plains in Kowanyama are particularly susceptible to even the most minor changes in sea level. Also, the predicted increase in tropical weather events in this flat country means monsoon flooding of one of Australia's largest river systems could well occur before major sea level change. This already seems to be happening and there is concern regarding the impact on Kowanyama — forty kilometres from the coast but located within the greater delta of the Mitchell river — because during the wet season, flooding pumps a freshwater plume 3 kilometres out to sea. The mythologies or "dreaming stories" of this country recount how

Further information:
UNU-TKI Indigenous Perspectives on climate change video series, http://www.unutki.org/default.php?doc_id=120; *Vimeo album*, <http://www.vimeo.com/album/85004>

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many years ago, the Kitehawk, an ancestral being, built a large stonewall to stop the tidal water from flooding the land and its people, while other clever ancestral parrot beings heaped up coastal dunes to keep the sea out. However, as the sea level rises, the tidal waters are slowly sweeping cultural artifacts away and that process threatens the ancestral stories and attachment to country of the Aboriginal peoples of Kowanyama. These biophysical changes are encroaching on spiritual and conceptual boundaries that are so integral to the Aboriginal identity.

344 AUSTRALIA | Walking on Country With Spirits, Wugal Wugal, videobrief

Local observations & impacts, culture, wetlands, multimedia

A short video about the effects of climate change on remote indigenous countryside located in the wet tropics in Northern Australia. Located on the eastern shore of Australia's tropical north, Shipton's Flat is home to Marilyn, a Kuku Nyungkal Aboriginal woman, and her family. She has been living here the ancestral way – far removed from the services and conveniences of modern life – as part of the sublime performance of nature. Like her ancestors before her, Marilyn walks through the Nyungkal bubu, the Nyungkal's country, acknowledging and conversing with the Spirit beings around her.

Further information:

UNU-TKI Indigenous Perspectives on climate change video series, http://www.unutki.org/default.php?doc_id=120; Vimeo album, <http://www.vimeo.com/album/85004>

345 AUSTRALIA | People on Country, Healthy Landscapes and Indigenous Economic Futures

Adaptation, natural resource management, policy & planning

The Centre for Aboriginal Economic Policy Research (CAEPR) is undertaking a 3-5 year applied research project focusing on Aboriginal land and sea management in the tropical savannah of Top End and Gulf Country of the Northern Territory. The research is called 'People on Country, Healthy Landscapes and Indigenous Economic Futures', largely sponsored by the Sidney Myer Fund, but also by the Australian National University (ANU) and the Australian Research Council. People on Country aims to transfer skills to land and sea management groups to address two major issues: how their activities are improving Indigenous well-being, and delivering better natural resource management on Aboriginal land and sea country. Working in partnership with traditional owners and their land and sea management groups, the research aims to strengthen Caring for Country projects by building partnerships, sharing skills, and capacity development especially in governance; assisting key Aboriginal organisations and natural resource management agencies with evidence-based research; using evidence-based research to better inform government policy on cultural and natural resource management on Aboriginal land and sea country and to attract more government and private investments in Caring for Country projects; and helping Aboriginal land and sea managers make their voice heard in national debates such as climate change, water, sea country, fire management, wildlife use and cultural and natural resource management.

Further information:

Centre for Aboriginal Economic Policy Research, Australian National University, <http://www.anu.edu.au/caepr-old/country/index.php>

346 AUSTRALIA | Management of climate change through Savanna burning

Adaptation, fire management

Aboriginal traditional knowledge relating to fire management remains strong throughout much of northern Australia, and the opportunity still exists to re-apply such knowledge to landscape management. As part of the northern Australian 'Burning for Biodiversity' project, CSIRO and the Bushfire CRC are working with traditional owners in Kakadu National Park to examine the biodiversity and cultural benefits of Aboriginal fire management. Results from CSIRO's recently completed landscape-scale fire experiment at Kapalga in Kakadu National Park indicate that fire frequency, and more particularly time-since-fire, is far more important than previously thought.

This article makes reference to a significant initiative involving the community management of landscape fire to reduce annual GHGE from savanna burning. This initiative appears to offer potential for engagement with global carbon markets, but it will need local, national and international support, along with appropriate changes in attitudes and legal arrangements, to ensure an equitable distribution of tangible rewards, while protecting the cultural and related benefits of customary fire use.

Further information:

CSIRO Tropical Ecosystems Research Centre, <http://www.terc.csiro.au/burningforbiodiversity/>; Peter J. Whitehead, Paul Purdon, Jeremy Russell-Smith, Peter M. Cooke, Stephen Sutton, 2008: The management of climate change through prescribed Savanna burning: Emerging contributions of indigenous people in Northern Australia Public Administration and Development Volume 28, Issue 5, Date: December 2008, Pages: 374-385.

347 AUSTRALIA | Human Rights Implications of Climate Change for Indigenous Australians

Local observations & impacts, human rights

This project examines the human rights implications of climate change for Australian Indigenous peoples through an analysis of international mechanisms and bodies and the way in which they may be used to garner a 'seat at the table'. Issues relevant to indigenous peoples on a global scale (e.g. loss of traditional life and land; 'environmental refugees') are being analysed for their social and cultural implications and subsequently for the way in which other indigenous nations have looked to address them. On the local level, this project looks at current legislation which impacts on Indigenous Australians and the way in which climate change will affect or even alter this impact.

Further information:

Indigenous Law Centre, UNSW Faculty of Law, http://www.ilc.unsw.edu.au/resources/resourcepage_humanrights-implications-of-climatechange-for-indigenoustralians.asp

348 AUSTRALIA | Indigenous Livelihoods Focal Project

Adaptation, biodiversity, payment for ecosystem services, livelihoods

This project is investigating new enterprises and job opportunities for Indigenous communities based on natural resource management. The research objectives include demonstrating how Western science and Indigenous knowledge can best work together to achieve sustainable Indigenous livelihoods and developing and testing better tools to plan, monitor and evaluate livelihood strategies based on natural resource management. Project activities include Indigenous monitoring of biodiversity and climate change Great Western Woodlands of Western Australia, and eco-tourism and payments for ecosystem service protection in Province Nord, New Caledonia.

Further information:

CSIRO, <http://www.csiro.au/science/Indigenous-Livelihoods.html>

349 AUSTRALIA | Scenario Planning for Climate Change

Adaptation, policy & planning

This project uses scenario planning and modelling to explore the impacts of climate change on the societal and environmental aspects of the Northern Territory. Scenario modelling is carried out in a participatory manner, with stakeholders from a wide range of sectors including Indigenous communities and organisations, business and economics, natural resource management, government agencies, and the scientific community. The project aims to develop realistic scenario models of future change to the Northern Territory so that planning and management across the NT can be prepared for a range of potential impacts from climate change.

Further information:

Savanna Explorer,
<http://www.savanna.org.au/all/walffa.html>

350 AUSTRALIA | West Arnhem Land Fire Abatement Project (WALFA)

Adaptation, fire management, payment for ecosystem services, culture

The West Arnhem Land Fire Abatement Project represents an important new way that skilled Indigenous fire managers in Australia's fire-prone tropical savannas can work with the broader community to reduce greenhouse gas emissions, protect culture and biodiversity on their country, and bring in social and economic benefits to their communities. The project is a partnership between the Aboriginal Traditional Owners and Indigenous ranger groups, Darwin Liquefied Natural Gas (DLNG), the Northern Territory Government and the Northern Land Council. Through this partnership Indigenous Ranger groups are implementing strategic fire management across 28,000 km² of Western Arnhem Land in Australia's Northern Territory, to offset some of the greenhouse gas emissions from the Liquefied Natural Gas plant at Wickham Point in the city of Darwin.

The project is now reducing greenhouse gas emissions from this area by the equivalent of over 100,000 tonnes of CO₂ each year. It does this by undertaking strategic fire management from early in the dry season to reduce the size and extent of unmanaged wildfires. There has been a significant reduction in the incidence of destructive wildfires, however it will take some time to verify that this has produced a recovery in the status of threatened and declining species on the plateau. The fire management has involved over one hundred part-time jobs for Indigenous Rangers and others and has allowed many different ranger groups and communities to coordinate their activities and build regional collaboration. Such practices are also helping to conserve environmental and cultural values in the project region - values equivalent to those in the adjacent World Heritage-listed Kakadu National Park. In return Darwin LNG is paying the Indigenous fire managers around AUD \$1 Million a year to provide this service – with this funding also bringing in new jobs, networks and educational opportunities to the region. The project is also helping to revive Indigenous culture on the Arnhem Land Plateau. This is a living tradition involving various aspects of culture including rock wall painting and customary land management that extends back over tens of thousands of years. The thousands of rock art sites alone likely represent the world's oldest continuing record of artistic endeavour – and the project is helping to protect some of these sites and other sites of cultural significance from the ravages of wildfire.

Further information:

School for Environmental Research, Charles Darwin University, <http://www.cdu.edu.au/ser/ClimateChangeandScenarioModelling.htm#scenarioplanning>; Scenario Planning and Climate Change Model for Alice Springs, <http://www.users.on.net/~treehugger/ser/index.htm>

351 AUSTRALIA | Fighting fire with carbon in Arnhem Land videobrief

Adaptation, payment for ecosystem services, multimedia

A short video about the effects of climate change on an indigenous community living in a dry savannah zone in Arnhem Land, Northern Australia. It examines the fire abatement scheme of Australia's Western Arnhemland - a carbon offset community programme gaining a lot of international attention. Aboriginal fire ecologist, Dean Yibarbuk, explains how traditional fire management practices have kept the country healthy for thousands of years. Recently, his mob at Wardakken have been working with local scientists to adapt traditional fire management to reduce greenhouse gas emissions.

Further information:

UNU-TKI Indigenous Perspectives on climate change video series, http://www.unutki.org/default.php?doc_id=120; Vimeo album, <http://www.vimeo.com/album/85004>

352 AUSTRALIA | Ikuntji Cool Community, West MacDonnell Ranges

Adaptation, waste management

The Cool Communities programme was funded by the federal government via the Australian Greenhouse Office and involved the collaboration of non-government environmental organisations. The programme, worked with communities, industry and government, to find ways to cut greenhouse gas emissions, save money and improve lifestyles. One community involved was the remote aboriginal community of Ikuntji in the West MacDonnell Ranges, which was the smallest community to participate in the programme. Its particular Cool Communities project was to provide a rubbish collection service using wheelie bins to replace the previous practice of burning off rubbish. The project was considered to be a success in providing for a new rubbish management system and in raising awareness about energy, pollution and health issues.

Further information:

UNU-IAS TKI Australian Carbon Trading Guide, http://www.unutki.org/downloads/File/Publications/2009_Emissions_Trading_IPs_Guide.pdf

353 AUSTRALIA | Bushlight

Adaptation, energy, traditional knowledge, fire management, payment for ecosystem services

Bushlight is a renewable energy project which aims to increase access to sustainable energy services within remote Indigenous communities across Australia. Bushlight does this with a strong focus on community engagement in the energy planning process, and by designing robust, technically advanced renewable energy systems. Bushlight is a project of the Centre for Appropriate Technology Inc. (CAT), based in Alice Springs. Many remote communities in Australia are not connected to the electricity grid or to gas pipelines. This means that they sometimes lack access to a reliable and affordable source of power. Funding and support for the installation of renewable energy systems, particularly solar power systems, is a great opportunity to provide a community with a more reliable source of energy while also reducing greenhouse gas emissions. Most commonly, this occurs when solar power (and sometimes wind power) replaces diesel or small petrol generators.

Further information:

Bushlight, <http://www.bushlight.org.au/default.asp?home>; UNU-IAS TKI Carbon Guide for Northern Indigenous Australians, http://www.unutki.org/downloads/File/Australian_Carbon_Guide.pdf; Australian Government Department of the Environment, Water, Heritage and the Arts, <http://www.environment.gov.au/commitments/publications/bushlight.html>

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Bushlight staff work with communities to help them plan and manage their energy services in a way that suits the community. They call this the Community Energy Planning process. Through this process, Bushlight staff work with local residents to ensure that residents have the technical and other information they need to be able to choose affordable, consistent and reliable renewable energy services to meet their energy needs. The process then involves the provision of training, information and resources to help communities design and build high quality, reliable renewable energy systems and to engage services to maintain these systems.

354 AUSTRALIA | Biosequestration and Natural Resource Management, Far North Queensland

Adaptation, natural resource management, payment for ecosystem services

The 'Wet Tropics Biosequestration Project' is being carried out under Terrain NRM, the natural resource management body of far north Queensland. The aim of the project is to develop emission reductions for sale on the voluntary carbon market through integrated, regional natural resource management by the landholders of Terrain NRM, one of which is an Aboriginal group. The project is based on Terrain's 2004 Regional Plan, "Sustaining the Wet Tropics: A Regional Plan for Natural Resource Management" and seeks to store carbon through biosequestration as well as to preserve biodiversity, provide for sustainable land use and help with natural resilience to climate change in the region.

The regional approach to the project provides a unique opportunity for many small landholders in the area to receive payment for ecosystem services. A range of natural resource activities will be involved, including afforestation and reforestation, farm forestry, assisted natural regeneration, avoided deforestation, grazing land management, and sustainable agriculture. It is understood that at this stage, the involved landholders have taken part in field-testing and have agreed in principle to proceed with contractual arrangements for the sale of their biocarbon.

Further information:

The Climate, Community & Biodiversity Alliance, http://www.climate-standards.org/projects/files/DegreeCelsiusFNQ_CCB_PDD_Poov5-small.pdf

355 AUSTRALIA | Indigenous Weather Knowledge Website Project

Local observations & impacts, traditional knowledge, forecasting, disaster preparedness

Aboriginals of central and northern Australia have preserved an intimate knowledge of plant and animal cycles, which was gained over thousands of years and passed down from generation to generation. The ability to link events in the natural world to a cycle that permitted the prediction of seasonal events was a key factor in their success. These natural barometers were not uniform across the land but instead used the reaction of plants and animals to gauge what was happening in the environment. The flowering of the rough barked gum and the bunch spear grass, for example, is a sign that the winds will soon blow from the southeast and the Dry Season will arrive. A traditional scientific explanation for the flowering of the rough barked gum could be that falling humidity associated with the beginning of the Dry Season triggers the flowering response noted. This illustrates the concept that plants and trees, when viewed by the educated eye, can be read in the much same way as the modern Automatic Weather Station. These seasonal weather calendars are displayed on the Bureau of Meteorology Indigenous Weather Knowledge website.

The website is the result of a joint effort involving the Indigenous communities, Aboriginal and Torres Strait Islander Commission (ATSIC), the Australian Government's Bureau of Meteorology, and Monash University's Centre for Australian Indigenous Studies (CAIS) and School of Geography and Environmental Science.

Further information:

UNFCCC Database on local coping strategies, Case Study 81, http://maindb.unfccc.int/public/adaptation/adaptation_casestudy.pl?id_project=81, Australian Government Department of Meteorology – Indigenous Weather Knowledge website, <http://www.bom.gov.au/iwkw/>

356 COOK ISLANDS | Kia Vai Teateamamao (Be Prepared): Traditional climate forecasting in the Cook Islands video

Local observations & impacts, multimedia, forecasting, disaster preparedness

This documentary examines some traditional methods of forecasting extreme changes in weather and explains how Cook Islanders have prepared for these changes.

Further information:

Cook Islands National Environment Service; Maori Kuki 'Airani/English, 2005, 28:00. In SPREP Sharing Community Stories, http://www.sprep.org/climate_change/filmproject/project.asp

357 KIRIBATI | Kiribati Adaptation Project (KAP)

Adaptation, water management, capacity-building

The Kiribati Adaptation Project (KAP) has focused on identifying climate-related problems and designing cost-effective adaptation solutions. The project has five broad components: policy, planning, and information; reducing the vulnerability of the coastline including key public assets and ecosystems; developing and managing freshwater resources; providing technical assistance to build capacity at island and community level; and project management. The project was approved in June 2006 and is funded through a US\$1.8 million grant from the Global Environment Facility (GEF), loans from Australia and New Zealand, and borrower funds.

Further information:

The World Bank, Projects & Operations, <http://web.worldbank.org/external/projects/main?pagePK=64283627&piPK=73230&theSitePK=40941&menuPK=441920&Projectid=Po89326>

358 KIRIBATI | A Future for Kiribati? video

Local observations & impacts, multimedia, water resources, sea-level rise

The Pacific island of Kiribati is at the frontline of climate change. This video shows a king tide inundating houses and land. Constant flooding contaminates fresh water supplies. Salt water in the soil makes it hard to grow crops. Sea-level rise will increase as global temperatures rise with climate change.

Further information:

Greenpeace Australia Pacific, <http://www.greenpeace.org/australia/resources/videos/climate-change/kiribati-impacts-200509>

359 KIRIBATI | The Island of my Ancestors video

Local observations & impacts, multimedia, culture

Another intriguing look at the climate-related problems faced by Kiribati and the unique solutions it has developed. The film focuses on the threat posed to the rich I-Kiribati cultural heritage by climate change, in addition to the potential loss of their homeland.

Further information:

Naamon Marae/Television Kiribati Limited, te taetae ni Kiribati/English, 2008, 17:34. In SPREP Sharing Community Stories, http://www.sprep.org/climate_change/filmproject/project.asp

360 MALDIVES | Sea level rise and the Safer Islands Strategy

Adaptation, sea-level rise, displacement, disaster preparedness

On a global scale, Maldives is one of the nations most vulnerable to the predicted impacts of climate change, especially sea level rise (SLR). More than 85% of land area is estimated to be less than 1.5 m above mean sea level, with the highest elevation in Maldives being as little as 4.0 meters. The geography of the country, which consists of small, low lying coral reef islands, renders the whole country vulnerable to both short-term changes in sea level (e.g. flooding produced by storms and swell waves), as well as long term sea level rise. There have been recent incidences of swells and storms affecting more than half the populated islands, which has resulted in loss of property and adverse impacts on water resources and agriculture (e.g. following the tsunami in 2004, 13 of the 200 inhabited islands were totally destroyed, 56 suffered major damage and 121 experienced moderate damage).

In response, the Maldives government has developed a 'Safer Island Strategy' that includes internal resettlement from smaller, less populated islands to larger islands with better natural protection and enhanced coastal defenses. The term 'safe islands' in the Maldives refers to a range of larger islands that should ultimately provide safe havens for people who are forced to migrate before or after extreme natural disasters. 'Safe islands' enable communities to sustain social and economic development during emergencies and disasters; this will be achieved by providing ecologically safe zones and structures to mitigate the impact of climate change induced events such as storm surges, tidal swells, as well as have benefits in the context of other hazards such as tsunamis. In addition, elevated areas and buildings will be provided on 'Safe islands' to enable vertical evacuation, if necessary. These safe places are intended to provide all basic services in an emergency (health, communication, and transport infrastructure), and have a buffer stock of basic food and water. In the long-term, 'safe islands' are envisioned to provide voluntary temporary relocation options for Maldivians living in a more and more hazardous environment as a result of sea level rise. The plan also addressed the possible relocation of all the Maldives population to another country such as India or Iceland.

Further information:

The Global Environment Facility, [http://www.gefweb.org/uploadedFiles/Focal_Areas/Climate_Change_\(PDF_DOC\)/LDCF1/Maldives_02-20-09%20Integration_CC_Risks_Safer_Island_LDCF\(1\).pdf](http://www.gefweb.org/uploadedFiles/Focal_Areas/Climate_Change_(PDF_DOC)/LDCF1/Maldives_02-20-09%20Integration_CC_Risks_Safer_Island_LDCF(1).pdf)

361 MARSHALL ISLANDS | Ad Jolet: Anikien RiMajol Kon Climate Change video

Local observations @ impacts, multimedia, culture, displacement

As one of the most vulnerable nations in the world, the Marshalls are among the very first to experience the devastating effects of sea level rise and other climate-related problems. Interviews with Marshallese from different segments of society shed light on the costs involved with the loss of their homeland and cultural identity as a result of climate change.

Further information:

High Tide Productions; Marshallese/English, 2008, 05:00. In SPREP Sharing Community Stories

362 MICRONESIA | Heritage loss and climate change

Local observations @ impacts, culture

A pilot study was conducted by the James Cook University in order to establish research processes and protocols for the investigation of the impact of climate variability and change on cultural heritage in the coral atoll islands of Micronesia. A mapping exercise on Moch Island to determine the geographical location and stories associated with the culturally important places identified by people as being affected by climatic events were recorded revealed Moch to be a cultural web of places constituting a land/seascape steeped in heritage significance. Analysis of interviews with key research participants demonstrated that people are deeply concerned about the potential loss of their home islands, significant places and place-based knowledge due to climate change.

Further information:

Rosita Henry, William Jeffery and Christine Pam, 2008: Heritage and Climate Change in Micronesia. James Cook University Project Report.

363 NEW ZEALAND | Maori environmental knowledge of local weather and climate change in Aotearoa

Local observations @ impacts, traditional knowledge

In partnership with the tribal group Te Whanau-a-Apanui, NIWA's Maori Research and Development Unit (Te Kuwaha o Taihoro Nukurangi) have initiated a pilot project to identify and document Maori environmental knowledge (MEK) of weather and climate in New Zealand. Using a Kaupapa Maori based research approach and semi-directive interviewing, an intimate understanding of local weather and climate was demonstrated by elders from Te Whanau-a-Apanui. This knowledge includes the use of a vast indigenous nomenclature for local weather and climate phenomenon, the oral recording of weather and climate based events and trends, and the identification of environmental indicators to forecast weather and climate. Learning from this knowledge provides an opportunity to understand what has helped Maori adapt to weather and climate variability in the past. It also provides clues on how to enhance present day Maori and western scientific understanding of local weather and climate in New Zealand.

Further information:

DNT King et al, 2008: M ori environmental knowledge of local weather and climate change in Aotearoa – New Zealand, Vol 90, No 4, 385-409, DOI: 10.1007/s10584-007-9372-y
<http://www.niwascience.co.nz/ncc/maori/knowledge>

364 NEW ZEALAND | Cultural Health Index for Streams and Waterways (CHI)

Adaptation, local observations @ impacts, water resources, culture

The Cultural Health Index (CHI) is a tool that Maori can use to assess and manage waterways in their area. The index allows iwi/hapu to assess the cultural and biological health of a stream or catchment of their choosing and then communicate this information to water managers in a way that can be understood and integrated into resource management processes. The (CHI) for rivers and streams is a tool that has been developed to facilitate the participation of iwi in resource management processes, specifically the management of streams and rivers. It was funded by the Ministry for the Environment as part of its Environmental Performance Indicator (EPI) Programme - a programme that has since ended. This developmental work arose in recognition by both Ngai Tahu and the Ministry for the Environment that limited attention had been paid to the incorporation of Maori values in river management. In addition to incorporating Maori values in river management, the index provides a potentially powerful diagnostic tool that can assist in the prioritisation of remedial actions once issues of concern to iwi are identified. The data gathered from field assessments as the CHI is applied will be used to identify areas of possible concern.

Further information:

Gail Tipa, Laurel Tierney, 2002: Introducing the cultural health index

http://niwa.cri.nz/_data/assets/pdf_file/0018/53712/Tipa.pdf

A Cultural Health Index for Streams and Waterways: A tool for nationwide use April 2006, Ref. ME710

<http://www.mfe.govt.nz/publications/water/cultural-health-index-for-streams-and-waterways-tech-report-apro6/cultural-health-index-for-streams-and-waterways-tech-report-apro6.pdf>

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Three stages were completed in the development of the CHI:

- The first stage of the work documented the association of Ngāi Tahu with the Taieri River catchment and identified a sizeable set of indicators that Ngāi Tahu use to assess the health of freshwater resources (Tipa 1999)
- in Stage 2 the indicators of cultural health and mahinga kai were refined to develop a tool and a process that could be used by kaitiaki to assess the condition of freshwater resources. This work focused on the Taieri and Kakaunui catchments (single-channel, rain-fed rivers) and involved Te Rūnanga o Moeraki and Te Rūnanga Otakou. The stream CHI was thus devised and first used in 2002 (Tipa and Teirney 2003). It has three components: site status, specifically the significance of the site to Māori; a mahinga kai measure; a stream health measure.
- Stage 3 recognised the need to validate the CHI to determine whether the tool could be implemented more widely. This involved the application of the process to another river type in the rohe of Ngāi Tahu (the braided Hakatere [Ashburton] River) and also involved a river similar to the Taieri and Kakaunui (the Tukituki) but in the rohe of another iwi (Ngāti Kahungunu).

In total, four catchment studies were completed on the Taieri, Kakaunui, Hakatere (Ashburton) and Tukituki Rivers. From the data collected, a Cultural Health Index was developed that is generic in the sense that it can be used confidently by any iwi at sites in streams of any size or river type. The index allows whānau/hapū/iwi to monitor the health of a stream or catchment of their choosing. Guidelines have been prepared that outline how to identify which areas need monitoring, how to set the programme up and how to collect data and analyse it so that changes are identified and remedial actions can be taken to restore or enhance the site. The CHI can also be used to monitor changes after restorative work has been carried out on a site.

365 NEW ZEALAND | Ministry of Environment, Consultation with Maori on Climate Change: Hui Report

Local observations & impacts, policy & planning

During March and April 2007, 13 regional consultation hui with Maori were held around the country to discuss the climate change issues and options proposed in the discussion documents. The Hui report provides a summary of the key themes that emerged from the 13 hui. At every hui there was widespread acknowledgement from tangata whenua that climate change is an important and urgent issue, that our actions—and inaction—will be judged by future generations, and that balance must be restored in the environment. During the hui, tangata whenua expressed their own values and had unique kōrero¹ in relation to the problems and opportunities in their own regions. This included Maori concepts and values, such as recognition of the importance of kaitiaki, as a core element of New Zealand's response to the challenge of climate change. There was also consensus among Maori that the Crown needs to observe the principles of the Treaty of Waitangi when developing policy that would affect Maori. The principle of partnership is particularly important in this regard.

The Treaty of Waitangi obliges the Crown to protect Maori people in the use of their resources to the fullest extent practicable, and to protect them especially from the consequences of the settlement and development of the land. Under the Kyoto rules only forests established from 1990 onwards can be counted as creating new carbon sinks and are therefore eligible for carbon credits. Clear boundaries in the proposed government policies, such as this 1990 date, flow directly from the Kyoto Protocol. Yet there had been insufficient consideration of tangata whenua issues when the government of New Zealand entered into that international arrangement. Ngāi Tahu openly made a point about its ability to use land that had been returned pursuant to a Treaty Settlement with the Crown. If that ability were to be constrained or penalised by the government's proposed policies, it may well lead to litigation, or a claim to the Waitangi Tribunal for a contemporary Treaty breach.

Further information:

Hui Report, <http://www.mfe.govt.nz/publications/climate/consultation-maori-hui-report-novo7/consultation-maori-hui-report-novo7.pdf>

366 NEW ZEALAND | Motu Economic and Public Policy Research: Carbon Sequestration on Maori Land

Adaptation, forests, payment for ecosystem services

This project addresses the challenge of how to effectively and fairly provide incentives to enhance the regeneration of native forest in order to increase carbon storage and hence mitigate climate change. It focuses particularly on the challenges of engaging with landowners on multiply owned Maori land, and their participation in the Permanent Forest Sink Initiative (PFSI). The East Coast Forestry project could also provide some resources. Neither of these mechanisms may however be well suited to participation by Maori so may fall well short of their potential. As a result of this work, the owners of two Maori landblocks signed contracts with Motu in February 2007. By signing the contracts they agree to protect regenerating native forest and hence promote carbon sequestration in return for cash payments.

Further information:

Motu Economic and Public Policy Research, http://www.motu.org.nz/research/detail/carbon_sequestration_on_maori_land

367 NEW ZEALAND | Emissions Trading Schemes

Adaptation, forests, payment for ecosystem services

A national emissions trading scheme is being implemented progressively for different sectors of the New Zealand economy between 2008 and 2013. The first sector to be covered was the forestry sector. Under the scheme, eligible reforested land (certain forested land planted after 1989) can voluntarily enter the scheme and receive emissions allowances, or 'New Zealand Units' (NZUs) for net increases in carbon stocks sequestered on that land. Additionally, owners of land forested prior to 1990 face certain obligations under the scheme if that land is deforested. These programmes are relevant because Maori are considerable landholders in New Zealand, including of forested land.

Further information:

UNU-IAS Guide on Emissions Trading, Carbon Financing and Indigenous Peoples. http://www.unutki.org/downloads/File/Publications/2009_Emissions_Trading_IPs_Guide.pdf; Climate Change New Zealand, <http://www.climatechange.govt.nz/emissions-trading-scheme/index.html>; NZ Ministry for the Environment, <http://www.mfe.govt.nz/publications/climate/consultation-maori-hui-report-novo7/index.html>

368 **NEW ZEALAND** | Permanent Forest Sink Initiative / Afforestation Grant Scheme**Adaptation, forests, payment for ecosystem services**

The Permanent Forest Sink Initiative offers New Zealand landowners, including Maori, the opportunity to earn Kyoto Protocol assigned amount units (AAUs) when permanent forests are established. Restrictions are placed on harvesting and a permanent covenant is entered into between the government and the landowner. The scheme operates separately to the New Zealand Emissions Trading Scheme, though it is possible that participants in the Permanent Forest Sink Initiative will have the option of switching to the trading scheme once the relevant legislation is in force

Under the Afforestation Grant Scheme (AGS), New Zealand foresters can receive a government grant for the planting of new forests on previously unforested land. Participants own the new forests and earn income from the timber, while the government retains the sink credits and takes responsibility for meeting all harvesting and deforestation liabilities. Additional environmental benefits are anticipated, such as erosion reduction, water quality improvements and better biodiversity outcomes.

Further information:

UNU-IAS TKI Australian Carbon Guide, http://www.unutki.org/downloads/File/Australian_Carbon_Guide.pdf, NZ Ministry of Agriculture and Forestry, <http://www.maf.govt.nz/forestry/pfsi>; <http://www.maf.govt.nz/climatechange/discussion-document/15-afforestation-options.htm>

369 **SAMOA** | An Assessment of Impacts, Vulnerability, and Adaptation to Climate Change in Samoa**Local observations of impacts, food security, assessment**

This case study focuses on adverse impacts of climate change on indigenous peoples in Samoa and identifies the confluence of tropical cyclones, temperature fluctuations, lengthening periods of drought, and flooding as a cause for severe adverse impacts on indigenous communities, including reduced day-to-day food supply from traditional sources, threat to income-generating agriculture activities and food security. The study also highlights problems related to accelerated erosion from wave activities, frequent storm surges, landslides causing destruction and land loss in indigenous communities. The case study identifies a number of vulnerabilities associated with climate change, including reduced agricultural production, reduced food security, reduced water quality and quantity, reduced biological diversity, reduced health security, threat to and destruction of coastal communities, infrastructure and environment, reduced economic security etc.

Further information:

Fiu Mataese Elisara-La'ulu, 2006, The Samoa Case Study: An Assessment of Impacts, Vulnerability, and Adaptation to Climate Change in Samoa, International Alliance of Indigenous and Tribal Peoples of Tropical Forests, <http://www.international-alliance.org/documents/Climate%20change%20-%20Samoa.pdf>

370 **SAMOA** | Conservation of the mangrove ecosystems as storm surge protection**Adaptation, disaster preparedness, capacity-building, extreme events**

Mangrove ecosystems provide a safe haven for fish breeding and invertebrates, and protect villages in Samoa from strong storm surges during bad weather. Several villages are working to conserve their mangrove ecosystems for their biodiversity value, food security, cultural significance and also a source of income for the community. In Matafa'a the mangrove is the only remaining wetland area, and a GEF-funded village project included developing a village policy for protection, undertaking an inventory of the mangrove ecosystems by identifying species found in the area, and by undertaking capacity-building training. Vaiusu village mangrove is the most highly degraded mangrove area in Samoa and its project involved replanting of the mangrove area along the whole of Vaiusu Bay, as part of a large restoration project intended to cover the neighboring villages of Vaigaga. It included capacity and educational awareness programmes for the village community so that everyone in the village from young children to adults can understand and help protect the mangrove ecosystem and its valuable uses, and development of income-generating activities through marketing trainings for the village people, who have different skills in handicrafts, collecting seashells, fishing, etc. O le Si'osi'omaga Society Incorporated (OLSSI), Samoa's BirdLife Affiliate, is working with the Matafaa Indigenous village community to protect their coastal mangroves from sea-level rise. This will help protect their agricultural land from cyclone and tsunami-related flooding and erosion, which is predicted to increase in frequency and intensity with climate change. The mangrove conservation project also helps the local people to enhance benefits from existing natural resources such as herbal medicine plants (the primary form of health care), fuel and fibre, fish, and associated biodiversity.

Further information:

GEF Small Grants Programme WSM/OP3/Y2/06/44, Conservation of the last standing mangrove ecosystem in Matafaa Village for its biodiversity and cultural significance to the community's heritage and sustainable livelihood <http://sgp.undp.org/web/projects/WSM/OP3/Y2/06/46>, Replanting of the degraded Vaiusu Bay to improve the mangrove ecosystem biodiversity for food security and to protect the community from storm surges, <http://sgp.undp.org/web/projects/11284/>; Birdlife International, 2010: Partners with nature: How healthy ecosystems are helping the world's most vulnerable adapt to climate change. http://www.birdlife.org/climate_change/pdfs/Ecosystemsandadaptation.pdf

371 **SAMOA** | A Climate of Change in Samoa**Adaptation, disaster preparedness, capacity-building**

Through a series of pilot projects, the Samoa Red Cross Society identified climate change priorities, and drew lessons that were then used for local capacity building on climate change and disaster risk reduction. They were able to identify many low cost adaptation options to complement the building of expensive sea walls, and provided advice on how national societies can become involved with climate change to assist the most vulnerable groups of society.

Further information:

Climate Centre, Red Cross/Red Crescent Centre on Climate Change and Disaster Preparedness, 2006, http://www.climatecentre.org/downloads/File/asia_and_pacific/Samoa%20RC%20CB%20fact%20Sheet.pdf

372 **SOLOMON ISLANDS** | Increasing Community Resilience to Natural Disasters through the Use of Traditional Coping Strategies on the Weather Coast Guadalcanal Communities in the Solomon Islands**Adaptation, traditional knowledge, disaster preparedness, policy and planning**

This grant of \$19,000 to the Solomon Island Development Trust (SIDT) supported the Babanakira and Kolina people in enhancing traditional coping strategies to build their resilience to cope with disasters, merging these practices, where necessary, with modern scientific and technical knowledge. This project is designed to promote the integration and documentation of indigenous knowledge and practices in disaster risk reduction by collecting and establishing a base line data, in the consultation of traditional leaders. The project begins a participatory planning process and develops a community-based disaster management plan that would foster self-reliance before during and after disaster. Community awareness raising and training workshops, fact-finding consultative sessions, and interviews with the indigenous communities were organized.

Further information:

Further information: IFAD IPAF Grants 2007, <http://www.ifad.org/english/indigenous/grants/projects/regions/asia.htm>

PACIFIC ISLANDS, AUSTRALIA AND NEW ZEALAND

373 SOLOMON ISLANDS | Relocation of atoll islanders

Adaptation, displacement

Ontong Java and Sikaiana, referred to as the Malaita Outer Islands, are atolls facing the full effects of climate change. Traditional leaders of Ontong Java, or Lord Howe Island, which has two villages, have raised the alarm on degradation of the atoll with low fresh water supply and taro crops not growing well. With increased population on the two atoll islands and the rising sea level, the people of Ontong Java have recently alerted the government of Solomon Islands on threats to their livelihoods as a consequence of climate change. The people of Sikaiana Atoll have been migrating primarily to Honiara, the capital.

Further information:
SPREP, http://www.sprep.org/climate_change/PYCC/deta.asp?id=489

374 SOLOMON ISLANDS | Community Based Adaptation Exchange (CBA-x)

Adaptation, disaster preparedness, traditional knowledge

The Solomon Islands are lashed by frequent storms, tsunamis, volcanic eruptions, droughts, earthquakes, floods and wave erosions, expected to accelerate with climate change. They result in loss of human lives and property, erosion of infrastructure and food crises and diseases. The awarded project will address damages coming from natural catastrophes by reviving, applying and sharing traditional and indigenous coping mechanisms of Babanakiras and Kolinas, and where appropriate merge them with modern knowledge. The project is innovative in its approach. It applies and adapts indigenous ways in anticipating, preparing and responding to hazards. It is directly relevant to global warming, and should be documented in detail.

Further information:
IFAD, 2010: International Day of the World's Indigenous Peoples, <http://www.ifad.org/media/events/2010/indigenous/index.htm>

375 PAPUA NEW GUINEA | An uncertain future video

Local observations & impacts, multimedia

A comprehensive look at the environmental, cultural and social impacts of climate change on PNG's rich heritage. The documentary was made by young people in Bougainville in 2008, at a forum organised by Pacific Black Box Inc in conjunction with local NGOs. Some of the youth involved were from the Carteret Islands, whose land is sinking under the ocean and who are being relocated on mainland Bougainville. The project aimed to give a voice to these young people about their situation and climate change.

Further information:
Pacific Black Box, <http://www.pacificblackbox.com.au/>; SPREP Climate Change Film Projects, http://www.sprep.org/climate_change/filmproject/; Vimeo video, <http://vimeo.com/2373361>

376 PAPUA NEW GUINEA | mmm.missing.taro video

Local observations & impacts, multimedia

Taro is a central part of life in Papua New Guinea and throughout the Pacific. Unfortunately it is also extremely sensitive to salt water intrusion as the result of climate change. This short film focuses on the dietary and cultural costs of losing these crops.

Further information:
Pacific Black Box, <http://www.pacificblackbox.com.au/>; SPREP Climate Change Film Projects, http://www.sprep.org/climate_change/filmproject/; Youtube video, <http://www.youtube.com/watch?v=D61ns2UQh6A>

377 PAPUA NEW GUINEA | Integrating indigenous and scientific knowledge bases for disaster risk reduction in Papua New Guinea

Adaptation, disaster management, traditional knowledge

Using a process framework identifying how indigenous and scientific knowledge bases may be integrated, three communities impacted upon by environmental hazards in Papua New Guinea have established how their vulnerability to environmental hazards may be reduced. This research explores the application of the framework within the communities of Kumalu, Singas and Baliau and how this could impact upon the future management of environmental hazards within indigenous communities in Small Island Developing States.

Further information:
Mercer, Jessica, Ilan Kelman, Sandie Suchet-Pearson and Kate Lloyd (2009). Integrating indigenous and scientific knowledge bases for disaster risk reduction in Papua New Guinea. *Geografiska Annaler: Series B, Human Geography*, 91 (2): pp. 157-183; CICERO, <http://www.cicero.uio.no/publications/detail.aspx?id=6827&lang=en>

378 PAPUA NEW GUINEA | Using indigenous knowledge to predict the impact of human activity on biodiversity

Local observations & impacts, forecasting, traditional knowledge

This practice involves the observation of birds in relation to habitat. It was developed in conjunction with the Hewa people of Papua New Guinea's Central Range - the Hewa are swidden horticulturalists occupying foothills and lower montane forests at elevations of between 500 and 1500 metres, with no written language. Informants identified the altitude and habitat favoured by bird species in order to generate a list of birds that would not tolerate habitat alteration or shortened fallow cycles. These lists were then checked against transect bird counts and vegetation surveys. The methodology essentially records generations of Hewa knowledge in a manner that is useful for conservation purposes. The principal benefit of this practice to the Hewa is that it reconciles the relationship between their culture and biological diversity in a manner understood by conservation biologists, and reinforces the importance of the Hewa culture in maintaining biodiversity through traditions governing mobility, fallow cycles, birth spacing and land tenure. This research was carried out by the New Jersey School of Conservation from 1994-1997 and supported by grants from the National Geographic Society and the Explorers Club.

Further information:
UNESCO Best Practices on Indigenous Knowledge BP-11.12, <http://www.unesco.org/most/bpik12-2.htm>

379 PAPUA NEW GUINEA | Local Solutions on a Sinking Paradise, Carteret's Islands videobrief

Adaptation, multimedia, sea level rise, displacement

A short video about the effects of climate change on indigenous communities living on a sandy island in Papua New Guinea. Hungry and frustrated, islanders have set up their own relocation team and have begun the urgent task of moving their families closer to safety. Encroaching salt water has contaminated the fresh water wells and turned vegetable plots into swampy breeding grounds for malaria-carrying mosquitoes. Taro, the staple food crop, no longer grows on the atoll. Carteret Islanders now face severe food shortages, with government aid coming by boat two or three times a year. The local people build sea walls and plant mangroves, only to see their land and homes washed away by storm surges

Further information:
UNU-TKI Indigenous Perspectives on climate change video series, http://www.unutki.org/default.php?doc_id=120; Vimeo album, <http://www.vimeo.com/album/85004>; How-to guide for environmental refugees, Ursula Rakova OurWorld 2.0, 16 June 2009; Tulele Peisa relocation program, <http://www.tulelepeisa.org>

and high tides. Han island, as shown in the video-brief, has suffered complete inundation from the King tides. Carefully designed and community-led action plan can serve as a model for communities elsewhere that will be affected by climate change in the future. In 2006, the Carteret's Council of Elders formed a non-profit association to organise the voluntary relocation of most of the Carterets' population of 3,300 to three locations on Bougainville (Tinputz, Tearouki and Mabiri) over the next 10 years. Exchange programs involving chiefs, women and youth from host communities and the Carterets are in progress for establishing relationships and understanding. The programme will also set up a Conservation and Marine Management Area that will let Carteret Islanders make sustainable use of ancestral marine resources.

380 PAPUA NEW GUINEA | Indigenous Community Forest Certification Scheme

Adaptation, forests

The Indigenous Community Forestry (ICF) group certification scheme was developed by the Foundation for People and Community Development (FPCD) to demonstrate and promote sustainable forest management and improved market for timber, and to bring access to forest certification to the forest resource owners of Papua New Guinea. The ICF group certification scheme works with local indigenous forest resource owners to manage and develop their forest according to the Principles and Criteria of Forest Stewardship Council (FSC) certification to enhance development that is economically viable, socially beneficial environmentally beneficial. FPCD's Eco-forestry programme focuses on building the capacity of the traditional resource owners and includes training in forest management, small sawmilling and small business, forest surveys, and clan-based forest management planning.

Further information:

Foundation for People and Community Development, <http://www.fpcd.org.pg/pages/Indigenous%20community%20forestry%20group.htm>

381 TORRES STRAIT | Inundation in Torres Strait

Local observations & impacts, extreme events

Inundations that occurred in July/August 2005 (Mer) and in January/February 2006 (Boigu and Saibai, Poruma, Iama, Masig and Warraber) caused much unease amongst Torres Strait Islander communities, some of whom had previously experienced such levels of flooding only once in living memory. The high tides affected the central islands and the northwest mud islands, destroyed sea walls and flooded houses, roads and airstrips. Prior to these recent inundation incidents, the islands' last major floods in living memory occurred at the end of 1947 and in early 1948 when a tropical cyclone combined with high tides to create a storm tide that inundated Boigu and Saibai.

Further information:

EPA Qld (2006). Fact Sheet: King Tides in Torres, www.epa.qld.gov.au/publications/p01864aa.pdf/2006_King_Tides_in_Torres_Strait.pdf

382 TUVALU | Sea level rise and environmental migration

Local observations & impacts, sea level rise, displacement, multimedia

As one of the smallest and most remote low-lying atoll countries on earth, Tuvalu exemplifies a country whose existence is threatened by sea level rise. Tuvalu's territory covers over 750,000 km², yet only 26 km² is dry land with no point more than 5 meters above high tide. Local knowledge of global warming is variable, but increasingly frequent saltwater flooding, accelerated coastal erosion and worsening agriculture provide day-to-day evidence of a changing environment. The adaptive capacity of many Tuvaluans is already exceeded with storm surges and king tides. Migration patterns in Tuvalu follow two paths: from outer islands to Funafuti, and from Tuvalu to Fiji and New Zealand. Currently about 3,000 Tuvaluans have migrated to Auckland, New Zealand, many of whom were prompted at least in part by concerns about the environment. Although media reports have suggested a nation-wide resettlement agreement made between New Zealand and Tuvalu, currently there are labor migration agreements with New Zealand, but not explicit policies to accept Pacific Islanders who have been displaced due to rising sea levels. The video 'Sinking rights' focuses on Tuvalu – a small atoll island state in the Pacific. Warm and welcoming, the Tuvaluan people talk about their fears as they feel the brunt of severe weather conditions, coastal erosions, depleting crops and the slow death of the Tuvaluan way of life. As the island nations come to grips with the adverse impacts of climate change, its people are starting to question – is there a "right to environment?"

Further information:

UNU-EHS In Search of Shelter, <http://www.ehs.unu.edu/file.php?id=621>; Fiji Human Rights Commission, Tuvaluan/English, 2007, 34:26. In SPREP Sharing Community Stories, http://www.sprep.org/climate_change/filmproject/project.asp

383 VANUATU | Facilitating and strengthening local resource management initiatives of traditional landholders and their communities to achieve biodiversity conservation objectives

Adaptation, natural resource management, biodiversity

The objective of the GEF project is to work with traditional landholders, chiefs and their communities to facilitate, adapt and strengthen traditional mechanisms to conserve biodiversity in lands under communal resource ownership schemes. The project's pilot initiatives on Gaua, Tanna and Santo Islands focus on strengthening local, provincial and national capacity to support local biodiversity conservation activity. The GEF's funding is directed at three objectives: 1) to facilitate, adapt and strengthen traditional mechanisms to conserve biodiversity; 2) to provide an enabling environment and strengthen government and non-government capacity to support community-based conservation initiatives and replicate successes in other areas of Vanuatu; and 3) to monitor the impact and effectiveness of landholder-based conservation areas to inform and direct work to strengthen and adapt traditional conservation approaches. There has also been an increase in local capacity to recognize and apply traditional measures that contribute to biodiversity conservation. Through the project interventions, the island indigenous communities have expanded the introduction of temporary tabus (sacred, no entry and no take zones) in coastal, marine and terrestrial environments in communities on Gaua, Santo and Tanna. Traditional practices are being used at more than 50 sites where resource management or conservation activities have been initiated. Inter-village committees have also been established to support the traditional landholders and maintain the customary tabus. The proportion of participating communities reporting that governance difficulties affect their resource management and conservation activities has been reduced by 50 percent.

Further information:

GEF, Indigenous Communities and Biodiversity, http://www.gefweb.org/uploadedFiles/Current_Issues/New_Publicat



GLOBAL PROJECTS

384 ACCAP | Cross-Regional Dialogue on Climate Change, Water Impacts and Indigenous People

Local observations & impacts, raising awareness, policy & planning

The Cross-Regional Dialogue on Climate Change, Water Impacts and Indigenous People is a partnership between the Alaska Center for Climate Assessment and Policy (ACCAP), Pacific Regional Integrated Science and Assessment (RISA) and the Climate Assessment for the Southwest (CLIMAS). The goals for this dialogue are to establish a cross-regional network of Native leaders and resource managers, share impacts and strategies for response among regions, document impacts and strategies in a report for participants and federal agencies, and create a written document for federal and state agencies that outlines important insights and things to consider when working with Native people and Native Tribes on climate change and water related issues.

Further information:

Alaska Center for Climate Assessment and Policy, http://www.uaf.edu/accap/research/cross_region_dialogue.htm

385 CONSERVATION INITIATIVE | Indigenous and Traditional Peoples Program

Adaptation, biodiversity, forests, redd, awareness raising

The Indigenous and Traditional Peoples Program (ITPP) works directly with Conservation International (CI) programs and partners, local leaders, communities, conservationists and other critical players in building a common agenda for the conservation of biological and cultural diversity. The program's activities strengthen the collaboration of these groups and expand the abilities of local communities to effectively manage their lands and resources while also maintaining their livelihoods and their natural and cultural patrimony. Beginning with an initial focus in Latin America's Andes region, ITPP continues to expand its support in response to a global indigenous call for collaborative conservation action. CI has also produced The Community Manual that presents basic information on climate change oriented toward audiences in communities to help provide information needed by indigenous peoples and other local communities to participate more effectively in planning and decision-making as REDD+ activities are planned and tested.

Further information:

Conservation International, http://www.conservation.org/discover/centers_programs/itpp/Pages/indigenous_traditional_peoples.aspx

386 EQUATOR INITIATIVE | Equator Initiative, Equator Knowledge, , Equator Prize and Community Knowledge Service

Local observations & impacts, database, policy & planning

The Equator Initiative is a partnership that brings together the United Nations UNDP, civil society, business, governments and communities created to develop the capacity and raise the profile of grassroots efforts to reduce poverty through the conservation and sustainable use of biodiversity. The Equator Initiative works to facilitate the incorporation of local and indigenous voices into national and international policy-making for through community dialogue spaces". In addition to providing a platform for peer-to-peer knowledge exchange on biodiversity conservation, adaptation to climate change, and income generation activities, community dialogue spaces offer a venue for local and indigenous communities to make policy interventions and give policy input. The Equator Initiative also awards the biennial Equator Prize to outstanding community work in biodiversity conservation and poverty reduction, provide venues for indigenous input into national and international policy formation as well as indigenous peer-to-peer knowledge sharing on conservation best practices, adaptation to climate change, and income generation activities. Over 40% of communities that have received the Equator Prize (a prize awarded biennially for outstanding community work in biodiversity conservation and poverty reduction) are Indigenous peoples.

Further information:

Equator Initiative, http://www.equatorinitiative.org/index.php?option=com_content&view=article&id=146&Itemid=539&greenSection=eqKnowledge&lang=en

A research and learning programme is focused on synthesizing lessons from local practice in conservation and income generation that can serve to inform policy and advance research called Equator Knowledge. Academic and research partners support the documentation of local-level best practice. Additionally, the Community Knowledge Service (CKS) ensures the ongoing exchange of local expertise. The Community Poble dialogue space is a venue within the World Conservation Congress for local, community and indigenous voices – grassroots groups working at the nexus of biodiversity conservation and poverty reduction – to share best practices, inform policy, celebrate successes, and tackle common challenges facilitates ongoing platforms for peer-to-peer knowledge sharing and expertise exchange on natural resources management with a broad range of stakeholders. Regional focal points coordinate activities and events, while the CKS Online web portal provides a virtual platform for global exchange.

387 FAO | Communication for Sustainable Development Initiative (CSDI)

Adaptation, awareness raising

In 2009, FAO and the Italian Ministry of the Environment and Territory launched a joint project called Communication for Sustainable Development Initiative (CSDI), which applies communication strategies and approaches to Climate Change Adaptation, sustainable Natural Resources Management (NRM) and Food Security. Working together with indigenous peoples, CSDI aims to implement communication programmes and services in Africa, Asia, Latin America and the Caribbean, and to make suitable ComDev methods and tools available at the international level through knowledge networks and partnerships. In Bolivia, the initiative is currently being implemented in conjunction with indigenous organizations, such as CIDOB and the Plataforma Indígena, and within the framework of the UN-REDD programme.

Further information:

Food and Agriculture Organization, <http://www.fao.org/nr/comdev/csd/en/>

388 **FAO | Globally Important Agricultural Heritage Systems initiative (GIAHS)****Adaptation, agriculture, traditional knowledge, food security**

FAO is supporting indigenous and other rural peoples in efforts to maintain their ingenious agricultural heritage systems for their own benefit and that of humanity and demonstrates the relevance of linking indigenous knowledge of natural resource management to development efforts in organizations such as FAO collaborative initiative between FAO and the Centre for Indigenous Peoples Nutrition and Environment (CINE) at McGill University in Canada, which has explored the concepts of food security and food sovereignty as they relate to indigenous peoples. In 12 case studies from different indigenous communities around the world, FAO and CINE professionals have documented the nutritional composition of their food systems and their correlation to the health levels of consumers.

These case studies have demonstrated that products derived from indigenous peoples' local ecosystems generally provide much greater nutritional value and energy content than those derived purely from the market. Traditional food practices are being threatened by environmental degradation, migration to urban areas and lack of resources due to poverty. As a result, indigenous peoples increasingly resort to market products. The inadequate nutrient quality of purchased "globalized foods" is manifested in poor health consequences such as decayed and missing teeth, obesity, heart disease and other conditions. These conditions have traditionally been linked to "rich" societies, and the fact that they are now also surfacing in the lowest socio-economic strata — of which many indigenous communities are part — has opened a new dimension in health-related development work. Indeed, the poor health status of indigenous children and adults is a growing concern. The GIAHS initiative has identified pilot sites in Peru, Chile, China, Philippines, Tunisia, Algeria, Kenya and Tanzania. In these pilot systems dynamic conservation management approaches will be developed and implemented, to assist national and local stakeholders in the conservation and adaptive management of the systems and their components.

Further information:

UNPFII, 2009. Information received from the United Nations System and Other Intergovernmental Organisations. E/C.19/2009/3/Add.3; FAO, <http://www.fao.org/rr/giahs/en/>

389 **FIRST PEOPLES WORLDWIDE | Indigenous Stewardship Initiative****Adaptation, agriculture, traditional knowledge, food security**

Led by indigenous people, First Peoples Worldwide (FPW) is an international organization dedicated to helping indigenous peoples control their assets and build community capacity to direct their economic futures in ways that fit their cultures. First Peoples uses an asset-based approach, providing indigenous peoples with the tools and information they need to direct and control their own assets, and to leverage these assets for sustainable economic development. FPW also advocates on behalf of Indigenous Peoples so that they may become a part of the world system and be recognized as stakeholders. The Indigenous Stewardship Initiative strives to protect the rights to subsistence hunting and gathering, access to sacred sites, and traditional and cultural practices—all with an understanding of how to balance biodiversity protection with sustainable economic development in Indigenous territories. Ongoing research and advocacy will demonstrate the success of the Indigenous Stewardship model, which will be used to advocate for equitable conservation funding for Indigenous communities.

Further information:

FPW, <http://www.firstpeoplesworldwide.org>

390 **FIRST PEOPLES WORLDWIDE | The Indigenous Peoples Climate Action Fund****Adaptation, traditional knowledge**

The goal of the Indigenous Peoples Climate Action Fund (IPCAF) is to strengthen social capital of Indigenous communities to adapt and thrive under climate change conditions. IPCAF is a small-grant fund that enables Indigenous Peoples to use their traditional knowledge to not only improve the resilience of their own communities facing global climate change, but also to contribute to the global search for solutions. IPCAF was designed as a joint effort between First Peoples Worldwide and the Social Development Department of the World Bank. The design allows for funding from different sources, such as private companies, foundations, bilateral and multilateral aid agencies, and development banks to reach directly and rapidly to practitioners in the field, reducing transaction cost and promoting quick learning and turnaround. IPCAF will be managed by First Peoples Worldwide, an NGO with principal office in the USA. The World Bank will play an advisory role. It is scheduled to be launched in mid-2010.

Further information:

First peoples worldwide, <http://www.firstpeoplesworldwide.org/ipcaf.asp>

391 **GAIA FOUNDATION | Community Ecological Governance****Local observations @ impacts, raising awareness, traditional knowledge, biodiversity**

Community Ecological Governance is a 2009-2011 programme of The Gaia Foundation (Gaia), with individuals, organisations and networks in Africa, South America, Asia and Europe, to regenerate healthy ecosystems, enhance traditional knowledge and practices for seed, food and water sovereignty, and to strengthen community ecological governance. This enables communities to become more resilient to climate change and related challenges. Funded by Comic Relief, Restore UK, Roddick Foundation, The Christensen Fund, Tudor Trust, The Funding Network (TFN).

Further information:

The Gaia Foundation, <http://www.gaiafoundation.org>

392 **GEF | Community Management of Protected Areas for Conservation (COMPACT)****Local observations @ impacts, database**

The COMPACT (Community Management of Protected Areas for Conservation) project seeks to demonstrate how community-based initiatives can significantly increase the effectiveness of biodiversity conservation in the co-management of globally significant protected areas by working to improve the livelihoods of local populations.

Further information:

UNEP/GEF Small Grants Program, http://sgp.unep.org/web/projects/8626/manejo_sustentable_de_especies_de_flora_y_fauna_de_uso_ancestral_en_dos_comunidades_waarani_de_L_parg.html

GLOBAL PROJECTS

393 GEF/UNDP | Small Grants Programme

Adaptation, database

The GEF Small Grants Programme (SGP) supports projects of non-governmental and community-based organizations in developing countries demonstrating that community action can maintain the fine balance between human needs and environmental imperatives. The main focal areas of the programme include climate change abatement and adaptation, conservation of biodiversity, and prevention of land degradation. They have also been collaborating with various partners such as The Mountain Institute, The Christensen Fund, Insight, and the Indigenous Peoples' Restoration Network website in order to develop new field-based tools, such as Participatory Video and community-based repeat photography in a number of SGP countries, in order to document and facilitate the traditional knowledge of indigenous peoples related to climate change.

Further information:
GEF Small Grants Programme,
<http://sgp.undp.org/>

394 IIED | Community Based Adaptation Exchange (CBA-x)

Adaptation, database

The Community-Based Adaptation Exchange Network (CBA-X) is an online resource set up by IIED, and hosted by IDS, to share resources supporting the exchange of up-to-date information about community-based adaptation to climate change. It contains a number of case studies relevant to climate change and Indigenous Peoples.

Further information:
Eldis, <http://community.eldis.org/cbax/>

395 IFAD-IFPRI | Strategic Partnership to Develop Innovative Policies on Climate Change Mitigation and Market Access

Adaptation, women, agriculture, livelihood diversification

The overall goal of the three-year programme is to enable rural poor people, particularly women, to have better access to, and the capacity to take advantage of, new market opportunities, especially markets for high-value agricultural products and those for climate change mitigation and other environmental services. The programme focuses on Ghana, Morocco, Mozambique and Viet Nam.

Further information:
IFAD, <http://www.slideshare.net/ifad/ifad-ifpri-flyer>

396 INTERNATIONAL ALLIANCE | The Indigenous People's Network for Change

Local observations & impacts, capacity-building, policy & planning

The Indigenous Peoples' Network for Change is a project aimed at responding to the need for indigenous peoples to effectively participate in international processes that have direct impacts on their daily lives, with particular attention to the Global Environment Facility (GEF) and Convention on Biological Diversity (CBD) meetings and related events. This three year project brings together ten regions of the globe collectively under the International Alliance of Indigenous and Tribal Peoples of the Tropical Forests (IAITPTF) and the Russian Association of Indigenous Peoples of the North (RAIPON). Its main tasks are to clarify and disseminate information; provide training and capacity building in relevant issues; support active participation at the local, regional, and international levels; and nurture partnerships with existing initiatives and organizations.

Further information:
IAITPTF, http://www.international-alliance.org/network_for_change.htm

397 INSIGHT | Indigenous Issues Climate Change (video)

Local observations & impacts, raising awareness, multimedia

Insight is a UK/France based organisation pioneering the use of Participatory Video as a tool for empowering individuals and communities. Participatory Video enhances research and development activity by handing over control to the target communities from project conception through to implementation, monitoring and evaluation. Video case studies have included desertification and community action in Central Asia and Natural Resource Management in the mountain regions of Asia. A special video project was undertaken by indigenous community leaders at the United Nations Permanent Forum on Indigenous Issues in New York, May 2008. It includes information on impacts of climate change on indigenous communities around the globe and advice from community elders to the outside world. 13 minutes.

Further information:
Insightshare, http://www.insightshare.org/video_UNPF.html

398 IPCC | Indigenous Peoples' Climate Change Assessment Project

Adaptation, local observations & impacts

The IPCC offers a conceptual framework that will empower local indigenous communities to assess the impact of climate change drivers on their ability to enhance indigenous resilience of their biocultural systems and support *buen vivir*, paying special attention to the rights of women and children. Simultaneously, an assessment of global climate change drivers will be performed to enhance understanding of how indigenous peoples are affected. Together, the two approaches will be synthesized to produce practical local responses and national and global policy responses. Broad objective is to empower indigenous peoples to develop and use indigenous frameworks to assess the impact of climate change on their communities and ecosystems and to develop and implement strategies for building indigenous resilience and adaptive strategies to mitigate impacts while enhancing biocultural diversity for food sovereignty and self determined development or "Buen Vivir." Assessments are currently being undertaken by the Pacific Northwest Tribes (USA/Canada); Zapara People of the Ecuadorian-Peruvian Amazon and Waorani; Quechua Communities in the Potato Park, Peru; Comarca de Kuna Yala, Panama; The Maasai of Kajiado, Narok and Nakuru Districts in Kenya; the Adivasi Eastern Ghats of Andhra Pradesh, India; and the Sorong, West Papua, Indonesia.

Further information:
Indigenous Peoples' Climate Change Assessment Project, <http://www.ipcca.net/index.php>

399 **IUCN | Indigenous and Traditional Peoples and Climate Change****Adaptation, local observations & impacts, database**

The International Union for Conservation of Nature (IUCN) issues paper on Indigenous and Traditional Peoples and Climate change reviews the impacts of climate change on vulnerable communities of the world. Chapter four provides case studies showing on climate change impacts and discusses traditional and adaptive practices, including: shoreline reinforcement, improved building technologies, rainwater harvesting, supplementary irrigation, traditional farming techniques to protect watersheds, changing hunting and gathering periods and habits, crop and livelihood diversification, use of new materials, and community-based disaster risk reduction.

Further information:

International Union for Conservation of Nature, Indigenous and Traditional Peoples and Climate Change, http://cmsdata.iucn.org/downloads/indigenous_peoples_climate_change.pdf

400 **UN-REDD | UN-REDD Programme (FAO, UNDP, UNEP)****Adaptation, mitigation, forests, redd**

The Programme's main aim is to contribute to the development of capacity for implementing REDD (reducing emissions from deforestation and forest degradation in developing countries) and to support the international dialogue for the inclusion of a REDD mechanism in a post-2012 climate regime. Initial activities in nine pilot countries in Africa, Asia and the Pacific, and Latin America and the Caribbean include monitoring of carbon programmes; consultative processes for engaging indigenous peoples and civil society links to benefits such as biodiversity; and strengthening the capacity of national institutions to address these issues. Over USD \$40 million in funding has been approved to date for preparation of "REDD readiness" action plans in the Democratic Republic of Congo, Indonesia, Papua New Guinea, Tanzania and Viet Nam. At the regional and global level, the Programme organizes consultations that inform the normative guidance it provides on the engagement of indigenous peoples and other forest-dependent communities.

Further information:

UN-REDD Programme, <http://www.un-redd.org/>

The UN-REDD Programme's Policy Board is composed of representatives from partner countries, donors to the multi-donor trust fund, civil society, Indigenous Peoples and FAO, UNDP and UNEP. All members have an equal voice in decisions on overall leadership, strategic direction, and financial allocations. Current funding is contributed by the governments of Norway, Spain and Denmark.

401 **MSV | Many Strong Voices****Adaptation, capacity-building, policy & planning**

Many Strong Voices (MSV) is a collaborative programme to ensure the well-being, security and sustainability of coastal communities in the Arctic and Small Island developing States (SIDS) in the face of climate change. Both regions are vulnerable to the impacts of climate change in similar ways. Many Strong Voices brings the two together to take collaborative and strategic actions on climate change mitigation and adaptation. The MSV programme is made up of a consortium of partners represented by nearly 20 Arctic and SIDS nations and involves the participation of international organizations, government agencies, non-government organizations, Indigenous Peoples' organizations, research institutes, communities and individuals. The collaborative actions aim to build capacity to strengthen the role of these vulnerable regions in negotiations on greenhouse gas mitigation and on climate change adaptation, raise awareness about the effects of climate change on vulnerable regions, increase understanding of needs and solutions and take action on adaptation.

Further information:

CBD (2008): UNEP/CBD/EM.CC-ILC/1/3, Compilation of Case-Studies on Climate Change and Biodiversity Considerations in the Arctic, <http://www.cbd.int/doc/meetings/tk/emccilc-01/official/emccilc-01-03-en.pdf>

402 **TEBTEBBA | Indigenous climate portal****Adaptation, database, redd, forests**

This portal aims to provide indigenous peoples and the general public with relevant information and resources on climate change and indigenous peoples, and on REDD+ or Reducing Emissions from Deforestation and Forest Degradation. Specifically, the website also serves as the portal for the project: "Ensuring the Effective Participation of Indigenous Peoples in Global and National REDD Processes." The website is managed by Tebtebba (Indigenous Peoples' International Centre for Policy Research and Education).

Further information:

Indigenous Portal, <http://www.indigenousclimate.org/>

403 **PLATFORM FOR AGROBIODIVERSITY RESEARCH | Agrobiodiversity and climate change****Adaptation, agriculture, biodiversity, database**

The Platform for Agrobiodiversity Research has been collecting information on the ways in which indigenous peoples and rural communities have been using agrobiodiversity to help cope with climate change. Three general conclusions have been drawn from an analysis of the different ways in which indigenous and traditional agricultural communities are coping with climate change. Firstly, adapting to climate change has usually involved a range of different actions at all three levels; ecosystem or landscape, farm or agricultural system, and involving both inter- and intra-specific diversity. Secondly, innovation based on both traditional knowledge and new information has been important, and social (e.g. community) cultural and political dimensions have played a key role. Thirdly, use of traditional crop and livestock species and varieties, with new materials where necessary, has been a common feature.

Further information:

Platform for Agrobiodiversity Research, 2010: The use of Agrobiodiversity by indigenous and traditional agricultural communities in adapting to climate change, http://www.agrobiodiversityplatform.org/blog/wp-content/uploads/2010/05/PAR-Synthesis_low_FINAL.pdf

GLOBAL PROJECTS

404 UNDP-GEF | Community-Based Adaptation Program

Adaptation, livelihoods

The Community-based adaptation program was designed by UNDP and the GEF Small Grants Program to achieve the goal of reducing vulnerability and increasing adaptive capacity to the adverse effects of climate change in the focal areas in which the GEF works, building the resilience of communities, ecosystems, and resource-dependant livelihoods in the face of climate change. The CBA program has a total of USD \$4.5 million in funding (up to \$50,000 per project). The 10 pilot countries each have 8-20 projects: Bangladesh, Bolivia, Guatemala, Jamaica, Kazakhstan, Morocco, Namibia, Niger, Samoa, Viet Nam. Of these, Guatemala, Bolivia and Viet Nam include projects targeting climate change risk reduction among indigenous communities.

Further information:

Community-Based Adaptation Program, www.undp-adaptation.org/project/cba

405 UNDP-RIPP | Asia-Pacific Regional Initiative on Indigenous Peoples' Rights and Development

Adaptation, database

In collaboration with indigenous peoples, UNDP Regional Initiative on Indigenous Peoples' Rights and Develop (RIPP) is implementing eight projects in Bangladesh, China, Lao PDR, India, Indonesia, Nepal, Philippines and Thailand. RIPP encourages governments and indigenous peoples to cooperate closely in widening the development choices available to indigenous peoples. It seeks to ensure better integration of indigenous issues into national development processes and outcomes. The projects showcase best practices from Asia of how indigenous communities manage natural resources to maintain their bio-cultural diversity and adapt to climate change without losing their culture and identity. [Nb: several of these projects are listed individually in the Compendium.]

Further information:

UNDP Regional Center in Bangkok, <http://regionalcentrebangkok.undp.or.th/practices/governance/ripp/InnovativeProject.html>

406 UNESCO | Management of Social Transformations (MOST) Programme

Adaptation, database

The MOST Programme's primary purpose is to transfer relevant Social Sciences research findings and data to decision-makers and other stakeholders. MOST focuses on building efficient bridges between research, policy and practice. The programme promotes a culture of evidence-based policy-making – nationally, regionally and internationally. As the only UNESCO programme that fosters and promotes social science research, it is placed in a pivotal position in the overall promotion of UNESCO's goals.

Further information:

UNESCO MOST Programme, <http://www.unesco.org/most/>

407 UNESCO-NHK | Heritage Images Archive Initiative

Adaptation, database, multimedia

The Heritage Images Archive Initiative, a partnership between UNESCO and NHK Japanese broadcasting corporation, contains videos and films produced by or in cooperation with the United Nations Educational, Scientific and Cultural Organization (UNESCO) to contribute to the documenting and safeguarding of tangible and intangible cultural heritage, and of natural heritage, in order to ensure transmission of knowledge between generations and promote cultural diversity.

Further information:

<http://www.youtube.com/user/UNESCOVideos>

408 UNESCO-LINKS | Climate Frontlines

Local observations & impacts, database

"On the Frontlines of Climate Change" is an internet-based online discussion forum exploring climate change of rural or indigenous communities living in small islands, the circumpolar Arctic, high-altitude zones, low-lying coastal areas, tropical forests, desert margins and other vulnerable environments. It is coordinated by UNESCO's Coasts and Small Islands platform and Local and Indigenous Knowledge Systems in partnership with the Secretariats of the Convention on Biological Diversity and United Nations Permanent Forum on Indigenous Issues, as well as the Office of the High Commissioner for Human Rights. It provides a platform for sharing observations, concerns and innovation in which participants share stories of impacts, opportunities and adaptation strategies from community-based experiences with climate change.

Further information:

On the Frontlines of Climate Change <http://www.climatefrontlines.org>

409 UNESCO | Learning and Knowing in Indigenous Societies Today (LINKS)

Local observations & impacts, raising awareness, biodiversity, natural resource management, disaster preparedness

The UNESCO LINKS project builds dialogue amongst traditional knowledge holders, natural and social scientists, resource managers and decision-makers to enhance biodiversity conservation and secure an active and equitable role for local communities in resource governance. The survival of indigenous knowledge as a dynamic and vibrant resource within rural and indigenous communities depends upon its continuing transmission from generation to generation. The LINKS project strengthens knowledge transmission between elders and youth, and explores pathways to balance community-based knowledge with global knowledge in formal and non-formal education.

Further information:

UNESCO-LINKS, http://portal.unesco.org/science/en/ev.php-URL_ID=1945&URL_DO=DO_TOPIC&URL_SECTION=201.html

Within the framework of the LINKS programme, several publications highlighting the value of indigenous and local knowledge in relation to sustainable development, natural disaster preparedness and response, biodiversity conservation and climate change, are available. These include one on indigenous Mayangna knowledge of the aquatic ecosystem in the Bosawas Biosphere Reserve (Nicaragua); a publication based on the 2007 international experts meeting entitled 'Indigenous knowledge and changing environments'; and a publication based on the 2005 conference entitled "Safeguarding the Transmission of Local and Indigenous Knowledge of Nature".

410 **UNFCCC | Local Coping Strategies (Adaptation) Database****Adaptation, database**

The UNFCCC local coping strategies database is intended to facilitate the transfer of long-standing coping strategies/mechanisms, knowledge and experience from communities that have had to adapt to specific hazards or climatic conditions to communities that may just be starting to experience such conditions, as a result of climate change. The database can be searched by climate hazard, impact or coping strategy, or a combination thereof and users can return a list of corresponding adaptation actions and associated case studies. Additional information on the case studies is provided, and includes a short summary on the coping practice, details on resource requirements, non-climate benefits and potential maladaptation, as well as contact information and links to relevant files and web sites. [Nb: Several relevant case studies have been elaborated as separate entries in the compendium.]

Further information:
UNFCCC Database on local coping strategies,
<http://maindb.unfccc.int/public/adaptation/>

411 **UNU | Indigenous Perspectives on climate change videobrief series****Adaptation, local observations & impacts, raising awareness, multimedia**

The UNU's indigenous perspectives on climate change project includes a series of videos about the effects of climate change on indigenous communities living in various ecosystems around the world. The case studies cover a variety of ecosystems and impacts, including several communities in Australia (Kowanyama, wet savannah; Kuku Nyugkal, wet tropics; Arnhem Land, dry savannah), Borneo Island in Indonesia, Carterets Island in Papua New Guinea, glacial and permafrost melt in Central Asia, including the Gobi desert, Mongolia and the Russian Altai Republic. [Nb: Several relevant videobriefs have been elaborated as separate entries in the compendium.]

Further information:
UNU-TKI Indigenous Perspectives on climate change video series, http://www.unutki.org/default.php?doc_id=120; Vimeo album, <http://www.vimeo.com/album/85004>

412 **UNU | Traditional Knowledge Bulletin****Local observations & impacts, raising awareness, policy & planning, traditional knowledge**

The UNU-IAS Traditional Knowledge Initiative's TK Bulletin provides a weekly review of TK issues in the global news (updated every Tuesday) as well as individual posts on issues of relevance to TK at a global level, including issues discussed at international meetings. International fora covered by the Bulletin include processes within WIPO, the WTO, the United Nations Permanent Forum for Indigenous Peoples, the United Nations Inter-Agency Support Group on Indigenous Issues, UNESCO, FAO (i.e. the International Treaty on Plant Genetic Resources), Convention on Biological Diversity (CBD), UNCTAD, processes of the World Bank and regional development banks, initiatives such as the Millennium Ecosystem Assessment and the International Assessment of Agricultural Science and Technology, and the work of regional organizations such as the Organization of American States. Climate change is a subcategory for relevant postings.

Further information:
United Nations University Traditional Knowledge Initiative Traditional Knowledge Bulletin, <http://www.unu.edu/tk>

413 **UNU | Traditional Knowledge Initiative****Local observations & impacts, raising awareness, policy & planning**

The United Nations University-Institute of Advanced Studies Traditional Knowledge Initiative seeks to build greater understanding and facilitate awareness of traditional knowledge (TK) to inform action by indigenous peoples, local communities and domestic and international policy makers. Key outputs from the climate change theme include research activities, policy studies, capacity development and online learning and dissemination.

Further information:
United Nations University Traditional Knowledge Initiative Traditional Knowledge Bulletin, <http://www.unutki.org/redd/>

414 **WORLD BANK | Climate Investment Funds (CIF)****Adaptation, forests, REDD**

The Climate Investment Funds are a unique pair of financing instruments designed to support low-carbon and climate-resilient development through scaled-up financing channeled through the African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank and World Bank Group.

The Clean Technology Fund (CTF) promotes investments to initiate a shift towards clean technologies. The CTF seeks to fill a gap in the international architecture for development finance available at more concessional rates than standard terms used by the Multilateral Development Banks (MDBs) and at a scale necessary to help provide incentives to developing countries to integrate nationally appropriate mitigation actions into sustainable development plans and investment decisions. Through the CTF, countries, the MDBs, and other partners agree upon country investment plans for programs that contribute to the demonstration, deployment and transfer of low carbon technologies with significant potential for greenhouse gas emissions savings. The Strategic Climate Fund (SCF) serves as an overarching fund to support targeted programs with dedicated funding to pilot new approaches with potential for scaled-up, transformational action aimed at a specific climate change challenge or sectoral response.

The Forest Investment Program's Indigenous Peoples and Local Communities Dedicated Initiative has been established to provide Indigenous communities grants in country or regional pilots to support their participation in development of FIP investment strategies, programs and projects. At the implementation stage grants to Indigenous Peoples and local communities will be an integral component of each pilot.

Further information:
Climate Investment Funds,
<http://www.climateinvestmentfunds.org/>

415 **WORLD BANK | Development Marketplace (DM)**

Adaptation, database

The Development Marketplace (DM) is a competitive grant program administered by the World Bank Group and supported by various partners for early-stage projects with high potential for development impact. DM competitions—held at the global, regional and country level—attract ideas from a range of innovators, including civil society groups, social entrepreneurs, academia, and business. DM has awarded more than \$54 million in grants, supporting projects through their proof-of-concept phase. Using DM funding as a launching pad, projects often go on to scale up or replicate elsewhere, winning prestigious awards within the sphere of social entrepreneurship. In 2009, the theme for the grant program is climate change. The competition on climate adaptation focuses on three sub-themes: (1) Resilience of Indigenous Peoples Communities to Climate Risks; (2) Climate Risk Management with Multiple Benefits; and (3) Climate Adaptation and Disaster Risk Management.

Further information:
Development Marketplace, <http://www.developmentmarketplace.org/>

416 **WORLD BANK | Forest Carbon Partnership Facility (FCPF)**

Adaptation, forests, REDD

The Forest Carbon Partnership Facility (FCPF) aims to reduce deforestation and forest degradation by compensating developing countries for greenhouse gas emission reductions. Tropical and sub-tropical countries will receive grant support as they build their capacity to tap into future systems of positive incentives for REDD, in particular by establishing emissions reference levels, adopting REDD strategies, and designing monitoring systems. The FCPF has established a Capacity Building Program for forest-dependent indigenous peoples and other forest dwellers—a US\$1,000,000 'small grants' program to build effective links with forest-dependent indigenous peoples and other forest dweller communities on REDD through the FCPF.

Further information:
Forest Carbon Partnership Facility, <http://www.forestcarbonpartnership.org/>

417 **WORLD BANK | World Bank Country Projects database**

Adaptation, database

The World Bank carries out projects and provides a wide variety of analytical and advisory services to help meet the development needs of individual countries and the international community. Summary operational reports are available through the online project database. Climate change is addressed under the environment and natural resources management theme, and indigenous peoples are included under the social development theme. The top-ranking countries with the largest number of projects that support Indigenous Peoples are Peru, Mexico, Costa Rica, Colombia, India, Laos, Ecuador, and Brazil. These projects have borrowed from the WB or have fully endorsed GEF funds toward Indigenous Peoples' traditional knowledge, land demarcation, capacity building, etc. There are few climate change projects where indigenous peoples are fully engaged but the number is increasing. There is a larger number where effects of climate change are tangentially addressed, such as the Integrated Ecosystem Management by Indigenous Communities regional project in Central America, which includes, among other activities, the strengthening of indigenous networks for ecotourism, organic cacao production, and payment for environmental services. [Nb: Several relevant case studies have been elaborated as separate entries in the compendium.]

Further information:
World Bank, <http://www.worldbank.org/projects/>

418 **WWF | Climate Witness**

Local observations of impacts, raising awareness

Through Climate Witness, WWF connects with people around the world and provides them with an opportunity to share stories about how climate change impacts their lives here and now. People are invited to tell their climate change stories through words, videos, and photos. All Climate Witness stories are reviewed by a member of WWF's Science Advisory Panel to ensure that all the stories collected are consistent with the latest science on human induced climate change. Some stories are provided by indigenous observers, such as Chukchi Vladilen Ivanovich Kavry in the in the Chukotka region, located at the far eastern edge of Russia, and Simon Oleekatalik, and Elder from the Eastern Kitikmeot region on the Boothia Peninsula in Nunavut, Canada.

Further information:
WWF Climate Witness, http://www.panda.org/about_our_earth/aboutcc/problems/people_at_risk/personal_stories/

The Climate Witness Tool kit resulted from a process undertaken on Kabara, Fiji, to document local impacts of climate change and to devise appropriate adaptation measures that local communities can implement themselves. The methodologies within the toolkit are an adaptation of participatory techniques WWF-South Pacific has used over the years in community resource conservation and development projects, and are designed give facilitators a clear sense of process when trying to elicit information specific to impacts of climate change and developing appropriate community response measures to them.

ANNEX I: ADDITIONAL RESOURCES AND REFERENCES

Specific case study publications and project websites and are referenced in each compendium entry – websites where available were most recently accessed to confirm contents and availability in August 2010. This section refers to additional knowledge resources used in the compilation of this report.

United Nations and International Organisations

- Gateway to the United Nations System's Work on Climate Change
<http://www.un.org/climatechange> (includes links to relevant UN agencies and programs and international organizations and their work on climate change).
- Food and Agriculture Organization of the United Nations (FAO)
<http://www.fao.org/climatechange/en/> (climate); <http://www.fao.org/economic/esw/esw-home/esw-indigenous-peoples/en/> (indigenous issues)
- Intergovernmental Panel on Climate Change (IPCC)
<http://www.ipcc.ch>
- International Fund for Agricultural Development (IFAD)
<http://www.ifad.org/climate> (climate); <http://www.ifad.org/english/indigenous/index.htm> (indigenous)
- International Labour Organization (ILO)
<http://www.ilo.org/public/english/indigenous/>
- International Organization for Migration (IOM)
<http://www.iom.int/jahia/jsp/index.jsp>
- International Strategy for Disaster Reduction (UNISDR)
<http://www.unisdr.org/eng/risk-reduction/climatechange/climate-change.html>
- International Work Group for Indigenous Affairs (IWGIA)
<http://www.iwgia.org/sw29085>
- Office of the United Nations High Commissioner for Human Rights (OHCHR)
<http://www2.ohchr.org/english/issues/climatechange/index.htm> (climate); <http://www2.ohchr.org/english/issues/indigenous/index.htm> (indigenous issues)
- Ozone Secretariat
<http://ozone.unep.org>
- Ramsar Convention on Wetlands
<http://www.ramsar.org>
- United Nations Convention on Biological Diversity (CBD)
<http://www.cbd.int/climate> (climate); <http://www.cbd.int/traditional> (indigenous issues)
- United Nations Convention to Combat Desertification (UNCCD)
<http://www.unccd.int>
- United Nations Department of Economic and Social Affairs (DESA)
<http://www.un.org/esa/desa.htm>
- United Nations Development Program (UNDP)
<http://www.undp.org/climatechange> (climate); www.undp.org/partners/civil_society/indigenous.shtml (indigenous issues)
- United Nations Education Scientific and Cultural Organization (UNESCO)
http://portal.unesco.org/education/en/ev.php-URL_ID=25846&URL_DO=DO_TOPIC&URL_SECTION=201.html (climate change); www.unesco.org/culture/en/indigenous/ (indigenous issues)
- United Nations Environment Program (UNEP)
<http://www.unep.org/Themes/climatechange> (climate change); www.unep.org/Indigenous/ (indigenous issues)
- United Nations Framework Convention on Climate Change (UNFCCC)
<http://www.unfccc.int>

- United Nations Permanent Forum on Indigenous Issues (UNPFII)
<http://www.un.org/esa/socdev/unpfii/>
- United Nations Forum on Forests (UNFF)
<http://www.un.org/esa/forests/>
- United Nations University (UNU)
<http://www.unu.org/climate/> (climate activities); <http://www.unutki.org/> (traditional knowledge initiative)
- World Bank Group (WB)
<http://go.worldbank.org/W13H8ZXS1> (climate change); <http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTSOCIALDEVELOPMENT/EXTINDPEOPLE/0,,contentMDK:20432643%7EmenuPK:906311%7EpagePK:148956%7EpiPK:216618%7EtheSitePK:407802,00.html> (indigenous peoples)
- World Meteorological Organization (WMO)
<http://www.wmo.ch>
- World Health Organization (WHO)
<http://www.who.int/globalchange/climate/en/> (climate change); <http://www.who.int/hhr/activities/indigenous/en/> (indigenous activities)

Non-Government Organisations and Research Institutions

- Bioversity International
<http://www.bioversityinternational.org/>
- Center for International Forestry Research (CIFOR)
<http://www.cifor.cgiar.org/>
- Centro Internacional de Agricultura Tropical (CIAT)
<http://www.ciat.cgiar.org/>
- Climate Ark: Climate Change and Global Warming Portal
<http://www.climateark.org>
- Consultative Group on International Agricultural Research (CGIAR)
<http://www.cgiar.org>
- Climate Action Network
<http://www.climateactionnetwork.org>
- The Climate, Community & Biodiversity Alliance
<http://www.climate-standards.org/>
- Climate Technology Initiative
<http://www.climate-tech.org>
- Columbia University Earth Institute
<http://www.earthinstitute.columbia.edu/sections/view/9>
- EcoEquity
<http://www.eco-equity.org>
- First Peoples Worldwide
<http://www.firstpeoplesworldwide.org/>
- Fondo Indígena
<http://www.fondoindigena.net/>
- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
<http://www.icrisat.org/>
- Institute for Development Studies
<http://www.ids.ac.uk>
- International Institute for Environment and Development (IIED)
<http://www.iied.org>
- International Institute for Sustainable Development (IISD) – Climate Change and Energy Program
<http://www.iisd.org/climate>
- IISD Reporting Services/Earth Negotiations Bulletin
<http://www.iisd.ca> (includes links to meetings and publications)

- International Research Institute for Climate and Society
<http://portal.iri.columbia.edu/portal/server.pt>
- IUCN-World Conservation Union
<http://www.iucn.org>
- Linking Climate Adaptation Network
<http://www.linkingclimateadaptation.org>
- Oxfam Climate Change Campaign
http://www.oxfam.org/en/programs/campaigns/climate_change/index.htm
- Pew Center on Global Climate Change
<http://www.pewclimate.org>
- Red Cross /Red Crescent Centre on Climate Change and Disaster Preparedness
<http://www.climatecentre.org>
- Renewable Energy Policy Network for the 21st century
<http://www.ren21.net>
- Stockholm Environment Institute
<http://www.sei.se/index.php>
- Tebtebba – Indigenous Peoples' International Centre for Policy Research and Education
<http://www.tebtebba.org/>
- Tiempo Climate Cyberlibrary
<http://www.cru.uae.ac.uk/tiempo>
- Tyndall Centre for Climate Change Research
<http://www.tyndall.ac.uk>
- World Resources Institute
<http://www.wri.org/climate>
- World Business Council on Sustainable Development
<http://www.wbcsd.org>
- WWF
http://www.panda.org/about_wwf/what_we_do/climate_change/index.cfm
- 2007: A joint submission by the Assembly of First Nations and the International Organization of Indigenous Resource Development to the United Nations 60th Annual DPI/NGO Conference, special theme Indigenous Peoples, Culture and Traditional Knowledge, September 6, 2007
- 2006: The Cultural Indicators for Food Security, Food Sovereignty and Sustainable Development from the 2nd Global Consultation on the Right to Food Security and Food Sovereignty for Indigenous Peoples (Bilwi, Nicaragua, September 2006) which includes an indicator for addressing adaptation and resiliency to environmental impacts, including climate change
http://www.hrusa.org/workshops/prepsession2007/resources/Conclusions_Global%20Consultation.doc
- 2006: Statement of Indigenous Peoples to UN Commission on Sustainable Development, Nairobi, December 2006
http://www.tebtebba.org/tebtebba_files/susdev/cc_energy/cc.html
- 2006: Declaration of Indigenous Peoples attending the COP 10, United Nations Framework Convention on Climate Change, Buenos Aires, 6-17 December 2006.
http://www.klimabuendnis.org/download/cop10_indigenous_declaration_en.pdf
- 2006: Statement of Indigenous Peoples to UNCSDD14 High-Level Segment, 11 May 2006
- 2005: Tiohtiá:ke (Montreal) Declaration, December 2005 International Indigenous Peoples Forum on Climate Change Statement to the State Parties of the COP 11/MOP 1 of the United Nations Framework Convention on Climate Change (UNFCCC).
http://www.forestpeoples.org/documents/law_hr/unfccc_tiohtia-ke_declaration_deco5.shtml
- 2005: Arctic Indigenous Statement, December 2005
<http://72.14.203.104/search?q=cache:UouH8nKIFDIJ:www.arcticpeoples.org/Newsletter/Documents/ArcticDayNews.doc+%22welcoming+the+commitment+by+arctic+council+ministers%22&hl=en&gl=us&ct=clnk&cd=1&ie=UTF-8>
- 2005: Arctic Youth Statement, November 2005
<http://www.taiga.net/ayn/declaration.html>
- 2004: Declaration of Indigenous Peoples Attending the COP 10, UNFCCC, Buenos Aires, Argentina, December 6 - 17, 2004
http://www.tebtebba.org/index.php?option=com_docman&task=doc_download&gid=77&Itemid=27

Indigenous Declarations on Climate Change

- 2009: The Anchorage Declaration of the Indigenous Peoples' Global Summit on Climate Change, Anchorage, Alaska, 20-24 April 2009.
<http://www.indigenoussummit.com/servlet/content/declaration.html>
- 2009: The Manila Declaration of the International Conference on Extractive Industries and Indigenous Peoples, Manila, 23-25 March 2009.
<http://www.indigenouportal.com/Mining-and-Extractive-Industries/The-Manila-Declaration-of-the-International-Conference-on-Extractive-Industries-and-IP-s.html>
- 2009: Joint Indigenous Peoples and NGO Statement on the occasion of the presentation of the Report of the Office of the United Nations High Commissioner for Human Rights (OHCHR) on the relationship between climate change and human rights
<http://int.piplinks.org/joint-indigenous-peoples-and-ngo-statement-relationship-between-climate-change-and-human-rights>
- 2008: The Mahinekura Reinfelds Declaration, SnowChange 2008.
http://www.snowchange.org/web/index.php?option=com_content&task=view&id=31&Itemid=1
- 2007: Declaration on the Rights of Indigenous Peoples, UN General Assembly, 13 September 2007
<http://www.un.org/esa/socdev/unpfii/en/declaration.html>
- 2007: 60th Annual UNDPI/NGO Conference Declaration, September 6, 2007, "Climate Change Threats – an NGO Framework for Action"
- 2003: Milan Declaration 6th International Indigenous Peoples Forum on Climate Change, Milan 29-30 November 2003.
http://www.tebtebba.org/tebtebba_files/susdev/cc_energy/milan.html
- 2003: Indigenous Peoples Kyoto Water Declaration, Third World Water Forum, Kyoto, March 2003
<http://www.indigenouswater.org/IndigenousDeclarationonWater.html>
- 2002: Indigenous Peoples Statement from the Indigenous Peoples Caucus of the Eighth Session of the Conference of the Parties, United Nations Framework Convention on Climate Change held 23 October to 1 November 2002 in New Delhi, India.
http://www.klimabuendnis.org/download/indigenous_peoples_statement_delhi_2002.pdf
- 2002: Bali Principles of Climate Justice. International Climate Justice Network, Johannesburg Earth Summit, 6 September 2002
<http://www.ienearth.org/docs-up/cj-16-bali.pdf>
- 2002: The Kimberley Declaration from the International Indigenous Peoples Summit on Sustainable Development in Kimberley, South Africa 20-23 August 2002.
<http://www.iwigia.org/sw217.asp>
- 2002: Indigenous Peoples Political Declaration from PrepCom IV in Bali, Indonesia, 6 June 2002.
http://www.tebtebba.org/tebtebba_files/summit/wssd/poldec.html
- 2002: Declaration of Atilán, Indigenous Peoples' Consultation on the Right to Food, Atilán, Guatemala, 17-19 April 2002.
http://www.tebtebba.org/index.php?option=com_docman&task=doc_download&gid=63&Itemid=27

- 2001: The Marrakech Statement on Climate Change from the Indigenous Peoples and Local Communities Caucus of the Seventh Session of the Conference of the Parties, United Nations Framework Convention on Climate Change held 29 October to 9 November 2001 in Marrakech, Morocco.
http://www.tebtebba.org/tebtebba_files/susdev/cc_energy/marrakech.html
- 2001: The Bonn Declaration of the Third International Forum of Indigenous Peoples and Local Communities on Climate Change held 14-15 July 2001 in Bonn, Germany.
http://www.tebtebba.org/tebtebba_files/susdev/cc_energy/bonndeclaration.htm
- 2000: Second International Indigenous Forum on Climate Change Declaration of Indigenous Peoples on Climate Change held in The Hague on 11-12 November 2000.
<http://www.c3.hu/~bocs/eco-a-1.htm>
- 2000: The Declaration of the First International Forum of Indigenous Peoples on Climate Change from 4-6 September 2000 held in Lyon, France.
http://www.treatycouncil.org/new_page_5211.htm
- 2000: The Quito Declaration on Climate Change, 4-6 May 2000.
http://www.tebtebba.org/tebtebba_files/susdev/cc_energy/quito.html
- 1998: The Albuquerque Declaration of 1 November 1998 from the 'Circles of Wisdom' Native Peoples/Native Homelands Climate Change Workshop-Summit held in Albuquerque, New Mexico.
<http://www.ienearth.org/globalcc.html>
- IPCC: Climate Change 2007—Synthesis Report (A contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change)
<http://www.ipcc.ch/ipccreports/ar4-syr.htm>
- Development and Climate Days
<http://www.dcdays.org/index.html>
- Development Marketplace
<http://www.worldbank.org/developmentmarketplace>
- The World Bank Carbon Finance Unit (CFU)
<http://www.carbonfinance.org>
- CRISTAL Tool
http://www.iisd.org/security/es/resilience/climate_phase2.asp
- United for Climate – Youth Powered Solutions
<http://www.uniteforclimate.org>

Other useful resources

- CC:iNet—Climate Change Information Network (UNFCCC)
http://www.unfccc.int/cc_inet/
- Climate Action, by Sustainable Development International (SDI) in partnership with the United Nations Environment Programme (UNEP), 2007.
<http://www.climateactionprogramme.org>
- Community Risk Assessment Methodologies and Case Studies, ProVention Consortium
<http://www.proventionconsortium.org/?pageid=43>
- The Economics Of Climate Change: The Stern Review, by Nicholas Stern, Cambridge University Press, 2007
http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm
- Eldis Community Based Adaptation Case Studies
<http://www.eldis.org/index.cfm?objectid=6375FE8D-047C-510A-8232A1530000CC5A>
- Fighting Climate Change: Human Solidarity in a Divided World: The Human Development Report 2007-2008, United Nations Development Program (UNDP), 2007.
http://hdr.undp.org/en/media/hdr_20072008_en_complete.pdf
- IPCC: Climate Change and Water 2008—Technical Paper VI Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds, IPCC Secretariat, Geneva, 210 pp. June 2008
<http://www.ipcc.ch/pdf/technical-papers/climate-change-water-en.pdf>
- IPCC: Climate Change 2007—The Physical Science Basis (Working Group I Contribution to the Fourth Assessment Report of the IPCC)
<http://www.ipcc.ch/ipccreports/ar4-wg1.htm>
- IPCC: Climate change 2007—Impacts, adaptation and Vulnerability (Working Group II Contribution to the Fourth Assessment Report of the IPCC)
<http://www.ipcc.ch/ipccreports/ar4-wg2.htm>
- IPCC: Climate Change 2007—Mitigation Of Climate Change (Working Group III Contribution to the Fourth Assessment Report of the IPCC)
<http://www.ipcc.ch/ipccreports/ar4-wg3.htm>

ANNEX II: FUTURE EDITIONS OF THE COMPENDIUM

This compendium of case studies and projects is intended to form the basis of a more comprehensive assessment of Indigenous Peoples, climate change, and adaptation activities.

Please contact the UNU-IAS Traditional Knowledge Initiative (tki@ias.unu.edu) with comments and suggestions, particularly with regard to feedback for this edition and/or to recommend additional case studies for inclusion in the second edition of the compendium, tentatively scheduled for publication in late 2011.

For inclusion in the compendium, projects and case studies must meet both criteria elaborated in the introductory notes (i.e. clear relevance to both Indigenous Peoples and climate change).

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The **Traditional Knowledge Initiative**, a programme of UNU-IAS, seeks to build greater understanding and facilitate awareness of traditional knowledge to inform action by indigenous peoples, local communities and domestic and international policy-makers. Our thematic focus areas include climate change, biological resources (including access and benefit-sharing) and natural resources (including water, marine and forest management).