International Union for Conservation of Nature (IUCN)

Indigenous and Traditional Peoples and Climate Change

Summary Version

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Presentation

It is widely recognised that poor, natural-resource dependent communities in the developing world are especially vulnerable to climate change, in particular those living in high risk areas such as small islands or low lying coastal areas.

Many such communities are indigenous or traditional and have preserved knowledge about agriculture, hunting, fishing, foraging and the use of medicinal plants. Through past exposure to environmental change, such communities have often developed elaborate coping strategies and can offer valuable knowledge in terms of future adaptation to and mitigation of climate change.

We are becoming increasingly knowledgeable about the impacts of climate change on species and ecosystems. However, we only have fragmented knowledge regarding the potential impacts of climate change on livelihoods and cultures of indigenous and traditional communities. Furthermore, until now, traditional knowledge on adaptation has been largely neglected in the policy realm. There is a lack of recognition of the importance which traditional people may play in their own future adaptation to climate change.

IUCN (International Union for Conservation of Nature) prepared this report as a contribution to:

- improve understanding of the potential impacts of climate change on vulnerable communities and cultures and their associated ecosystems;
- identify further research required to reduce the risks of climate change;
- propose approaches for appropriate adaptation and mitigation, particularly in areas with high risk of socio-cultural impacts;
- facilitate integration of socio-cultural considerations in programmes and actions to address climate change impacts.

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Executive Summary

The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report published in early 2007 confirmed that global climate change is already happening. The report concluded that communities who live in marginal lands and whose livelihoods are highly dependent on natural resources are among the most vulnerable to climate change. Many indigenous and traditional peoples are among those at greatest risk, having been pushed to the least fertile and most fragile lands as a consequence of historical, social, political and economic exclusion.

However, people living in marginal lands have long been exposed to many kinds of environmental change and have developed coping strategies. Whilst they have valuable knowledge about adaptation, there is concern that the magnitude of future hazards may exceed their adaptive capacity, especially given their current conditions of marginalization.

The potential impacts of climate change on the livelihoods and cultures of indigenous and traditional communities remain poorly known.

Climate change policy documents, including the Stern Review (2006) and the Fourth IPCC Report (2007) agree that the costs of climate change are going to fall inequitably on the world's poorest and most disadvantaged communities, including traditional and indigenous peoples. Documented examples of adaptation are often drawn from developed regions, with little consideration given to the majority of traditional and indigenous peoples who live in the tropics. The reports also tend to recommend only monetary, knowledge and technology transfer towards developing countries for adaptation and tend not to recognise traditional and indigenous peoples' own coping and adaptive strategies.

The determining factors of social and biophysical vulnerability of indigenous and traditional peoples are not well understood and require further investigation. The vulnerability of a system to climate change is based on the level of biophysical hazard, combined with the sensitivity of communities and ecosystems to impacts. The adaptive capacity of a group depends on their physical location, entitlements to the use of certain resources and land, and access to various factors including knowledge, technology, power, decision-making, education, health care and food.

This report presents maps that superimpose the location of indigenous and traditional peoples (ethno-linguistic groups) over IPCC projections of the impacts of climate change on temperature, precipitation and sea-level change. These highlight areas of coincidence of indigenous and traditional peoples and greatest predicted climatic change. While predicting change at a regional or local level remains challenging due to modelling constraints, it is possible to identify broad regions which are likely to experience particularly pronounced climate change. These include the Arctic, Caribbean, Mediterranean, southern Latin America, the Amazon, southern Africa, the Arabian Peninsula and large parts of Australia. Areas at particular risk from sea-level rise include small islands, the Arctic, and low-lying Asian coastal areas.

Case studies on the impacts of climate change on coastal areas, islands, watersheds, tropical forests and drylands demonstrate that climate change is already having serious implications for traditional and indigenous peoples' livelihoods. The adaptation practices they have developed over centuries, such as shoreline reinforcement, rainwater harvesting and crop and livelihood diversification, have the potential to alleviate adverse impacts and to allow communities to capitalize on new opportunities. However, adaptive capacity depends on many factors and can also be heterogenous within a community, with women often particularly vulnerable. The report aims to identify ways in which adaptive capacity can be developed in a culturally appropriate way.

In conclusion, climate change is already having serious implications on the livelihoods and cultures of traditional and indigenous peoples. Even though these peoples have developed important strategies to adapt to these changes, the rate of change and magnitude of future hazards may constrain their capacity to adapt.

Recommendations include:

- Actively involving indigenous and traditional communities in international, regional and local climate change policy discussion.

- Recognizing, building awareness of, and actively promoting indigenous adaptation and mitigation strategies.
- Promoting culturally appropriate technology transfer.
- Improving social and physical infrastructure.
- Helping communities to secure entitlements to self-determination, land, natural resources, information, education, health services, and food.
- Supporting and enhancing livelihood diversification.
- Addressing the specific aspects of the vulnerability of women and other groups within communities, as well as their potential role in enhancing community resilience.
- Ensuring the conservation of natural resources and biological diversity.
- Supporting further research on impacts of climate change on vulnerable cultures and their associated ecosystems.
- Collecting and analyzing information on past and current practical adaptation actions and measures.
- Developing ways to combine scientific and indigenous knowledge.
- Promoting collaborative research and action between indigenous peoples and scientists.
- Monitoring the implications of mitigation efforts including the Clean Development Mechanism (CDM) and Reduced Emissions from Deforestation and Degradation (REDD) in developing countries on indigenous and traditional peoples.

1 The Policy Context

Two recent reports frame the policy context of climate change. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change Working Group II (IPCC, 2007b) focused on impacts, adaptation and vulnerability. The 2006 Stern Review, commissioned by the UK Treasury focused on the economics of climate change adaptation and mitigation. Both reports highlight that the costs of climate change are being inequitably borne by developing countries as a result of their geographic exposure, low incomes, and greater reliance on climate-sensitive sectors such as agriculture.

The Fourth Assessment Report gives some attention to indigenous and traditional peoples, particularly those living in Polar Regions, North America, Australia and New Zealand. The report reveals that indigenous peoples' livelihoods, for instance those living in the Arctic, have already been altered as a result of changes in sea and ice extent and the ranges of animals and plants on which they depend for their livelihood and cultural identity.

Given the disparity of responsibility for, and vulnerability to climate change, both reports appeal to the international community to support developing nations to increase their resilience to climate change. The IPCC report promotes the use of innovative technology transfer in response to climate change impacts, cautioning however that importing technology may precipitate a loss of indigenous cultural practices.

Until recently, there has been little recognition of the reservoir of knowledge latent in the coping strategies and adaptive capacity of local communities. However, the Fourth IPCC Assessment Report does recognise ongoing adaptation to climate change, and IPCC authors urge the climate change research community to further study indigenous knowledge systems which could prove to be valuable resources for future adaptation.

2 Vulnerability of Traditional and Indigenous Peoples to Climate Change

Vulnerability to climate change is a socially and spatially variable phenomenon, and is also dynamic through time. As such, the IPCC (2007b; 21) defines vulnerability as:

> *"the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity."*

Adaptive capacity is a component of human societies and defined by the IPCC (2007b; 21) as:

> *"the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences."*

Adaptive capacity can therefore reduce vulnerability by moderating the impacts of climate change. Examples of adaptations of indigenous and traditional peoples to climate variability and change are described in the following chapter of this report.

Recent literature has made the distinction between biophysical vulnerability and social vulnerability (Cutter, 1996, Füssel, 2007; Brooks, 2003). Biophysical vulnerability represents the amount of damage experienced by a system due to a specific type of hazard and, in contrast to social vulnerability, is a function of the frequency and severity of hazards (Brooks, 2003). The following factors are some which determine the biophysical vulnerability of indigenous and traditional peoples.

2.1 Biophysical Vulnerability

2.1.1 Location of residence

Exposure to climate change impacts depends on where people choose or are forced to live (Brooks, 2003). Indigenous and traditional peoples often live in physically isolated, fragile and harsh environments, making them especially vulnerable. Whilst housing may be well adapted to local conditions, it may be less resistant to hazards of a new nature or force.

Mountain areas

Mountains are often areas of high cultural and biological diversity but are also considered among the regions most susceptible to climate change. Mountain glaciers and snow packs feeding lakes and rivers have already declined significantly, especially in the northern hemisphere. Permafrost has also degraded, leading to change in land surfaces and drainage systems (IPCC, 2007a). High alpine flora, used by people for food, medicine and clothing are at risk from climate change.

2.1.2 Availability of natural resources and species migration

Traditional and indigenous communities tend to be highly reliant on natural materials and fibres for food, timber, fuel, income generation, spiritual purposes and medicines. Climate change is expected to alter the availability and distribution of these resources. Increased frequencies of drought and flood are projected to adversely affect crop production, especially at low latitudes (IPCC, 2007b). A decrease in the availability of water and fuelwood would have serious implications for the time-burdens of women and children, who are often responsible for gathering these. A loss of biodiversity would impact on indigenous peoples' food sources and reduce their ability to cope with pests and diseases.

Long before the advent of complex numerical climate models, many indigenous communities have used changes in their environments to predict fluctuations in the weather and climate (Penehuro, 2003). Adaptation has often been based on such indigenous systems of climatic observation and interpretation of migration of animal and bird species. The possibility of more rapid and complex climate change may jeopardise these traditional systems and potentially mislead decision-making. Facilitated access to scientific information and technology such as early warning systems may help decrease indigenous and traditional peoples' vulnerability to hazards.

2.2 Social Vulnerability

Social vulnerability exists independently of external hazards, but is governed by internal properties of human societies, for instance poverty, marginalisation, literacy, food entitlement and health (Brooks, 2003). As a consequence of social and political exclusion some indigenous groups have been pushed to marginal and sometimes fragile lands. Whilst they may be tightly connected to their lands, through livelihoods and spiritual bonds, their tenure and access may not be legally recognised. With exceptions, they have very limited access to power and decision-making. The particular characteristics of traditional and indigenous communities which govern their social vulnerability in the context of climate change are outlined here.

2.2.1 Poverty and marginalisation

Insufficiency of income, assets or wealth is one of the most important determining factors of socioeconomic vulnerability of indigenous and traditional peoples. A recent World Bank study has shown that indigenous peoples in Latin America remain among the poorest of the region with very little poverty alleviation over the past decade. In some situations, their overall situation has worsened (Hall & Patrinos, 2004). In this context, climate change acts as another stressor which limits coping ability (DFID, 2004). As such, climate change is expected to adversely affect poverty eradication measures and to jeopardise the Millennium Development Goals.

2.2.2 Health and nutrition

The IPCC report (2007b) predicts that climate change will further weaken the health status of millions of people, particularly those with low adaptive capacity. Groups residing within natural ecosystems may be exposed to higher health risks, as well as having limited access to mainstream health services and health promotion programmes.

In certain places, climate change is expected to increase exposure to Ultra Violet radiation causing damage to skin and eyes. Other predictions include under-nutrition resulting from diminishing crop productivity; deaths caused by heat waves, droughts, floods and storms; and water-borne diseases as a result of poorer water quality causing increased incidence of diarrhoeal and respiratory disease. Changes are expected in the spatial distribution of infectious vector-borne disease, e.g. malaria and dengue fever (DFID, 2004).

Malaria and Climate Change

Malaria is thought to be particularly sensitive to long-term climate change. Assuming a global temperature increase of 2-3 ºC the number of people at risk of malaria in climatic terms would rise by about 3-5%, equating to several hundred million. The following figure shows the expected spread of the primary malaria agent, the *falciparum malaria* parasite, into new regions by 2050 (WHO, 2003).

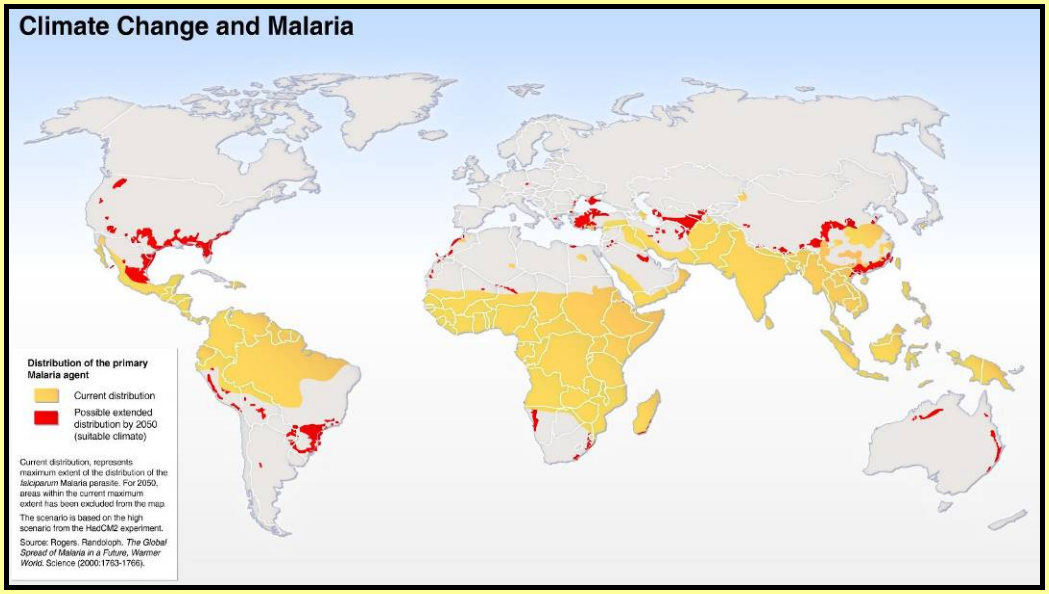


Figure 1 Climate Change and Malaria, scenario for 2050 (from Ahlenius, 2005)

2.2.3 Social networks and mobility

Indigenous and traditional peoples are often reliant on social networks and maintain exchanges of food and labour through reciprocal links and local markets. These have been important components of adaptation strategies to environmental change in the past. If they can be maintained, they are likely to remain important, particularly if resources decline in local availability. In addition, families and communities that rely on seasonal employment migration may be more resilient to adverse climatic impacts. Diversified livelihood systems also allow communities to draw on various sources of food and income and in doing so, spread the risks of climate change. Mobility is also important for some groups, for instance the Makushi of Guyana, who move their savannah homes to forest areas in times of drought.

It is striking that the IPCC reports of 2001 and 2007 have focussed primarily on indigenous communities living in developed regions, where there is greater governmental support. The majority of traditional and indigenous peoples living in developing countries get very little consideration from the state. However, in a position of increased vulnerability through climate change and other stressors, indigenous and traditional peoples may become more reliant on aid provided by the state, NGOs or international organisations, especially in times of crisis.

2.3 Effective Policy for Vulnerable People and Climate Change

The vulnerability of traditional and indigenous peoples to global environmental change is therefore determined by social and biophysical factors. Biophysical vulnerability is exacerbated by social aspects such as poverty and marginalization, lack of entitlements to networks, resources, power and decision-making, and other stressors such as violent conflicts or epidemics.

Institutions and policy makers have a key role to play in empowering indigenous and traditional peoples by securing and enhancing their entitlement to resources and improving their adaptive capacity. Where institutions fail to secure these entitlements, climate change and other stressors could exceed the adaptive capacity of some indigenous and traditional peoples (Adger, 2006).

3 Overview of Potential Impacts and Evidence of Adaptation Strategies

Accurately identifying the areas and groups most vulnerable to climate change remains challenging due to modelling constraints. Nevertheless, it is possible to identify broad regions which are likely to experience certain types of climate change and extreme events (Dow et al., 2007).

The following maps superimpose the location of indigenous and traditional peoples (ethno-linguistic groups) on climate change prediction data from the IPCC (2007)[1]. The maps show the coincidence of some areas of high concentration of indigenous and traditional peoples and areas of greatest predicted climatic change. These areas therefore represent regions of particular concern.

These broad projections form the basis for the later part of this chapter, which considers projected impacts at the level of biomes. It also documents examples of adaptation within natural resource dependent communities.

3.1 Modelling Surface Temperature

Figure 1 (see Annex 1) shows the multi-model mean of annual mean surface warming for the time period 2080 to 2099, overlaid with the distribution of the world's ethnolinguistic groups.

It is very likely that global climate change will cause higher maximum temperatures and more hot days over nearly all land areas (IPCC, 2007). This is associated with higher minimum temperatures and fewer cold and frosty days. The biggest changes in surface temperature are expected to happen in high latitudes as well as in the interior of the continents, hence throughout the USA and Canada, across Bolivia and Brazil, in the Mediterranean region (especially north-western African states), in southern Africa (around the Kalahari Desert), the Arabian Peninsula, the Tibetan plateau and north-west Australia.

3.2 Modelling Precipitation

Precipitation is a function of inherently small scale processes, such as cloud formation and moisture availability, and is therefore inherently difficult to predict (Frame, 2007). However, based on data from the IPCC (2007), the majority of models indicate:

- An increase in precipitation across the seasons in high latitudes and in some of the monsoon regimes.
- A widespread decrease of summer precipitation except for increases in eastern Asia.
- Major decreases in precipitation across the subtropics, particularly pronounced in the Caribbean and Mediterranean regions.

Thus, people living across the Caribbean and Mediterranean regions, parts of Brazil, southern Chile and Argentina, southern Africa and large parts of Australia are expected to face increasing freshwater stress over the course of this century. Increases in precipitation over 20% have been projected for most high latitudes, as well as in eastern Africa, central Asia and the equatorial Pacific Ocean.

Figure 2 (Annex 2) shows the multi model mean changes in precipitation for the time period 2080 to 2099, overlaid with the distribution of the world's ethnolinguistic groups.

Many of the regions of greatest change in surface temperature (Figure 1) coincide with the regions of greatest decrease in precipitation as shown in Figure 2. Hence, indigenous and traditional groups living in the Caribbean region, the Mediterranean region and the Middle East, southern Africa and large parts of Australia will have to cope with increasing water stress coupled with rising surface temperatures.

3.3 Oceans, Coastal Areas and Islands and Climate Change

This section focuses on projections of climate change for oceans and potential repercussions for coastal and island communities. A case study on indigenous peoples in the Arctic shows how climate change is altering traditional ways of life.

[1] All climate and sea level change data were taken from the IPCC Forth Assessment Report of Working Group 1 (2007) and represent an average prediction of several climate models for the A1B emissions scenario during the period 2080-2099. Maps showing the location of ethnolinguistic groups are derived from Oviedo et al. (2000).

Approximately 20% of the world's human population lives within 30km of the sea, and nearly double that number lives within 100km of the coast (IPCC, 2001). The rate of population growth in coastal areas is further accelerating (United Nations, 2007).

Sea-level rise is considered to be the biggest challenge posed by climate change for inhabitants of coastal regions (GACGC, 2006). Sea-level rise will involve economic, ecological, cultural and subsistence impacts, through loss of land, infrastructure, and coastal habitats.

Despite limitations, it is possible to predict the areas of greatest projected change in sea-level. Figure 3 (Annex 3) shows projected changes in sea level, with superimposed densities of indigenous and traditional peoples.

The most pronounced change in sea level is projected to take place in the Arctic. It is also expected to have especially serious impacts along the low lying coastline of the Indian states of Gujarat and Kerala, the Bay of Bengal as well as around the Korean peninsula and Japan. Low lying parts of Madagascar, Sri Lanka and the Pacific Island states are particularly at risk.

While the number of extreme coastal weather events such as tropical cyclones is not expected to rise due to climate change, several studies suggest that the strength of these events is very likely to increase. The IPCC (2001) estimated that the number of people potentially affected by storm-surge flooding will double, and perhaps even triple, in the next century. Tropical coral reefs can be damaged by rising sea temperatures, eroding their ability to act as natural barriers to wave action, tsunamis and coastal erosion. They also support fisheries, which provide a major dietary and income source for coastal communities. It is estimated that more than 100 million people are economically dependent on coral reefs (GACGC, 2006).

Below is a brief summary of the expected regional impacts of climate change and sea-level rise projected by the IPCC (2001).

3.3.1 Africa

More than one-quarter of the population of Africa resides within 100 km of a sea coast, making them vulnerable to sea level rise. It has been estimated that as many as 70 million people could be affected by flooding in 2080, compared to 1 million in 1990. As an example, Banjul, capital of The Gambia, could disappear in 50-60 years because of coastal erosion and sea-level rise.

3.3.2 Asia

1.7 billion people live in coastal areas of Asia. Rapid unsustainable development has led to Asian coasts being less resilient, and their vulnerability will be further exacerbated by climate change. In terms of sea-level rise, the consequences will be most dramatic in Bangladesh, where 17 million people could be exposed following a 1.5 metre rise in sea-level (Figure 4).

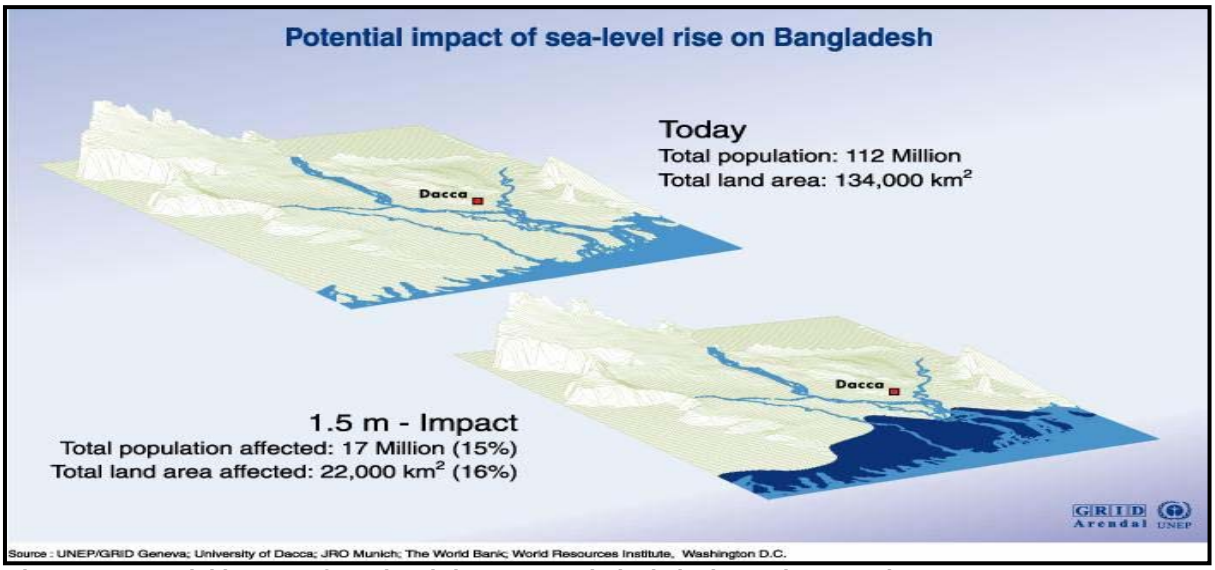


Figure 4. Potential impact of sea-level rise on Bangladesh (Rekacewicz, 2000)

3.3.3 Latin America

Approximately 1600 km of coral reefs and 870km of mangroves are located in the Central American region. The second largest coral reef system in the world dominates the offshore area of the western Caribbean. Impacts of climate change on these fragile ecosystems could put at risk thousands of species and resources for rural communities living in coastal areas.

3.3.4 Small Island States

Small Island States contain a high proportion of the world's linguistic and cultural diversity. Despite being a heterogeneous group, Small Island States tend to have limited space and resources, live in relative isolation and have often poorly developed infrastructure. All these combine to reduce the possibility for retreat from sea-level rise. The Maldives are faced with inundation, and inhabitants likely to become sea-level 'refugees'.

Indigenous peoples in the Arctic

The Arctic is experiencing some of the most rapid and severe climate change on earth (ACIA, 2004). Arctic air temperatures have risen by up to 5°C during the 20th century, combined with marked decreases in sea-ice extent. Communities face challenges of shifting vegetation zones and animal range and distribution, reduction of sea-ice, sea-level rise and increasing exposure to storms.

Peoples of the Arctic are also the only indigenous communities mentioned in the summary of IPCC's Fourth Assessment Report. Arctic communities have a long history of adaptation to extreme environments, to environmental changes as well as to other type of changes such as colonization, forced resettlement and rapid cultural change (Nuttall, 2001).

Modern adaptation strategies to changing arctic climates include:

Housing
- Shoreline reinforcement and relocating buildings from the shoreline.
- Use of innovative building materials to counteract instability caused by changing permafrost.

Subsistence
- Increasing consumption of bottled water due decreasing water quality and accessibility.
- Changing hunting and fishing habits and quotas.
- Increased consumption of bought foods due to more scarce local foods.

Emergency preparedness
- Marking of danger zones in avalanche prone areas.
- Expansion of search and rescue teams due to increased snow slides and avalanches.
- Development of better emergency preparedness plans e.g. carrying more supplies during travel.
- Increasing use of Global Positioning Systems (GPS), cellular phones and CB radio.

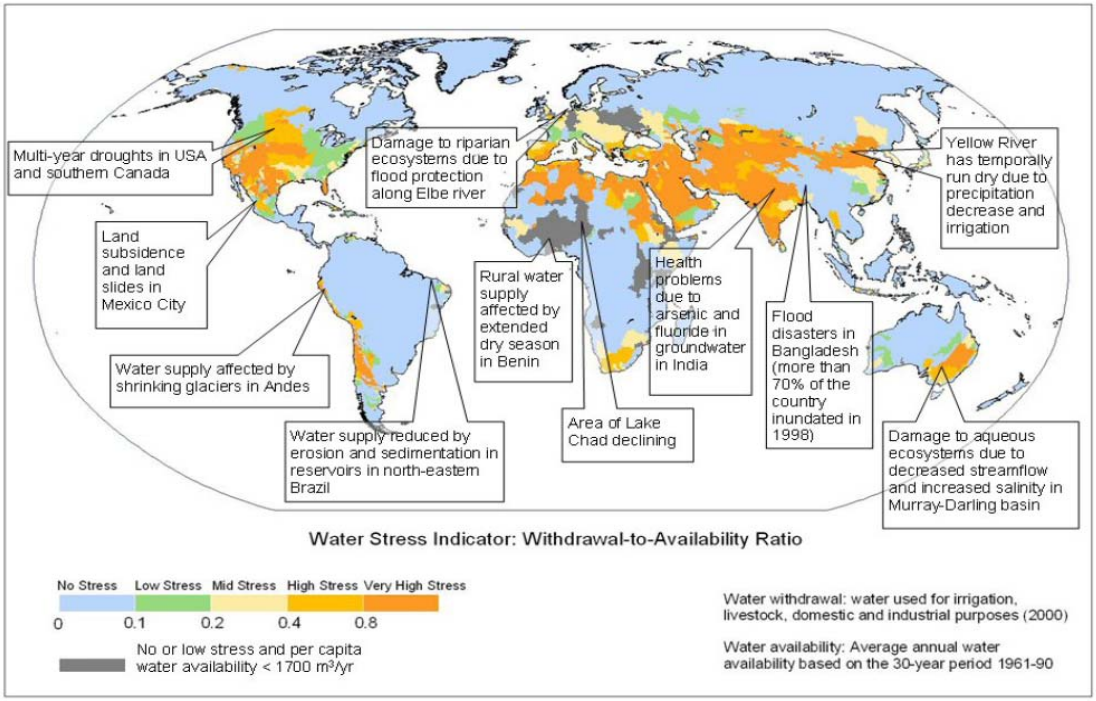
(Indian and Northern Affairs, 2007)

In terms of knowledge for adaptation, the Arctic Climate Impact Assessment (ACIA, 2004) report benefited from the input of local people, drawing upon both scientific and traditional knowledge (Couzin, 2007). It will be equally important to include indigenous peoples at the decision-making level, so that their experience can shape policy and governance to meet the challenges of climate change.

3.4 Watersheds and Climate Change

Specific projected impacts in various parts of the world are summarized in Figure 5.

Figure 5. Examples of current vulnerabilities of freshwater resources and their management (IPCC 2007)



Freshwater environments tend to have the highest proportion of species threatened with extinction (MA, 2005), and climate change provides a further threat. Changes in climate could exacerbate periodic and chronic shortfalls of water, particularly in arid and semi-arid areas of the world (Watson et al., 1998). Flood and drought risk is projected to grow as precipitation intensity and variability increases. The following case studies illustrate adaptations and constraints to adaptation in watersheds.

Using traditional techniques to protect watersheds in Honduras

In the remote village of Guarita in Honduras, traditional techniques have become the starting point for climate change adaptation. The village was one of few places in the region that successfully avoided the worst destruction of Hurricane Mitch in 1998. Traditional Quezungal farming methods protected the upper catchment and only 10% of crops were lost. Crops are planted under trees whose roots consolidate the soil and terraces reduce soil erosion. Techniques such as this are being actively promoted by the Government of Honduras in collaboration with the UN Food and Agricultural Organisation (Bergkamp et al., 2003).

Indigenous peoples in Nicaragua

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 and food from the forest and rivers. The Miskito are being affected by climatic change, with summer floods and winter droughts disrupting traditional rhythms of agriculture. Significant deforestation is also thought to contribute to the deterioration of river flows in the region.

The Rio Coco usually flows during the rainy season, but has been extremely low recently, meaning that basic supplies can no longer reach the villages. Pollution and disease have become concentrated in the river.

Oxfam have helped 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 lives. However, the long-term ability of the Miskitos to adapt is looking increasingly uncertain (Kelly, 2007).

Mount Kilimanjaro, Tanzania

Mount Kilimanjaro's glaciers are projected to disappear by 2020. Recent studies indicate that increasing temperatures and decreasing precipitation have increased the intensity of forest fires, which

in turn alter the hydrological balance of the drainage basins. Climate change adaptation strategies must focus on conservation plans for the Kilimanjaro ecosystem and urgent adaptation measures in the agriculture and water sectors (PBWO/IUCN, 2007).

Future watershed adaptation strategies need to examine the possibilities existing within indigenous knowledge systems, community structures and institutional management agencies for sustainable mountain and site-based resource conservation in the Kilimanjaro area (Mwangi, 2002).

Qhuthañas in Bolivia
Aymaran indigenous peoples of Bolivia have been coping with water insecurity and scarcity over centuries. In order to collect rainwater in the mountains and pampas they have developed a sophisticated system of small dams (qhuthañas). This traditional technique has proved vital not only to people but also to livestock in times of drought. These water reservoirs also serve as thermo-regulators of humidity and help to reduce the risk of skin cancer by diffusing harmful sun-rays (UNFCCC, 2007).

3.5 The Tropical Forest Belt and Climate Change

At least 1,400 distinct indigenous and traditional peoples inhabit tropical forest worldwide (Oviedo et al. 2000). Significant populations of ethnically distinct indigenous peoples live in the major humid forest areas of the Amazon and Congo Basins, the islands of Borneo and New Guinea, the Guyana shield, Central America and in other humid forest areas in Asia, Africa and Latin America. Climate change creates particular risks for these peoples and their interests are rarely taken into account in climate change negotiations on mitigation or adaptation options.

This section gives an overview of the projected impacts of climate change on tropical forests and illustrates this with case studies from Borneo and the Congo Basin on adaptation to environmental change.

Tropical forest ecosystems are vulnerable to changes in climatic variability and directional changes in temperature and rainfall (CIFOR, 2007). In many cases climate change may result in longer dry seasons for humid forests. In combination with disturbance associated with industrial forestry, this will increase the likelihood of forest fires. These have been seen in Indonesian Borneo (especially in 1983 and 1997), the northern fringe of the Congo Basin (1983) and vast areas in the southern part of the Amazon Basin. The increasing intensity and extent of these fires will require major adjustments.
Most forest indigenous peoples have typically been hunters-gatherers. Responses to environmental change have been linked with broader changes associated with changing external pressures on their habitats, contact with other groups, and market integration. However, specific coping strategies to extreme variations of weather have included:

- Crop diversification in order to minimize the impacts of failure of one crop.
- Mobility in response to climatic variability.
- Change of hunting and gathering periods to adapt to changing animal migration and fruiting periods.
- Changing livestock varieties to account for new disease challenges.
- Changes in food storage methods, e.g. drying or smoking foods.
- Use of a mix of cultivation or hunting/gathering.
- Trade or barter at local markets.
- Use of aid from international agencies (the World Food Programme, UN agencies etc).
- New materials e.g. asbestos and zinc roofing from the market.

Indigenous peoples in Borneo, Indonesia

The Dayak of Borneo

The Dayak have detected various indicators of climatic change. They have observed bird species never previously seen, become aware of river water level changes and the loss of traditional plants used as medicinal remedies. Migration patterns of birds have traditionally been used to guide hunting and cultivation activities but they no longer provide reliable guidance.

The Punan of East Kalimantan
The Punan plant agricultural and tree crops and hunt according to timescales aligned to the lunar cycle. Climatic, and associated ecosystem change may mean these lunar signals no longer calibrate with favourable times for these activities, affecting decision-making (Boedhihartono, 2004).

The Baka Pygmies of South East Cameroon and the Bambendzele of Congo

The Baka and Bambendzele people have been subject to change from industrial logging in the past. Rainfall has recently become less regular and harder to predict. Women who normally catch fish in small streams in the dry season are often unable to achieve traditional fish catches as the flood patterns of the rivers change. 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 people. 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.

3.5.1 Current issues relating to climate change mitigation measures

Carbon trading and carbon sequestration plantations are likely to create demand for land in the humid tropics. In many cases the benefits from carbon payments may accrue to industry and bigger, richer landowners. Those who are less integrated into the market economy, whose land rights are less clear or less easily defended in courts will rarely benefit from payments and, at worst may be dispossessed. Payments through Avoided Deforestation are likely to flow to central or regional governments and not to forest dwelling peoples. Payments may be linked to restrictions on forest use that restrict development options for indigenous peoples. The Stern Review urged caution over climate change mitigation measures, due to risks of the accompanying social problems.

3.6 Drylands, Climate Change and Indigenous and Traditional Communities

Drylands cover 40% of the earth's terrestrial surface and are home to over 2 billion people, some of whom are the poorest people in the world (MA 2005). Indigenous groups in drylands include pastoralists, hunter-gatherers and other traditional communities. The Millennium Ecosystem Assessment expressed medium certainty that 10–20% of drylands are degraded. Desertification thus ranks among the greatest environmental challenges, yet drylands are very resilient ecosystems. Similarly, people living in drylands have developed complex pastoral and cropping systems to cope with the erratic and harsh climate (Bonkoungou and Niamir-Fuller 2001). Promoting the adaptive capacity of drylands people will build on their traditional coping strategies. This chapter gives a brief overview over the projected impacts of climate change in drylands and outlines traditional coping strategies to climate variability.

Although the impacts of climate change are likely to be expressed regionally in drylands, it is projected that climate change will lead to a decrease in water availability and a projected increase in extreme weather events such as droughts and floods (IPCC 2007a; MA 2005). Water availability in drylands is expected to decrease in the next 40 years by 10-30% while drought-affected areas will likely increase in extent and floods are expected to become more frequent (IPCC 2007a). Although agricultural productivity is expected to rise in some regions, it will likely decrease overall in drylands (IPCC 2007a; MA 2005), with potentially severe impacts on food security (IPCC 2007a). In addition, climate change is projected to overall severely affect the health of vulnerable people through malnutrition, decrease in water quality, heat waves, floods and droughts (IPCC 2007a).

Drylands people are acknowledged to be among the most vulnerable communities due to a combination of political, economic and social factors (Trench et al 2007). Traditional drylands people often live in remote parts of a country, characterized by poor infrastructure, limited basic services and poor government presence. Land privatisation, borders and inadequate policies have further marginalized drylands people and eroded their traditional management practices. However, over centuries, these people have extensive knowledge about adaptation to climatic variability. The following section outlines projected regional impacts of climate change.

3.6.1 Africa

According to the IPCC reports (2007), between 75 and 250 million people in Africa are expected to be affected by increasing water scarcity. In addition, climate variability and change is predicted to adversely affect agricultural production which could exacerbate malnutrition. In the Sahelian region, crop productivity has dropped due to warmer and drier conditions and thus a shorter growing season (IPCC 2007a). Overall, Africa is expected to be one of the most vulnerable continents to climate change, due to low adaptive capacity and high social vulnerability.

Community based rangeland rehabilitation in Sudan

The drought-prone Bara province is situated in western Sudan and is mainly composed of desert scrub vegetation and undulating sand dunes. 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) has been developed in 17 villages in central Bara province. The CBRR project has been successful, with over 700 hectares of rangeland improved. A major achievement of the project has been to build the capacity of the affected communities in order to enable them to cope with climate-induced stresses (IISD, 2003).

3.6.2 Asia

The IPCC project a decrease of crop yields of up to 30% in Central and South Asia, increasing the risk of malnutrition and under-nutrition. Freshwater availability is projected to decrease, particularly in large river basins, whilst the likelihood of floods and droughts may rise, potentially exacerbating disease (IPCC 2007a).

3.6.3 Latin America

In the semi-arid and sub-humid areas of Latin America, climate change is projected to negatively affect agricultural productivity due to salinisation and degradation. Likewise the productivity of some important crops as well as of livestock is expected to decline (IPCC 2007a).

3.6.4 Australia and New Zealand

Water scarcity is expected to increase in southern and eastern Australia as well as in the northern and eastern parts of New Zealand. In addition, because of projected droughts and fires, agricultural productivity and forestry is expected to decline.

3.6.5 Europe

Southern Europe as well as central and eastern Europe are expected to face increasing water stress. In southern Europe the likelihood and frequency of wildfires is expected to impose further pressure on a region already vulnerable to aridity (IPCC 2007a).

4 Conclusions and Recommendations

Previous sections have shown that indigenous and traditional peoples will be particularly burdened by climate change, and some impacts are already in evidence. Adaptive capacity depends on a range of factors including social capital, social networks, values, perceptions, customs, traditions, and levels of cognition. External factors including violent conflicts or the spread of infectious diseases can undermine adaptive capacity. Vulnerability varies between groups and can be unevenly distributed within communities. For example, women are expected to be particularly affected by climatic impacts.

The case studies above reveal a long record of adaptations to climate variability practiced by indigenous peoples which have enhanced adaptive capacity in the past. Within these practices is the potential to alleviate adverse impacts and to capitalise on new opportunities brought about by climate change. Further research is required to assess whether the adaptive capacity of traditional and indigenous peoples will be sufficient to cope with the rate and magnitude of projected changes. It is essential to explore culturally appropriate ways of enhancing the latent adaptive capacity of traditional and indigenous peoples. This would be a crucial part of climate change policy which includes indigenous peoples at all levels.

Losing indigenous and traditional cultures and their knowledge systems would be a major loss for humanity and highly detrimental to the conservation of biodiversity. Hence, supporting traditional and indigenous peoples in adaptation and mitigation processes will not only enhance their resilience to climate change, but at the same time also help preserve the world's culturally and biologically diverse areas. This corresponds with IUCN's mission *to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.*

The following section provides policy and research recommendations to improve understanding of the impacts of climate change on ethno-cultural diversity and to build adaptive capacity to climate change.

4.1 Policies and Actions

- Promote **land tenure and access rights** as well as **access rights to natural resources** of indigenous and traditional peoples, including in the context of mitigation measures such as biofuels plantations or carbon offset projects.
- Promote **entitlement to power** and **self determination.**

- **Incorporate indigenous knowledge and perceptions** into climate change policy and enable indigenous peoples to **actively take part in decision-making** within climate change policy making at regional, national and local levels.
- Facilitate **access to (scientific) information** and **technology.**
- **Recognize** indigenous and traditional peoples' own **coping strategies** to adapt.
- Support **the protection of natural resources** including habitats, species and culturally important resources.
- Support countries in the process of developing **National Adaptation Programmes of Action** (NAPAs) and ensure the integration of indigenous and traditional knowledge.
- Address specific **risk management strategies** in areas where traditional and indigenous peoples live and where projected hazards will have the most serious impacts.
- **Explore carbon offset strategies** that indigenous peoples practice and for which they should be rewarded through payments and other means.
- Promote innovative, culturally appropriate **technology transfer** in combination with **indigenous practices** including sustainable water use and traditional coastal management.
- Improve the overall situation of indigenous peoples: **poverty alleviation**, **health care services** and **food security.**
- Improve social and physical **infrastructure.**
- Maintain or enhance **livelihood diversification.**
- Address the **specific aspects of the vulnerability of women and other groups** within communities, as well as their **potential role in enhancing community resilience**.
- **Conservation of biodiversity** (including agro-biodiversity) in order to increase resilience of traditional and indigenous peoples and to enhance their capacity to adapt.
- Support **networks of indigenous peoples** enabling them to share their knowledge and lessons learned.
- Develop and implement **risk management strategies** including early warning systems or evacuation strategies.
- Make full use **of the agenda of the World Conservation Congress in 2008** to advance the discussion of 'Indigenous and Traditional Peoples and Climate Change". Invite Indigenous peoples to the Congress.
- **Implement recommendations from climate impact and vulnerability assessments** which take into account indigenous knowledge systems, culture, social values, spirituality and ecosystems; as well as the full and equal participation of indigenous peoples in all aspects and stages of assessment.
- **Capacity building** and **empowerment** of indigenous peoples to deal with climate change.
- **Create awareness on traditional adaptation and mitigation strategies** and **expand knowledge** on these practices.

4.2 Further research

- **More rigorously identify indigenous peoples living in the most vulnerable areas** to climate change.
- **Improve knowledge** on the **impacts of climate change** on vulnerable cultures and **monitor impacts**.
- **Collect** and **analyse** information on **past and current practical adaptation actions and measures.**
- Establish networks of **conjoined research and action** between indigenous peoples and scientists.

- Investigate how to best **triangulate scientific and indigenous knowledge** in the development process of adaptation and mitigation strategies to climate change.
- Monitor the **implications of mitigation efforts** under international mechanisms, such as the Clean Development Mechanism, on indigenous and traditional peoples.
- **Monitor progress on traditional and non-traditional adaptation** and assess the direct and ancillary effects of such measures.
- **Explore economic and social costs and benefits** of adaptation measures.
- Explore options to advance approaches to **Reduced Emissions from Deforestation and Degradation (REDD) in developing countries** that foresee benefit sharing with traditional and indigenous peoples in a way that is culturally appropriate.

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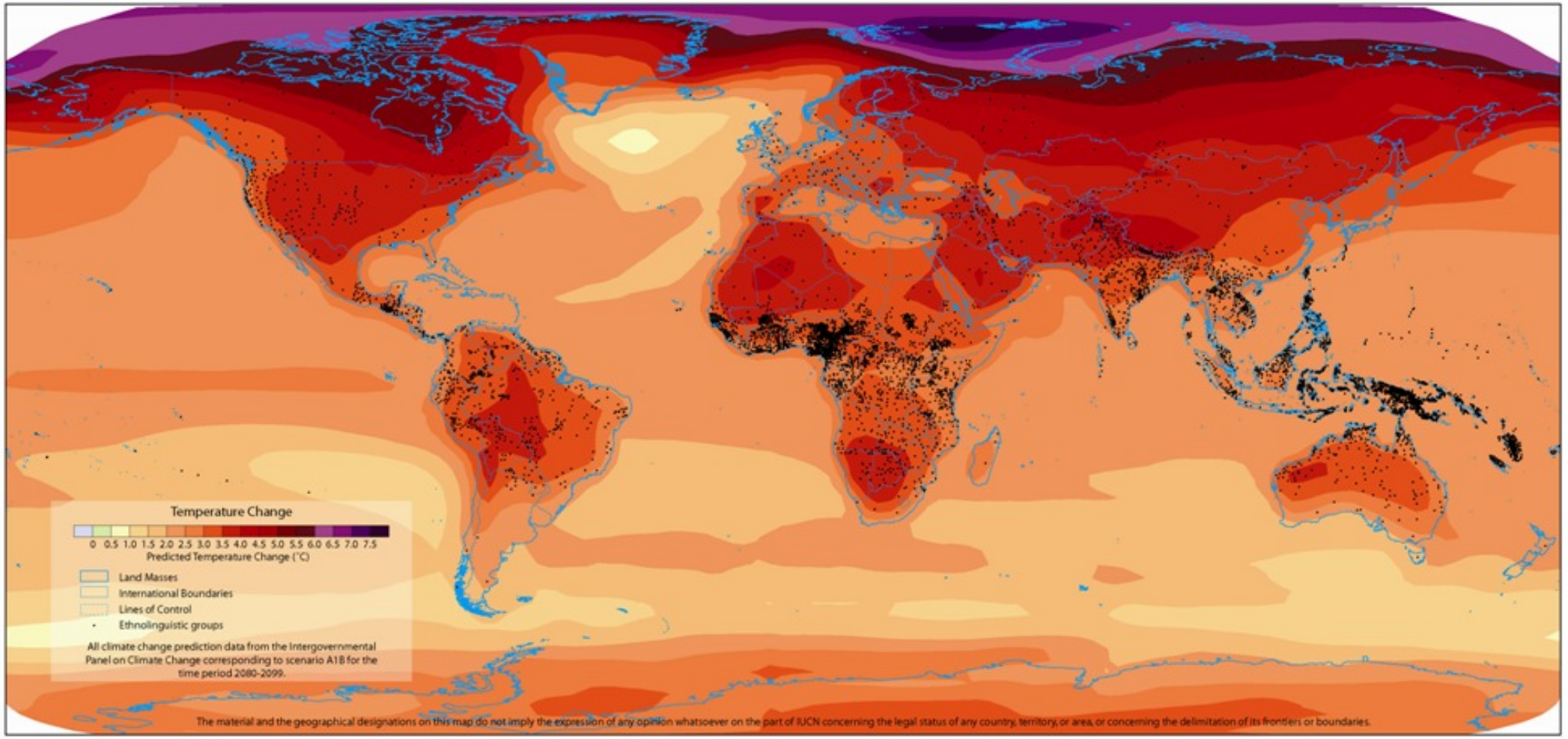
Annex 1

Ethnolinguistic Groups of the World and Projected Global Changes in Temperature

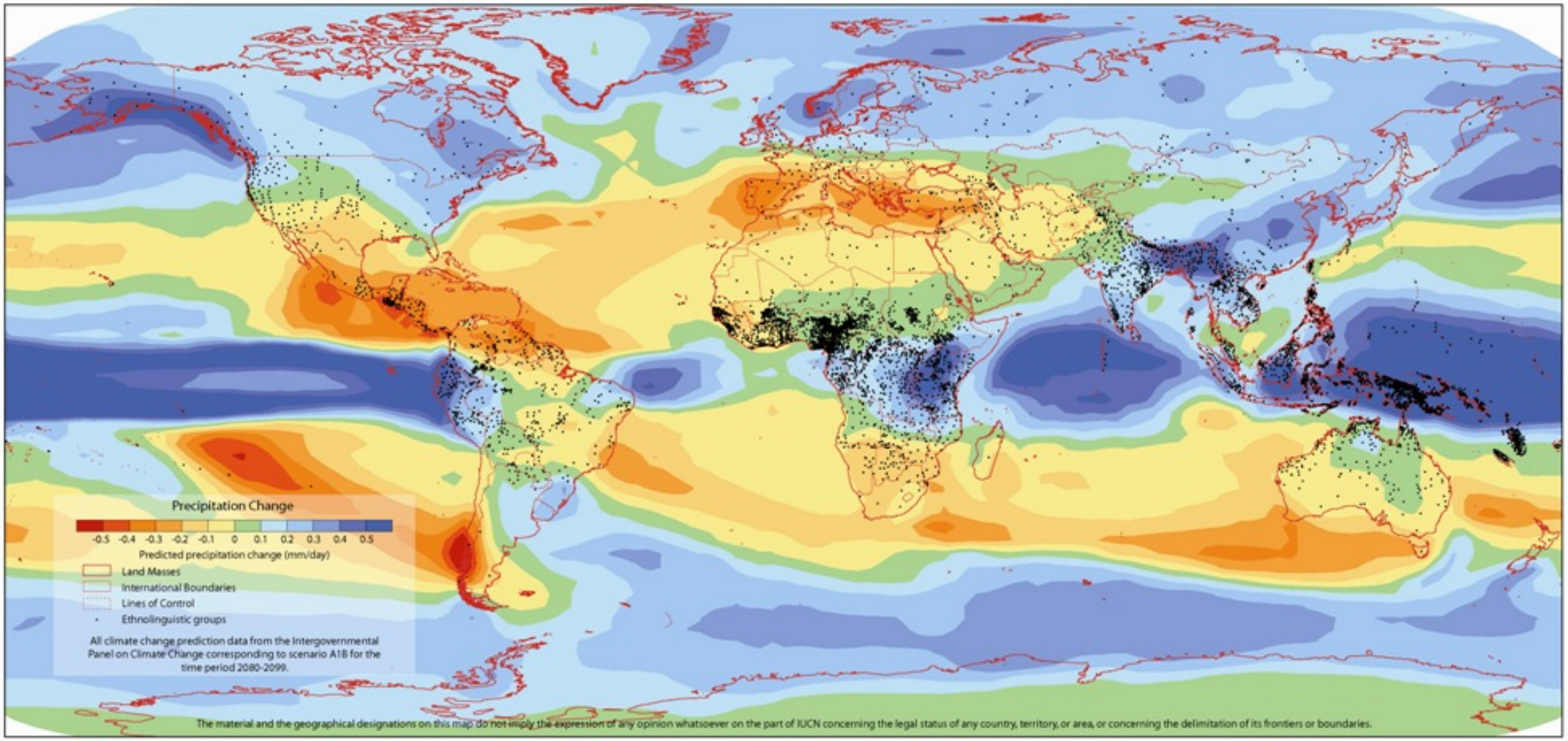


Source for climate prediction data: Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver and Z.-C. Zhao, 2007: Global Climate Projections. In *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Sources for ethnolinguistic groups: WWF International and Terralingua, 2000: *Indigenous and Traditional Peoples in the Global 200 Ecoregions*, Gland, Switzerland.

Annex 2

Ethnolinguistic Groups of the World and Projected Global Changes in Precipitation



Source for climate prediction data: Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver and Z.-C. Zhao, 2007: Global Climate Projections. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

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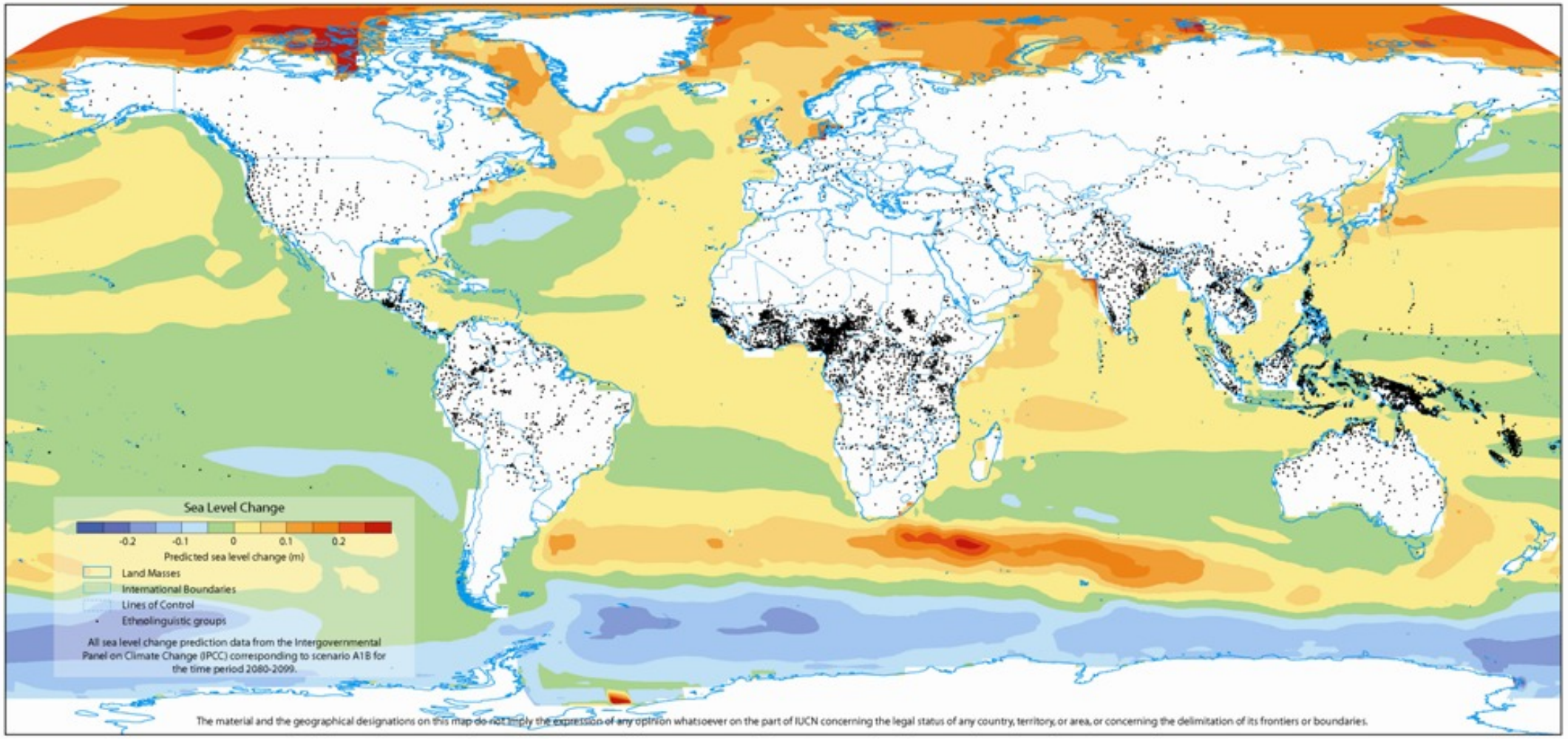
Annex 3

Ethnolinguistic Groups of the World and Projected Global Changes in Sea Level



Source for climate prediction data: Meehl, G.A., T.F. Stocker, W.D. Collins, P. Friedlingstein, A.T. Gaye, J.M. Gregory, A. Kitoh, R. Knutti, J.M. Murphy, A. Noda, S.C.B. Raper, I.G. Watterson, A.J. Weaver and Z.-C. Zhao, 2007: Global Climate Projections. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

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