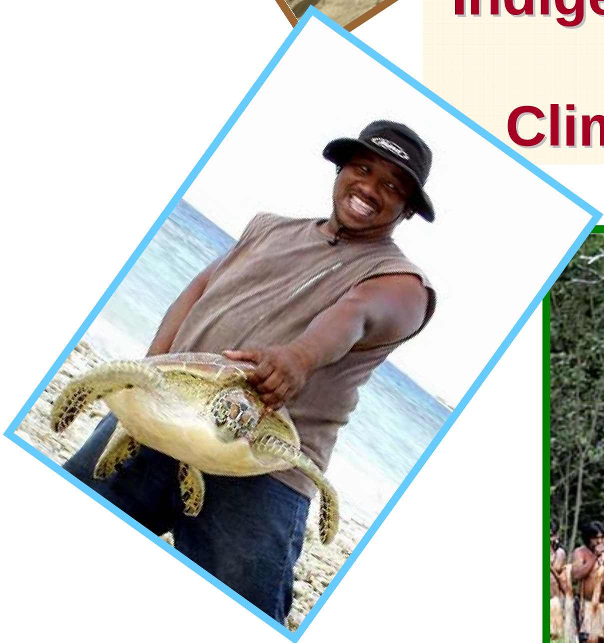
Indigenous Peoples and Climate Change



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Indigenous Peoples and Climate Change

1. Introduction

Indigenous and other traditional peoples are only rarely considered in academic, policy and public discourses on climate change, despite the fact that they will be greatly impacted by impending changes. Their livelihoods depend on natural resources that are directly affected by climate change, and they often inhabit economically and politically marginal areas in diverse, but fragile ecosystems. Symptomatic of the neglect of indigenous peoples, the recently released IPCC II report summary on climate change impacts [http://www.ipcc.ch/SPM13apr07.pdf] makes only scarce mention of indigenous peoples, and then only in polar regions and merely as helpless victims of changes beyond their control. The IPCC III report [http://www.ipcc.ch/SPM040507.pdf] on mitigation of climate change does not consider the role of indigenous peoples. This view of indigenous peoples as passive and helpless at best, and as obstructionist and destructive at worst is not new, with roots going back to colonial periods and reoccurring in contemporary discussion of development, conservation, indigenous rights, and indigenous knowledge. Our aim is to shift the focus to indigenous people as primary actors in terms of global climate change monitoring, adaptation and innovation. We believe theirs should be a voice in policy formation and action.

Indigenous and other local peoples are vital and active parts of many ecosystems and may help to enhance the resilience of these ecosystems. In addition, they interpret and react to climate change impacts in creative ways, drawing on traditional knowledge as well as new technologies to find solutions, which may help society at large to cope with the impending changes. We contrast the IPCC summaries with the recent Kauai Declaration "Ethnobotany: The Science of Survival":

> "Such vital environmental resources as the air we breathe, the quality of the water we drink, the topsoil upon which our agriculture depends, the relatively stable global climate we have enjoyed until recently, and the global stock of biodiversity are all being degraded rapidly. Concurrently, human cultural diversity is being eroded rapidly everywhere. For example, one of the remaining 7,000 languages is being lost every week, yet each one represents a distinct philosophical and pragmatic approach to the organization of our lives. We are losing our cultural heritage at a rate that will seriously diminish our opportunities to achieve sustainability in the future."
>
> Kauai Declaration 2007
> Economic Botany 61: 1-2

At the same time however, indigenous peoples will also need the support of the international community to continue their role as traditional caretakers of marginal and fragile ecosystems. Projected climate changes will exceed any previously experienced changes and traditional coping mechanisms may therefore not in themselves be sufficient to deal with impacts of climate change.

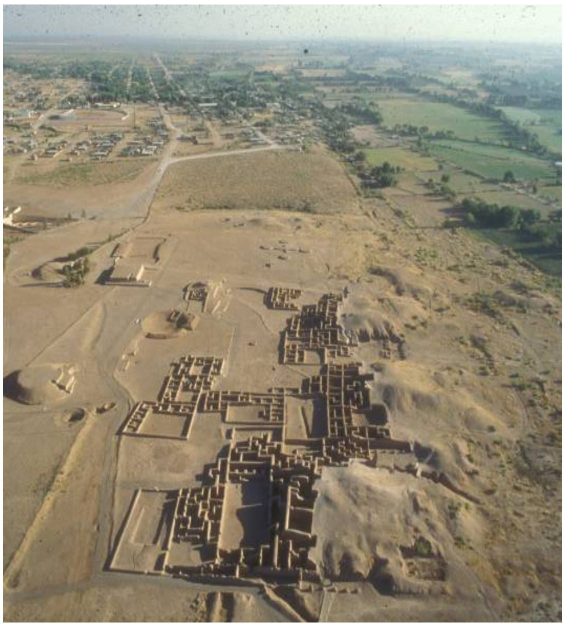
At a recent two-day symposium (April 12-13, 2007) at the Environmental Change Institute of Oxford, researchers from different disciplinary backgrounds from the humanities and social sciences to the natural and physical sciences, as well as representatives of academic, research, and non-profit organisations gathered to discuss how indigenous and other local peoples are affected by global climate change, and how they perceive and react to these changes. The focus was not only on the plight of indigenous peoples, but also on their resourcefulness and active responses to climatic variation. We discussed how to promote indigenous peoples' voices and actions within climate change policy, research and actions. Here, we synthesize these presentations, findings and discussions of the symposium.

2. Indigenous People and Climate Change

a. Looking back at climate change

People have faced climate change and adapted to it since our species evolved. The great majority of that time[1] is obscure and can only be reconstructed through archaeological or proxy[2] analyses, which have much to contribute to our understanding of past human adaptation to and mitigation of climate change.

From archaeology, we know that food shortage is common and food storage and sharing are central to survival during disasters and climate change. The invention of agriculture was almost certainly a major adaptation to climate change. However, much of what people have developed in response to disaster has also been lost: domesticated crops have been lost, water harvesting techniques have been lost, and dry land management has been lost. Now we must rely on archaeology to reconstruct these processes, as well as prehistoric farming techniques, plant use, and especially environmental management. What were prehistorically common seasonal foods have now become famine foods, with the danger that knowledge of them and their management will be lost forever. We know that above all, in times of disaster and climate change that people depended on



[1] 96.3% of human history is archaeological in the New World and much, much more in the Old World.

[2] Proxy analysis: analysis of data not directly related to the primary factor (here, people and/or climate change) but possibly indicative of that factor (e.g., pollen analyses indicate climate change and human activities).

diversity – diversity of crops and their varieties, of wild plants, and of environments. We know that environmental and social stress resulted in conflict and in massive death. Extinction of ancient cultures is more common than survival. These are fierce and powerful lessons to contemplate as we consider what indigenous people can teach us about climate change.

Around the world, agriculture was developed at the end of the last ice age, at the beginning of the Holocene dating back approximately 11,500 years. What do we know about climate change during this period? There have been major changes in hydrological events and also in extreme weather events, as well as temperature changes during the Holocene. All indications are that conditions were wetter during the first half of the Holocene, followed by varying degrees of desiccation. The 'Anthropocene' hypothesis (Ruddiman 2003) proposes that human activities – largely deforestation and agriculture – resulted in CO_2 increases over the last 8000y and in CH_4 increases over the last 5000y. If this theory is correct, there are major implications for human-induced climate change long predating our present focus on industrial, fossil fuel driven climate change. Nonetheless, the climate change, driven by recent (200 y) fossil-fuel and deforestation carbon emissions, predicted for this century (see IPCC I http://www.ipcc.ch/WG1_SPM_17Apr07.pdf) is far greater than anything previously known in the Holocene or indeed in human history and prehistory. Only during the mid-Cretaceous (~ 100 Ma when the dinosaurs roamed the planet), the late-Paleocene (~ 55 Ma when tropical plants and cold-blooded animals ranged within the Arctic Circle), and the mid- Pliocene (~ 4 Ma) were temperatures higher – all long predating humans. So, people have never adapted to climate change on the scale that we now face.

b. Contemporary Climate Change problems

Climate change is projected on a global scale and is a global phenomenon. However, different areas and different environments are affected very differently. People too will face different aspects of climate change depending on where they live. We divide the world into broad environmental categories within which there are some climate change commonalities but also much local and regional variation.

i. Polar regions

The one region for which the IPCC II summary acknowledges Climate Change impacts on indigenous peoples is the polar region of which they say, "Detrimental impacts would include those on infrastructure and traditional indigenous ways of life." Fortunately, we need not depend on this fleeting mention for information. After polar bears, the Inuit are the best known victims of climate change. Traditional livelihoods of all peoples of the arctic are threatened by melting ice shields and permafrost. For arctic peoples, hunting and fishing strategies depend on stable ice; homes are built on ice or permanently frozen ground; and travel depends on solid ice. Temperatures in the arctic are rising disproportionately – predicted to increase by as much as 8^{o}C in the 21st century under present conditions – affecting the livelihood strategies and knowledge of arctic peoples more quickly than elsewhere.

ii. Alpine areas

Alpine ecosystems around the world, too, are warming at a disproportionate rates (predicted to increase by as much as 5-6^{o}C in the 21st century under present conditions). Glacial retreat was one of the first phenomena to draw our attention to global warming. Iconic peaks such as Kilimanjaro will have snows no more. Detailed studies track the upward movement on mountains of treeline and alpine plants (www.gloria.ac.at). Plants at the highest elevations are being pushed off the top of mountain peaks (or more accurately stated, out competed by plants normally found at lower elevations). Palynological studies have mapped floral retreats and advances on mountains in the past but nothing compared to the speed of change today. Alpine warming and aforestation will further threaten endangered animals like Snow Leopards and mountain sheep. However, what receives very little attention is the importance of these floras and faunas to Indigenous Peoples. For example, Tibetan and Andean highlanders depend on Alpine floras for medicines, food, grazing and hunting. In the future, when trees cover the high mountains, these people will be deprived of important traditional resources central to their livelihoods. Where will Tibetans be without Tibetan medicines and Alpine meadows to graze their Yaks? Can high Andean tuber-crops and animals, such as llama and vicuña, survive the warming?

iii. Deserts

What will happen to the deserts of the world is more difficult to predict. It is not just a mater of increasing temperatures but also changing rainfall, ocean currents, monsoon circulations, river systems, winds, and human behaviour – all difficult to model. Variability, which is notoriously difficult to predict, is also significant. Nonetheless, some very sophisticated models have been developed with startling results (for example, see BBC report on the Kalahari of southern Africa: http://news.bbc.co.uk/cbbcnews/hi/newsid_4480000/newsid_4481400/4481402.stm). What will happen to Kalahari dunefields in the 21st century? There are 2.5 million km^2 of dunes in southern Africa, deposited by wind during the Quaternary. Currently, most dunes are vegetated and used for grazing. However, predictions are for 2.5-4.3^{o}C temperature rise this century with dune expansion and transport unequalled in the Holocene. The Kalahari Desert is expected to double in size and wind speeds will increase dramatically. Thousands of people, who inhabit this area presently, will struggle to survive, with cattle and goat farming becoming increasingly less feasible and their traditional resource base for hunting and gathering restricted or absent. Even today, indigenous groups, which have been forced to become sedentary, huddle around government drilled boreholes for water, many dependent on government handouts for survival. Without doubt, indigenous peoples of the deserts are on the frontline of global climate change.

iv. Tropical Rainforests

In the tropical rainforests of the world there is predicted to be a 2-8^{o}C temperature rise in this century. However, even more important than temperature rise are other factors such as rainfall and seasonality, which depend on sea-surface temperatures, which are themselves difficult to model and the sea-rainforest interactions even more so. For instance, Asian, Pacific and even Amazonian tropical forests are already profoundly impacted by existing climatic variation caused by the ENSO, and these are predicted to be more frequent and of greater intensity in the future, bringing extended droughts, crop failures and even larger forest fires then are presently experienced in these regions. There is a quite high concurrence of models predicting a 20% or more overall decrease in rainfall in the Amazon. Additionally, the reduction in precipitation is larger during the dry season when plants and people are most stressed. These effects of climate change on the Amazon forest are exacerbated by deforestation and forest fragmentation which in turn release more carbon into the atmosphere creating yet more climate change, forming a positive feedback loop. There was a preview of what is to come during the severe drought of 2005 when much of the western Amazon burned. Models suggest that in this century much of the Amazon rainforest will first be replaced by savannas and then even possibly by bare soils. What sort of future is this for the indigenous peoples of the Amazon rainforest?

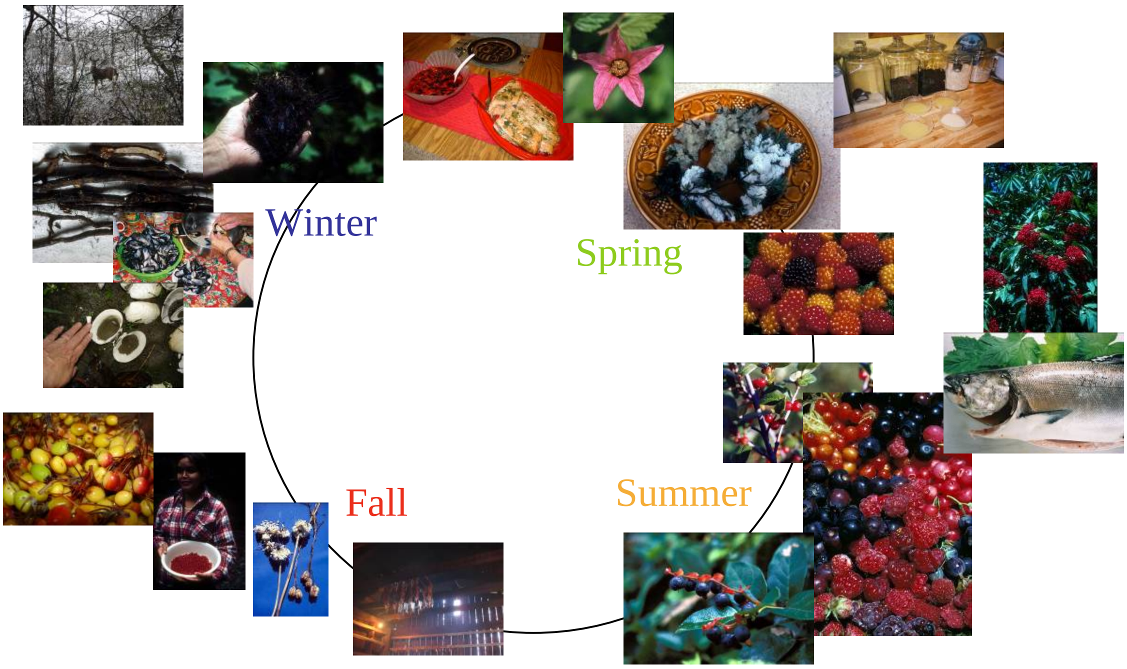
Is there hope in this ‘doom and gloom’ scenario? If so, it lies with the indigenous peoples themselves, who are very successful at preventing deforestation and managing natural rainforests. A global carbon market in avoided deforestation is likely to emerge in the next few years, which represents a huge financial opportunity for indigenous people to be paid for preserving their forest lands. However, will governments recognize tenure-rights, local priorities and the cultural contributions of indigenous peoples and will they address the challenges in implementation, such as equitable benefit sharing?

v. Islands

Climate changes common to many islands are rising sea levels and temperatures, ocean current oscillation changes (such as the ENSO), and increasingly violent storms. Other climate changes – temperature, winds, rainfall, and so forth – differ with island location. Other environmental changes are important everywhere in the world and often interact with climate change (see below), but these others factors are particularly prominent on islands. Islands are dynamic, ephemeral platforms: volcanoes build and erode; coral atolls submerge and reappear. Island endemism is extraordinarily high and the majority of extinctions on earth are on islands although they represent only 3% of land area. Thus, island biodiversity is already precarious. Diverse indigenous peoples on islands live on the margins between sea and land and between survival and failure. Natural disasters they face include island subsidence, drought, loss of fresh water; rapid anthropogenic disasters include disease, invasion, and nuclear testing; slow anthropogenic problems include deteriorating public health, social reorganization, economic globalization, and invasive species. Nonetheless, island peoples have extensive indigenous knowledge of environmental management that will be necessary for their survival in the face of climate change: land stabilization and fisheries management, to name but two.

vi. Temperate ecosystems

Climate change affects temperate ecosystems quite differently depending on geography, with inundation at sea level and either more or less rainfall. However, temperatures are rising. Plant and animal distributions, ranges, phenologies, symbioses, and community structures are changing. Deterioration of ecosystem services is just one anthropocentric concern. Indigenous peoples depend on seasonal abundances of resources which are changing. They rely on predictable levels of rainfall, winter snowpack and glaciers to feed the lakes, creeks and rivers that are critical habitat for fish and other resources. On-shore and off-shore marine resources are weather dependent and yet weather is becoming increasingly unpredictable. Dry periods, which can no longer be depended upon, are needed for preserving fish, seaweed, and other resources; people are now trying to dry indoor or freeze foods. Indigenous people have stories, taboos, and knowledge about great changes in the past, but these are inadequate in the face of present climate changes. "*They don't even know what to do with this weather!*" says a woman elder of the Gitga'at Nation, British Columbia. And yet the future is predicted to bring even greater climate changes.



3. Biodiversity and Climate Change

Indigenous peoples universally use biodiversity as a buffer against variation, change, and catastrophe. In the face of plague, if one crop fails, another will survive, with biodiversity additionally staving off attack of susceptible crops. Indigenous peoples use biodiversity over space and time, among species and varieties, in forests and agriculture, from landscape to genetic levels. Biodiversity is central to indigenous environmental management and livelihoods. Biodiversity is especially important among indigenous societies living on the margins of fragile and changing ecological, economic, and political systems. Nonetheless, biodiversity itself is threatened by climate change. Again and again, we heard this recurring theme of biodiversity and climate change.

Prehistorically, biodiversity of the earth has been devastated during periods of drastic climate change. During human history, climate change, societal change and biodiversity have been closely linked. We focus on the development of agriculture as a major human advance, but setbacks – such as loss of crop biodiversity, both domesticated species and landraces – are equally salient features in human history. Today, we see many links between global warming and biodiversity. Climate change is greatest at high elevations and simultaneously biodiversity is among the highest on

earth. For example in Europe, 25% of the flora is alpine on less than 3% of the land surface. In alpine areas, upward movement of plants is measurable with the highest floras predicted to be displaced off the top of mountains, off their “sky islands.” Global warming is causing the loss of alpine biodiversity. On islands, many factors interact resulting in the greatest rates of extinction on earth: island ephemerality, habitat destruction, violent storms, salinization of ground water, over-exploitation, invasive species – as well as climate change. In deserts, both people and biodiversity cling to existence in small, dynamic, non-equilibrium patches which may be decimate by climate change. Tropical rainforests of the world are havens of outstanding biodiversity, as well as indigenous cultural diversity; as tropical rainforests burn (outside of indigenous territories), this heritage of biodiversity is threatened. Changes of distributions, phenologies, and extinctions of individual species are being traced and modelled by scientists but also by indigenous peoples and through "citizen science."

Indigenous peoples are fighting loss of biodiversity and adapting to climate change through migration, irrigation, water conservation techniques, land reclamation, changing where and at what elevation plants are cultivated, livelihood adaptation and myriads of other techniques. Nonetheless, as climate change threatens biodiversity, it simultaneously removes the major defence that indigenous people have against variation and change. Their primary tool for adaptation is at risk.

4. Indigenous Peoples observe climate change

While climate models can paint the bigger picture of climate change and provide estimates for the likely consequences of different future scenarios of human development, they are not very good at providing information about changes at the local level. In recent years, there has been an increasing realisation that indigenous groups are a valuable source of this information. Most published reports on indigenous observations of climate changes have come from Arctic regions where the co-operation between scientists and indigenous peoples is strongest. However, as the symposium amply demonstrated, it is not only in the Arctic where indigenous peoples are observing climate changes. From the British Columbian coast to the Kalahari Desert to the English countryside and to the Himalayan mountains, local people are noticing changes in climatic conditions. These changes include:

a. Temperature changes: there is the greatest agreement among peoples concerning temperature increase. The degree of temperature increase varies (see above) and, in some cases, the increase in temperature is mainly manifest in certain seasons.

b. Changes in rain and snow: Models and records of precipitation mainly focus on changing amounts of precipitation with climate change (and are less accurate than temperature models). In contrast, indigenous peoples also emphasize changes in the regularity, length, intensity, and timing of precipitation. Where precipitation used to occur in clearly delimited seasons of rain or snow, nowadays seasons are less distinct or occur at different times. In other areas, where precipitation used to be regular, now there may be distinct dry periods and more intense rainfall in shorter periods of time.

c. Changes in seasons and phenology: most indigenous peoples have prominent phenological markers that signal the change of the seasons. These can be the appearance of certain birds, the mating of certain animals, or the flowering of certain plants. With climate change, many of these phenological events are occurring earlier or may be decoupled from the season or weather that they used to indicate.

d. Changes in wind, waves, and violent storms: in many areas people report that winds are stronger nowadays and that there are more thunderstorms and lightning. Increases in the number and violence of hurricanes and typhoons are being recorded around the world. Accompanying storm surges (often with the same effects as Tsunamis) are devastating to island and coastal peoples.

e. Variation among years: in addition to specific changes, more variation in year-to-year weather patterns is reported from many areas, with some years being unusually dry, some rainy, some much hotter and some colder than usual. Stormy years are also variable and unpredictable. Variation today is often more extreme than in the past.

f. Changes in glaciers, snow cover, ice, rivers and lakes: in most areas glacial retreat is very obvious while snow and ice cover is decreasing and may occur later than before. Impacts on rivers and lakes are variable depending on local changes in glacial melt, precipitation and temperature.

g. Species variation: in many areas people have noticed the disappearance or decline in abundance of species (especially noted are valuable resources). At the same time, new, hitherto unknown species arrive. These may constitute new resources, while others may be pests.

5. Indigenous Peoples adapt to climate change

Indigenous peoples are not only keen observers of climate changes but are also actively trying to adapt to the changing conditions. In some instances, people can draw on already existing mechanisms for coping with short-term adverse climatic conditions such as droughts or flooding. Some of these responses may be traditionally included in their normal subsistence activities, while others may be acute responses, used only in case of critical weather conditions. In general, there appears to be a hierarchy of responses, whereby as conditions worsen additional physical and biological responses are added, and social and political relations become more important for providing resources for basic survival. The following are some of the traditional as well as innovative responses that have been reported from various locations around the world:

a. Diversified resource base: a commonly employed strategy to minimize the risk due to harvest failure, traditional people often grow many different crops and varieties (e.g., with different susceptibility to droughts and floods) and supplement these by hunting, fishing and gathering wild food plants. Diversity of crops and food resources are often matched by a similar diversity in field location, some which are more prone to flooding, others more prone to drought, so that in extreme weather some fields are likely to produce harvestable crops. In areas with market access people may also supplement their subsistence base by selling surplus crops, handicrafts, wage labour, forest products, and so forth.

b. Change in varieties and species: While indigenous agricultural techniques commonly include many crop varieties and species even in non-crisis times, a crisis may trigger a shift in which new crop varieties or species are planted, and unusual resources are harvested. In the Kalahari, for example, recent changes in precipitation have encouraged a shift from rain-fed agriculture to manually watered homestead gardening and have exacerbated a shift from cattle to goats.

c. Change in the timing of activities: crop harvests, wild plant gathering, hunting and fishing are being adjusted to changes in growing seasons and times of animal migrations and reproduction. Adjusting the time when different resources are exploited may, however, not be easy if timing conflicts with other activities, or if people depend on specific climatic conditions. High water levels are needed for boats and sunny weather is needed to dry harvested plants and meat; if weather conditions do not occur when needed, people suffer or must adapt.

d. Change of techniques: where changing climatic conditions are making the use of traditional techniques such as sun-drying foods impossible, people may resort to novel techniques, such as the British Columbian Gitga'at who recently have been unable to sun-dry their food reliably because of unseasonable wet spells and are having to freeze their food until they get sunny weather, or dry it indoors. Changes may also take place in the agricultural techniques, such as irrigation replacing rain-fed agriculture.

e. Change of location: Acute climatic crises as well as more long-term climate changes may cause people to shift their agricultural activities and/or their settlements to new locations, which are less susceptible to adverse climatic conditions. The Makushi of Guyana thus move from their savannah homes to forest areas during droughts and plant cassava, their main staple crop, on moist floodplains normally too wet for the crop. With temperature rises, mountain peoples begin cultivating crops at higher elevations. The Kenyah in Borneo plant new crops such as maize in the drying river beds during droughts cause by El Nino events.

f. Changes in resources and/or life style: many agricultural peoples resort more to wild foods in the case of emergency situations such as droughts and floods. For example, the Kenyah of Borneo, who normally rely on agriculture, sometimes switch to extracting starch from wild Sago palms during El Niño droughts. Similarly, many traditional peoples in the Amazon basin switched to a reliance on fish during the drought of 2005.

g. Exchange: In addition to using locally available wild resources in times of crisis, many peoples also obtain food and other necessities from external sources in times of crises. Such resources may be obtained through exchange, reciprocity, barter, or markets. People may also grow to depend on emergency aid from the state or NGOs.

h. Resource management: Scarce and climate-sensitive resources may be enhanced by traditional management techniques. In the Marshall Islands, people have traditionally secured their freshwater supplies on which their survival depends by placing coral blocks around them to build up land around the freshwater lenses and protect them from salt-water intrusion. Similarly, in many rain-forest locations, traditional peoples enhance biodiversity by planting, transplanting, and weeding around useful species. Irrigation technologies create whole agroecosystems in the desert oases of North Africa. Often these resource enhancing techniques are subtle and go unrecognised by outsiders. However, traditional management may become apparent once it is removed (e.g., if traditional peoples are removed from an area or are no longer active due to political, economic, or demographic restrictions).

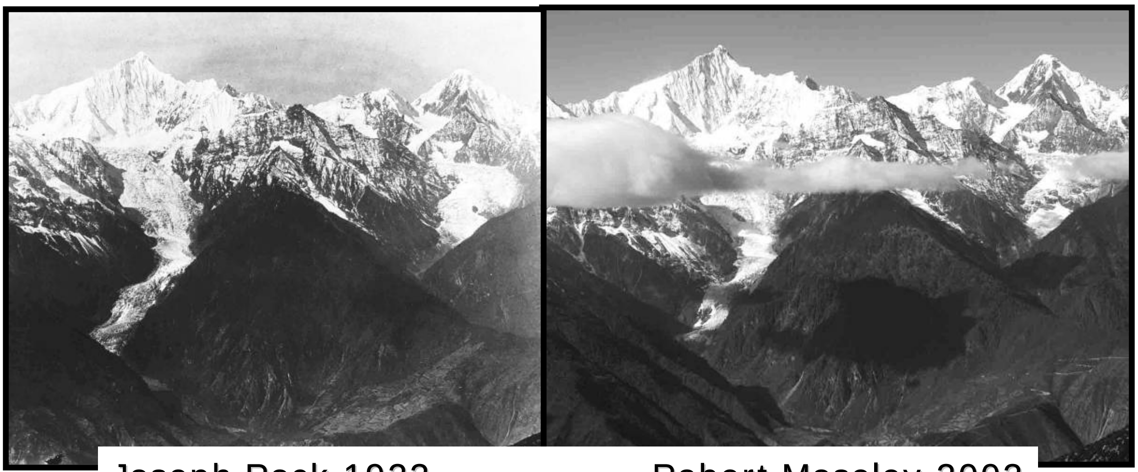
6. Indigenous Peoples interpret climate change

While scientific explanations of climatic changes have mainly concentrated on anthropogenic, greenhouse gas emissions, local interpretations of observed climate changes are often much more varied and encompassing. Whether or not scientific models are incorporated into local explanations depends on the status and accessibility of science within a culture and on the influence of media. In some places, media and their coverage of climate change issues dominate people's understandings of climate changes. Nonetheless, people's own observations are local and tangible. Seldom do the media report on climate changes that impact the timing and outcome of agricultural activities, hunting, fishing and resource gathering. These personal observations and experiences evoke deeply felt emotions, as familiar signs of seasonal changes become decoupled and traditional knowledge of the weather becomes invalidated. Scientific causal explanations of climate changes may be seen as removed and abstract: invisible things are being put out into the atmosphere by anonymous corporations and states. As a consequence, people may feel powerless and/or not responsible for combating climate changes, despite their own vivid experiences of climate change impacts. This was seen to be the case with farmers in western Austria, who had many detailed observations of climate changes, ranging from increased wind-felled trees, increased drought, and decreased snow cover, but whose information on climate change causes were largely based on the media and who did not see themselves as connected to the causes or their solutions.

In contrast, where media play a limited role, interpretations are more closely dependent on people's own observations and local cultural framework. Many local interpretations contain strong ethical elements, often framed in terms of a cosmological or spiritual balance, which has been upset. These interpretations are not created ad hoc to explain present-day climate changes, but have in many instances their roots in traditional ways of interpreting climatic and weather phenomena as signs of something more than mere biophysical processes. In many parts of the world and within the context of many different belief systems local people have traditionally interpreted adverse weather conditions as well as more catastrophic events as punishments for human wrongdoings. Examples are thunder storms and hail, which express the wrath of local deities in Tibet or forest spirits in Borneo, and volcanic eruptions in British Columbia, which were interpreted as retributions for cruelty. The adverse climatic conditions or catastrophic events are thought to be caused by the breach of taboos, such as hunting at certain times or places, picking specific plants, or eating certain foods. General mores against human cruelty, selfishness, greed, or lack of spirituality, if transgressed, are also thought to precipitate catastrophe. These moral or spiritual explanations of climate change contrast with scientific explanations. However, other traditional peoples integrate scientific and local explanations. For example, there is a view that climate change is caused by people's greed and selfishness in over-consumption that leads to greenhouse gas emissions. Local views of climate changes

are characteristically interwoven with other environmental and societal problems. One example is proposed oil and gas drilling and tanker traffic along the north coast of British Columbia that the Gitga'at and other local communities resist because of concerns over both pollution and climate change.

While many traditional peoples see climate change as having spiritual and social causes, there are also inverse examples of climate changes being perceived as a threat to local deities and spiritual powers. In Tibet, local deities are physically manifest in snow capped mountains. Hence, some Tibetans are worried about the fate and power of these mountain deities melting away with the snow. Such interpretations cause great anxiety and distress. While certain climatic phenomena, such as droughts, have long established traditional interpretations, others, such as snow-melt and glacial retreat, have no precedent, so that local explanations may vary.



Joseph Rock 1923 Robert Moseley 2003

In general, local interpretations of climate change may help people better make sense of observed climate changes, but do not necessarily empower them to act. This is especially the case where climate change threatens landscape features of spiritual value, or where the culprits of climate change are perceived to be outsiders. These 'others' can be other parts of society, the state, companies or western cultures, which are generally seen as being outside the sphere of local influence.

7. Interacting factors affecting perception, interpretation and adaptation

Local peoples' experiences and interpretations, as well as scientific research, indicate that climate change seldom acts in isolation, but interacts with other environmental and social factors. Interactions tremendously affect peoples' perceptions, interpretations, and adaptations to climate change.

Many of the climate change factors previously discussed are interconnected. Peoples' interpretation of climate change is affected by both media and cosmology. Peoples' perception of climate change may be influenced by normal inter-annual variations such as El Niño-related droughts in Borneo and multi-year rain-drought-patterns in southern Africa. Such irregular patterns make it harder to detect any long-term climate change. Difficulties in detection of climate changes will influence people's ability to adapt. On the other hand, people who normally respond to recurring climatic variation (e.g., droughts or floods) may be better prepared to adapt to long- term climatic changes. They may adjust their existing strategies for coping with short-term crises to create long-term adaptive strategies. Other factors that may influence adaptation of human societies include insurance schemes, government benefit schemes, policies, social relationships with other groups, access to information, NGO projects, land rights, and access to resources and ecosystems. While insurance and government help may provide crucial assistance to disaster-struck people, it may also remove the incentive for adaptation and preventative measures. This is the case in diverse settings such as farmers in the Austrian Alps, Pacific Islanders, and desert peoples of the Kalahari. Government policies and development initiatives (whether government of NGO) may promote or hinder adaptation, depending whether these only aim at short-term economic development or also take into account impending climate changes. There are ample examples of projects that have promoted agricultural or economic enterprises, which will be unsustainable under changing climatic conditions. For example, with decreasing access to water, dependence on irrigated agriculture will increase people's vulnerability. However, where NGOs and state agencies help to disseminate information and promote crops and management methods suitable under changed climatic conditions, agricultural assistance can support people's own efforts at adaptation. One problem with such directed efforts is that some future predictions are still uncertain especially local precipitation patterns, which are of crucial importance in agricultural systems.

Social and economic ties between different groups of peoples may be beneficial in times of crisis. Groups hit by adverse climate conditions can acquire resources from other groups not experiencing the same problems (e.g., due to reliance on different agricultural techniques, use of different resources and ecosystems, or local variation in climatic conditions). This is the case among the Penan Benalui foragers and Kenyah Badeng farmers in Borneo (see above). However, with impending climate change some of these reciprocal systems may break down, as certain groups may become more permanently disadvantaged. The breakdown of such systems is evidenced in the archaeological record of Mimbres Valley in New Mexico. The Mimbres culture predominantly inhabited moist valley bottoms, which buffered them against droughts. Nonetheless, in a period of above average rainfall, satellite settlements were established in higher and drier areas, which probably received support from the more humid main settlement areas in dry years. However, when conditions became permanently dry, there was not only the dissolution of upland settlements but of the whole Mimbres culture. Thus, interacting factors can have positive or negative effects.

Migration between environments in times of stress

Many risk aversion strategies depend on different crop species and varieties, as well as on access to wild resources and ecosystems (see above). Hence, agricultural policies, such as permanent settlements, can hinder indigenous coping mechanisms. In Guyana, for example, the Makushi have traditionally responded to drought by leaving their main settlements in the savannah and migrating to rain forest areas in times of drought. Government settlement policies prohibited the Makushi from traditional temporary migration. So even though the government provided food aid during the drought, the Makushi had no seeds (or clonal stakes) to re-establish agriculture after the end of the drought.

Markets may undermine traditional coping strategies if traditional crop species and varieties are replaced by high-input, high-yielding commercial seed varieties susceptible to pests, diseases and climate variation. However, in some cases, markets may also help people cope with climate change if there is food and other resources to buy in times of crisis.

Benefits of newly created opportunities (e.g., markets) are determined, not surprisingly, by factors such as power relationships within and among groups. Powerful individuals, households and groups may appropriate new opportunities presented by climate change and monopolize resources threatened by climate change. Many indigenous and traditional peoples not only inhabit marginal areas, but also are politically and economically marginalized. They are extremely vulnerable and yet are forced into new situations, such as markets, where their traditional knowledge and skills are not applicable.

8. Policy

Significant changes have occurred in the climate change discussion within the last year. This is partly related to the release of reports such as the Stern review and the Fourth Assessment Report by the Intergovernmental Panel on Climate Change

(IPCC). The Stern review, released in autumn 2006 was commissioned by the UK Treasury (rather than the environmental ministry) to assess the economic impacts of climate change as well as the cost of mitigating climate change. The Stern review was partly an attempt to counter claims that it would be too costly to try to mitigate climate change compared to any damages that might arise from climate change. Main findings of the Stern review were that mitigation costs are relatively moderate, while climate change related losses are likely to be much larger than previously thought. Although criticised by many economists for its underlying assumptions (especially about discount rates) and methods, it has informed policy discussions in the UK and elsewhere, including climate-sceptic countries like Australia.

During the first months of 2007, two of the working groups under IPCC have released policy maker summaries of new assessment reports, summarising current knowledge about climate change. In February 2007 IPCC working group I released a summary for policy makers of its report on the Physical Science Basis. This report contained stronger scientific evidence of observed global warming and its human causes and a new set of projections about how climate might change into the future. In April 2007, this was followed by the policy maker summary of the assessment of IPCC working group II on “Impacts, Adaptation and Vulnerability”. As in the first report, more and stronger evidence was presented for the impacts of climate change on natural systems as well as on human activities in many parts of the world. Impacts are predicted to be especially large for poor countries as well as for many of the ecosystems that indigenous peoples inhabit (see above). The report also notes that some human adaptation is already taking place, but that adaptation efforts need to be increased. In May 2007, IPCC working group III released “Mitigation of Climate Change” that holds realistic hope for stabilization and reversal of climate change. Emphasis is, however, on large-scale projects and initiatives such as infrastructure projects and government responses to acute crises, while the adaptive responses and mitigations of indigenous and other local peoples receive far less attention.

In addition to these reports, several national, regional and international regulatory frameworks are currently being considered and negotiated. Notably, the ending of the current Kyoto commitment period in 2012 has sparked debates about the form and content of any follow-up agreement. While the Kyoto agreement (and similar regional agreements such as the European Trading Scheme) started a flourishing trade in carbon credits, only modest emission reductions have been achieved. It is therefore being debated whether carbon-emission permits for the future should be allocated in different ways (e.g., on the basis of population, or by auction). Another point of debate is the efficiency of carbon off-set projects for reforestation or lower carbon fuels and the possible inclusion of standing forests and prevented deforestation (which are currently not considered off-sets under Kyoto). Others argue that the focus should shift completely away from carbon credits to other mechanisms of curbing emissions such as taxes and technology transfer. This could partly be achieved by the development and transfer of cleaner technologies, but there remain questions such as how to pay for technology development and transfer. Similarly, there are still heated debates on costs of adaptation, which will be very unevenly distributed around the world with poor nations predicted to bear the brunt of climate change related damages and costs. Indigenous Peoples and their plight are seldom mentioned in these discussions.

In addition to global agreements and negotiations, there are also recent regional developments. In March 2007, the EU agreed on new climate commitments including 20% cuts in greenhouse gas emissions by 2020 (30% if other countries participate). Similarly, many nation states such as the UK are currently drafting new national climate change policies and legislation. In addition to commitments by nation states and international bodies there are also growing commitments from non-nation state actors, such as corporations, states, NGOs and individuals. How much these voluntary commitments will be able to contribute to the emission reductions remains to be seen.

9. Methods available for Climate Change research and participation

Notably, scientists are studying Indigenous Peoples and Climate Change employing a huge array of methods. Deliberating and deciding on diverse methodologies will strengthen not only our data and results but will also broaden our perspectives and hopefully our analyses of potential solutions to Climate Change. Combining disparate methods can help to build transdisciplinary bridges. Pairing quantitative and qualitative methods helps overcomes inherent weaknesses, as well as optimizing strengths. Participatory methods “decolonize methodologies” and integrate indigenous peoples into all stages of research: setting the agenda, developing methods, carrying out the research, and analyzing the data, as well as disseminating research results and returning them to local people. In this spirit of inclusiveness and integration, we briefly outline the methods used and promoted by our conference participants; each of the following methodologies is really a grouping of diverse and complimentary techniques described elsewhere:

a. Climatology and climate modelling
b. Ice-core analyses
c. Paleobiology and geology
d. Palynology, peat stratigraphy, megafossils, and macrofossils
e. Palaeolimnology and limnology
f. Archaeology and palaeoethnobotany
g. Vegetation science
h. Population ecology
i. Conservation science
j. Geographic information systems
k. Soil science
l. Repeat photography, repeat inventories, and time sequence sampling
m. Interviews, questionnaires, open discussions
n. Cultural domain analysis
o. Participatory techniques and "citizen science"
p. Participant observation
q. Policy and economic analyses

10. A Proposal with Indigenous Peoples and Climate Change

From the data and perspectives on Indigenous Peoples and Climate Change, it becomes evident that indigenous knowledge and perceptions must be incorporated into the Climate Change forum. Indigenous Peoples offer local observations and techniques for adapting to and mitigating climate change. Indigenous Peoples must exercise self-determination and be empowered to deal with climate change which threatens their traditional livelihoods, indeed their very existence. Integration and feedback loops between climate change science and indigenous peoples must be established and employed. Both parties can gain knowledge from the other and support each other in action.

We propose conjoined research and action with indigenous peoples to afford them more prominence in international climate change discussion and action. Researchers and indigenous peoples around the world call for networks. Coordinated and concerted efforts may include:

1. Self-representation of Indigenous Peoples in Climate Change forum
    a. Building and supporting social capital:
        i. Network of indigenous peoples to discuss climate change experiences, responses, and actions
        ii. Virtual "Culture and Climate Change Center": knowledge bank of TEK
    b. Documenting knowledge (TEK) and insights on Climate Change

   i. weather patterns and indigenous climatology
   ii. changes in abundance, distribution, seasonal development and interactions of plant and animal species
   iii. ecosystem changes
   iv. agricultural and livelihood changes
   v. health and welfare changes
   vi. cultural changes
   vii. recommended and instituted adaptations, mitigations, and policies
2. Ethnoecological Research on Climate Change
   a. Baseline data and monitoring of climate change and vegetation patterns that will be affected by climate change and will in turn effect livelihoods
   b. Ethnometereology and ethnoclimatology: classifications and explanations of weather and climate; how weather and climate fit into cosmologies and activity schedules.
   c. Perceptions, effects, adaptations, and mitigations of climate variation and change
   d. Disaster responses: vulnerability, resilience, change
   e. Policy and carbon credit benefit sharing potentials
   f. Network of ethnecologists studying climate change
3. Joint actions
   a. Joint network of climate change researchers, ethnoecologists, and indigenous peoples
   b. Participatory agenda and responses to climate change
   c. Exploring carbon offset strategies that Indigenous Peoples practice and for which they should receive benefits
   d. Indigenous Peoples' and Ethnoecology Forum in World Conservation Congress in 2008 (or other major Climate Change Forum)

Around the world, Indigenous People have developed sustainable carbon neutral and carbon negative livelihoods that would behove us to learn from and to emulate. At the same time Indigenous People around the world are on the front-line of climate change, experiencing the brunt: temperature rises, sea-level rises, both droughts and floods, ice sheet and snow melt, glacial retreat, increasingly violent storms and unpredictable weather, and more. Their voices must be heard and their insights abided. A Tibetan villager warns, "*If the snow disappears [from our sacred mountains], people will disappear from the earth*."

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