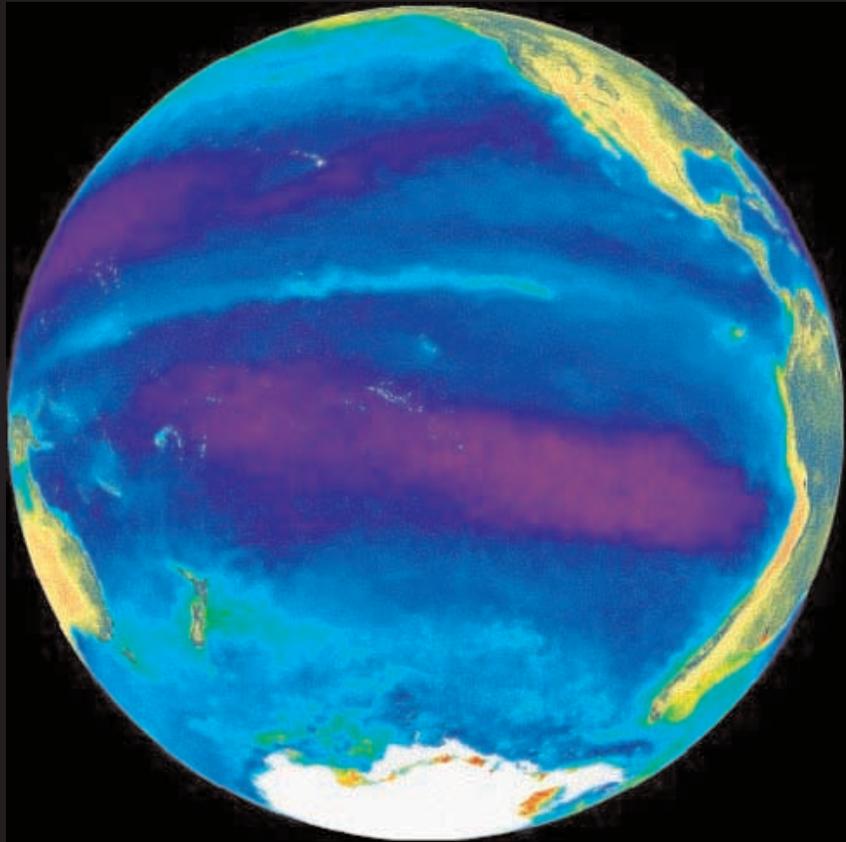


# Climate Change and Pacific Rim Indigenous Nations



**By Alan Parker, Zoltán Grossman, Edward Whitesell,  
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**Published in October 2006 by the  
Northwest Indian Applied Research Institute (NIARI),  
The Evergreen State College, Olympia, Washington, USA**

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# Executive Summary:

## Indigenous peoples are the “miner’s canary” of global climate change.

“Like the miner’s canary, the Indian marks the shifts from fresh air to poison gas in our political atmosphere...” Felix Cohen (1953)

“Indigenous Peoples are like the miner’s canary. When their cultures and languages disappear this reflects the profound sickness in the ecology.”

Paul Havemann & Helena Whall (2002)

“I say canary in the coal mine because the Arctic is one part of the world that is experiencing faster impact from global warming.” Al Gore (2006)

### Indigenous peoples are the “miner’s canary” of global climate change for the rest of humanity.

Native nations of the Arctic and Subarctic are already feeling catastrophic effects of warmer temperatures, in the melting of sea ice, permafrost, and glaciers, and increase in fires, insects, flooding and drought patterns. South Pacific Indigenous peoples are finding their islands inundated by rising sea levels, erosion from intense storms, and saltwater intrusion into freshwater supplies.

These changes have drastically affected Indigenous peoples’ hunting and fishing, economic infrastructure, water and housing availability, forest and agricultural resources, and even their health. Using traditional ecological knowledge, they are describing today the same drastic shifts in the environment that Western scientists had predicted would occur in the future. This scale of change will present severe challenges to all tribal cultures, resources and well-being.

### Climate change is already here.

The latest global scientific evidence, summarized in Al Gore’s movie *An Inconvenient Truth*, as well as documentaries by Discovery, CNN and other media, compels us to recognize that global warming is accelerating at a much faster rate than predicted even a year ago. Like the Katrina disaster in Louisiana (itself worsened by

warmer Gulf of Mexico temperatures), we can see climate change coming. We can see it is going to devastate us if we are not prepared, so we have to go out and meet it. The people of the world, and especially our Native communities, no longer have 5 to 10 years to begin planning. *We must begin today!*

The consensus of leading climate scientists is that it is no longer a question whether there is human-caused climate change. The Intergovernmental Panel on Climate Change (IPCC) in 2001, and in its upcoming 2007 report, put the range of climate-induced temperature increases expected in this century at 2°-5°C (some models estimate as high as 10°C). Mitigation measures to prevent disastrous effects must be taken. However, scientists believe that we’re now locked into unavoidable climate change, and there are considerable lag times in the impacts of greenhouse gases, many taking 20-200 years to reach the upper atmosphere to degrade.

These changes may not be as slow as once predicted. Scientists now have strong evidence of abrupt climate change, with sudden and dangerous shifts in climate that can lead to catastrophic loss of human lives and property. *The primary impacts on Indigenous peoples are prolonged droughts or excessive rainfall and other weather shifts brought on by warming, diminishing and disappearing sources of fresh water, changes in habitat for wildlife that impact cultural and sustainability for our communities and impacts on food sources.*

### Climate change is a potential Culture Killer.

Native rights are primarily place-based rights, based on the long-time occupation of Indigenous territories. Climate change shifts and disrupts plant and animal habitats, and in doing so forces cultures to adapt to these conditions, or die. Species adapt to rising temperatures by shifting their ranges farther north or to higher elevations. Many species driven entirely out of their habitats and feeding areas may face extinction. Other “invasive”



species are migrating into new areas, and competing with or displacing native and culturally important species. Shifting conditions may also directly threaten species, such as in the “dead zone” on the U.S. Pacific Northwest coast, where fish and crabs are being starved of oxygen by wild swings in ocean upwellings of phytoplankton. *Treaty-guaranteed rights to hunt, fish and gather may be rendered moot by these changes, or may adapt by transferring harvesting rights, for example, from salmon to tuna.*

The loss or migration of culturally important species on which traditional knowledge depends will make it more difficult for elders to practice and pass their knowledge to the next generation. Some climate stresses will fall directly on the elders, who are particularly vulnerable to heat waves, food stress and water stress. It is precisely these traditional elders who possess the greatest knowledge of how to survive with local natural resources, and who can recognize subtle shifts in nature. The 1993 Hanta virus outbreak in the Southwest U.S., for example, was a mystery to scientists until Navajo elders noted that increased rainfall had caused an explosion in the population of mice who feed on piñon nuts. (The increased rainfall had been caused by El Niño ocean temperature oscillations, which are expected to intensify as climate change further warms the Eastern Pacific.)

Climate change impacts are expected to impose hardships on Indigenous nations. They will directly impact Native economies through loss of economically important plant and animal species, and through increased costs of defending against climate change impacts. Loss of traditional economic activities, economic revenue, economic opportunities and the practice of traditional culture are expected to increase the social and cultural pressures on Native peoples. The outmigration of tribal youth to seek economic opportunities expected under severe climate impacts (or their daily lives limited to the indoors) could lead to further erosions of tribal economies and culture.

### **Devastation of tribal economies and health**

Climate change not only changes the average temperature, but also changes temperatures extremes, which are expected to increase the severity and frequency of storms, hurricanes, floods, droughts and other natural hazards in different regions—leading to increased defense and mitigation costs for tribes. The most common impact is expected to be a 1-3 foot rise in sea level, but this may rise to 6 feet and more in some low-lying areas. Tribes living on islands and coastal areas will be

most impacted. Coastal estuaries, wetlands and marshes, already degraded by coastal development, will be highly affected. For example, the Shishmaref tribal community in Alaska has had to relocate homes as permafrost melting and increased storms have led to coastal erosion.

Climate change can affect water availability through changes in rainfall, and lowering of water infiltration into aquifers and reservoirs. Decreased rainfall in mountains lowers snowpack. Shorter winter seasons leads to earlier and more rapid spring melt, resulting in flooding. The vegetation changes and loss of ground cover decrease water holding capacity and infiltration, and increase erosion. Atmospheric carbon interacts with water chemistry to acidify freshwater and marine waters. Increased runoff can cause irreversible changes in river and stream dynamics and increase loads of sediments, heavy metals, and sediment borne diseases, and destroy aquatic habitats. These changes would raise costs for tribes in storing and cleaning water supplies, increase water rights conflicts and litigation costs related to defending reserved water rights.

Fires are expected to increase due to increased droughts, lightning strikes, and forests impacted by new levels and kinds of infestations. Forest vulnerability from insect infestations can already be seen in the spruce bark beetle crisis. Fires destroy or modify habitat and culturally important species, and increase timber management and firefighting costs. Climate change is also expected to increase the frequency and severity of human, wildlife, plant, livestock and crop diseases and pests. Shorter and more mild winters favor disease and pest buildup. Heat stress and environmental stress further increase vulnerability to diseases and pests. These will cause increased tribal costs in health services, veterinary services, in losses to tribal natural resource enterprises.

### **What can Native nations do?**

On one hand, Indigenous peoples are on the frontline of climate change—the first to feel its effects, with subsistence economies and cultures that are the most vulnerable to climate catastrophes. On the other hand, Indigenous people can also be viewed as the most historically adaptable and resilient, because of our traditional ecological knowledge and community ties. Unlike the non-Native population, Indigenous peoples still have “community” and leadership that is responsive to community. This imposes a special duty on tribal leadership to come together and share information on what climate change impacts means specifically to tribal communities, what behavior patterns will emerge in the general

population and governance institutions around us, and what preparations tribes can begin to make in light of this sharing of data and insights. Preparations should include both individual tribal planning and planning for joint efforts. Effective, responsive tribal planning could serve as a model for non-Native communities.

Indigenous nations are in a uniquely vulnerable position in regards to climate change. Their land base provides few opportunities to relocate or expand to cope with changing climate. Treaty rights and reserved rights are fixed to specific parcels of land, so that it is unclear what tribal rights to resources might shift away from their reserved lands. Even if tribal rights can be expanded to include species and other resources that migrate off reserved lands, this will impose extreme hardships and problems of access for Native elders, members, and enterprises. Tribal governments could elect to integrate climate adaptation measures into tribal planning (such as water conservation, crop rotation, housing shifts, etc.), and cooperate with other Indigenous peoples in the process. Harvesters may have to be trained by other practitioners on how to interact with new species coming into their area. This is one area where Indigenous climate change concerns intersect with intergovernmental cooperation, and the process of developing a Pacific Rim Indigenous Nations Treaty.

Indigenous nations are also often vulnerable to the loss of government funding. Economic downturns associated with climate change could impact funds available for Native programs. In the U.S., climate impacts on non-reservation trust lands could also severely impact rents and receipts from those lands. Tribes should take measures to increase their levels of climate mitigation and adaptation actions on their lands. Mitigation must be restorative, and look to historical baselines, not current baselines, for the environmental and hydrological processes that maintain healthy watersheds and communities. U.S. and British Commonwealth law on reserved rights and treaty rights place Indigenous nations in a unique position to pressure Pacific Rim governments to take actions to protect those rights.

U.S. tribes can also use diplomatic rights associated with government-to-government relationships. Indigenous NGO demands have historically made recommendations at each conference of the UN Framework Convention on Climate Change (UNFCCC). U.S. tribes should study this record, and determine where they may be strengthened by their formal involvement. Indigenous nations could also elect to adopt the Kyoto Protocol themselves, even with its obvious shortcomings.

U.S. tribes could use their sovereign standing to promote federal actions to prevent, mitigate and adapt to climate change. For example, tribes can pressure the U.S. federal government to adopt the Kyoto Protocol as a matter of trust responsibility. Although the U.S. currently refuses to sign on to the Protocol, mechanisms exist that take into account local government actions to reduce and mitigate greenhouse gas emissions. Effective fireland management by Australian Aborigines, for example, has not only prevented larger fires, but in the process has reduced carbon emissions from fires and made these Indigenous communities eligible for international carbon credit payments.

Native nations can also bring legal and political pressure to bear upon their settler states, based on potential liabilities for impacts to their trust resources by climate change. They can demand that agencies change laws and policy to recognize tribal rights to shifting species and resources. They can demand a co-management role in any government climate planning, or mitigation or adaptation measures that affect tribal resources. They can also promote the development of climate mitigation and adaptation trust funds (climate trusts) for Indigenous climate change defense. Indigenous governments can also request the development of national government policy statement and policy guidelines for agencies on climate impacts on Native resources.

Indigenous and national governments can work jointly on assessments, monitoring, prevention and mitigation of impacts of climate change to Indigenous resources through the establishment of permanent institutions or agencies. Their actions should create integrated, holistic solutions that address health, housing, transportation, labor, economy, production, population growth, consumption, environment and development, and the full range of climatological, hydrological, environmental and ecological relationships.

These solutions must address problems at multiple environmental and societal scales, and devise action appropriate to each scale. They must be flexible to respond to changes in the environment and in scientific and local knowledge, and should be designed to monitor and respond to the effectiveness of their objectives. The only ways to guarantee this effectiveness are to respect the rights and privileges of the entire range of stakeholders, to base solutions on ecological and cultural sustainability, including input regarding traditional ecological knowledge. Solutions must include mechanisms to ensure the sustained financial and administrative support for their implementation.

# Introduction

The Evergreen State College undertook this assessment of the impacts of climate change on Indigenous nations of the Pacific Rim in Summer 2006, as a project of the Northwest Indian Applied Research Institute (NIARI). Institute director and Evergreen faculty member Alan Parker also serves as co-chair of the Special Committee on Indigenous Nation Relationships of the National Congress of American Indians (NCAI). The Special Committee has, over the past three years, been engaged in discussions with representatives of Pacific Rim Indigenous nations regarding a proposal to initiate an Indigenous nation-to-nation treaty agreement.

The proposed treaty will serve as a structure to address major issues and challenges that are common to the nations including, most particularly, developing joint action plans that address the impacts of climate change upon Indigenous nations of the Pacific Rim, their homelands and their future survival as Indigenous peoples—including Maori in Aotearoa (New Zealand), Native Hawai'ians, Alaskan Natives, First Nations in Western Canada, and Western U.S. Native American nations.

NIARI requested Dr. Zoltan Grossman, an experienced geographer and faculty member in the Native American & World Indigenous Peoples Studies academic program at Evergreen, to serve as project coordinator and editor of this research report. We were also joined by Ted Whitesell, Director of the Masters in Environmental Studies program at Evergreen, and Brett Stephenson,

director of environmental studies at Te Whare Wananga o Awanuiarangi, a leading Maori University. Professors Grossman and Stephenson have authored separate chapters of this report, as have Tulalip Tribes Natural Resources staff Terry Williams and Preston Hardison, whose knowledge and expertise acquired during years of service representing Indigenous concerns at the international level with the Convention on Biodiversity. We also wish to acknowledge the support from Dr. Graham Smith (Maori visiting professor at the University of British Columbia), and NIARI Assistant Director Jennifer Scott and Program Assistant Bonnie Graft.

Our research project centered around three questions:

- **Existing effects:** What are the existing and likely impacts of climate change on Indigenous peoples and their homelands around the Pacific Rim?
- **Present responses:** What are Indigenous organizations, communities and nations presently undertaking to address issues of climate change (from the local to global scales)?
- **Future paths:** What are potential recommendations for research and action by Indigenous nations, to deepen and expand their powers to combat global climate change? How can Indigenous nations influence the global discussion and international regulatory processes around climate change?

## COUNTRIES AND COLONIES OF THE PACIFIC RIM



In light of these research questions, we concluded that it was appropriate to examine how Indigenous nations are represented in their status as political bodies uniquely empowered to speak for their constituencies with distinctive cultural concerns within the various international bodies charged with addressing global environmental issues.

The Kyoto Protocol in particular is structured around UN member state representation, whose citizens must depend on their government delegates to be responsive to represent their interests. In the case of the U.S., it has long been a source of contention that the Bush Administration does not support the Kyoto Protocol, and is not representing the concerns of many citizens and local governments who have concluded that the scientific evidence linking global warming with carbon emissions from human activity is overwhelming (and thus a responsibility of human society acting through national political bodies).

In the case of Indigenous nations, we have a long history of conflict with and oppression by the various settler-states that are successors to earlier colonial governments.

To our knowledge, none of the Pacific Rim countries have expressed a willingness to hear from their Indigenous communities regarding those impacts of climate change that present unique or distinctive problems, and challenges to a subsistence way of life or to preservation of fish and wildlife species essential to their diet and the practice of traditions and ceremonies. A central purpose of our study is to ask how are these distinctive Indigenous concerns can be represented.

Our inquiry includes an examination of possible mechanisms for Indigenous nation intervention in global forums addressing environmental and species protection. We have concluded that continued reliance only upon Non-Governmental Organizations (NGOs) for representation and advocacy of Indigenous nation concerns before such international and global forums is neither adequate nor appropriate, in relation to the gravity of the issues and the right of Indigenous nations to speak directly on behalf of their constituents.

Our project is the first phase of a multi-year project involving environmental scientists from the Pacific Rim,



Dr. Alan Parker, representing the National Congress of American Indians (NCAI), presenting the Indigenous Nations Treaty proposal to the Assembly of First Nations (AFN) in Vancouver, B.C., Canada on July 13, 2006. At right are NCAI Vice-Chair Les Minthorn (Umatilla) and University of British Columbia Professor Dr. Graham Smith (Maori). Photo by Zoltan Grossman.

as well as Indigenous nation political leaders. Particular focus is on development of a united representation of Indigenous nation concerns, independent of settler state national governments. Climate change is one of the three emphases of the unfolding process to develop an Indigenous Nations Treaty—an independent compact among sovereign Native governments.

### The Indigenous Nations Treaty process

Indigenous people have through time immemorial, traveled great distances, sometimes across continents, sometimes across oceans, to explore and meet with each other. Their gatherings have been used as an opportunity to engage in trade with each other, to share information at many different levels, and to develop different kinds of alliances with each other.

Beginning in 2002 a series of meeting took place between U.S. and Maori tribal officials and Indigenous scholars. Their goal was to identify common ground in terms of issues and concerns that were shared by Indigenous communities throughout the Pacific Rim. Further, they sought to identify issues where the Indigenous position could clearly be advanced through political unity and a common strategy.

A structure was envisioned under which Indigenous nations could come together and join in unified action to advance their goals through common strategies and tactics. In 2004, the recommendations of the Special Committee on Indigenous Nation Relationships was adopted by the NCAI, the largest and oldest organization of U.S. Indian tribes. NCAI serves as the umbrella group for the development of positions on important policy issues by those tribes who are members. Thus, the policy of international Indigenous nation relationships properly came before the NCAI.

In their deliberations, the NCAI tribal delegates agreed that a treaty agreement would be the appropriate means to bring Indigenous nations together around common goals and objectives. It was acknowledged that only

Nations entered into treaties and that an agreement between Indigenous nations should be in the form of a treaty. Tribal delegates discussed the history of treaty-making with colonial governments and concluded that a common history of treaty relations with the British Crown further supported the idea of an “Indigenous Nations Treaty”.

A strong motivation for developing unity between Indigenous nations and a common strategy on common issues was to act independent of the United Nations and its member states. If a critical mass of Indigenous

nations decide to make a treaty committing themselves to an alliance on common goals, they will increase their influence and political leverage in proportion to their numbers.

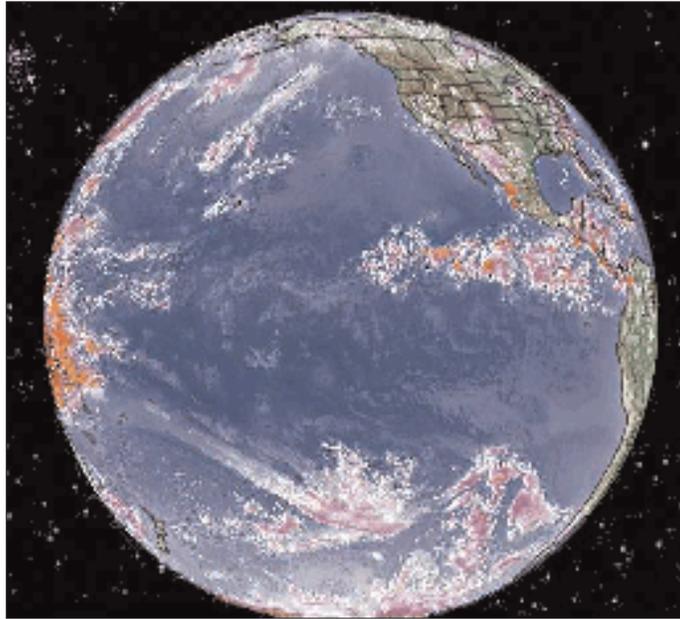
Such a group of allied nations will need a structure to work with and through to accomplish their treaty-related goals, thus a united “League of Indigenous Nations.”

### Goals Of The Indigenous Nations Treaty

During our inquiry into the proposed Treaty of Indigenous Nations we noted that the proponents have recommended the following goals:

- 1. Cultural properties.** Formulate joint strategies on the common goals of protecting cultural properties, sacred items and traditional knowledge.
- 2. Indigenous trade.** Develop a structure for international trade relationships and profitable commerce between Indigenous nations.
- 3. Climate change.** Create political unity on the position that Indigenous nations have a right to directly participate in environmental agreements and conventions regarding global climate change that is having a devastating effect upon them.

Treaty objectives are specific elements to be achieved through taking concrete, practical steps and actions designed to accomplish the broader goals of treaty participants. Thus, the goal of politically unifying the repre-





Meeting on the Indigenous Nations Treaty in Aotearoa (New Zealand) in December 2005. *From left:* The Honorable Hirini Moko Mead, Chairman of Te Runanga (Council) for Ngati Awa Tribe; Alan Parker, representing the National Congress of American Indians (NCAI) as co-chair of the Indigenous Nations Relations Committee; Prof. Graham Smith, Chairman of Board for Maori University Awanuiarangi; and Maori tribal delegates for Mataatua Assembly of Tribes. Photo by Sharon Parker.

sentation of Indigenous nation concerns before international bodies regarding the impacts of climate change would include many of the specific and concrete steps recommended for Indigenous nation leaders in the “Recommendations...” chapter of this report.

Recommendation #8 is particularly pointed: “Consider active involvement as sovereign Indigenous governments in global climate change negotiations, including formal Indigenous government representation at the annual “Conference of the Parties” of the United Nations Framework Convention on Climate Change (UNFCCC). This UN forum has only seen representation of the special and unique concerns of Indigenous nations through Non-Governmental Organizations (NGOs). It is recommended that U.S. tribal governments, First Nations based in Canada, Maori tribal nations and other Indigenous nations in the Pacific Rim consider a joint, coordinated strategy, perhaps through the structure of the NCAI-sponsored Treaty of Indigenous Nations, to have a voice and presence at the international level. The UN Convention on Climate Change is the most appropriate venue for such advocacy, but certainly not the only one. If a Pacific Rim coalition of Indigenous nations is created, the alliance should also consider directing its attention to put pressure on

Asia-Pacific Economic Cooperation (APEC) Forum states to reduce carbon emissions.”

However, representation of political rights is only one of many concerns addressed in this report. Indigenous nations throughout the Pacific Rim are in a very precarious position in relation to the impacts of climate change. Their survival as Indigenous peoples over the years of contact with European explorers and subsequent colonization has depended upon their ability to remain connected to the land. These connections have served as a wellspring of spiritual energy and have linked them to their ancestors. These links provide a body of knowledge that defines who they are in the cosmos and how they must structure their lives in order to survive.

If future generations of Indigenous people are to continue the traditional practices that make culture a source of spiritual nourishment, these vital connections must be maintained. Moreover, as Maori environmental scientist Brett Stephenson points out, the ecological knowledge possessed by Indigenous people is going to be essential to the ability of all peoples to understand the behavior of the earth’s ecosystem as it attempts to adapt to the impacts of global warming.

# Impacts of Global Climate Change

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Global warming is here. It is an issue and phenomenon that has already affected much of the globe. As the effects of increasing surface air temperatures spread and intensify, more people will realize that “combating climate change is the greatest challenge of human history” (Johansen 2003). It is widely accepted that there has been a rise in the average global surface air temperature and that, in the near future, more is expected to occur. The changes due to global warming will most likely include melting of glaciers, ocean level rises with submersion of lands, extinction of species, and more climate-related health issues for people.

Scientific evidence that stretches back at least 420,000 years shows a regular rise and fall of the Earth’s average surface air temperature. Scientific evidence also shows that humans have affected this natural phenomenon. The current rise in the average surface air temperature is in part caused by our industrial and other everyday activities (Houghton *et al.* 2001).

The atmosphere is composed of many gases. Some of these gases are called greenhouse gases because they act like a greenhouse—they let sunlight in but do not let all of the heat out. The atmosphere lets the shortwave radiation from the sun through to the Earth. The Earth absorbs much of the shortwave radiation and then emits longwave radiation back into the atmosphere. Some of the longwave radiation is absorbed by greenhouse gases, trapping the heat in the atmosphere (Waggoner 1990). The retained heat makes the average temperature of the atmosphere what it is today. An increase in greenhouse gases, though, will result in an increase in global average atmospheric temperature. This is the theory of global warming which is widely accepted in the scientific community.

Scientific discoveries point to two important issues that need to be addressed. First, we need to curtail our activities that affect global warming. An immediate cessation in our activities will not, however, stop all of the predicted global warming. We would still experience at least some warming because there is a lag in time from affecting the cycle and the effects on air temperature

and the environment. A recent study shows “that if concentrations of all greenhouse gases (GHGs) could have been stabilized at the year 2000, the climate system would already be committed to 0.4°C more warming by the end of the twenty-first century” (Meehl 2006). Therefore, secondly, we also need to prepare for global climate change, whether it is a little or a lot.

## **Our Connection with the Changes**

Studies of past climate changes have shown a connection between climate changes and societal changes. “Our records suggest a strong relationship during this time [from A.D. 1150 to 1300] between climatically induced changes in environmental conditions and social, political, and economic responses, including the emergence of more intensified fishing, and increased sedentism, violence, and trade” (Kennett and Kennett 2000). In the Andean altiplano of South America there is evidence that a period of drier climate (ca. A.D. 1100–1400) caused the Tiwanaku civilization (300 B.C.–A.D. 1100) to disappear. Their agricultural production declined to the point of making them abandon their fields (Binford and Kolata 1996).

A study of recent climate change from evidence in stalagmites in the Guadalupe Mountains of Texas shows a relationship between climate change and changes in human population redistribution. The evidence from dating of the stalagmites showed the climate to shift from one like present from 4000 to 3000 years ago to a cooler and wetter environment 3000 to 800 years ago, and then shifting back to a present-day climate. “The stalagmite record correlates well with the archaeological record of changes in cultural activities of indigenous people. Such climate change may help to explain evidence of dwelling abandonment and population redistribution” (Polyak and Asmerom 2001).

The climate does not need to change for the warmer to affect people. In the Pacific Island region evidence has been found that with rapid cooling and sea-level fall around A.D. 1300 conflict among peoples increased as coastal villages were abandoned and populations moved



At left, the confluence of the Muir and Riggs glaciers in 1941 in Alaska's Glacier Bay National Park. At right, only Riggs Glacier had survived 63 years later in 2004. Photos by U.S. Geological Survey.

to fortified positions inland. The climate changes caused a water-table fall, storminess, reef death, and changes to wetlands. The changes to the peoples of the area were significant and long-lasting (Nunn 2003).

The present era is no exception to the pressures imposed on societies by changes in the environment. Small island states usually have narrow coastal plains that have, until recently, been ideal places to settle. Many of the islands have high central regions, such as Seychelles, Réunion, and Fiji, but others such as the Caribbean islands also have a significant portion of their population living within 2 km of the coast. These areas are especially vulnerable to changes in sea-level, and more intense and frequent storms and storm surges (Ahmad *et al.* 2001).

Many of the Pacific Island communities have observed changes in their environment, as well, and realize that they need to prepare for others that are predicted to occur in the next few decades. The Pacific region does not contribute significantly to global warming, but the region will feel the affect of changes in the global climate. "This is partly due to limitation in our land area, our largely coastal dwelling populations and almost complete dependence on natural resources for subsistence living and economic development." (McFadzien *et al.* 2004)

In low islands and micro-atolls people may have to be resettled within national boundaries. The rise in sea-level may completely submerge some islands. Some atolls may need to be abandoned altogether. Cities and towns on low island chains such as the Bahamas, Kiribati, the Marshall Islands, and the Maldives are only a few meters above sea level. In addition to losing land these islands will have saltwater infiltration into their fresh water supply and septic systems. "Sea-level rise

and climate changes, coupled with environmental changes, have destroyed some very important and unique cultural and spiritual sites, coastal protected areas, and traditional heritage sites in the Federated States of Micronesia, Tuvalu, the Marshall Islands, Niue, and Kiribati and continue to threaten others" (Kaluwin and Smith, 1997, cited in Ahmad *et al.* 2001).

### **The Inuit and the Arctic**

The Inuit of northern Canada, Alaska, Siberia and Greenland have had to deal with environmental changes brought on by a warming climate. "Since the millennium they have seen their landscape, their livelihood and their very cultural identity eroded at such an alarming rate that they now look set to become the first society to fall victim to climate change in the 21st century" (Kendall 2006). Dr. Robert Corell, Chair of the recently completed Arctic Climate Impact Assessment, spoke at the 11th Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC): "For Inuit, warming is likely to disrupt or even destroy their hunting and food-sharing culture as reduced sea ice causes the animals on which they depend to decline, become less accessible, and possibly become extinct" (Corel 2005).

The capacity to adapt is a part of Inuit life. The rate of change, however, mixed with increased variability of seasonal conditions and extreme events might make it difficult for traditional resources to be used effectively in coping with the predicted change (Fast and Berkes, 1998, cited in Riedlinger 1996). Traditional knowledge and science have begun to be combined to better predict what is happening, what will happen, and how people, especially those in the northern latitudes, will cope with the changes. Former Vuntut Gwich'in chief, Randall

Tetlich, framed the challenges of integrating traditional and local knowledge with the work of science and policy as a need to “double understand” (Bermana 2004).

The changes in climate and the variability of the seasonal conditions impacts the Nunavut community of Sachs Harbour access to resources (the ability to travel on the land or sea ice), safety, predictability, and species availability. The community members have had difficulty reaching traditional seasonal hunting and fishing camps. They have had to alter the time they use the areas due to warmer springs with earlier and faster snowmelt. The ice conditions are also less reliable, which makes traveling on it for fishing, and seal and polar bear hunting more dangerous. The changes in the ice have included thinning and differences in the locations and amounts of leads, cracks, and pressure ridges (Riedlinger 2001).

The changing climate has changed the distribution of some animal species in the Arctic and Subarctic. Ringed seals have had population size changes that are connected to the changes in sea ice conditions. Some species of fish have increased in numbers in rivers. The populations of caribou and musk-ox have benefited from increased forage, due to increased summer rains, but they are also being negatively affected by an increase in the occurrences of autumn freezing rain (Riedlinger 2001).

The Vuntut Gwich'in in Old Crow have a strong connection with the Porcupine Caribou herd in North America. The annual harvest averages about two animals per-capita and an average of some households showed that it is consumed on average 241 times per year. Climate change has affected the herd and the community's ability to hunt the caribou. A study of climate change impact on Vuntut Gwich'in caribou hunting showed that with “a discrete-choice travel-cost model of subsistence hunting, projecting that climate warming may cost a typical household the equivalent of a half day of lost time during a hunting” (Bermana 2004). The herd was affected by environmental conditions, such as fall storms, snow depth, rate of spring snow melt, and the hunters access to hunting areas was affected by timing of freeze-up and break-up, shallow snow cover, and the presence of “candle ice” on lakes (Bermana 2004).

Multi-year sea ice is now melting at about 10% per decade. At this rate polar bears and other species dependent on stable ice platforms might become extinct before the end of the century. (Rosentrater 2005). “Ice is a supporter of life. It brings the sea animals from the north into our area and in the fall it also becomes an

extension of our land. When it freezes along the shore, we go out on the ice to fish, to hunt marine mammals, and to travel. Ice is a very important element in our lives. We see ice in different ways. When the quality of ice, in other words, its hardness, its durability, and our ability to walk on it, hunt on it, changes, then it affects our lives. And it affects the animals too. They depend on the ice for breeding, for pupping, denning, lying, and having their young. They molt on it, they migrate on it. And so ice is a very important element to us. When it starts disintegrating and disappearing faster, it affects our lives dramatically,” says Caleb Pungowiyi, a Yupik from Nome, Alaska (Moreno 2000).

Inuvialuit hunters on Banks Island in Canada's High Arctic have strong connections with their environment. They have been noticing the climate conditions becoming more unpredictable and the landscape unfamiliar. The annual ice and multi-year ice has changed and is causing problems for the wildlife and the hunters. The ice is less predictable and, therefore, less stable and safe. The freeze-up is up to a month later and the thaw earlier. The change in climate has brought new phenomena, such as thunder and lightning. New species are arriving with warmer weather. Barn swallows and robins visit now and salmon has been caught in nearby rivers for the first time (Ashford and Castleden 2001).

“To many outside the Arctic these questions may seem of little importance, but Hugh Brody evocatively cautions: ‘Without the hunter-gatherers, humanity is diminished and cursed; with them, we can achieve a more complete version of ourselves.’ ” (Fenge 2001).

### **The Changing Temperature**

The average temperature of the air at ground-level has increased over the last century. The global average surface temperature, which encompasses the whole world from pole to pole, has increased over the 20th century by 0.6°C. This increase is 0.15°C greater than what was predicted in 1994 for the time period (Houghton *et al.* 2001). Although this increase seems small, it is an important increase. The average blends all of the highs and lows, and many regions have experienced record-setting high temperatures recently that are above the average increase. In general, the landmasses of the world experience average surface temperatures slightly above the global average surface temperature.

The change in the average temperature is not evenly distributed throughout a day, between the seasons, nor across the globe. It has been thought that some of the

recently measured increases to average temperatures might be a consequence of many weather data gathering stations being in urban areas. One recent study did not find evidence for this hypothesis. “The trends in temperature are almost unaffected by this subsampling, indicating that urban development and other local or instrumental influences have contributed little overall to the observed warming trends” (Parker 2006).

Nighttime hours have experienced more change, so far, than daytime hours. The nighttime low temperatures have been changed more than the day-time highs. The night-time daily minimum air temperatures over land has increased about 0.2°C per decade and the daytime daily maximum air temperatures has increased 0.1°C per decade (Houghton *et al.* 2001). The winter has been affected more than the summer in many regions. The nighttime lows are less cold, so there are fewer below freezing nights. This translates into a shorter winter. In the Northern Hemisphere, many lakes and streams

freeze about a week later in early winter and thaw about 10 days earlier at the end of winter (Johansen 2003).

The changes over landmasses will not be uniform, either. The northern high latitudes in the cold seasons will have heightened increases. The northern regions of North America and northern and central Asia are predicted to have increases that are 40% greater than global mean warming. The warming will be less than the global average for South and Southeast Asia and southern South America in the winter (Houghton *et al.* 2001).

All land areas are predicted to have increases in surface temperatures above the global average because the oceans can absorb more heat and moderate changes effectively. The global average surface temperature is expected to continue to rise. The rise in temperature is predicted to be 1.4° to 5.8°C over the period from 1990 to 2100 (Houghton *et al.* 2001).

The rising temperatures will have adverse effects on public health. “The increased frequency/intensity of heat waves is expected to increase heat-related mortality and illness” (Dessai 2003). Dessai conducted a study about the changes in heat-related mortality for Lisbon. The possibility of acclimatization was not factored in but the results showed an increase from 5.4 and 6 (per 100,000) for 1980–1998 to between 5.8 and 15.1 for the 2020s. In the 2050s the potential increase ranges from 7.3 to 35.6 (Dessai 2003).

### The Changing Atmosphere

Our activities are changing the amounts of greenhouse gases in the atmosphere. As more greenhouse gases increase in abundance, more of the sun’s heat will be trapped in the atmosphere, raising the average temperature. “In the light of new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gases” (Houghton *et al.* 2001).

The change in the amount of heat that the atmosphere retains is called radiative forcing. It is measured in Watts per square meter. An event or phenomenon that lowers the amount of heat retained by the atmosphere is a negative radiative force and one that raises it is a positive radiative force. There is natural radiative forcing from solar variation and volcanic aerosols. These two elements seem to have had a negative effect on temperature increases in the past two decades and possibly the past four decades (Houghton *et al.* 2001).



The positive radiative forcing for this time period may be from increases in greenhouse gases. The U.S. Environmental Protection Agency and a growing list of international scientists and business leaders acknowledge the heat-trapping qualities of greenhouse gases (Shelley 2006). The increase in well-mixed greenhouse gases from the years 1750 to 2000 is estimated to be 2.43 Wm<sup>-2</sup> (1.46 Wm<sup>-2</sup> from carbon dioxide, 0.48 Wm<sup>-2</sup> from methane, 0.34 Wm<sup>-2</sup> from halocarbons, and 0.15 Wm<sup>-2</sup> from nitrous oxide) (Houghton *et al.* 2001).

Carbon dioxide (CO<sub>2</sub>) concentrations have increased 31% since 1750. This concentration has not been exceeded during the past 420,000 years and probably not during the past 20 million years. This rate of increase surpasses what has occurred during at least the last 20,000 years. Seventy-five percent of the CO<sub>2</sub> emissions during the past 20 years have been from fossil fuel burning, the rest is probably greatly due to deforestation. Methane (CH<sub>4</sub>) concentration has increased 151% since 1750 and continues to increase. About half of the emissions are anthropogenic in origin from fossil fuels, cattle, rice agriculture, and landfills.

Nitrous oxide (N<sub>2</sub>O) has increased by 17% since 1750 and continues today. This concentration has not been exceeded during the last 1000 years. About 30% of the emissions are anthropogenic (agricultural soils, cattle feed lots and chemical industry). Some halocarbons (CFC<sub>13</sub>, CF<sub>2</sub>Cl<sub>2</sub>) have decreased due to regulations, but their substitutes (CHF<sub>2</sub>Cl and CF<sub>3</sub>CH<sub>2</sub>F), some of which are greenhouse gases, are increasing. The atmospheric concentration of CO<sub>2</sub> is expected to rise by 2100. The concentration of CO<sub>2</sub> may increase 90% to 250% above the 1750 concentration (Houghton *et al.* 2001).

### Geographic Changes

The shorelines of the world will be redrawn due to climate change. Global warming is expected to result in acceleration of current rates of sea level rise. The rise will be a combination of a slight expansion due to increased heat and from a volume increase due to the predicted melting of land-based ice. Tens of millions of people living in low-lying areas will be affected by sea level rise. Areas such as Dhaka, Bangkok, Calcutta, Manila, and the states of Florida and Louisiana, are particularly susceptible to rising sea levels (Rosentrater 2005).

The average sea level has already risen between 0.1 and 0.2 meters during the 20th century. The rises in temperature and greenhouse gases will also affect the heat in the

ocean, the severity of storms over the ocean and coasts, and will change the chemistry of the oceans as more greenhouse gases are absorbed (Houghton *et al.* 2001).

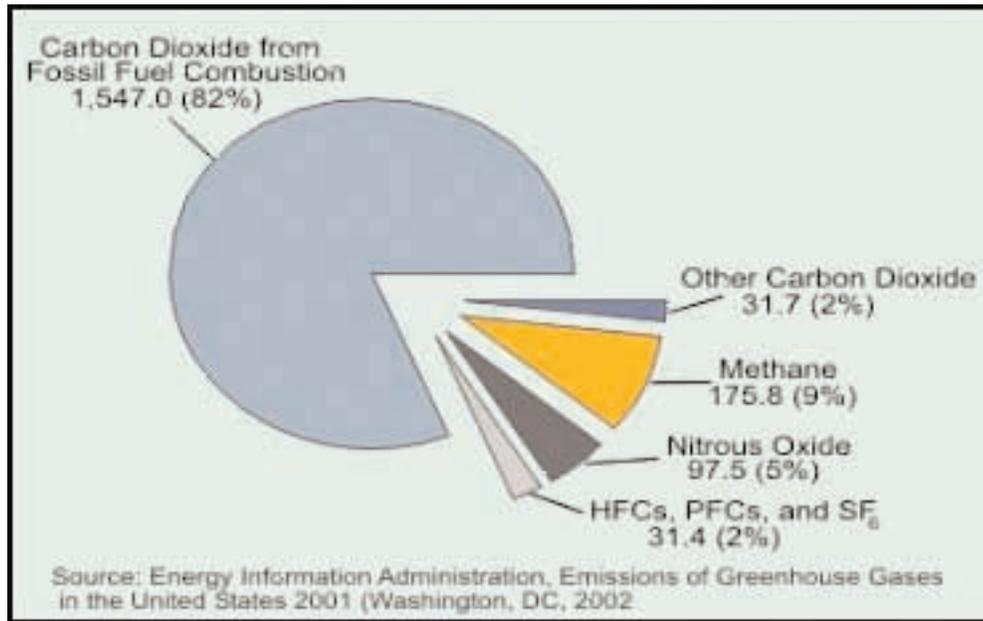
It is predicted that the ocean level will rise 0.09 to 0.88 meters between 1990 and 2100 (Houghton *et al.* 2001). This will inundate many low-lying coastal and intertidal areas where many fragile habitats and millions of people live. One study by Albraith of some major coastal areas of North America projected great potential loss of coastal habitat. The author assumed a conservative global warming scenario of 2°C within the next century (the most recent projections range between 1.4°C and 5.8°C). The author projected major intertidal habitat loss at four of the sites (Willapa Bay, Humboldt Bay, San Francisco Bay, and Delaware Bay) that range between 20% and 70% of current intertidal habitat (Galbraith 2002). The losses were due to the inability of the habitat to migrate up the coastline with the rising ocean level. There were natural or man-made topography or structures near the coast that acted as barriers to migration of the habitat.

A study of uplifted coral terraces at Huon Peninsula, Papua New Guinea showed evidence of relatively fast sea level rises, which suggested that climate was more sensitive to temperature changes during the Last Interglacial than was previously thought to have occurred. The western tropical Pacific will play an important role in climate change. It is a large expanse of water at the equator and has a dynamic relationship with long-term climate events, such as El Niño-Southern Oscillation, or ENSO (Esat *et al.* 1999).

The weakening of the ocean thermohaline circulation is likely, as well. This is a phenomenon that transports heat to high latitudes. The circulation disappears in some models after 2100 (Houghton *et al.* 2001). The Gulf Stream is due to the thermohaline circulation in the North Atlantic and it carries warmth from the Gulf of Mexico to Europe. If the thermohaline circulation is altered due to global warming, then Europe could experience an extreme change in its climate.

### The Weather Forecast

The amount of precipitation, temperature ranges, wind strength, and other measurements of local climate, or weather, will change all over the world with global warming. The amount of change will vary by measurement type and geographic location. The change has already begun, though, in many regions and weather systems. During the 20th century there have been slight



increases in the land areas experiencing severe drought, such as in Asia and Africa, and increases in severe precipitation, some of which is due to local effects of multi-decadal climate variations (Houghton *et al.* 2001).

It is predicted that Bolivia will experience longer dry seasons and more frequent storms with climate change. Bolivians are wondering if they can cope with these changes and how resilient are their social systems and local ecosystems will remain (Houghton *et al.* 2001).

The Northern Hemisphere will receive the greatest change in weather, according to scientists' predictions. The effects to weather from climate change are not evenly distributed across the world because the landmasses and oceans are not evenly distributed. The oceans can absorb and moderate changes in temperature more effectively than land, so the extremes of change will be more associated with the Northern Hemisphere with its abundance of landmass.

Climatologists have discovered evidence that changes in precipitation have already occurred during the 20th century. It is likely that precipitation has risen 0.5 to 1% over most of the mid- and high-latitudes in the Northern Hemisphere, and a 2 to 3% increase over the tropical land areas. The change may not be as noticeable in the tropics due to the higher averages of precipitation during a year (Houghton *et al.* 2001).

The change is not always an increase. Many regions of the world may experience a lessening of precipitation. In the Northern Hemisphere (between 10 and 30 degrees of latitude) precipitation has probably decreased by

0.3%. The Southern Hemisphere land masses have not experienced measurable changes in precipitation during the 20th century (Houghton *et al.* 2001). Some of this lack of change may be due to a lack of data. There is much more weather-related data available from Northern Hemisphere landmasses for the past century. Temperature changes are predicted to be less for Southern Hemisphere regions but that does necessarily mean that precipitation and other weather measurements will also be as moderate with climate changes.

The increase in precipitation that is predicted for many geographical locations may not translate into more available water for the environment. The frequency and severity of storms are predicted to change with increases in temperature. In the Northern Hemisphere there has already been an increase of 2 – 4% in the frequency of heavy precipitation events, which could be from increases in atmospheric moisture, thunderstorms, and large-scale storms (Houghton *et al.* 2001). Intense storms may deposit more precipitation than soils and habitats can absorb, which could lead to increased flooding and erosion for many areas.

Some environments will be affected more than others from changes in precipitation (Jackson *et al.* 2001). Vernal pools, which dry up for part of the year, would be adversely affected by more sporadic precipitation and increased evapotranspiration, the movement of moisture from the soil (evaporation) and plants (transpiration) to the air. These pools could dry up earlier in the year and stay dry for longer. Many species of amphibians use these seasonal pools for reproduction and would be negatively affected. In addition, some successful breeding

populations of amphibians that live in unaffected pools may become isolated as nearby pools experience longer drying episodes (Brooks 2004).

Winds may also be affected by global warming. An increase in severity of winds from more intense storms will probably not be the only type of change for winds. The trade winds may change in speed, duration, and location. Wind is usually generated by differences in air temperature and air pressure from region to region. Air that is warmed rises and creates an area of low pressure due to the upward movement. Nearby cooler air is drawn into the region. The trade winds act as conveyor belts moving warm air that has risen from warm regions of the equator and mid-latitudes into the cooler higher-latitudes. Scientists have already noticed a slight change in the path of the jet-stream of the Northern Hemisphere. This wind has occasionally moved slightly higher in latitude (Johansen 2003).

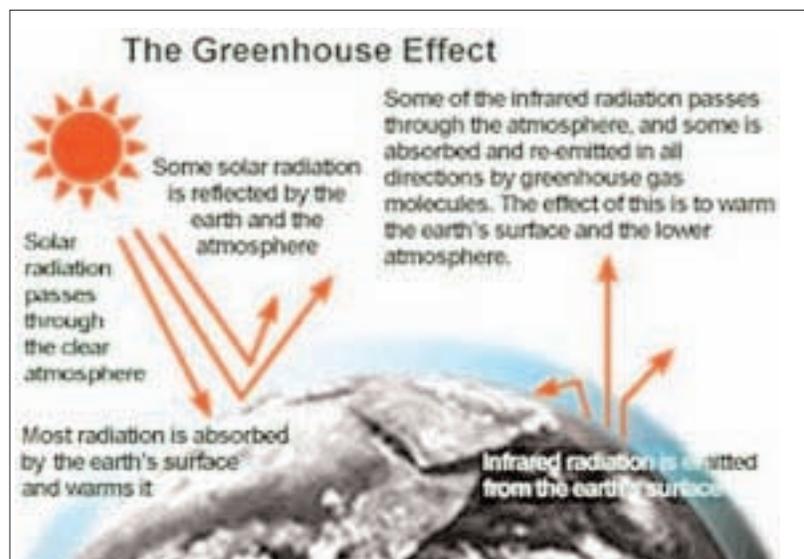
The oceans have a great influence on weather in any particular region. The oceans absorb and retain much heat from the sun. Global ocean heat content has risen since the late 1950s data collection period (Houghton *et al.* 2001). An increase in heat may translate into more storm events and more intensity of the storms. Intense storms, such as hurricanes and typhoons obtain much of their energy from warm ocean water, as could be seen prior to the 2005 Katrina disaster. As the warmth of the oceans increases so does the possibility of greater intensity storms. The heat in the oceans can also affect longer

time frame events, such as the El Niño-Southern Oscillation (or ENSO) phenomenon. ENSO have been more frequent and intense since the 1970s, compared with the last 100 years (Houghton *et al.* 2001).

### Shifting Habitats

Global climate changes will cause a wide variety of shifts in local climate conditions, or climates, to the regions of the world. Climate changes may translate into environmental changes that are great enough to alter the conditions that many species of plants and animals need to survive. Some organisms may be able to cope with the changes and live in a slightly stressed state, while others will not be able to survive in the region any longer. A study in California showed that increased variability in precipitation, which is predicted to occur with global warming, hastened the local extinctions of two species of checkerspot butterfly (McLaughlin *et al.* 2002). Decade-scale climate change can affect some species more than others. Ungulates in northern temperate zones are known to respond strongly to decadal-scale climate change (Alroy 2001).

A warming environment might help non-native invasive species outcompete native species in many habitats. Species of animals and plants that are introduced by human activities or arrive by natural mechanisms are sometimes able to outcompete native species living in an ecosystem. A warming environment will likely stress many native species, so a non-native species with a



higher range of temperature tolerance may successfully outcompete a native species (Stachowicz 2002).

A changing climate will exert pressure on species to adapt through natural selection. The process of adaptation, or evolution, through natural selection is different varies for each species and availability of niches, or roles in a particular environment. A change in the climate can create changes over a short period of time as well as over decades. One study of the reproductive health of puffins and auks in Tauyskaya Bay in Siberia's Okhotsk Sea (northwestern Pacific) discovered that the prey species of the birds changed from one year to another due to a warmer summer season in 1989. "Reproductive success of planktivorous auklets was negatively correlated with the SST [sea-surface temperature warming] in the western part of Tauyskaya Bay, whereas reproductive success of piscivorous puffins was positively correlated with SST" (Kitaysky and Golubova 2000).

Some scientists have been studying the rate of adaptation through natural selection in certain environments. One study discovered that North American red squirrels in the Yukon are not experiencing increased natural selection due to the current rate of climate change. The researchers conclude that evolution by natural selection is a relevant force to consider for present climate changes. They also suggest that not all species will have the same capacity to keep up with climate change (Berteaux 2004).

A study conducted in the Rocky Mountains also concluded that climate changes have not yet exerted enough pressure to create more than usual changes in many mammal populations of the region. "Climate-induced faunal changes reported for the current global warming episode in Rocky Mountain mammalian communities probably does not yet exceed the normal background rate, but continued warming during the next few decades, especially combined with the many other pressures of humans on natural ecosystems, has a high probability of producing effects that have not been experienced often, if ever, in mammalian history" (Barnosky 2003).

The Alaskan tundra is melting due to increases in average temperatures. The Alaska North Slope looks like Swiss cheese from a plane, with small-to-large melt water lakes on top of the permafrost. As the permafrost thaws "peat in the frozen subsoil can decompose, releasing greenhouse gases into the atmosphere, impacting global warming" (Bach and Beckman 2006).

The polar environments will most likely experience the greatest change in climate due to global warming. Scientists have recorded some significant changes that have already occurred. The oceans and the land have slowly been warming in recent history to the point that there has been a "10 to 15% decrease in the extent of sea ice in the Northern Hemisphere since the 1950s and a possible 40% decrease in the thickness of sea ice in the Arctic during summer in recent times" (Houghton *et al.* 2001).

The loss of sea ice affects many species. "Ice-breeding seals, particularly those that are endemic to inland seas and large lakes, are most likely to be affected by climate change. Climate change will also affect distribution and availability of prey in the short and long term. Although highly mobile species, such as marine mammals, can respond more rapidly to effects of climate change than their terrestrial counterparts, central-place foragers, such as many otariid seals, may still be seriously affected" (Harwood 2001).

Predators of seals will also have a difficult time living with climate change. Bear species that live in the northern latitudes are able to change their habits or location relatively easily to deal with a changing climate. However, with "the long generation time, and the highly specialized nature of polar bears, it is unlikely that polar bears will survive as a species if the sea ice disappears completely as has been predicted by some" (Derocher 2004).

The Antarctic has also experienced climate change in recent times. Some of the loss of Antarctic ice has been attributed to global warming. There are parts of the Antarctic that experience season or multi-year changes in ice cover, however, some changes are attributed to global warming. A recent survey of the entire Antarctic ice sheet with a gravity survey found that the ice sheet's mass decreased significantly from 2002 to 2005 (Flinn 2006).

When the ice retreats it creates a movement of an important habitat—the ice itself. The bottom and edge of the ice act as a home for algae and plankton, which are the basis of Antarctic food chain. The southerly movement of the ice forces penguins to migrate south as well. Some species of penguin are living farther south than ever before due to the movement of ice. The decline of penguin populations on the Antarctic Peninsula (Ardley Island) during the past century seems to be caused by the warming climate (Liu 2005). In many environments, the changes to flora and fauna

In many environments, the changes to flora and fauna due to global warming may not be what are expected to occur. One study found that the number of species of bats increased in an area during a 27-year period. The average number of individual bats captured for study each year did not change but the diversity of species increased. "Capture rates did not change significantly during the 27-year sample period, but relative species abundance increased, and at least 24 new species (of mostly lowland distribution) were recorded in the study area during the 1980s, 1990s, and through early 2002. These changes are likely a consequence of climatic change following global warming, forest clearing, and an increase in amount of secondary forest. This latter factor is a result of changes in land use due to development for tourism" (Laval 2004). The bat population sizes of the species present in the beginning of the study have most likely declined as a result of increased competition.

High-latitude mountainous regions in the Northern Hemisphere are already experiencing climate changes. There has been a loss or retreat of mountain glaciers in non-polar regions in the 20th century (Houghton *et al.* 2001). The increase in melting of the glaciers affects seasonal stream and river flows for downstream environments. The models predict that lasting effects of long-lasting greenhouse gases may cause Greenland ice sheets to completely melt thousands of years from now and cause sea level to rise by 7 meters.

In addition, tree lines have risen to higher elevations in many mountains due to increased average temperatures. There has been more re-growth along the tree lines and they have slowly been moving higher up the mountains as temperature increases (Houghton *et al.* 2001). In Japan, a study of forests showed that in many areas there will be a decrease in the extent of *Fagus crenata* forests but an increase in others. Some areas would have up to a 91% decrease, because the forests would retreat from the southwest and shrink in central regions. They would expand northeastwards beyond their current northern limits, though. A vulnerability index (the reciprocal of the predicted probability) suggests that Kyushu, Shikoku, the Pacific Ocean side of Honshu and southwest Hokkaido will have high numbers of many vulnerable *F. crenata* forests (Matsui 2004).

Coral reef communities are vulnerable to slight changes in their environment, such as temperature, water chemistry, and sea level. A coral reef habitat is a collection of coral colonies that build hard external skeletons for themselves. Coral colonies grow as one generation

builds on top of the previous. The large coral heads and branches that are created provide a habitat for other animals, such as sea urchins, sea stars, and fish. These habitats do not survive when the corals die. After corals die, storms slowly tear the reef apart because there are no living corals to grow new hard skeletal reefs.

Corals expel their zooxanthellae, microscopic yellow-green algae, as the water reaches 30°C. The expelling of the algae is called bleaching because corals get much of their color from the algae. Corals rely heavily on zooxanthellae for oxygen, nourishment, and minerals for coral building and without them they soon die. Corals can also be harmed by the changes in water chemistry that occur as more carbon dioxide is absorbed by the ocean due to increasing amounts in the air. The carbon dioxide reduces the calcification rate of corals making it more difficult for them to produce dense skeletons (Houghton *et al.* 2001).

The record setting temperatures of 1997 and 1998 harmed tropical corals in many regions of the world. There were recorded bleaching events in coral reefs that included 32 countries and island nations (Houghton *et al.* 2001). Some robust corals in the Great Barrier Reef were harmed, as well, including one that had been dated back 700 years (Houghton *et al.* 2001).

A study of many coral reefs in the Great Barrier Reef of Australia showed evidence of synchronized changes in growth and expansion rates over time. "Although local Great Barrier Reef conditions no doubt exert some influence over these growth patterns, the apparent synchronicity of these growth and quiescent phases over wide geographical areas suggests the involvement of broader scale influences, such as climate and sea-level change" (Smithers 2006).

## CONCLUSIONS

The scientific evidence shows that there has been climate change recently and that some of the changes have been caused by the production of greenhouse gases during the last century and a half. The current warming period has been lasting longer than usual, and it appears as if we have altered the natural cycle of heating and cooling for the Earth. Changing the cycle and increasing greenhouse gases to levels not seen in human history, and possibly mammalian history, may bring the predicted and some unpredicted consequences. The best that we can do is to prepare for what is predicted to occur and be ready to modify plans and preparations as new information becomes available.

All landmasses will experience climate changes but the change will not be evenly spread across the globe. The mid- to high-latitude areas of the Northern Hemisphere, and the Antarctic, will most likely receive the greatest amount of change in surface air temperature. Low-lying coastal areas and island nations will most likely receive the greatest amount of geographical change as glaciers continue to melt and raise the ocean level. Coastal areas could also experience more intense storms as the oceans warm and provide more heat energy to hurricanes, cyclones, and monsoons. In addition, more sporadic and intense precipitation will affect many areas.

The changes in climate will create stress for many species of plants and animals. Species already under stress or ones that cannot meet the challenges of change may disappear from many locations or even become globally extinct. Fresh water inland habitats and species are vulnerable to climate change, especially ones already under stress from human pressures. "Anthropogenic changes in temperature and stream flow, associated with watershed land use and climate change, are critical influences on the distribution and abundance of riverine fishes" (Peterson & Kwak 1999).

In our preparations, we need to include plans that protect as many species and habitats as possible for the near and far future. It is our hope that human beings can lessen our contributions to changing the natural cycles and protect environments, species, and people through stewardship and forward thinking.

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# Impacts on Indigenous Peoples

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## **INEVITABLE SURPRISES, INESCAPABLE CHANGE**

Indigenous Peoples are rich in traditional knowledge inherited from the wisdom of their ancestors. This knowledge has guided them through many difficult episodes in the ancient past when the Earth has brought forth numerous natural catastrophes. Indigenous peoples have survived through many cycles of creation and destruction. The pulse of life that has sustained tribal cultures has ebbed and flowed. Indigenous peoples developed extensive networks of alliances and trade that helped them to survive environmental changes and upheavals. Many tribes moved with the changes of the waters and lands.

The great encounter of Native peoples and settlers brought great changes to all sides, and to the environment. Much of the law relating to water and the environment was brought to this continent through European settlers, who saw these lands primarily through the lens of English common law and sensibilities. One hallmark of this worldview is that the world was seen primarily as static and unchanging, and while change may come and go, it cycles around a relatively fixed state. When the new nation of the United States signed treaties with the Indian tribes, the common phrase "as long as the rivers run" was used to describe the permanent relationship between the new society and the first inhabitants. By this, it was understood by all that the resources and the land base could forever be assumed to exist in a relatively fixed state and provide abundant and sufficient resources for all.

Standing at the beginning of a new millennium, we now see that this worldview was overly optimistic. In 1992, over 1,500 world scientists, including a large number of Nobel Laureates, issued the "World Scientists' Warning to Humanity" that began:

"Human beings and the natural world are on a collision course. Human activities inflict harsh and often irreversible damage on the environment and on critical resources. If not checked, many of our current practices

put at serious risk the future that we wish for human society and the plant and animal kingdoms, and may so alter the living world that it will be unable to sustain life in the manner that we know. Fundamental changes are urgent if we are to avoid the collision our present course will bring about."

One of the gravest threats that face humanity as a whole, and Indigenous nations as culturally distinct peoples, is global climate change. Globally, the nations of this world have recognized the potential severity of this threat, negotiating the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 at the United Nations Conference on Environment and Development (UNCED) (the "Earth Summit"). The strong scientific consensus is that climate change will likely occur, warming the global mean temperature from between 1.4-5.8°C. Even if all greenhouse gas emissions ceased today, many of the greenhouse gases already in the atmosphere will take up to two centuries before they will cease warming the climate. Contributing to the impacts is also natural variability in the climate system that can change local and regional climates over scales of decades to centuries.

These changes are expected to have severe impacts on Indigenous economies and cultures around the world. Some regions will benefit from these changes, which may bring more moderate climates and more rainfall to some of the world's most arid and extreme environments. The majority of regions are expected to experience moderate to severe impacts. Average temperature rises are implicated in increasing frequencies and intensity of droughts, floods, storms, erosion, freshwater losses, human diseases, wildlife diseases, livestock diseases, wildfires, invasive species, species range shifts, ecological degradation and a host of other effects that will strain the economic, social and cultural resources of many Indigenous peoples.

Changes in mean levels of natural processes is only part of the story. Climate change is also expected to change the extremes, increasing the variability of environmental conditions. The models for the impacts of climate

change predict different responses region-by-region. Even in regions where average temperature rises are expected to be moderate, models predict that environmental variability will increase. Some regions, for example, may get about the same amount of rain as they now receive, but the length of wet-dry cycles may increase, leading to longer periods of drought. Indigenous peoples are often economically, socially and culturally vulnerable to climate-induced environmental extremes that disrupt their livelihoods and access to cultural resources.

Land use changes, such as urban sprawl and the expansion of large-scale corporate agriculture often reinforce the impacts of climate change. Large-scale deforestation for agriculture and increases in exposed impervious surfaces in urban sprawl can increase local temperatures and lead to greater soil erosion and freshwater loss. In some recent climate change models, land use changes can reinforce and amplify climate impacts.

We are entering a period when we have diminished or removed many of the natural buffers for adapting to environmental change. Recent science has underscored that when similar conditions have been encountered in the past, they have led to many abrupt changes in climate dynamics and ecological organization that severely disrupt the ecosystem services on which human communities deeply depend. Cumulative impacts, threshold effects, and unpredictability are less seen as occasional environmental risks to be handled at the margins, but core principles in the dynamics of nature. We are entering the Anthropocene Era, in which the functions of these processes are dominated by human activities, and we are committed to inevitable surprises and inescapable change.

Indigenous peoples need to take the issue of climate change very seriously, as it could become one of the largest-scale threats to their continued existence as distinct peoples. Many of the expected impacts are direct - sea level rise can flood reservations and villages, storms can cause lethal flooding, elders and children are vulnerable to extremes of heat and cold. Other expected impacts are more indirect. The shift of a culturally-important species range so that it no longer occurs on tribal lands or usual and accustomed lands may make it extremely difficult for elders to effectively access needed plants and animals. By threatening Indigenous peoples' traditions, climate change may become the largest weapon of mass destruction facing tribal cultures.

## CAUSES FOR CONCERN

Space and time do not allow for anything but a very cursory treatment of the many aspects of the repercussions of climate change, climate variability and land use change. Several preliminary observations frame the assessment of climate change and environmental change.

- **The impacts of these changes are not isolated from one another**, but changes are interconnected in a web of relationships. Large-scale climate phenomena, for example, may be highly influenced by abiotic factors impacted by thermal forcing, such as ocean-atmosphere interactions that affect thermohaline circulation, the ocean circulation patterns created by ocean temperature differences. The interactions of the oceans with the atmosphere are not wholly abiotic. Carbon storage is affected by the "biological pump", in which phytoplankton capture atmospheric carbon which becomes a rain of carbon sediment that drifts to the ocean floor when they die.

Abiotic factors affecting the production of phytoplankton, such as acid precipitation or iron fertilization from continental dust storms ("brown clouds") can push phytoplankton productivity down or up, affecting whether the ocean is a net sink for carbon or a net emitter of carbon. Scientists have used the concept of "bioclimatology" to describe the relationship of the life history and physiology of individual organisms to climate, and more recently of "ecohydrology" and "ecoclimatology" to conceptualize and describe the feedback interactions between ecology and the water cycle and ecology and climate.

- **Many of the changes work synergistically.** Land use changes and climate change can have similar and reinforcing impacts. Land clearing and climate-induced warming and drying may both lead to opening forest canopies similar impacts on stream temperatures, plant growth, stream sedimentation rates, and so on.

- **We must avoid "shifting baselines"** by referring climate adaptation and mitigation goals to historical conditions. Daniel Pauly has observed that environmental managers are often assume that the conditions of the environments to which they were first exposed is the "normal" state of the natural world around which management and restoration goals should be built, though they are willing to allow for some "slippage" in an imperfect world. As each generation accepts some amount of degradation, ignorant of the significant losses that have already occurred, species and ecosystems suf-

## A BRIEF CATALOG OF IMPACTS

Each of the following vignettes is a composite of some general phenomena, and merely meant to indicate how climate-induced changes in hydrology can negatively affect native biota and ecosystem functions, and climate-induced changes in ecosystems and species can alter hydrologic regimes. The chains of causation are complex in any real cases, and would require detailed assessment in any policy or legal case.

### 1. Ecohydrologic Alterations

**Change in the timing of precipitation:** The winter season in the Pacific Northwest has been reduced by approximately two months. The warm fall water lasts longer into the winter season, and the spring freshet appears earlier than historically. Precipitation falls as rain rather than snow in the fall, reducing snowpack. The snow melts more rapidly and earlier in the spring, resulting in higher peak flows. The high peak flows work to increase channel erosion, and deliver higher sediment loads, nutrient loads and contaminants to downstream receiving waters. This damages salmon and other in-stream habitat through scouring and sedimentation. The high flows also may damage streambanks and destroy streamside vegetation. This can lead to more erosion and weaken streambanks, which both brings more sediment from slumps, decreases the ability of the riparian to filter nutrients and toxins in runoff, and decreases the transfer of important stream nutrients (such as from salmon carcasses) to the forest riparian zone.

The high volume of water reduces infiltration and passes the soup of unfiltered sediments, pollutants, and nutrients downstream, degrading instream habitats. The mix is passed to waters such as estuaries, increasing their loads of these materials, and reduces estuarine salinity. Similar impacts occur with the increasing amount of impervious surfaces conveying stormwater into streams and estuaries. The loss of streamside vegetation and structures that slow the passage of water further reduces the infiltration of snowmelt and rainwater. The freshwater in the nearshore environment may interfere with salmon development and increase the stressors acting on salmon in their critical transitional habitats. Agricultural compaction of soils also increases surface water runoff and reduces infiltration.

### 2. Temperature Alterations

Both climate change and common land use practices fragment the landscape and create open canopy in areas



The Inuit village of Shishmaref, Alaska (above), inhabited for 4,000 years, is facing evacuation due to a reduction in sea ice. The thawing of permafrost along the coast is allowing higher storm surges to reach shore, and making the shoreline more vulnerable to erosion. The town's homes, water system and infrastructure are being undermined, and sandbagging (below) has not solved the problem. Photos from NOAA Arctic Change.



for the "death of a thousand cuts" as losses accumulate. The purpose of an historical baseline is not to try to define a world in a bell jar or return to a mythical Eden, as change has always been with us. The purpose is to attempt to define the set of historical conditions at a time when the waters, air, soils, and living things were in a much healthier state than they are today, and provided a wealth of goods and services that sustained cultures and provided substantial buffers against change. Defining historical conditions is also an exercise to define "natural" rates of change in order to better define those forces leading to extreme, abrupt and odious changes in order to attempt to avoid turbulent changes that break apart communities, destroy economies and livelihoods, and ruin our collective well-being.

with long histories of closed canopy ecosystems. Climate change can break up canopies through reductions of base flows and general drying, which is paralleled by clearing streamside forests and vegetation. The clearing of riparian forests reduces stream overshadowing, raising stream temperatures. Many northern aquatic invertebrates are dependent on cold winter temperatures to activate diapausing eggs, and scientists have documented dramatic declines in many temperate aquatic invertebrates. The warm water also induces whirling disease in salmon, and increases their susceptibility to other aquatic diseases. The problems are amplified by the decrease of cold water seepage into streams that normally comes from groundwater. Climate- and land-use related damage to streamside vegetation further reduces sediment and nutrient trapping, and contributes further to channel erosion and simplification of stream habitats.

Higher temperatures may also favor increased damages from diseases, pests and invasive species. The generation times of many pathogens and pests decreases with increasing temperatures, with may increase their pathogenicity. Since pests and pathogens and hosts both have longer active seasons under increased temperatures, this may allow pests and pathogens to build up to epidemic proportions. Forests where trees have been weakened from such attacks have been shown to be more susceptible to forest fires, which further reduces ground cover and increases erosion, reducing the overall infiltration capacity of the soils.

Open canopies and riverside soil compaction also reduce the survival of soil mycorrhiza. These are important for nutrient cycling in forest ecosystems, and also linked to hydrology. A number of forests grow on relatively poor soils, and the majority of nutrients are cycled through the mycorrhizal "biological pumps". The mycorrhiza are also important in water cycling, slowing and holding water in the soil leading to greater groundwater infiltration. Soil compaction, drying, and fire-related mycorrhizal mortality decrease soils' ability to support native vegetation and decreases groundwater recharge.

### **3. Invasive Species**

Climate change is known to foster the intrusion of invasive alien species. Invasive species commonly invade disturbed ecosystems. Disturbed riparian corridors provide an invasion pathway into new uncolonized areas for a number of invasive plants. Invasive vegetation often provides poor habitat to native species, and can reduce burrowing and other activities that turn and aerate soils, reducing infiltration capacity and nutrient

turnover. Invasive plants can alter stream hydrology by narrowing stream flood channels and trapping sediment. This can lead to extreme overbank flooding and further erosion of the streambank. Some invasive plants have been shown to have different root systems and may provide less cover than native vegetation, causing erosion.

Invasive species can also increase through increased transport related to climate change. One important invasion pathway is through hitchhiking on commodities used in international trade. As climate change reduces self-sufficiency on traditional diets, Indigenous peoples may have to have a greater reliance on foreign foods. The increased import of foods may further add to pressures to substitute traditional foods for foreign foods, to take up wage activities to pay for food once produced through subsistence activities, and increase the introduction of exotic species. This can have significant impacts on Indigenous peoples living on small islands.

Invasive species may alter habitats important for the survival of traditionally-used species. Invasive species also replace many native species of importance to Indigenous peoples that are not only important economically, but have great significance in religious, social and cultural practices.

### **4. Species Range Shifts**

Some species are plastic enough in their characteristics to adapt to a range of environmental changes and remain in place, although they may possess characteristics that put them at risk of extinction. Some species, for example, may be tolerant of a wide range of temperature and moisture conditions, but have genetically fixed times for reproduction and feeding. For example, if predators and prey appear at shifted times or the timing of reproduction and availability of mates or offspring rearing conditions become separated by climate- or land-use-induced changes, species will decline.

Other species may shift their ranges to follow their preferred bioclimatic envelope or preferred habitats as environments change. Some of these shifts are vertical, as species move up mountains, where they may become "trapped" if unable to escape from the tops of the mountains as situations degrade. Other species shift laterally across the landscapes, if they can. Range shifts may also put species at risk from the existence to human-made barriers and natural barriers to dispersal. Unlike historical episodes of change, species now have to cross roads, pass through cities, move across open agricultural landscapes providing little shelter from the climate and pred-

ators, and so face innumerable barriers.

Such lateral shifts disturb ecosystem functions, and can move economically and culturally important resources away from local communities, impact local economies and community health for those who depend on the species for food. For Native American tribes, such range shifts may threaten their cultural existence. The treaty-protected rights of tribes to hunt, fish and gather traditional cultural resources are based on tribal territories and usual and accustomed areas on public lands.

Species, such as medicinal plants and game animals, shifting away from these areas are no longer available to the tribes. Even if rights to these species can be secured, if tribal members cannot realistically access them they are effectively extinct.

## 5. Emerging Diseases and Pests

Temperature alterations have been mentioned one cause of the increase in diseases that effect the health of forests, streams, and other ecosystems. Hydrological changes can also increase disease incidence in ecosys-



More than 4 million acres of spruce forest in south-central Alaska have sustained heavy mortality caused by spruce bark beetle infestation. A significant portion has occurred within the forests of the Copper River Basin, increasing the risk to communities of catastrophic wildfire. Photos by KPB Spruce Bark Beetle Task Force.



tems in a number of ways. Increases in nutrient load can favor the growth of algae or phytoplankton that creates conditions for hypoxia and red tides. Increased surface- and storm-water runoff from compacted soils and impervious surfaces can also increase the delivery of pathogens and toxins into aquatic ecosystems. The loss of riparian ecosystem services, such as riparian vegetation that prevents erosion and filters diseases and toxins from runoff also increases disease burdens in aquatic ecosystems. Stirring up sediments can stir up trouble, as pathogens that are normally benthos-dwelling are pushed into water columns and move downstream. Pathogens such as aquatic viruses in this way sometimes are able to meet and exchange genes to produce more virulent strains.

Invasive species can bring their foreign pathogens with them, and cause "virgin water epidemics" in aquatic organisms never exposed to them, and virgin soil epidemics in riparian zone species. Similarly, species range shifts can move disease-carrying plants and animals into new, often disturbed, environments that provide opportunities for the pathogens to infect new hosts. Many of these diseases have been called "emerging diseases" that although they may have existed for some time, are becoming new and prevalent threats to public health, wildlife health, livestock health, crop health and vegetation health because of the rapid changes in human and non-human populations and the environment.

Climate-related changes also leave many ecosystems vulnerable to pests and diseases. Warmer winters mean greater survival for many of them, so that pest can build up greater levels of infestation and diseases can infect more people, often with more virulence. Many forests around the Pacific, for example, are being attacked by wood-boring and bark beetles. This leave the trees valueless for commercial use and highly susceptible to very hot fires that destroy the capacity of the land rather than rejuvenate it.

## 6. Sea Level Rise and Island Erosion

Some recent data from Greenland has been found glaciers have increased their rate of melting 2.5 times in the last 5 years. Glaciers in Alaska in 2006 have been found to be melting nearly twice the speed than believed previously. The polar ice cap has lost significant portions of it permanent sea ice. Even at current warming levels, most glaciers in the Pacific Northwest are expected to be gone in the net 100 years. Under some projected climate change scenarios, the period of glacier loss is expected to be more on the order of 30 years.

The massive loss of terrestrial freshwater to the oceans is expected to raise sea levels. Sea level rise over the next century is currently projected from .3-3 feet, depending on location. Even small, 1 foot rises in seal level put many low-lying islands at risk of being largely or completely flooded.

Even if sea level does not rise greatly, increases in the frequency and severity of storms associated with climate change can cause erosion and significant storm damage to low-lying islands. Many islands and coastal regions are already experiencing significant coastal damage from coastal development. Many coastal industries, such as shrimp aquaculture and industrial development have reduced much significant coastal vegetation and habitats, such as mangrove stands, that act as natural barriers against storms. Climate change is expected to cause further declines in these biological barriers.

### 7. Ocean Acidification

Carbon dioxide in the atmosphere, when adsorbed in seawater, makes it more acidic (lowers seawater pH). The acidity of the ocean is now thought to be at its highest concentration for the past 300,000 years. The

impacts of this acidification are unclear. It is known that acidification lowers the concentration of calcite and aragonite, elements used in building the calcium shells and skeletons of marine organisms. Many of these organisms are critical for Indigenous livelihoods. Calcium carbonate provides the building material for coral reefs, which are also already suffering from sea-water temperature rise. It also affects the abundance of may plankton that form the basis for marine food webs. Their degradation or loss could lead to a widespread decline in fisheries production, leading to increased coastal destruction and loss of livelihoods.

### 8. Water for Humans and Nature

Hydrological changes related to climate change, environmental degradation and land use have caused significant and often unappreciated declines in water supply and quantity. Models by the Tulalip Tribes and Battelle Pacific Northwest, for example, suggest that the level of freshwater lost to the ocean has increased from .6% to 33%. In other words, almost 1/3 of the freshwater that used to get into the groundwater. Over two months have been lost to warming, so that there is less time for snow to accumulate in the mountains. When spring comes, it



The Nisqually River headwaters emerge from under the Nisqually Glacier on Mount Rainier, Washington, providing fresh water for the salmon and other aquatic life downstream—but the glacier is receding. Above, the Nisqually River gushes unimpeded from a large opening at the base of the glacier in August 2006. At right, a huge avalanche of rocks and debris from the top of the receding glacier has blocked most of the large opening by October 2006—only two months later. Enormous stones and debris flows continue to detach from the glacier and tumble down its slope every few minutes. Photos by Zoltan Grossman.



happens quickly so that much of the meltwater is released very quickly in large volumes. This process scours and channelizes the streams, which destroys salmon habitat and stirs up sediment and toxic materials. Tribal fishermen in the Pacific Northwest report seeing more salmon with lesions associated with warm-water disease. It also leads to significant water storage loss. This loss can then lead to permanent losses in soil and aquifer storage capacity as the land dries out and natural storage structures collapse. On smaller islands, extremes of drought and rainfall-variability can allow for salt water intrusion into freshwater lenses, destroying freshwater supplies and requiring expensive desalinization.

## THE NEED FOR TRIBAL ENGAGEMENT

Unlike other citizens, the Tribes are tied to their homelands in a unique relationship to their lands and to the United States. Their identity is deeply rooted to their lands - the places from which they emerged, where their ancestors dwell, about which their stories and language refer, and to which they have continuing spiritual and collective obligations. Because of their unique political history, their recognized prior rights and treaty rights only apply to their reservations and usual and accustomed lands. Moving from these lands to adapt to large-scale environmental decline would cut them off from their origins, from the places of their collective memory, and the rights to self-determination the Tribes possess as peoples.

The Tribes, who have contributed very little to these large-scale changes, have few options but to stay in place and attempt to survive and sustain their cultures. The Maldivians, who have had no discernable contribution to global warming, must face the possibility that sea level rise will obliterate the Maldivian nation. Indigenous peoples of the face the risk of seeing their homelands washed over by waves of climate change, over which they have very little control. Climate change has the potential of scattering the resources on which their cultures are based.

Human-caused climate change is the largest-scale case of a failure of the global community and nation states to fulfill their trust and fiduciary obligations to Indigenous peoples. The changes associated with global climate change pose grave threats to Indigenous peoples. Many of these threats will have to be faced, as they will not go away soon even if greenhouse gas emissions are reduced. On the other hand, some leading climatologists believe we are a decade or so away from a climatological "tipping point" in which climate change becomes a

"runaway process", escaping simple control by emissions reductions.

## Adaptation and Mitigation Policy Frameworks

For Indigenous peoples to cope with our current environmental changes, we must stop treating the natural world as static, but incorporate policies and law into our planning and management that allows us to sustainably maintain healthy, resilient communities in the face of change. These policies and law need, among other things, to be:

- **Integrated** - they must involve multiple sectors, often moving independently of one another, in the creation of holistic solutions that address:
  - a) health, housing, transportation, labor, economy, production, population growth, consumption, environment and development; and
  - b) a full range of climatological, hydrological, environmental and ecological relationships;
- **Cross-scale** - they must address problems at multiple environmental and societal scales, and devise action appropriate to each scale, while working to ensure that policies and actions at other scales do not work to defeat measures taken at any one scale;
- **Adaptive** - they must be flexible to respond to changes in the environment and in scientific and local knowledge, and should be designed to monitor and respond to the effectiveness of their objectives, and to change the objective themselves when necessary;
- **Restorative** - they must be built on the recognition that even in the face of environmental changes, mitigation must look to historical baselines, not current baselines, for the environmental and hydrological processes that maintain healthy watersheds and communities;
- **Participatory** - they must include the entire range of stakeholders, federal, state, tribal and private, in the development of objectives, adaptation measures and mitigation measures and be based on the principle of stakeholder equity in a manner that respects the rights and privileges of all stakeholders and is transparent and legitimate; and
- **Sustainable** - they must be built on the basis of ecological and cultural sustainability, and include mechanisms to ensure the sustained financial and administrative support for their implementation.

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# Building Indigenous Perspectives

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The reality of climate change is slowly dawning but public debate is largely confined and conditioned to a heralding of global shifts, potential changes, and in some instances the somewhat alarming [politicized] possible impacts on existing human resources and behaviors. Global *warning* of global warming seems to be a pre-occupation of the socially conscious as much as it is an anathema to the economy of an industrialized world.

For most it would appear that the voices or opinions of Indigenous people have little meaning or value – more particularly that their hegemony would dictate such views. On a region by region basis indigens hold a collectively powerful body of climatological knowledge holistically interwoven with what we might package as the environmental knowledge of a culture [*matauranga putaiao*] together with properties of its collective management [*rangatira, kaitiaki*].

The opportunity therefore exists for indigens to move beyond waiting - the poignant moment of global realization, acceptance and acknowledgement – outside of a framework of political correctness determined by capitalistic economic and political expediency. We can look at new opportunity both as a form of self and social constructivism, ideals of community, and in some ways this may entail altruism, offering to non-indigens ‘lost’ resources access and management skills through our detailed knowledge of a forgotten or unwanted natural world.

In general we hold management practices that are least wasteful and more biodiverse. Issues like crop monoculturalism and over-fishing are distasteful, our attitudes and behaviors always hold strong regard for the inter-reliance of species and resources in both current and future generations. We do not have a particular sense of *ownership* to land and resources - we are *part* of those resources and as we identify to land through *whenua* [umbilical attachment] it is not a simple conception to destroy the resources with which we are connected.

## MAORI IDEOLOGY AND IDENTITY

### Pacific connections

Indigenous people hold long assemblages of natural observations, a detailed and expert knowledge of sea, landscape and atmospheric phenomena. While the migratory pathway of Maori from a Pacific source is suggested to be little less than a thousand years our arrivals did not come from a vacuum, the kind of *Terra nullius* suggested by the first British explorers of Australia. Neither can western science be excused for overwriting (Stephenson, 1998) and trivializing the Maori knowledge base of the natural world it was all part of a concerted hegemony to establish, second settlement, through British colonisation.

We live on the edges of Pacific Plate boundaries and subduction zones – earthquakes and volcanoes are part of our history. We are sea voyagers, navigators, peoples of first exploration and discovery different from those who came later following pre-determined routes.

The depth of geomorphological knowledge held by Maori is reflected in a passage of oral history “*Ko Ngatoro I Rangi raua ko Tia he rangatira no Te Arawa waka*” [after, New Zealand Geographic Board, 1990.]

Two chiefs of Te Arawa brought their canoes from Hawaiki down the Kermadec-Tonga trench guided by their taniwha [left track markers of hot embers along the line of the trench\* into *Te Moana a Toi* [Bay of Plenty]. These two [parties] explored the landscape, lakes and mountains. From Mt. Tongariro Ngatoro I Rangai could command a view and challenged another chief Hape Tu A Rangi on the desert floor below “do not dare to climb this mountain or I will cause darkness to descend upon you” Hape began his descent and Ngatoro I Rangi immediately called on Ruamoko to destroy the trespasser. A massive eruptive force was created from underground, dense black clouds created darkness. Snow fell over the desert and Hape was frozen to death. After destroying his rival Ngatoro I Rangi continued to climb but encountered snow sleet and cold winds. Weakened



Flooding brings instant change to the Matata wetland in Aotearoa (New Zealand), from May 2005 (left) to June 2005 (right). Photos by Brett Stephenson.

by his climb he cried out to his two sisters Kuiwai and Haungaroa who resided in Hawaiki to assist. They heard him and sent sources of heat with the assistance of fire gods. That trail remains marked by a succession of basaltic volcanoes Whakaari, Mautohora, Putauki, Rotoehu, Tarawera, Taupo – and from a collection of ara [talismans stones] one thrown to mark the sacrificial death of his servant – now stands as Mt. Ngauruhoe.

\**Purakau* – common place stories of explanation but sourced from a deeper body of knowledge held by *tohunga* – fire markers to the trench now prove to be a series of undersea active volcanics at the western edge of the subduction zone, ‘black smokers’ and cones [Monowai and others].

The migratory seabirds like Albatross and Titi [Sooty shearwater] reflect the high degree of connectiveness between Pacific people and their resources. Between September and mid- May breeding and pre-breeding Titi (*Puffinis griseus*) disperse widely throughout New Zealand waters some may move into the Southern Ocean as far south as the outer edges of Antarctic pack ice. Most adults depart on migration to the North Pacific between late March and early May – fledglings leave colonies from mid April and follow a similar route. Birds arrive along the west coast of North America from April to May and drift northwards to reach the Gulf of Alaska by June. Breeding adults return south in August with non-breeders leaving a little later. Recent reported

tracking of bird migrations [Sept 2004] followed home-coming birds from San Luis Bay, California gave flight passages of about 20 days to reach Taiaroa Head, Otago. Titi traveled at about 25 km/hr often following a zig zag course and some evidence suggested that birds travel further in 24-hour spans during periods of full-moon [Adams, 2005]. Of interest to Maori navigators was the return home passage was the possible avoidance of head winds [northern trades] between Hawaii and central America on route to the equator. Equally a second route adjustment to follow the Kermadec-Tonga trench [which is a magnetic anomaly] the same passage navigated in our migration from the Pacific.

Research of the Southern New Zealand population has been successfully developed by a cooperative venture between Rakiura Maori harvesters of juvenile titi [knowledge holders and kaitiaki of a food resource] and the University of Otago [a source of western science information]. To date, however, little is known about the potential or actual interbreeding but data is crucial for the assessment of harvesting/mortality estimates required for population sustainability. Preliminary results indicate that there are no major differences between eastern and western Pacific populations in the first set of gene sequences – but more to be discovered. If interbreeding was found to be frequent between New Zealand populations and South American populations then they could have a strong influence on each other on respect of harvesting and climate change

## Aotearoa – New Zealand situation

Throughout most of the last 65 million years sea surface temperatures around New Zealand have been warmer. Marine fossils, particularly Molluscs, provide excellent evidence of subtropical temperature peaks in the early Eocene [c. 50 Ma Bp] where seas were thought to be approx 9°C warmer, and at a later stage early Miocene [c. 16 Ma Bp] seas of 8°C. Many warm water species that had earlier dispersed into the region in shallow warm water currents, as planktonic larvae or juveniles, died out [fossil evidence] as the climate progressively cooled in the late Tertiary.

Evidence of sea level changes that can be seen in terraced coastal cliff topographies come from the more recent Pleistocene Ice Ages (c. 2 Ma Bp) changes resulting from world-wide locking [unlocking] of water on land into ice caps. While sea levels have periodically risen to varying heights [c.15-105 m] above current positions concurrent land instability, small upward movements of land can interfere with the exact calculation of level changes.

Climate shifts occur naturally and in the modern context of record keeping there is a progressively growing wealth of accurate and precise information. Mean surface air temperature and sea-surface data show a close relationship and evidence from marine data shows a warming trend of 0.7°C over the period 1871-1995. The decade of 1900 was the coldest of the 20th century while the most marked warming occurred around 1950. Additionally, since 1950 night time temperatures have warmed more than daytime maximum temperatures, with a marked decline in frost frequency (Bosselmann et al, 2002). We detect a 20-year cycle in climate shifts for the New Zealand – South Pacific situation driven by a recently described climate feature [Power, S. et al. 1999] the Interdecadal Pacific Oscillation [IPO] which swings climate features in every one- three decades. In the positive phase of IPO our south westerlies are more frequent; conversely, a negative phase brings periods of greater northeasterly winds in the New Zealand region

Our deep sea fauna, in depths of more than 1000 m, is mostly world wide in its representation because dispersal and distribution of these faunas relies on the major deep sea current circulation system. Water carries more heat capacity than air and relative to global climate it is oceanic circulation that drives climate patterns. Warm currents of lower density moves at the surface from equatorial to polar regions giving warm climates (such as the U.S. eastern seaboard) conversely, cold current

move cool water towards the equator. Ocean water becomes stratified by temperature differences and this causes the establishment of a permanent thermocline. Polar water is both cool and more highly saline [cf. high daily precipitation that occurs over equatorial seas giving effective dilution] – its resultant higher density causes sinking before circulation, deep water is cold. Deepwater thermohaline circulation largely separated from surface oceanic circulation but it retains good oxygenation and nutrient supply – upwelling brings sources of high productivity.

What is at risk through climate change is the alteration of atmosphere-sea surface exchange at any point between equatorial and polar region to which deep sea circulation is sensitized and interrupted. By way of example we might note the relationship of the Humboldt deep cool current on the shift in La Niña/El Niño oscillation in the Pacific.

There is an emerging band of information suggesting that global climate changes may soon/are impacting on deep-sea circulation not least of which is the frequently reported decay of Arctic and Antarctic coastal boundaries, ice sheet/berg melt, confirming land/sea temperature warming. A recent news report (*New Zealand Herald* 8 Sept 06) talks of compounding issues in ‘unexpected’ greenhouse gas (GHG) emissions and cites the director of global ecology, Carnegie Institute, Washington, on research into the releases of ice trapped methane and CO<sub>2</sub> during the melting of Northern Hemisphere permafrost – potentially up to 100 times greater than equivalent gas releases from the burning of fossil fuels. Coupled with the conversion of frozen water mass to liquid state is an associated shift in sea level – global mean sea level is predicted to rise by somewhere between 9cm and 88cm between the years 1990 and 2100.

For tropical [Pacific Island nations] apart from the risk of low island/atoll submergence there is a parallel concern for an increasing carbonate solubility with rising atmospheric CO<sub>2</sub> the trend in oceanic water acidity which will interrupt calcium carbonate deposition for invertebrate skeletons – coelenterate/coral reef systems seem to be particularly at risk

## FACTORS CAUSING CLIMATE CHANGE

For most regions the Earth’s atmosphere [blanket] maintains a ‘comfortably warm’ situation – at/about ground surface level temperatures 0-50°C; more essentially for the tolerance level of living cells a temperature variable where the water molecule exists in a liquid state. Once



Flora and fauna can be reliable predictors of changing weather patterns, for those who will listen. Above, the *Ruru* lets (more than one) shrill cries before rains begin. Below, if the *Pohutukawa* flowers early, it is a sign of a long, hot summer.



outside this atmosphere the temperature extremes are known to exceed biological/cellular capacity of life known to us. By comparison the airless surface of the Moon [a similar distance from the solar heat source – Sun] rises to 100°C on the sunlit surface and falls to – 150°C at night; with obvious implications for the various states of water. While the surface of Earth is warmed by insolation it is the long wavelength [ $> 0.4$  micrometers] infrared energy that creates a sensation of warmth. Water vapour absorbs strongly in the band 4-7 micrometers and carbon dioxide in the band 13-19 micrometers which leaves a window at 7-13 micrometers through which more than 70% of insolation is radiated from the surface back into space – entropy applies.

Together with clouds, a greenhouse effect arises as a result of atmospheric [ $\text{H}_2\text{O}$ ,  $\text{CO}_2$ ,  $\text{O}_3$ ,  $\text{CH}_4$ ,  $\text{N}_2\text{O}$ ] gaseous absorption of this fraction of long wave radiation as it becomes emitted from the warmed surface. Amongst the gas components of the atmosphere responsible for absorption it is carbon dioxide that takes up and stores by far the larger proportion – in effect  $\text{CO}_2$  is the warming blanket. To this extent any changes to the atmospheric ratio of carbon dioxide is similarly matched by the greenhouse effect on global temperature. It is the changes in the concentration of greenhouse gases that alter the efficiency with which Earth cools to space.

Evidence shows that  $\text{CO}_2$  varied little in the several million years before present but that in the last c. 200 years human impacts have made dramatic shifts on once rather stable levels of greenhouse gases. Since 1960 total atmospheric carbon dioxide has increased from about 320 ppm - 350 ppm, a rise of more than 10%. Over the same period the average world temperature [compared to the previous three decades] increased from 15.0°C to 15.2°C. About three-quarters of the anthropomorphic emissions of  $\text{CO}_2$  to the atmosphere during the last 20 years are due to fossil fuel burning – the rest mostly through land uses changes, particularly deforestation (Bosselmann et al. 2002).

Anthropomorphic contribution to climate changes will persist for centuries after greenhouse gases are stabilized because of their lasting effects on atmospheric composition, shift in solar radiation effects and long time span involved in any corrective reversal of the deep oceanic circulation. Global mean surface temperature increases and rising sea level from thermal expansion of the ocean are projected to continue for the next few hundreds of years even on the basis of present level greenhouse gas concentrations.

## RHYTHMS OF WEATHER

### **El Niño and La Niña events [coupled with IPO]: A seesawing pattern**

In normal years [La Niña phase] sea conditions off the coast of South America is kept relatively cool, sky cloud free, by the cool Humboldt current upwelling. Sun-heated surface water of the central Pacific is steered eastward by trade winds towards Australia. The Southern Oscillation Index [SOI] is positive and the Pacific rain-belt shifts to the south. Trade winds are strong, Australia receives a longer wet season, New Zealand northland coast have sea breezes and warm, moist, north-easterly weather patterns.

In an El Niño phase, the trade winds are weakened and ponds of hot salty equatorial water develop east towards Peru creating their own pockets of moist rising air that condenses into rain cloud. The New Zealand situation becomes altered by more frequent south-westerlies. The SOI index is negative and the Pacific rain-belt shifts to the north. A ridge of high pressure settles well to the north of the country [hence below average rainfall in Northland, Auckland and along the east coasts from Gisborne to Canterbury which lie in a rain shadow developed under the Western/High Country ranges]. To the south average rainfall and cooler weather persists in Southland, Westland and Otago.

Changes in the El Niño frequency and amplitude associated with Global warming are predicted to lead to greater extremes of drying and heavy rainfall the droughts and floods that are associated regionally by El Niño. (Bosselmann et al, 2002)

### **Impacts for global communities**

Climate changes will exacerbate water shortages in many of the existing situations of drought risk and arid land masses - central Asia, southern Africa, European and African countries bordering the Mediterranean. Alternatively other regions such as parts of southern Asia may receive greater precipitation and so become alleviated. Some several hundreds of millions of corresponding populations are projected to suffer a supply reduction of 10% or more by the year 2050 for climate change predictions corresponding to 1% annual increase in CO<sub>2</sub> emissions. The multiple effects of water scarcity, water quality and the frequency and intensity of floods and droughts will create massive difficulties in water management from which few will escape (Bosselmann et al, 2002).

Predictive sea level rises suggest that communities of low-lying coasts and small island territories are at risk of sea water encroachment creating severe social and economic effects. Those familiar with the 2005 tsunami effects on coastal populations bordering the Indian Ocean or indeed the extreme cyclonic events in the Gulf of Mexico will be able to partially gauge the extent to which populations are vulnerable to sea level shifts. It is expected that sea water inundation will result in the permanent displacement of people and the loss of infrastructure. Sea level rises, however, go beyond the mere loss of useable land/crop area in the extent to which it alters natural resource there will be consequential losses in fishing and wildlife habitat the sources to food sustainability – many situations already at risk by over population and communities with less than adequate food resources. Storm cycle events [even without consideration of changes to storm frequency or intensity] involving ocean generated waves and wind/pressure surges will impose additional risk on many small island communities and to some extent coastal land strips [already] at or below sea level.

For the New Zealand situation there will be gain and losses water is likely to become a key issue in eastern areas if a projected drying trend in climate takes effect, equally we are subject to IPO and El Niño oscillations which create uncertainty. The increases in high intensity rainfall and the higher incidences of tropical cyclones would alter the risks to life, property and ecosystems from flooding, storm surges and wind damage.

Predictive climate changes are seen to operate differently over regional areas from those of national or global trends.

Analysis for trends in the Bay of Plenty (Griffiths et al, 2003) indicate that total annual rainfall has generally decreased [note current storm flood intensity levels are higher] – a decrease of 25 mm per decade over the period of recorded returns [1910-2002] with fewer rain days – 1.5 fewer days per decade since 1960's. For very short durations [30min] extreme rainfalls have tended to be higher in the positive phase of the IPO rather than in the negative. Also during the La Niña periods seasonal extremes and rainfall intensity are above normal [rainfall associated with easterly airflow]

In terms of the future, mean annual rainfall is projected to decrease in the Bay of Plenty about 1-4% by the 2030's but with no further drying trend by the 2080's – nonlinearity in trend is typical of all models. (Griffiths et al, 2003)



The *Marae* is the Maori mark of cultural identity and the focal point of a community, similar to a longhouse in some North American Indigenous cultures. It symbolizes the continuity in Native social cohesion, which can be a key aspect in Indigenous survival of climate change. Pictured here is the Ngati Pukeko Marae in Whakatane, Aotearoa (New Zealand). Photo by Brett Stephenson.

The trend for air temperature shows similar rises up to 0.2°C per decade over the last 50 years and the number of days exceeding 25°C has significantly increased. Temperature is above normal during La Niña phases of the southern oscillation. Correspondingly there are fewer days of frost-decreasing at a rate of about one air frost per year.

The mean westerly wind component across New Zealand is expected to increase by approximately 10% of its current value in the next 50 years. Stronger wind speeds are associated with intense convection currents, which is expected to increase in regionally warmer/drier climate, and also with intense low-pressure systems which could become more common.

These predictive outcomes collectively signal the possibility for greater flooding events and, on the intensely cultivated Rangitaiki plains, higher ratios of soil loss, increasing river sediment loading and a continuance of pro-grading to the existing coast. Events of this type

have downstream consequences associated with long-shore drift, sediment in-filling adjacent to the Whakatane river entrance and shallowing of Ohiwa Harbour.

## **SOCIAL NETWORKS**

Regional economic wealth and community infrastructure will to some extent determine how well populations will manage and survive but on a global scale the existing forms of infrastructure for relief and redevelopment aid are quite inadequate. Moreover, there is evidence that in larger scale or repetitive disasters the availability of national/global aid and the nature of voluntary assistance can become determined by culture, religion and social class of the displaced people. Communities, rather than the individual reliance on what might emerge from political governance and voluntary arrangements (consider the unraveling of the New Orleans crisis) may be pivotal to a way forward in disaster preparedness. It is a community that holds and shapes the network of

people who's skills and social organization can be promptly initiated and trusted because they are 'known' to each other.

For New Zealand Maori our *whanau* [families] are bound by kinship ties and *whakapapa* in *hapu* [sub-tribe or regional community] relationships (Mead, 2003) and they provide the basis for community. Central to hapu organization is the *marae*, a focal point in which its meeting house offers a physical space for gatherings and decision making along with a recognizable symbolic strength to cultural practice and unity. The marae through its assemblage of buildings on a dedicated space may, on the decision of its people, provide for various forms of hospitality [accommodation, sleeping, food preparation, meals] as well as the collective and social skills of people who regularly associate. As an extension is the high cultural value placed on *manaakitanga* [hosting & care giving] and a *hapu* responsibility to provide without limitation for those who seek to use that marae. Marae have commonly acted to provide *manaaki* on a long-term basis in natural disasters [the 1987 Edgecumbe earthquake causing extensive damage in the Bay of Plenty, is recalled – J. Peri, pers comm] and the management committees of many marae have well established planning for coordinated relief and care in these situations (H. Hauwaho, pers comm).

## CLIMATE CHANGE STRATEGY

### **Reducing or slowing the rate of climate warming and sea-level rise by reducing GHG emission**

The UN Framework Climate Change Convention (including the Kyoto Protocol) was the first international environment agreement to be negotiated by virtually the whole international community. It seeks to integrate an environmental approach to sustainable development and the protection of the global climate while considering the vital need of nation states to pursue their own form of economic development.

To achieve, stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, ensuring that food production is not threatened and to enable economic development to proceed in a sustainable manner

A close inspection of the Convention shows considerable areas of difficult unresolved/understated issues such

that climate change – a change that can be attributed directly to human activity that alters the composition of global atmosphere and which is in addition to natural climate variability observed over a comparable period. This places an onus on a scientific community to determine and define what constitutes a change – the separation of human induced and natural variability .... a near impossible task.

The convention recognised that some climate change is inevitable. Its approach in measuring/recognition of effects and impacts will allow some vulnerable countries to prepare for the adverse effects of climate change. The inclusion of food production in the objectives is important for Africa in the short term. Parties should take measures and policies that are precautionary, cost effective and comprehensive but which would also take into account socio-economic contexts. They should not constitute a means of arbitrary and unjustifiable discrimination or a disguised restriction on international trade.

The initial target underlying the Kyoto Protocol stipulates and overall emission reduction in greenhouse gasses of at least 5% below the 1990 emission level during the commitment period 2008 to 2021. In addition to the reduction of emissions + technological improvements - carbon sinks resulting from human-induced land use change and forestry activities ... shall be used to meet the commitments. For New Zealand the responsibility is to reduce [or mitigate] GHG emission by 8% on 1990 levels by the years 2008- 2012.

Unlike other regions the three most important GHG in New Zealand are carbon dioxide, methane and nitrous oxide that arise principally from the agriculture sector rather than industrial productivity. The difficulty of our responsibility in the reduction of emission arises from the 'unknown state' where methane and nitrous oxide come specifically from enteric fermentation by ruminants. Research indicates that there are high and low emitting animals and that feed quality can reduce ruminant emission by 10% - the modification of stomach bacteria seems a potential source of emission improvement. Diet manipulation and changing winter management practices offers another potential source to the reduction of nitrous gasses but these could be counter-effected by methane emissions and carbon storage in soils.

In respect of carbon dioxide various attempts to reduce fossil fuel consumption through improvement to technologies, particularly vehicle emissions [reduce private car usage], transport planning and traffic management

are all 'on going' issues. Of significance is our greater use for renewable energy hydro, wind and solar as well as continuing trends for building insulation, heat reflection and better uses in entropy – promotion of energy efficiency.

Increasing our carbon sink through afforestation and the prevention of deforestation are considered short term options both in the removal of carbon dioxide and having the additional benefit of stabilizing land and soil.

The land-use, land-use change and forestry sector represented the removal of approximately 30.3% of all New Zealand greenhouse gas emissions in 2003. While net removals were at a level 7% above 1990 figures New Zealand has a substantial area of estate planted forests [essentially *Pinus radiata*] which are an avenue to Greenhouse gas emission management. Future directions for GHG emissions may, however, need to place greater emphasis on the ecology and effectiveness of plant species [or stages of life history] that maximize CO<sub>2</sub> conversion during a photosynthetic period. Commercial plantations [some of which cover Maori land estates or have Maori controlling interests in management – skilled Maori workforce] have removed and stored substantially more CO<sub>2</sub> than has been emitted through forest harvesting of both planted and natural forests.

### Indigenous knowledge bases

Our understanding of climate change makes greater sense when scientific data can be read in conjunction with Indigenous knowledge. Valuable historical information is located within oral testimony *purakau*, *waiata* and *whakapapa* which identify previous experiences of a type that will assist in the reconstruction of long-term climate trends, and to some extent a regional predictability.

From Tangaroa: *tiaki mai I ahau, maku ano koe e tiaki* – look after me and I will look after you

Most *hapu* have generations of experience using environmental indicators to predict current events and change in weather patterns. These are based on a consistency of observation of particular events arrival/departure of migratory species, the calls and flock movements of birds, an onset and intensity of flowering in native plant species and the phenomena of cloud caps and sun halo. Shifts in wind directions and wind speeds are associated with both local short weather events and the onset or conclusion a seasonal period. Activities for planting, harvesting, fishing, weaving were often regulated by

predictive events in regional weather patterns but the onset of all seasonal activities was largely governed by the astronomical event of *Matariki* [Pleiades]. The arrival of this cluster on the dawn eastern horizon (c. June 19-25) marks the beginning of the Maori New Year – a time of resting and preparation with main crop planting still about three months away. When the stars of *Matariki* appear widely apart a warm season is expected but when stars appear close together the following growing season will be cooler. King et al, (2005) acknowledge the success and reliability of Maori weather and climate predictability and suggest potential benefits to a cohesive model [complementarity] of climate understanding that might be gained through the cooperative deployment of Maori knowledge and western science capabilities.

### Human impacts on habitat fragmentation and species loss

In New Zealand more indigenous land habitat has been converted to pastoral and horticultural farmland (c.51%) than the given world average (37%) for similar agricultural practice. Our forest cover, once greater than 85% of land area, has been reduced to remote mountainous areas or to widely dispersed and highly fragmented lowland and coastal relics. Clear felling and extensive burning were the conventional preliminaries to pastoral farming – habitat loss and wildlife recovery programmes were not was not perceived as a particular issues. Replacing native forest and grassland with pastoral plant species has resulted in the contraction of territorial range for native biota and a contemporary exploitation by non-native varieties. There is an associated similarity of responses prevalent in soil faunas - contraction of native earthworms, ring nematodes, land snails and various arthropods, while in areas that have undergone land use changes there is evidence to suggest increases in native insect faunas have occurred.

Habitat and niche space has become reduced by the total conversion or fragmentation of an existing natural habitat, including wetland, duneland and tussock grassland, to pasture. Natural habitats have secondarily become degraded by introduced but commercially significant species like *Pinus radiata* plantations, pastoral grasses and crops, introduced horticultural varieties and invasive weeds.

Satellite imagery records of two northern native forests Waipoua (22 750 ha) and Omapere (5151 ha) show that both have been extensively fragmented - Waipoua 537 patches (mean size 42.5 ha) and Omapere 404 patches



*Paru* is a carbonaceous mud (found at the Kakahoroa reserve in New Zealand), which provides an important traditional black dye. Climate change can alter the dispersion of these types of sediments in rivers and estuaries. Photo by Brett Stephenson.

(mean size 12.75 ha). Size and patchiness of these forest relics have a major impact on habitat and niche space affecting the viability of faunal home range and feeding territory and depressing both linear and circular forms of plant succession as well as cross pollination and seed dispersal opportunities. A similar argument exists for wetlands and tussock land.

Distribution and densities of native faunas, many of which exist as ancient relics (isolated from continental evolution during the tertiary period) have suffered huge losses through human impacts. Ground feeding, nocturnal, New Zealand Brown Kiwi have the usual feeding /foraging range of about 100 m but because of forest disturbances they may encounter open pasture intervals >300m between foraging sites. Patch intervals have even greater significance when considered in relation to seed masting effects which is common place amongst New Zealand podocarps. In most years it is estimated that some species [beech and rimu] increase seed production up to 5000%.

Though not fully understood there is strong evidence that hot, dry, conditions in late summer and autumn will lead to a mast year in the following spring/summer. The reliance of New Zealand flora on reptile and bird faunas for seed dispersal [food resource] means that the seed mast may operate to control population sizes. In years when seed production is poor some bird species do not attempt to breed. Climate change will bring drastic change to the already precipitous event of seed masting and the reliance of native species for seeds as food resources.

## Impacts of sea level changes on Indigenous resources

Water, food sources and habitat diversity are critical to Maori cultural practices. Loss of habitat stability in climate change brings concerns for distribution and survival of migratory species on which Maori rely as food resources. Progressive rises in sea level will alter the character of existing estuary proportions and the extent of a tidal wedge may occur further upstream of current exchanges creating additional delays to freshwater river/stream flow. There will be alterations to the dispersion of river sediments, flow channels, estuarine biota – palustrine habitat becomes saline. For diadromous species nesting sites may become lost or displaced, the passage of water [direction and velocity] or water in olfactory messaging [Kokopu egg release] will be altered to the degree that life cycles are disrupted. Tuna [freshwater eel] stocks will suffer similar disruptions consider the implications given by oral whakapapa – Maori use of lunar cycle timing in predicting the sea migration [pre-spawning] catadromy of tuna is now also used in hydro dam water release operations to prevent turbine clogging.

Water depth and current velocity determine the predominant use of a water way passage during fish life history phases. Criteria for salmonids and galaxiids [fish spawning, feeding movements and fish passage] habitat uses show velocity and depth preferences with increasing fish size. There is a relative importance of different feeding behaviour associated with channel morphology and flow regime. Salmonid drift feeding (Hayes, 2004) predominates in steep to moderate gradients of river reaches – benthic browsing and cruise feeding occurs in low gradient slow water especially where the stability of water velocity has over a passage of time allowed for invertebrate taxa to establish successfully.

## Wetlands offer unrealized value

Water is the life giver and preserver – a source drawn from the mixing of the blood of Papatuanuku and the tears of Ranginui - therefore significant in spiritual and whakapapa relationships. Wetland was a recognised water source but also a living space determined by its sponge-like quality, absorbing excess water during high rainfall and releasing it slowly during drought periods. The wetland is a major source for food, cultivation and plant/organic materials associated with our physical culture. Maori developed an intensified form of domesticated horticulture through an interrelated complex of irrigation and drainage using wetland and associated stream networks. The complex was simply not one of drainage

to secure dry pastoral land - the essential conservation of a water system having regard for its life bearing properties to [other than human] organisms by ponds and waterway networking was maintained within the land use mosaic.

More importantly, wetland biodiversity offered a multitude of opportunity and resources each one 'at a time' a phase of succession, seasonal rhythm or life stage. Depending on the extent of the wetland or its riparian character with deeper/running water there is a significant relationship as a means to flood and drought protection, travel and communication. Waterways are the home to many forms of taniwha that ensure physical and spiritual protection – in this way particular types or areas (wahi tapu) of wetland became a source of cleansing and healing. *Paru* an organically rich, anaerobic altered, blue/black mud supply was sourced from certain wetland spaces and is a traditional source to dying fabrics.

Maori resistance to European wetland ownership and destruction has been continuous throughout the history of colonisation - much of which was embedded in their expert knowledge and high regard for wetland resource. Pastoral farming has misinterpreted and misused the opportunity of wetland spaces. The engineering effort to discharge water (particularly floodwater) from wetland failed to note geomorphological principles associated with sediment transport and soil loss as well as downstream events at river discharge points, on coastal sediment supply and its redistribution. Under climate change wetlands will become pivotal to water storage, filtration and re-supply. The dynamics of the floodplain will make the summertime pasture paradise of a few cows even less desirable and economically unviable.

### Changing food resources

Like other indigens, those of us with access (albeit limited supply) to natural resources still carefully maintain, use and enjoy their benefits. In the sense of food resources they extend or substitute our diet and as much as some might simply be morsels or flavorings we retain the knowledge of their cultivation, collection and preparation. These may include the more unusual materials like *karengo* (red seaweed), *pikopiko* (fern fronds), *puha* (sour thistle), *karaka* berries, water cress, gourd and rotten corn. Equally we make wider use of each product for example *kina* (sea urchin), *tio* (oyster), *paua* and *kutai* (mussel), have their shells retained for other uses; fish heads and crayfish bodies are more of a specialty than other body parts enjoyed by non-indigens.

In altered rainfall and temperature regimes Maori may choose to substitute their principle root storage crop [carbohydrate source] from Kumara plantations warm/dry to Taro wet/tropical with no new social/horticultural experience required. Non-indigens may not feel so comfortable about replacements for rice and potato – sago and tapioca come to mind. What emerges is the significance of retaining and nurturing traditional knowledge and expertise since it provides for shifts in food (or pharmacological) sources and supply outside of a current commercialized crop bound to a pathway of genetic selection and horticultural experience – one that is modeled in a contemporary climate regime. The rapidity of climate change will almost certainly disaffect commercial supply and in so doing will fail the expected demands of a society in which diet and food sources have become overwhelmingly conditioned by the market place.

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# International Indigenous Responses

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For the past decade, Indigenous Non-Governmental Organizations (NGOs), and some Indigenous governments, have been attempting to participate in the international discussion around global warming, and to intervene in the international climate change regulatory framework. Since 1998, for example, they have attended the Conferences of the Parties (COPs), or the annual meetings of the state signatories of the global warming treaty: the United Nations Framework Convention on Climate Change (UNFCCC). Indigenous groups' goals are both to urge a reduction in greenhouse gas emissions that threaten Native lands and resources, to secure recognition of Indigenous nations as holding a "special status" in climate change negotiations, and gain international support for their efforts to mitigate global climate change.

Indigenous NGOs and nations have also taken a number of other paths to work internationally around climate change. They have called the attention of other United Nations agencies to climate change as a pressing issue of economic, social and cultural rights, and asserted the role of Traditional Ecological Knowledge in identifying and adapting to climate change. They have used international law to bring legal complaints to international legal forums, such as the Inter-American Human Rights Commission. Indigenous nations have also asserted their sovereignty through the pursuit of "climate justice"--by developing partnerships with local governments to reduce carbon emissions, and using trust responsibility mechanisms to influence national government actions. Native nations have also weighing whether to sign the Kyoto Protocol themselves as sovereign entities, and most recently whether to adopt renewable energy technologies to pull back from the centralized fossil fuels economy and develop their tribal economies.

## **INTERNATIONAL LEGAL CONVENTIONS**

Indigenous NGOs consistently refer to specific international legal conventions to justify their call for a stronger Indigenous role in combating and mitigating climate change. The body of international law they cite is situated at the intersection of racial minority rights,

minority cultural rights, Indigenous land rights, global environmental protection and sustainable development. Some of the international law was established by regional bodies, such as the American Declaration of Rights and Duties of Man, in which Western Hemisphere governments agreed to rights protections later adopted by the Organization of American States (Inter-American Commission on Human Rights 1948).

Most of the international law involved in Indigenous climate change advocacy was promulgated by the United Nations. For example, Indigenous groups cite the UN Convention on Racial Discrimination, which states "Special concrete measures shall be taken in appropriate circumstances in order to secure adequate development or protection of individuals belonging to certain racial groups with the object of ensuring the full enjoyment by such individuals of human rights and fundamental freedoms." (UN Convention on Elimination of All Forms of Racial Discrimination 1963). Other UN conventions and declarations have also provided fodder for Indigenous organizations, even if the UN agencies involved do not primarily work around Indigenous issues.

## **International Labour Organization**

The International Labour Organization (ILO) is a United Nations agency originally founded in 1919 to improve employment and workers' rights and conditions. In 1989, it adopted Convention 169, "concerning Indigenous and Tribal Peoples in Independent Countries." Much of ILO Convention 169 concerns employment and working conditions for Indigenous communities, but Article 4 specifically addresses environmental and cultural rights: "Special measures shall be adopted as appropriate for safeguarding the persons, institutions, property, labour, cultures and environment of the peoples concerned. Such special measures shall not be contrary to the freely-expressed wishes of the peoples concerned."

In addition, ILO Convention 169 Article 7 relates to development activities: "The peoples concerned shall have the right to decide their own priorities for the

process of development as it affects their lives, beliefs, institutions and spiritual well-being and the lands they occupy or otherwise use...In addition, they shall participate in the formulation, implementation and evaluation of plans and programs for national and regional development which may affect them directly.

...Governments shall ensure that, whenever appropriate, studies are carried out, in cooperation with the peoples concerned, to assess the social, spiritual, cultural and environmental impact on them of planned development activities. The results of these studies shall be considered as fundamental criteria for the implementation of these activities. Governments shall take measures, in cooperation with the peoples concerned, to protect and preserve the environment of the territories they inhabit” (International Labour Organization 1989).

### **United Nations Environmental Summits**

The United Nations Conference on Environment and Development (UNCED), popularly termed the “Earth Summit,” drew world leaders to Rio de Janeiro, Brazil, in June 1992. A parallel conference was held by environmental NGOs (and some Indigenous groups) critical of pro-corporate biases of the attending governments. At the Rio Earth Summit, world leaders signed key agreements on the global environment and sustainable economic development, some of which include references to Indigenous rights.

For example, the “Rio Declaration on Environment and Development” signed by world leaders at the Earth Summit included Principle 22, which states that “Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests, and enable their effective participation in the achievement of sustainable development.” (Rio Declaration on Environment and Development 1992).

The Earth Summit leaders also adopted “Agenda 21” as a global “Program of Action on Sustainable Development” to guide the UN and national governments. Agenda 21 included Chapter 26, specifically “Recognizing and Strengthening the Role of Indigenous Peoples and their Communities.” Chapter 26 offers “Recognition that the lands of Indigenous people and their communities should be protected from activities that are environmentally unsound or that the indigenous people concerned consider to be socially and culturally inappropriate; Recognition of their values, traditional

knowledge and resource management practices with a view to promoting environmentally sound and sustainable development; Recognition that traditional and direct dependence on renewable resources and ecosystems, including sustainable harvesting, continues to be essential to the cultural, economic and physical well-being of indigenous people and their communities” (UN Department of Economic and Social Affairs 1992b).

Agenda 21 also included Chapter 11 on “Combating Deforestation,” another section that Indigenous NGOs have cited to combat climate change. Chapter 11 commits governments to “undertaking supportive measures to ensure sustainable utilization of biological resources and conservation of biological diversity and the traditional forest habitats of indigenous people, forest dwellers and local communities.”

In a related document at the 1992 Earth Summit, the UN issued Annex III, or the “Statement of Principles for a Global Consensus on the Management, Conservation, and Sustainable Development of All Types of Forests.” Principle 5(a) of this Statement on Forest Principles states that “National forest policies should recognize and duly support the identity, culture and the rights of indigenous people, their communities and other communities and forest dwellers. Appropriate conditions should be promoted for these groups to enable them to have an economic stake in forest use, perform economic activities, and achieve and maintain cultural identity and social organization, as well as adequate levels of livelihood and well-being, through, inter alia, those land tenure arrangements which serve as incentives for the sustainable management of forests” (UN Conference on Environment and Development 1992).

One decade after the Earth Summit, the United Nations held the World Summit on Sustainable Development (WSSD) in Johannesburg, South Africa. The 2002 Summit assessed the progress made since the 1992 Summit, and so was popularly termed “Rio+10.” The WSSD was also criticized by many environmental NGOs, and Indigenous NGOs held a parallel International Peoples International Summit on Sustainable Development. The Indigenous delegates issued the “Kimberley Declaration” that echoed many of the same demands as Indigenous statements at the UNFCCC, and reiterated that “Since 1992 the ecosystems of the earth have been compounding in charge. We are in crisis. We are in an accelerating spiral of climate change that will not abide unsustainable greed” (Kimberley Declaration 1992). The Kimberley summit also issued an “Indigenous People’s Plan of

Implementation on Sustainable Development” which specifically urged governments to ratify and strengthen the Kyoto Protocol to reduce greenhouse gas emissions, but opposed UNFCCC programs for carbon sinks and carbon-trading mechanisms.

### **Convention on Biological Diversity**

The Convention on Biological Diversity (CBD) was also adopted at the 1992 Rio Earth Summit, but followed its own separate evolution. Indigenous representatives participated directly in the negotiations, as part of national government delegations. For example, Tulalip Tribes Natural Resources Director Terry Williams, from Washington state, participated as part of the U.S. State Department delegation, but in the process had to educate his fellow delegates about Native American treaty rights. He played a similar role in the successful Stockholm Convention talks for the 2001 treaty banning Persistent Organic Pollutants (POPs)—the bioaccumulating harmful chemicals such as PCBs. In that case, the Clinton Administration directed the U.S. Environmental Protection Agency to consult with tribes on their interests in the POPs Treaty process.

The final CBD included Article 8(j) on Indigenous knowledge and biological diversity, which states: “Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices.” (UN Convention on Biological Diversity 1992a). As part of the follow-up to the Convention on Biological Diversity, the CBD Secretariat developed a Working Group on Article 8(j) to recognize and deepen the role of Indigenous Traditional Knowledge in the implementation of UN projects (UN Convention on Biological Diversity 1992b).

### **Draft Declaration on the Rights of Indigenous Peoples**

Indigenous nations have taken their visions and grievances to international forums in Geneva since Haudenosaunee statesman Deskaheh visited the League of Nations in 1923, and especially since Native leaders attended the United Nations Conference on Discrimination Against Indigenous Peoples of the

Americas in 1977. Greater world attention and understanding focused on Indigenous rights around the time of the 1992 Columbus Quincentennial and, as a result, the United Nations declared the International Decade for the World's Indigenous Peoples in 1995-2004, and established a Permanent Forum on Indigenous Issues.

As part of the International Decade, intense negotiations began in Geneva to develop a Draft Declaration on the Rights of Indigenous Peoples. Representatives of Indigenous NGOs and some governments attended the negotiations, and often sparred with representatives of UN member states, particularly the U.S., Australia, New Zealand, Canada and Russia. After 12 years of talks, the United Nations Human Rights Council finally settled on a draft in June 2006, and recommended its passage in the General Assembly. (Canada and Russia were the only two countries to vote against the Council’s approval of the Draft Declaration.) The adoption of the Draft Declaration would in particular direct UN agencies, including the UNFCCC, to be more open to Indigenous concerns. If approved by the General Assembly in its present form, the Declaration would strengthen Indigenous appeals for governments to curb or mitigate climate change, because of Articles (listed below) that specifically refer to impacts of environmental and development policy on Indigenous peoples (United Nations Human Rights Council 2006):

*Article 21:* “Indigenous peoples have the right to maintain and develop their political, economic and social systems or institutions, to be secure in the enjoyment of their own means of subsistence and development, and to engage freely in all their traditional and other economic activities.”

*Article 25:* “Indigenous peoples have the right to maintain and strengthen their distinctive spiritual relationship with their traditionally owned or otherwise occupied and used lands, territories, waters and coastal seas and other resources and to uphold their responsibilities to future generations in this regard.”

*Article 27:* “Indigenous peoples have the right to redress, by means that can include restitution or, when this is not possible, of a just, fair and equitable compensation, for the lands, territories and resources which they have traditionally owned or otherwise occupied or used, and which have been confiscated, taken, occupied, used or damaged without their free, prior & informed consent.”

*Article 28:* “Indigenous peoples have the right to the conservation and protection of the environment and the

productive capacity of their lands...and resources....”

*Article 30:* “States shall provide effective mechanisms for just and fair redress for any such activities, and appropriate measures shall be taken to mitigate adverse environmental, economic, social, cultural or spiritual impact.”

## **INTERNATIONAL INDIGENOUS EFFORTS ON CLIMATE CHANGE**

At the 1992 Earth Summit in Rio, the participating states finalized an international environmental treaty to reduce the emission of greenhouse gases that cause global warming. The United Nations Framework Convention on Climate Change (UNFCCC) has since been signed by 189 nations, including the United States. The UNFCCC provides the main arena for global climate change politics. But some Indigenous peoples have also been pursuing other strategies outside the United Nations framework, by using human rights avenues, building partnerships with city governments, and adopting renewable energy technologies to pull themselves away from fossil fuels. All these international strategies build not only from international legal doctrines, but from the cultural and spiritual values of Indigenous peoples themselves.

### **United Nations Framework Convention on Climate Change (UNFCCC)**

The initial UNFCCC treaty included no mandatory limits on greenhouse gases, and no enforcement mechanisms, but established a framework for “protocols” or updates to reach these goals. Every year, the signatory countries attend a Conference of the Parties (COP) to develop and approve protocols. Indigenous representatives have attended all the COPs since 1998, and have issued demands of the signatory countries for inclusion into the UNFCCC process.

In 1997, nations attending COP-3 in Kyoto, Japan, approved a protocol that established mandatory targets would reduce emissions by 6-9% (to below 1990 levels) by 2012. The Bush Administration refused to ratify this particular “Kyoto Protocol.” It has since been approved by 163 signatory countries, which emit 65 percent of all greenhouse gases. The Kyoto Protocol, which has become better known than the UNFCCC itself, entered into effect in 2005. Beginning at COP-12 in Montreal in 2005, the Protocol signatories began to meet concurrently in a separate Meeting of the Parties (MOP). COP-13/MOP-2 will be held in Nairobi in November 2006.

At each COP since 1998, Indigenous representatives have attended the proceedings, and met together as a caucus, sometimes in conjunction with local (non-Native) governments. Most of the Indigenous delegates represent NGOs, but some have also represented Indigenous governments (such as the Buffalo River Dene Nation in Canada). Before or during the COPs, the Native representatives have met in an International Indigenous Forum on Climate Change (IIFCC), and issued declarations or caucus statements that outlined their interest in climate change, and made demands of the UNFCCC Secretariat and the treaty’s signatory countries. These demands would be even stronger if they were made by Indigenous government officials, as part of a government-to-government relationship with a signatory state.



Parshuram Tamang (standing) of the UN Permanent Forum on Indigenous Issues, and Marcial Arias Garcia (right) of the International Alliance of Indigenous Peoples, call for increased participation of Indigenous peoples in the UNFCCC process in Bonn, 2004.

The annual declarations establish an inherent Indigenous interest in the effects of climate change, and call for a reduction in greenhouse gas emissions for the sake of their survival of their cultures and the planet. Indigenous nations (like many of the smaller “Annex II” countries that signed the Kyoto Protocol) emit very few greenhouse gases themselves, and are therefore at the mercy of the “Annex I” countries that emit the lion’s share of the harmful gases (and are counted by the UN as part of these larger countries).

The declarations all point to the need for the UNFCCC to recognize the “special status” of Indigenous nations in the international regulatory processes around climate change, and to have their own seat at the table.

Indigenous nations are not only the “miner’s canary” that are the first affected by climate change, but also have Traditional Ecological Knowledge that offers early warning of impending climatic changes (and offers traditional practices that can reduce emissions), and the ability to “test-drive” possible models for community mitigation and adaptation to these changes. Indigenous nations are neither NGOs nor full U.N. member states, so need their own intermediate political niche in order to participate fully in the regulatory process.

The declarations specifically demand the creation of an open-ended inter-sessional Working Group on Indigenous peoples and climate change, to study and propose effective solutions to respond to the emergency situations caused by climate change affecting Indigenous peoples. In addition, many of the declarations demand that Indigenous concerns become a permanent agenda item for each COP, and that the UNFCCC Secretariat in Bonn create a permanent division for Indigenous concerns. In 2003, the United Nations Permanent Forum on Indigenous Issues demanded that the UNFCCC include a Working Group on Indigenous Peoples and Climate Change—a demand that may be reinforced by the passage of the Draft Declaration.

The Indigenous declarations point out that Native peoples possess practices and knowledge for minimizing the emission of greenhouse gases, and are currently undertaking scientific and technical initiatives based on their traditional practices, which generate knowledge on production systems which have a minimal greenhouse

effect. They also volunteer Native communities for renewable energy projects that use solar, wind, and other alternative power, both to provide models for energy conversion, and to strengthen the sovereignty and economic sustainability of their communities.

The declarations also point out that Indigenous peoples have funding needs to participate fully and equally in the climate change research and regulatory processes. These needs include financial mechanisms to attend COPs and other UNFCCC meetings, financial capacity to research local impacts of climate change, and particularly to mitigate harmful effects on their communities. They ask that any Climate Impact Assessments of their regions involve full and equal Indigenous participation (including Indigenous knowledge systems and observations), and generate scientific data and knowledge that can be used directly by the affected communities. The statements generally do not ask for financial compensation for harmful effects, given that the gases’ specific origins are difficult to track in any legal sense, and money is no compensation for the loss of ancient cultural systems and natural resources.

## CONFERENCES OF THE PARTIES (COPS) OF THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

### Indigenous declarations to the UNFCCC

In the first Indigenous statement intended directly for the United Nations climate change treaty process, the 1998 Albuquerque Declaration stated: “There is a direct relationship between the denial of Indigenous Peoples land and water rights, along with the appropriation without consent of Indigenous Peoples’ natural resources,

### INDIGENOUS STATEMENTS TO CONFERENCES OF THE PARTIES (COPS) OF THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC)

Year	COP	City	International Indigenous Forum on Climate Change (IIFCC) statement, or other Indigenous declaration before or at UNFCCC
1998	4	Buenos Aires	Albuquerque Declaration
1999	5	Bonn	
2000	6	The Hague	1st IIFCC (Lyon), 2nd IIFCC (The Hague), Quito Declaration
2001	6-B	Bonn	3rd IIFCC (Bonn Declaration)
2001	7	Marrakech	Indigenous Peoples & Local Communities Caucus
2002	8	New Delhi	Indigenous Caucus Statement on Climate Change
2003	9	Milan	6th IIFCC (Milan Declaration)
2004	10	Buenos Aires	Buenos Aires Declaration
2005	11	Montreal	Tiohtiá:ke (Montreal) Declaration, Arctic Indigenous Statement / Youth Statement
2006	12	Nairobi	



Indigenous representatives provide a briefing on their positions on the UNFCCC in Bonn, 2001. Panel (left to right): Patriona Dumar (Pacific Concerns Resource Centre, Fiji), Raymond de Chavez (TEBTEBBA Foundation, Philippines), Alfred Ilenre (Ethnic Minority and Indigenous Rights Organizations of Africa, Nigeria), Sebastião Manchineri (Coordinating Body for the Indigenous Peoples Organizations of the Amazon Basin, Brazil), Translator; Moderator Hector Huertas (Indigenous Peoples of Meso America on Climate Change, Panama), and Robert Gough (Intertribal Council on Utility Policy, United States). Photo courtesy of ENB-Leila Mead, IISD: <http://iisd.ca>

and the causes of global climate change today...The four elements of fire, water, earth and air sustain all life. These elements of life are being destroyed and misused by the modern world. Fire gives life and understanding, but is being disrespected by technology of the industrialized world that allows it to take life such as the fire in the coal-fired powered plants, the toxic waste incinerators, the fossil-fuel combustion engine and other polluting technologies that add to greenhouse gases. Coal extraction from sacred earth is being used to fuel the greenhouse gases that are causing global climate warming" (Albuquerque Declaration 1998).

The 2000 Lyon Declaration stated: "Despite the recognition of our role in preventing global warming, when it comes time to sign international conventions...once again, our right to participate in national and international discussions that directly affect our Peoples and territories is denied. Our active opposition to oil exploration, logging and mining helps prevent the accelerated deterioration of the climate. Nonetheless, our territories have been handed over to national and multinational corporations who exploit our natural resources in an

indiscriminate and unsustainable fashion. Any decision or action...must include our full and effective participation." (International Indigenous Peoples Forum on Climate Change 2000a).

The 2000 Hague Declaration of Indigenous Peoples and Climate Change asserted: "We are profoundly concerned that current discussions...do not recognise our right to adequate participation. These policies and mechanisms exclude us as participants, deny our contributions, and marginalize our Peoples. These policies and mechanisms will permit developed countries to avoid their responsibility to reduce emissions at source, promote the expansion of global capital, and deepen our marginalization....Concepts, practices, and measures, such as plantations, carbon sinks and tradeable emissions, will result in projects which adversely impact upon our natural, sensitive and fragile eco-systems, contaminating our soils, forests and waters. In the past, even well intentioned development policies and projects have resulted in disastrous social and ecological consequences" (International Indigenous Peoples Forum on Climate Change 2000b).

The 2001 Bonn Declaration added: “The discussions under the UNFCCC and the Kyoto Protocol have totally excluded the indigenous peoples to the extent that neither recognizes the right of indigenous peoples to full and effective participation and to contribute to discussions and debates. This contrasts with other international processes which assure our participation and contribution within discussions....We openly oppose the measures to mitigate climate change under discussion that are based essentially on a mercantilist and utilitarian vision of the forests, seas, territories and resources of Indigenous Peoples, which are being exclusively valued for their capacity to absorb CO2 and produce oxygen, and which negate our traditional cultural practices and spiritual values” (International Indigenous Peoples Forum on Climate Change 2001).

At COP-7 in Marrakech, Morocco, the Indigenous Peoples and Local Communities Caucus stated: “No development mechanism can be clean, from our point of view, if it does not guarantee the rights of Indigenous Peoples including the right to free, prior informed consent of indigenous and local communities and the respect of our cultures, practices, sciences and knowledge. Nonetheless, we resolve to continue contributing with our knowledge of nature conservation and management to prevent and mitigate the effects of climate change...To correct this inconsistency, we need an adequate space and special status in the structure of the UNFCCC” (Indigenous Peoples and Local Communities Caucus 2001).

At COP-8 in New Delhi in 2002, the Indigenous Peoples' Caucus Statement on Climate Change asserted: “We, Indigenous Peoples, live in sensitive zones where effects of climate change are most devastating. Traditional ways of life are disproportionately affected by climate change particularly in polar and arid zones, forest, wetland, river and coastal areas...The Kyoto Protocol is not sufficient to reverse, mitigate or stop the catastrophes that threaten our Mother Planet Earth” (Indigenous Peoples' Caucus Statement on Climate Change 2002).

At COP-9 in Milan in 2003, the Sixth International Indigenous Peoples Forum stated: “Our special relationship with Mother Earth is sacred and must be honored, protected and loved. We further declare our holistic vision which strongly binds biological diversity, cultural and spiritual identity and unites people with its ancestral territories. Our ancestral territories, spiritual, social, biological and cultural resources are the fundamental basis for our existence, health and livelihoods but are threat-

ened and destroyed by climate change and its consequences....The United Nations has clearly recognized our rights to participate in the UN processes.... We call upon the UNFCCC to recognize that through the protection and promotion of Indigenous Peoples' rights and through recognizing and integrating our dynamic and holistic visions, we are securing not only our future, but the future of humanity and social and environmental justice for all” (International Forum of Indigenous Peoples on Climate Change 2003).

The tone of Indigenous representatives' frustration became evident at COP-10 in Buenos Aires in 2004: “We are hearing from the states the same old arguments being discussed on how to alleviate and mitigate the climate disasters that affect all humanity. These arguments do not address the mounting costs of adapting to climate changes within our Indigenous communities, exemplified by the Indigenous peoples of the Arctic region whose lands are literally melting before their eyes...We consider this planet our Mother Earth where all humanity is born and nurtured. It is time that we looked to each other and that we listen to each other, recognizing and valuing the cultural and human qualities within each of us. .... Why our previous requests to ...provide a mechanism for us to actively participate in the UNFCCC were not listened to, are we not part of this planet?” (Buenos Aires Declaration. 2004).

COP-11 was held in Montreal in 2005, the first year after the implementation of the Kyoto Protocol. Indigenous representatives issued the Tiohtiá:ke Declaration, named after a Mohawk word for Montreal: “We reaffirm our inherent rights over our territories, lands and resources. Our cosmovision strongly binds biological diversity, cultural and spiritual identity and unites our peoples with our ancestral territories. This is the fundamental basis for our existence, health and livelihoods which are being disproportionately threatened and destroyed by climate change and its consequences. Indigenous Peoples require a human rights based approach in addressing climate change...Establish a process that works towards the full phase-out of fossil fuels, with a just transition to sustainable jobs, energy and environment. We are against the expansion of and new exploration for the extraction of oil, natural gas and coal within and near Indigenous lands, especially in pristine and sensitive areas....We once again remind you that one is only as healthy as the air we breathe, the water that we quench our thirst with each day, and the earth in which we plant our seeds to have the various products of sustenance for the duration of our journey here on Mother Earth” (International Indigenous

Peoples Forum on Climate Change 2005).

### **Should Indigenous nations sign the Kyoto Protocol?**

Part of the recent Indigenous discussion around the UNFCCC process has been whether Native governments should symbolically sign the Kyoto Protocol, much as many cities and municipalities have done in Europe and the U.S.—committing themselves to reducing greenhouse gases. Indigenous governments can certainly make a powerful statement of sovereignty by symbolically signing the Protocol. This statement would be particularly strong in the United States, which is responsible for at least a quarter of global emissions yet refuses to sign the Protocol. The Little Traverse Bay Odawa in Michigan and Lac Courte Oreilles Chippewa in Wisconsin have signed on to the Kyoto Protocol, by adopting a resolution created by the Honor The Earth organization, adopting renewable energy standards as their way to curb climate change (Honor The Earth 2005). The Little Traverse Bay Bands resolution states:

“...Global warming poses significant threats to indigenous and non-indigenous communities across the world in the form of heat waves, drought, shrinking water supplies and snow pack, catastrophic fires, floods and storms, coastal erosion, new diseases, and loss of traditional plant and animal life....We believe that it is our right and our duty to institute a new energy economy, one whose foundation is built on the efficient and profitable use of clean energy that supports our tribal self-sufficiency and sovereignty....Actions taken to reduce greenhouse gas emissions and increase energy efficiency provide multiple local benefits by decreasing air pollution, creating jobs, reducing energy expenditures, and saving money for the community....The Little Traverse Bay Bands of Odawa Indians commits to meeting the requirements of the Kyoto Protocol and, in doing so, will strive to obtain 25% percent of our total energy from renewable energy sources by 2020” (Little Traverse Bay Bands of Odawa Indians 2005).

Yet not all Indigenous representatives to the UNFCCC advocate signing the Kyoto Protocol, and question whether the UNFCCC has been weakened to such an extent that it undermines Indigenous interests. They cite the UN Intergovernmental Panel on Climate Change (IPCC) that greenhouse gas emissions need to be immediately reduced by 60% in order to stabilize global temperatures—far above the Kyoto targets. They also oppose the implementation of “carbon sinks” and “carbon-trading mechanisms” in the Clean Development Mechanism (CDM) of the Kyoto Protocol, and the

World Bank’s Prototype Carbon Fund. Both economic programs treat carbon as a tradable commodity, and allow Annex I (developed) countries to buy and sell carbon credits on a global market. Carbon-trading mechanisms allow corporations that emit carbon to avoid fines and penalties by offsetting their carbon production, in the form of buying carbon credits from operations that reduce the amount of carbon emissions.

Environmental groups point out that these carbon commodity mechanisms allow developed countries such as the U.S. to continue polluting the atmosphere with greenhouse gases, if they offset the pollution in other ways. For example, the CDM identifies large forests (in countries such as the U.S. or Brazil) as “carbon sinks” that absorb carbon dioxide, thereby allowing those countries to emit more gases. Indigenous declarations to the UNFCCC have pointed out that so-called “conservation” measures in these “carbon sink” forests and fields would restrict Indigenous harvesting practices, and that such land use priorities could even exclude traditional activities in the name of protecting the atmosphere.

Indigenous critics of carbon trading also fear that the CDM goal to “clean up” the emissions of burning fossil fuels may lead to the mining of more oil, coal, and natural gas on Native lands (not to mention uranium as nuclear power is increasingly promoted as an alternative to fossil fuels). Some southwestern U.S. reservations have already seen detrimental effects from fossil fuel and uranium extraction on their air, surface waters, and underground water tables. A commitment by resource-rich tribes to not participate in this fossil fuel extraction would send a strong message to the energy industry, yet the mining revenues would need to be replaced to continue tribal economic development. The Council of Energy Resources Tribes (CERT), which represents these resource-rich tribes, has initiated renewable energy projects, but has not yet discussed reducing fossil fuel extraction in order to secure carbon credits.

In contrast, northern Australian Aboriginal communities have reduced greenhouse gas emissions by instituting traditional fire abatement practices. As *Cultural Survival* notes, “The scheme, called the Arnhem Land Fire Abatement Project, is aimed not only at reducing the severity of wildfires, but also at providing a substantial stream of income for Aborigines through international carbon-emissions trading programs” (Cherrington 2006).

Indigenous Pacific Island states, such as Vanuatu and Kiribati, stand to lose the most from climate change, and in fact have already begun to lose islands to rising

sea levels. Since they emit only a tiny fraction of the world's atmospheric carbon, and have few forests that qualify as carbon sinks, they tend to favor carbon credit systems. Although they are fully sovereign, and are member states of the United Nations, they have little voice in global climate change forums. As former colonies that only recently gained independence, they are subjected to neocolonialism, with their economic survival still dependent on the U.S., Australia, New Zealand, etc.

The experience of Pacific Island states is an object lesson for Indigenous nations that are not fully sovereign, and that are counted as part of states in "developed regions" that are large carbon emitters. If sovereign UN member states do not have powers to protect their environment and cultures, how can semi-sovereign Indigenous nations? Yet Pacific Island states do have a positive track record of cooperation in the face of a common environmental threat. In 1968, France began conducting nuclear weapons tests in its colony of French Polynesia, contaminating some fishing zones with radiation. In the 1970s-80s, the tests were met with united objections by member states of the South Pacific Forum, and protests by Greenpeace and other environmental groups. In 1985, French intelligence agents bombed a Greenpeace vessel in New Zealand, killing one. The strong protests of South Pacific states, including New Zealand, played a role in pressuring nuclear powers to develop and sign the 1996 Comprehensive Test Ban Treaty.

This environmental mobilization of South Pacific island peoples is being repeated as they face the new threat of global climate change. Yet as small countries, they face more of an uphill struggle against global warming, and have been critical of many aspects of the UNFCCC process. As Tuvalu leaders told COP-5: "Providing us with capacity building, adaptation and other imaginative measures to mitigate climate change while refusing to institute domestic policy and political measures that will genuinely reduce global emissions is like treating us like the pig you fatten for slaughter at your eldest son's 21st birthday party" (South Pacific Regional Environment Program 1999).

### Human rights strategies

Besides the UNFCCC process, Indigenous organizations and nations have also used other approaches to internationalize their climate change demands, and expand the scope of their local community-based concerns to the global level. One of these approaches is to use the argu-

ment of human rights, for which there is a much more developed body of international law than for Indigenous rights or cross-border rights of environmental protection. The downside of using a human rights argument is that it focuses attention on the individual Indigenous person, rather than the collective sovereignty inherent in nationhood. It also tends to focus on compensation or financial settlement rather than complete justice.



Inuit panel representatives to the forum "Putting the Human Face on Climate Change: Perspectives from Inuit" at the UNFCCC COP-11 in Montreal, 2005.

Yet human rights approaches have also drawn attention to the violations of Indigenous rights, most notably the recognized right of cultural and religious expression of Native peoples. For example, in 1998 the United Nations Commission on Human Rights dispatched its Special Rapporteur on Religious Intolerance to (for the first time) investigate the United States for human rights violations. After visiting Native American communities and interviewing tribal members, he issued a statement and report condemned the U.S. for desecrating Native American sacred sites, and relocating Native peoples from ceremonial areas in their homelands (Amor 1998). A Special Rapporteur conceivably could be charged with investigating the impacts of climate change on Indigenous peoples, including their rights to traditional foods and other natural resources.

The most publicized use of human rights conventions has been by the Inuit Circumpolar Conference (ICC) which represents Inuit communities in Alaska, Canada, Greenland and Russia. In 2005, the ICC submitted a petition to the Inter-American Commission on Human Rights (based in the Organization of American States in Washington, DC) seeking relief from violations of the

human rights of Inuit resulting from global warming caused by greenhouse gas emissions from the United States. At COP-11 in Montreal, ICC Chair Sheila Watt-Cloutier explained that the petition is to pressure the U.S. to reduce greenhouse gas emissions, and not to secure financial compensation: “This petition is not about money, it is about encouraging the United States of America to join the world community to agree to deep cuts in greenhouse gas emissions needed to protect the Arctic environment and Inuit culture and, ultimately, the world. We submit this petition not in a spirit of confrontation—that is not the Inuit way—but as a means of inviting and promoting dialogue with the United States of America within the context of the climate change convention” (Inuit Circumpolar Conference 2005).

The ICC Chair further explained that the petition “will seek a declaration in international law that the erosion and potential destruction of the Inuit way of life brought about by climate change resulting from emission of greenhouse gases amounts to a violation of the fundamental human rights of Inuit. It will draw on the compelling combination of official science and traditional knowledge within the Arctic Climate Impact Assessment to focus political attention on the Arctic and Inuit dimensions to this global issue” (Watt-Cloutier 2004). She cited the previous success of the ICC in using scientific assessments of Persistent Organic Pollutants (POPs) in the Arctic to pressure states to hold the Stockholm Convention that banned the harmful chemicals. The POPs Treaty specifically cited Arctic peoples in its preamble, so serves as precedent for small Indigenous peoples having a central role in global environmental policy.

ICC attorneys Martin Goldberg and Martin Wagner submitted the petition to the Inter-American Commission on Human Rights. They cited the 1948 American Declaration of the Rights and Duties of Man as the basis for the complaint: “Many rights contained in the American Declaration, including the rights to life and personal security; to residence and movement; to inviolability of the home; to the benefits of culture; and to work and to fair remuneration, could serve as the basis of a complaint. Other rights – such as the rights to means of subsistence, to freely dispose of natural resources, and special protection for indigenous communities – have been recognized by the mission.... Formal recognition by an international authority like the Inter-American Commission of the connection between global warming and human rights would have a powerful impact on worldwide efforts to address global warming.... It would bring to the global warming discourse a

basis for holding responsible those who have profited from poorly regulated greenhouse gas emissions, and for placing limits on such emissions in the future. And it would be consistent with the growing international recognition that a healthy environment is fundamental to the enjoyment of nearly all of the most fundamental human rights” (Goldberg and Wagner 2004).

### **Energy partnership strategies**

Another innovative Indigenous approach to combat climate change has stepped outside of international legal regimes entirely, by developing direct relationships between Indigenous peoples affected by climate change and local governments in cities that generate greenhouse gases. The Climate Alliance of European Cities with Indigenous Rainforest Peoples is an association of European Union cities linked in partnership with Indigenous rainforest peoples. The 1,300 member municipalities in the Climate Alliance (representing about 50 million citizens) have resolved to reduce their emissions of the greenhouse gas carbon dioxide by 10 percent every five years, to cut their 1990 levels of greenhouse gas emissions in half (Environment News Service 2006).

Through the Climate Alliance, the European cities and municipalities are partnering with the Coordinating Body for the Indigenous Organizations of the Amazon Basin (COICA), a network of more than 400 Indigenous peoples, and the International Alliance of the Indigenous-Tribal Peoples of the Tropical Forests (IAIP). They “partner” with the Indigenous peoples by taking action to support Indigenous demands to protect the rainforest from the effects of climate change. The Manifesto of European Cities on an Alliance with Amazonian Indian Peoples supports “the preservation of the tropical rain forest, the basis of their very existence, through the demarcation and sustainable use of the Amazonian territories. Their defense of the forests and rivers is a contribution to sustaining the earth's atmosphere for future generations as the basic precondition for human existence” (Climate Alliance 1990).

Perhaps the most promising direction for Indigenous nations in combating climate change is in adopting renewable energy technologies that reduce Native dependency on the colonial economy, at the same time as providing a model for non-Indigenous communities of reducing fossil fuel use. As the Michigan tribal resolution backing the Kyoto Protocol states: “Tribal lands represent a vast amount of renewable energy potential, including wind and solar power that can meet the energy

needs of both local tribes and surrounding communities; wind power blowing through Indian reservations in just four northern Great Plains states could support almost 200,000 MW of power, enough to reduce output from coal plants by 30% and reduce our electricity base global warming pollution by 25%, and Great Lakes Indian nations could similarly produce alternative non-polluting renewable energy for our tribal communities and for export” (Little Traverse Bay Bands 2005).

Renewable energy projects on Native American reservations enable tribes to tap into federal funds, and use their sovereignty to shift their energy economies away from the centralized, fossil fuel-dependent model. On the Hopi Reservation, for example, Native SUN has been installing photovoltaic panels on tribal homes to harvest the Southwest’s abundant solar power (LaDuke 1999: 187-196). Other U.S. tribes are involved in energy projects that tap into geothermal, tidal or wind energy sources. They have asked Congress for renewable energy production tax breaks, because the export of renewable power can build a sustainable reservation economy that brings revenue and jobs to rural communities. The Intertribal Council On Utility Policy (COUP), a council of federally recognized tribes in the northern Great Plains, provides a tribal forum for policy issues



Terry Fredericks, of the Three Affiliated Tribes (Mandan, Hidatsa and Arikara), and vice-president of Intertribal Council On Utility Policy (COUP), after the recent installation of a 65-kilowatt wind turbine on the Fort Berthold Reservation in North Dakota. Photo by Robert Gough, Intertribal COUP ([www.nativewind.org](http://www.nativewind.org)).

dealing with energy operations and services. It asserts that U.S. tribes have “tremendous untapped energy potential in reservation wind resources” such that the Northern Great Plains could become the “Saudi Arabia” of renewable wind energy (Intertribal COUP 2006). In partnership with Native Energy, Intertribal COUP is developing an 80 MW distributed wind project, hosted in 10 MW clusters at eight different reservations (Native Energy 2006). With access to a predictable revenue stream from renewable energy, the tribes can sell power at a profit through the federal energy grid, and at the same time reduce dependency on incoming power through the same grid (Native Wind 2006). A successful tribal effort to convert to renewable energy can become the prototype for non-Native communities that also wish to develop decentralized energy economies and reduce fossil fuel use.

This concept of Native American renewable energies is slowly being combined with the European concept of a Native-urban “climate alliance.” Mayors from 180 U.S. cities have symbolically signed the Kyoto Protocol, committing their governments to reducing carbon emissions even though the federal government has not ratified the Protocol. In November 2005, a Native Renewable Energy Summit was held in Denver to discuss ways that U.S. cities and tribes can partner to achieve their economic and environmental goals. The Summit was one step toward tribes and cities working together to reduce fossil fuel consumption while generating sustainable energy employment. At the Summit, the mayors of Seattle, Boulder and Aspen agreed to explore possible partnerships with tribes. As *Indian Country Today* noted, “The many cities that have pledged to reduce their dependence on carbon-producing power share a common ground with the tribes. Tribes could lead the way by showing their commitment to clean air and water, and creating the potential to expand the distribution of power” (Melmer 2005).

## CONCLUSIONS

Most of the international strategies that Indigenous peoples have pursued to combat harmful climate change have been in arenas dominated by the same settler states that have colonized Native lands. The countries that emit the greatest amount of greenhouse gases have been those that have been the most resistant to the recognition of Indigenous sovereignty in the international legal system—particularly the United States. Although inserting an Indigenous voice into the United Nations process is critical to raising awareness and applying moral pressure, it would do little to practically curb climate

change. A “special status” of Indigenous peoples within the UNFCCC process would at least offer Native representatives a place at the table, even if they are being dealt a stacked deck.

Yet Indigenous peoples are not dealing entirely with a rigged game. The direct involvement of recognized Indigenous governments in the UN processes could gain more results than have been gained by NGOs, by framing Native concerns in a government-to-government context (and in the U.S., though federal trust responsibility). The Biodiversity Treaty and POPs Treaty both involved direct Indigenous input, which may have been critical to their success. The Inuit petition to the Inter-American Commission on Human Rights could serve as a precedent to more international legal challenges to emissions of greenhouse gases, which in turn can (as in the POPs Treaty process) result in real pressure on the U.S. government.

But the most promising avenues for Indigenous climate change advocacy appear to bypass the established global system of sovereign states, by asserting Native sovereignty in other arenas. The development of renewable energy systems in Indigenous communities can not only protect the environment from fossil fuel burning, but to develop tribal economies and build a new web of economic relationships with non-Native local governments and communities. These innovative and creative approaches may be initially reliant on national government funding, but can help build a *de facto* sovereign reality on the ground for Indigenous nations. At the same time, they can provide a model to non-Native communities that they do not have to be reliant on centralized corporate control of the energy economy—the *status quo* that generated the global climate change crisis in the first place.

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# Local Indigenous Responses

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This section examines existing efforts by Pacific Rim Indigenous peoples to deal with climate change issues on the local scale. By reviewing existing literature, it tries to answer the question, "What are Indigenous organizations, communities and nations presently undertaking to address issues of climate change?"

The issue of response to climate change is important because people have observed and the science community agrees that Earth is experiencing a warming trend due to the presence of greenhouse gases in the atmosphere. Over time, we will see different precipitation patterns, a rise in sea level, more floods and droughts, and other changes. The effects of climate change are broad and vary by location. Overall, Indigenous peoples contribute less to the problem than the rest of the world, but they are experiencing disproportionately severe climate change impacts.

This paper begins with a discussion of traditional ecological knowledge and science, including methods of integrating the two, because that issue is central to the assessment and monitoring of and strategies of adapting to climate change. It is followed by local responses to climate change in three regions: Arctic, South Pacific, and Continental. Each section is organized to reflect the information available and included in this paper. It is worth noting that peer-reviewed publications and the Internet probably do not capture all of nor the most valuable work on local responses to climate change, but this paper was limited to those resources. Finally, the paper concludes with a brief summary of themes in local responses and a bibliography.

## TRADITIONAL ECOLOGICAL KNOWLEDGE (TEK) AND WESTERN SCIENCE

It is important to recognize the differences and connections between Traditional Ecological Knowledge (TEK) and science. These perspectives frame the ways that problems are perceived, assessed, monitored and solved. Climate change is a global issue, and dealing with it will require collaboration and dialogue between communities and governments at all level. Some academic and policy

issues with TEK and science are discussed below.

The term "science" can also be called "Western science," the international knowledge system or contemporary knowledge (Stigter *et al.* 2005). According to *Wikipedia*, the online encyclopedia: "Science refers to a system of acquiring knowledge based on empiricism, experimentation, and methodological naturalism, as well as to the organized body of knowledge humans have gained by such research."

The terms Traditional Ecological Knowledge (TEK), Traditional Knowledge (TK) and Indigenous Knowledge (IK) refer to what Berkes as a "cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living things (including humans) with one another and their environment" (Riedlinger 2000). TEK is often termed "Native science."

## The validity of TEK

Researchers have repeatedly documented Indigenous peoples' detailed knowledge of biology, animal behavior and ecological relationships, land use, environmental assessment, management, protected areas planning, co-management, and contaminants research (Fenge 2001; Riedlinger 2000). "Traditional, experiential-based ecological knowledge (TEK) of the land by Inuit and Dene is now broadly recognized as legitimate, accurate and useful" (Fenge 2001). As Fenge points out, it is important not to attribute all observations on phenomena such as animal distribution, abundance and behavior to climate change: these observed changes may be related to other processes (Fenge 2001). After five years of researching Inuit traditional knowledge and Arctic climate change, Shari Fox said her research seems to parallel the findings of scientists taking exact measurements of climate (McKibbin 2000).

In some cases where TEK was compared with Western science, one method proved favorable. Where traditional methods are shown to be less precise or less reliable, it

is often due to the unusual increase in weather variability—some traditional methods cannot keep up (Stigter *et al.* 2005). Accordingly, Sachs Harbour elder Pete Esau is paraphrased by Riedlinger, “When there is going to be a big storm there is a sign and we prepare for it. Now, I can’t predict the weather like before” (Riedlinger 2000).

Riedlinger notes that traditional knowledge is beneficial because the local trends, patterns and processes it includes are “guided by generations of experience and embedded in a historical context” (Riedlinger 2000). Western, empirical science is limited by its history of assuming its concepts and perspectives are the ‘correct’ ones; traditional knowledge can offer new concepts to expand upon those available in Western science (Riedlinger 2000). Cruikshank adds, “Glacier narratives have the power to create or to establish what they signify—in this case, a land that responds to humans in a reciprocal rather than a hostile manner. This constitutive part asserts the ongoing importance of human agency and human responsibility, a perspective that is frequently missing from detached scientific expertise” (Cruikshank 2001).

If included in early phases of the scientific research process, Indigenous communities could also enhance the identification of research priorities by offering a local community perspective (Riedlinger 2000).

### **Relating TEK and Western science**

Riedlinger acknowledges, “...questions of how to link, integrate, bridge or create a conversation between TK and science recur in Arctic science and literature,” (Riedlinger 2000). Stigter *et al.* suggests that the best way to interpret and use TEK is alongside science through local case studies (Stigter *et al.* 2005). Cruikshank agrees that we need “knowledge bridges” from both local concepts and from science if we are to bring broadly based human values to bear on problems like climate change (Cruikshank 2001).

Integrating traditional knowledge and science is not straightforward. Although the former Canadian minister of the environment has said that Canada’s role was to integrate Indigenous and Western knowledge systems, it remained unclear what was meant by traditional knowledge (Bielawski 1992). The Canadian Traditional Knowledge Working Group debated the term for two years before reporting that there was more than one definition. Bielawski resolves this with philosophical realism: “A realist approach requires that one accept the natural world as real and amenable to explanation....

This position takes science seriously, as a special form of knowledge different from the Indigenous knowledge of societies without science; and it allows that such Indigenous knowledge can also contribute to understanding the world,” (Bielawski 1992).

### **Integrating TEK and Western science**

This is a hotly debated topic in scientific and Indigenous communities. Research that includes traditional knowledge may be outside usual institutional funding structures and timelines, and must deal with complex intellectual property, data accuracy, consistency and cross-cultural awareness issues (Riedlinger 2000). Linking Indigenous communities with institutions will require collaborative effort and understanding on both sides. There are formal strategies such as co-management and inter-coastal zone management that facilitate collaboration through written agreements, equal stakeholder representation, careful planning and operational protocols. The concept is that Native and non-Native groups will work together to manage shared resources. This has been successful in some cases (Borrini-Feyerabend 2000), but failed in others (Elmqvist 2000). Informal methods such as scientist-stakeholder collaboration are also helpful for fostering integration of traditional knowledge and science. The three formal and informal strategies are discussed below.

### **CO-MANAGEMENT OF NATURAL RESOURCES**

Co-management, also called participatory management, collaborative management or joint management, is “a situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, entitlements and responsibilities for a given territory, area or set of natural resources,” (Borrini-Feyerabend 2000). Borrini-Feyerabend suggests a highly structured framework and ‘syncretic approach’, involving “the development and use of a more or less consolidated synthesis of knowledge and practices of different historical and cultural origin,” (Borrini-Feyerabend 2000). A case of co-management in Samoa failed due mostly to disrespect for the role of local institutions and a lack of mutual trust (Elmqvist 2000). Samoans have long used a traditional system of sea resource conservation called *Raui*, centered on community-based natural protected areas (World Wide Fund for Nature South Pacific Program 2002).

Co-management, when successful, represents actors on more or less equal power in the management process.

For potential actors without sufficient political recognition, status and influence could be gained through co-management. A United Nations Environment Program report on preserving our “last wild shores” recommends that Indigenous peoples of protected Arctic coastal areas be involved in co-management of the coastal zones they depend on. This would both minimize the pressure on the land from outside (industrial) forces and help Indigenous people buy time needed to help shape their future and manage the resources they depend on sustainably (Ahlenius *et al.* 2005).

### **Intercoastal Zone Management**

Similar to co-management, Inter-Coastal Zone Management (ICZM) is an approach to develop and implement environmentally, culturally and economically sustainable uses of the coastal zone. It requires a clear set of resource management policies and practices across the public and private sector that determine the processes for sustainable development. All uses and activities must be coordinated according to these agreed upon policies, and the ICZM plan must be effectively implemented. It requires some kind of coordinating body, such as a council or commission with representatives from all public and private sectors involved, and mechanisms for proper implementation. Knowledge and programs must be integrated, and sound infrastructure and planning is also required. The ICZM authority should concentrate on policy, strategy, planning, design, supervision of research and coordination, while existing agencies carry out specific management programs at the operational level (Caribbean Environment Program). ICZM has helped Indonesian villages rehabilitate mangrove forests. Coastal areas of Malaysia, Ecuador, Bangladesh, Mexico and Venezuela have been identified by a nongovernmental organization called Both Ends as being good candidates for ICZM (Both Ends).

### **Scientist-Stakeholder Collaboration**

Less formal collaborations for integrated assessment or sharing of knowledge can be very beneficial. Cohen examined a scientist-stakeholder (s-s) collaboration on climate change: the Mackenzie Basin Impact Study. The idea behind the s-s collaborative study is that “it encourages the development of interdisciplinary approaches to research, and provides a common ground for linking scientific expertise (“What if”) with stakeholders’ knowledge (“So what” and “What should be done”).” The study included in its framework integrated modeling exercises to account for resources, model input and output between regions and survey communities to assess

the non-wage economy of aboriginal peoples. It also included exercises for a multi-objective model focusing on scenarios of changing land utilization and a land assessment framework with goal programming. Throughout the study, integration was attempted through information exchange. In these ways, it addressed Indigenous interests. The integrated modeling exercises mentioned above, however, were misunderstood and had low stakeholder participation. Another missed opportunity was that local (traditional) knowledge could not be included in any of the qualitative models. Better communication between scientists and stakeholders (including Indigenous peoples), and involving stakeholders in the model design process would have helped. The s-s collaborative concept is successful in moving toward an integrated assessment of climate change that seeks to provide all aspects of this issue, including environmental, economic and social (Cohen 1997).

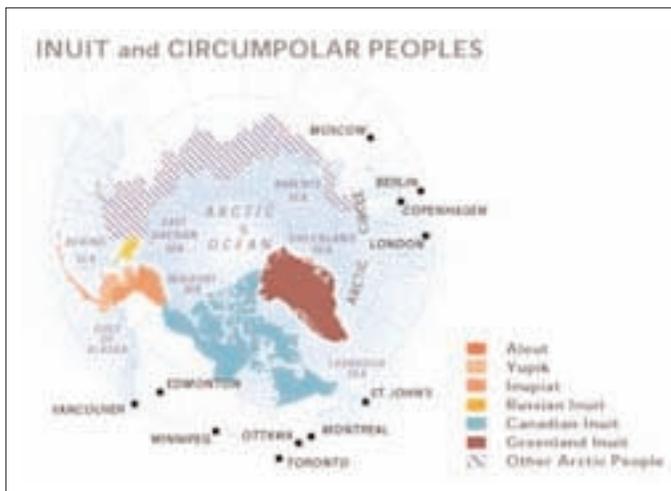
### **ARCTIC RESPONSES TO CLIMATE CHANGE**

This section covers areas along the northwestern coast of North America and the northeastern coast of Asia, including Alaska and parts of Canada and Siberia. Relevant data about inland Arctic peoples was also included. Local responses fell into one of three categories: assessment, adaptation or preparation. Adaptation is any immediate coping with the impacts of climate change. Assessment is observation, monitoring and data collection. Preparation is planning for the future: proactively anticipating or mitigating the effects of climate change.

#### **Adaptation in the Arctic**

In response to the changes in ice and the distribution of harvested species, Inuit are altering their hunting patterns (Fenge 2001). Likewise, the Inuvialuit of Sachs Harbour are coping by changing when, where, or how seasonal hunting and fishing occur. People are adjusting their “seasonal calendar” in response to increased seasonal variability. To travel when there is not enough snow, they use all-terrain vehicles instead of snowmobiles. They hunt seal in open water from boats to adjust to the lack of ice floes in summer months. The community may harvest different species than usual: one season they collected almost no goose eggs, but they noticed higher numbers of mainland ducks and other waterfowl (Riedlinger 2001).

Another Inuvialuit coping strategy is to minimize risk and uncertainty. They are monitoring rivers and springs more closely. Only experienced people are advised to



travel on sea-ice, and even they are being more careful. Despite these adaptations, Riedlinger found that the majority of the hunters, trappers and fishers interviewed were hopeful: “We always find some way of getting something” (Riedlinger 2001).

On the other hand, some Inuit leaders are beginning to question the value of their land and resource agreements if key species can no longer withstand hunting or cannot be found as a result of climate change (Fenge 2001).

### Assessment in the Arctic

“Uggianaqtuq is a North Baffin Inuktitut word that means to behave unexpectedly, or in an unfamiliar way.” The term has taken on a new meaning in the context of drastic climate change underway in the Arctic (National Snow and Ice Data Center 2004).

The Inuvialuit community in Sachs Harbour, Banks Island, Northwest Territories and the Winnipeg-based International Institute of Sustainable Development (IISD) initiated in a project that documented community observations of climate change in 1999. They produced a video that affected delegates at the 2000 U.N. climate change conference in The Hague. The video importantly broadened the image of northern climate change beyond thinner polar bears to the commonplace and cumulative changes that threaten the cultural future of the Inuvialuit (Fenge 2001).

The Nunavut Tunngavik Incorporated, the Canadian Inuit organization in charge of implementing the 1993 Nunavut Land Claims Agreement, united elders and hunters from 15 Nunavut communities at a two-day workshop. They shared observations, many mirroring those made by Inuvialuit in Sachs Harbour, and concluded that they must prepare for climate change and

the inevitable social and economic developments (Fenge 2001).

In 1994, a graduate student demonstrated the utility of Inuit ecological knowledge in understanding climate change impacts on a Bathurst caribou herd in Canada. The student came up with 20 hypotheses from Qitirmiut observations as a guide for future scientific and traditional knowledge research on the effects of climate change (Thorpe 2000).

In a book called *Voices from the Bay*, the Canadian Arctic Resources Committee and the Nunavut municipality of Sanikilua, a small Inuit community on the Belcher Islands in Hudson Bay, published a verified collection of ecological change observations, including those related to climate change. The study covered the large bioregion along the shores of the James and Hudson bays. Inuit and Cree hunters and elders from over 28 communities provided the observations in a series of workshops. Published in 1997, this book represents one of the most ambitious and successful Traditional Ecological Knowledge (TEK) studies of northern environmental climate change (Fenge 2001).

### Preparation in the Arctic

Caleb Pungowiyi, a Yupik native from Nome, Alaska, said in an interview with *Native Americas* that his region is preparing for global climate change by collecting samples from seals, walrus and whales. They are looking at blubber, skin, reproductive tracts and teeth. Some are being tested for pollutants and contaminants. The reproductive tracts are being monitored for productivity. The teeth are being looked at for age samples. They are also collecting baseline harvest data, including how much people are catching, what sex, and what age group. In all cases, they want to be able in the future to look back and examine the changes (Moreno 1999).

They are trying to tie scientific data in with their observations and experiences. Pungowiyi says, “If the Arctic should melt, our people are not going to move south...this is our homeland. This is something we are going to have to live with. So by gathering what we know, what we observe, it will help the scientists and us understand the changes that are occurring and help to mitigate or address the problems that are going to be brought forth by global warming” (Moreno 1999).

Pungowiyi noted that the government must recognize Indigenous subsistence economies so that if their food sources died or were otherwise lost, the government

would extend assistance. “Unless I was a commercial fisherman or a tour operator who can show economic loss, [the loss] doesn’t exist” he said. Pungowiyi emphasized the need for policy makers to connect to the findings of the scientific community in order for the science community to work with Indigenous people (Moreno 1999).

If he could send one message related to coping with the impacts of climate change to Native youth, or all young people, Pungowiyi would tell them to keep passing on their knowledge, their values associated with nature, the love for Mother Earth, and protection of the environment: “Whether we think they are listening or not, we need to keep telling the younger generation about our values, our beliefs, and how we need to protect the environment.... There is no doubt in my mind that the younger generation will continue with the things that we believe in” (Moreno 1999).

Pungowiyi would tell other Native people, based on his experience in the north, that “we should continue to hold our values” and Native people should continue to be cautious about developing their land and resources (Moreno 1999).

Nunavut peoples also recognize the need for preparation for the impacts of climate change. In 2001, *Nunatsiaq News* stated that a Nunavut action plan for addressing climate change was under development. It would include the collection of Inuit ecological knowledge, and also recommendations based on it, such as employing alternative energy and making Arctic power plants more efficient. The Nunavut Minister of Sustainable Development called climate change the most significant environmental issue facing northern Canada (Spitzer 2001).

## **SOUTH PACIFIC RESPONSES TO CLIMATE CHANGE**

Nations included in the South Pacific region are Australia and the island groups of Melanesia (Papua New Guinea, Solomon Islands, New Caledonia, Vanuatu, Nauru and Fiji), Polynesia (New Zealand, Tonga, Tuvalu, Niue, Cook Islands, Tokelau, Wallis & Futuna, Samoa, American Samoa, French Polynesia and Hawai’i) and Micronesia (Kiribati, Marshall Islands, Federated States of Micronesia, Northern Mariana Islands, Guam and Palau). This section includes a short background on Pacific island issues, some overall adaptation tools, and examples of responses organized by geography.

Small, often geographically remote island states depend upon limited natural resources, economies and environments. Due to their low elevation and concentration of population and infrastructure in the coastal zone, South Pacific islands are extremely vulnerable to climate change and variability and sea-level rise (United Nations Environment Program). Only about one meter above sea level, Kiribati, the Republic of the Marshall Islands and Tuvalu have already lost islets to sea level rise (UNEP). Other impacts to Pacific islands include salt-water intrusion, coastal erosion, storms, drought, coral bleaching, and damage to forests. Research shows that New Caledonia, Fiji and Tonga have become drier since the 1970s (UNEP).

Climate change is not the only factor complicating the environments and economies of Pacific islands. Land development, increased energy needs, overfishing, pollution, radioactive contamination from nuclear weapons testing and internal political conflict also effect the lives of Indigenous peoples (UNEP). These issues tend to exacerbate the impacts of climate change and add complexity to the process of dealing with those impacts.

### **Adaptation in the South Pacific**

A first step in dealing with climate change and other environmental issues is assessing and monitoring to establish history, baselines and trends. The World Wildlife Fund (WWF) South Pacific Climate Change Team developed a set of tools for assessing climate change impacts called *Climate Witness Community Toolkit*. It is a set of instructional materials for a two-day workshop with a series of activities such as mapping; seasonal calendar; animal and plant inventory; root cause analysis; assessment on adaptation options and community action plan. The toolkit was adapted from a process undertaken on Kabara, Fiji to document local impacts of climate change and to devise appropriate adaptation measures that local communities can implement themselves (McFadzien *et al.* 2006).

Other tools developed to assist Pacific island countries in coping with the impacts of climate change are the *WWF Climate Change Newsletter*, *Surviving Climate Change in Small Islands – A Guidebook*, and other reports on the Alliance of Small Island States (AOSIS) website. AOSIS describes its 43-state membership as a “coalition of small island and low-lying coastal countries that share similar development challenges and concerns about the environment, especially their vulnerability to the adverse effects of global climate change. It functions primarily as an ad hoc lobby and negotiating

voice for Small Island Developing States within the United Nations system” (AOSIS).

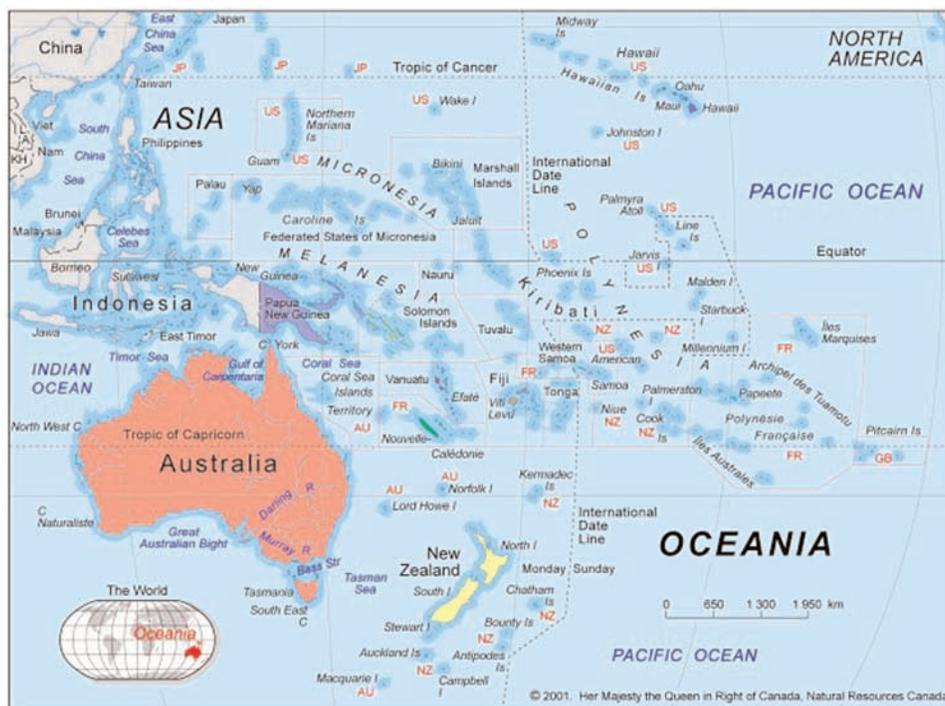
Pacific islands also benefit from the assistance of international donors, such as the United Nations Environment Program (UNEP), United Nations Development (UNDP) Program, and the World Bank. The Pacific Islands Climate Change Assistance Program (PICCAP), a South Pacific Regional Environment Program (SPREP) in 1997-2000, assisted 10 Pacific island countries that signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) with their reporting, training and capacity building under the convention. As part of the program, Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Republic of Marshall Islands, Nauru, Samoa, Solomon Islands, Tuvalu and Vanuatu appointed Climate Change Country Teams and a Climate Change Country Coordinator. The coordinator was to inventory carbon sinks; identify and evaluate options to reduce greenhouse gas emissions; assess vulnerability to climate change; develop adaptation options; and develop a national implementation strategy for mitigating and adapting to climate change over the long term. Niue and Papua New Guinea have climate change programs funded by the Global Environment Facility (GEF) through the UNEP and the UNDP (Ministerial Conference on

Environment and Development in Asia and the Pacific 2000).

### Local responses in the South Pacific

In Fiji, mangrove conservation will likely help manage sea level rise impacts in the future. Mangrove forests offer shoreline protection, and much of the mangrove land is linked to village subsistence economies. Fijian villages are better recognized and are more active in the political system than many subsistence villages elsewhere in the world. These factors provide opportunities for more sustainable mangrove management in Fiji. Non-Governmental organizations (NGOs) have initiated many environmental restoration and rehabilitation projects there, such as the Kuta wetlands project run by village women that restores threatened wetlands and promotes the kuta plant, which is used as a source of income. However, the conservation interests of villages, NGOs and the Fijian government compete with pressure from agriculture, resorts and towns to clear mangrove forests for development (Agrawala *et al.* 2003).

Fiji is part of a trend in certain Pacific Island countries where there is a shift from climate change impact assessment to the implementation of adaptation strategies. The primary adaptation philosophy adopted by the



## KEY NORTH AMERICAN INDIGENOUS CONCERNS AT THE NATIVE PEOPLES / NATIVE HOMELANDS CONFERENCE

### Arctic region

- Those who live in the Arctic are experiencing shorter winters that disrupt the life cycles of plants and animals that they depend on.
- The Yupik people see the winter ice pack receding sooner every year limiting walrus to breed and feed themselves.
- Rising water level from the melting glaciers forced several communities on the Arctic coast and islands to abandon their homes and traditional lands.
- Many Arctic communities already have their lands and natural resources polluted by oil spills and oil development that has seriously disrupted the environment and their health.

### Eastern Woodlands Cultural Area

- Severe ice storms show how dependent we have become on transmitted energy sources.
- Damage to traditional foods from shifting climate, natural disasters, and current practices, though those with seeds and traditional knowledge can survive.
- Extreme weather events could release more industrial pollution, impacting our diet, polluting our water, plants, fish, and animals.
- Culturally significant sugar maples and birch trees will be gone from our territories.
- Black ash trees and sweet grass are already disappearing, plants cannot adapt fast enough to changing environments.
- Greater imbalance in insect and animal communities: high level of black flies and mosquitoes, predatory fish, and fewer hummingbirds.
- Severe water pollution will result from flooding, which will mobilize chemicals applied to the land, and from droughts, and which will concentrate materials already present in our waters.
- More destructive storms will impact communities.

### Great Lakes Region

- Climate change provides an ecological risk that disrupts traditional foods of wild rice, berries, and maple syrup for the Indigenous communities that live in northern Minnesota and other Great Lake areas, such as the *Anishinaabe*.
- Early and rapid winter snowmelt led to flooding of various rivers and lakes causing damage and havoc.
- Dramatic fluctuations in water levels and warmer temperatures of lake waters has affected fish populations and insect populations such as fish kills from

increasing dead zones in lakes and severe infestation of disease spreading insects such as mosquitoes.

### Great Plains Region

- Increased extreme weather events such as blizzards and droughts are threatening Great Plains tribal economies where livestock and land extensive agriculture are the primary sources of income.
- Water resources are becoming scarce and depleted before they can be replenished.
- In the past 10 years droughts, blizzards, and flooding have caused six national disaster declarations in the Dakotas.
- Summer heat and severe weather has increased health risks of children and elders

### Southwest Region

- Drought has affected the water table levels and limited water sources that depend on the little rain the region gets to replenish them causing plants and livestock to die.
- Droughts have caused beetles to suck the saps of trees such as the piñon tree for water and lead to tree deaths, some of which are medicinal plants.
- Much of the Navajo (Diné) and Hopi peoples have suffered their lands being desecrated and poisoned by fossil fuel mining companies.

### Pacific Coast and Rocky Mountain Regions

- Increased winds not just periodic any more, but tend to be constant.
- Violent weather changes where storms wipe out intertidal shellfish and hurt economy. Indian people and their resources.
- Declining salmon runs.
- Deformed fish.
- Significant decrease in life spans of Indians due to unavailability of traditional foods.
- Transportation and shipping costs affected
- No more birds, frogs along the river.
- Air pollution due to burning forests.
- Minimum river/stream flows for fish
- Too much rain saturates soil, causing erosion.
- Erosion due to rising sea levels.
- Contamination of fresh water by saline water.

government and the donor agencies like the World Bank supports a “no regrets” approach, involving measures that make sense for reasons beyond coping with climate change such as water conservation or leakage prevention (Agrawala *et al.* 2003).

In December 2005, the people of Tegua, an island in the Vanuatu island chain, became the world’s first climate-change refugees. The Pacific Regional Environment Program helped more than 100 villagers settle on higher ground further inland. People are being forced to build sea walls to defend their homes and agricultural land. They are also dealing with increased mosquito populations and subsequent malaria infections and skin diseases due to standing water left by the floods. Another challenge is finding fresh water: the villagers had relied on low-tide fresh water springs along the coast; in their new inland location, they get their water from rain catchment tanks on rooftops (Cherrington 2006).

In Samoa, first efforts have been made to capture and examine traditional ecological knowledge and begin assessment programs. A study of weather and climate knowledge by Lefale served as a first source for historical and baseline data, provided initial insights into how Indigenous communities like Samoa can formulate adaptation and response strategies, and recognized the need for continued documenting of local Indigenous knowledge (Lefale 2004).

An effort in American Samoa initiated by the Samoa Coral Reef Advisory Group (CRAG), and informed by territorial agencies, non-profit groups, interested individuals, local fishers, federal agency partners and other stakeholders, resulted in Local Action Strategies for fishing management, land-based sources of pollution, local response to global climate change and population pressures. The goals and objectives for the local response to global climate change focus area include devising mechanisms and projects to better understand and mitigate potential effects of climate change, and promoting American Samoa as a national field site for studying climate change. While the approach might prevent coral reef bleaching, it does not appear to include traditional knowledge or interests.

## **CONTINENTAL RESPONSES TO CLIMATE CHANGE**

This region covers the west coast of the Americas and the east coast of Asia. A central theme in North American Native responses to climate change is the study and sharing of historical, traditional adaptation

methods. There seems to be more action in this area than in planning or implementing adaptation strategies, partly due to less immediate, obvious impacts of climate change in these regions. Political, economic and social factors might also play a role in this emphasis.

Perhaps the most significant project on Indigenous responses to climate change in the United States was the United States Global Change Research Program’s *Native Peoples-Native Homelands* (NP-NH) component of the larger national assessment *Climate Change Impacts on the United States: The Potential Consequence of Climate Variability and Change* published in 2000/2001. The report produced from the smaller study on Native peoples includes anticipated impacts and adaptation strategies from Indigenous perspectives across the United States. It represents a starting point from which to build better strategies based on more comprehensive knowledge, data and perspectives. Only 180 delegates from Native American communities represented all U.S. tribal perspectives at the three-day workshop in 1998 that the report was based upon. The workshop was also informal, not an official government-to-government interaction. There are limitations to what the report tells us about local responses to climate change in the United States (Maynard 2001).

### **Key issues in North America**

The *NP-NH* report identified some key issues facing Native peoples:

- 1) *Tourism and Community Development:* Tourism, agriculture and other environmentally sensitive activities are essential to many Native economies. Temperature, precipitation and ecosystem shifts will require adjustments away from traditional activities.
- 2) *Human Health and Extreme Events:* Native housing is more climate-sensitive than the national median. Air conditioning is not adequately available to address more frequently extremely hot conditions.
- 3) *Rights to Water and Other Natural Resources:* A variety of treaties, agreements and court decisions determined Native water rights. If tribes were to exercise their rights on reservations, which contain a large amount of potentially irrigable land, it would complicate current water resource management regimes.
- 4) *Subsistence Economies and Cultural Resources:* Few Tribal economies are subsistence-based but many rely upon the environment for various cultural

## REGIONAL RECOMMENDATIONS FROM THE WORKSHOPS AT THE NATIVE PEOPLES / NATIVE HOMELANDS CONFERENCE

### Eastern Woodlands Cultural Area

- Hold corporations accountable
- Incentivize reduction of pollutant emission
- Advocate respect for treaties as international law
- Prepare children for the future
- Do demonstration projects in reforestation, fish farming, renewable energy technologies and other areas
- Encourage communities to produce their own energy and food to become more sustainable
- Control the flow of Tribal money, local economies
- Create a Spiritual Network that goes beyond organized religion
- Create an information clearinghouse

### Great Lakes Region

- Work toward sustainability
- Encourage Congress to support clean and renewable energy initiatives and other “no regrets” strategies
- Reduce greenhouse gas emissions
- Assess the impact of current forestry practices
- Reduce non-point source pollution
- Promote biodiversity
- Reestablish Tribal jurisdiction over threatened areas
- Use and support indigenous sovereignty to co-manage different regions
- Protect spiritual rites
- Create a story that lays out all the steps in unsustainable industrial activities such as industrial forestry, i.e. how such practices cause local environmental damage yet are tied to the global economic picture
- Establish policies for environmental conservation, especially in food production areas
- Preserve historic and cultural practices for food production
- Examine how western technology and free market policies have impacted food production & sacred sites
- Respect, give thanks, give offerings and conduct ceremonies
- Recognize the importance of sacred sites
- Ensure Tribal access and control over sacred sites
- Take control over resources
- Follow existing rules and laws, including natural laws

### Great Plains Region

- Save the prairie ecosystem
- Develop native land use practices
- Plan and develop Tribal food production projects
- Use spiritual intelligence
- Improve science curriculum

- Use available technology and funding to research land
- Comparatively analyze differences between beef and buffalo economies
- Request funding for sustainable agriculture development and energy resources
- Develop intertribal markets and trade agreements to support sustainable development in food production and energy use
- Propose “green” energy technology to Tribal councils
- Develop Tribal energy efficiency codes and weatherization programs
- Address nutritional issues and the Native diet
- Protect medicine plants and transplant to safe land area
- Use elders to help teachers develop environment and ecology curriculum
- Plant and protect trees

### Southwest Region

- Change the way we all live
- Continue adapting
- Conclude and adjudicate legal issues
- Get regulations in place: e.g., water use contracts
- Solidify your finite land/space resources
- Quantify and qualify resource management using Indian terms
- Improve or eliminate detrimental obstacles
- Consider both positive and negative consequences of resource management
- Base planning on sound information and good decisions

### Pacific Coast and Rocky Mountain Regions

- Increase carbon sinks by reducing forest harvesting and increasing planting
- Avoid actions that reduce stream integrity and change runoff patterns
- Restore stream ecosystems
- Use native or natural controls to replace chemicals in agriculture
- Give nature a rest from agriculture
- Conserve natural habitats
- Fight for sensible and sustainable development
- Maintain and appreciate wildlife
- Develop buffers and plant riparian zones
- Promote graduate programs in Native colleges and educational institutions
- Develop stronger Native American offices in federal science agencies
- Accommodate flood zones and wetlands

resources. Climate change presents a risk to these resources, affecting both sustenance and culture.

#### 5) *Cultural Sites, Wildlife and Natural Resources:*

The climate and landscape provide an important sense of place for Native peoples, historically and culturally. Climate changes will disrupt the cultural context of Native peoples by shifting vegetation patterns and the presence of wildlife and migratory species.

Workshop participants, grouped by geography, came up with many action strategies for coping with climate changes. Some are listed in the box on the following page.

Another result of the NP-NH workshop was a 3-year project at the University of New Mexico's Preparation for University Research of Students in Undergraduate Education (PURSUE) program. The Native Peoples/Native Homelands Initiative required an assessment of ancestral and traditional water conservation and management technologies used by Indigenous peoples to evaluate climate change impacts on modern regional cultures. To do this, five Native American students in the PURSUE program participated in a unique and important research and documentation project to understand past environmental coping strategies and to understand better how to plan future sustainable economic development in the arid Southwest over the next century. The students used modern technology to enhance traditional knowledge about adaptations such as pebble-mulch fields, grid gardens and a large dam and canal system (Watson and Morain 2000).

## CONCLUSIONS

There are several responses that repeat throughout the Pacific Rim:

- Integration of local, traditional knowledge with Western science;
- Collecting traditional knowledge including historical adaptation strategies;
- Climate and environmental assessment & monitoring;
- Co-managing natural resources;
- Sharing and collaborating with stakeholders and other Indigenous peoples;
- Adapting subsistence methods;
- Getting involved in the political process on the local, national, international and global scales;
- Strategizing and planning for the future; and
- Implementing action plans.

It seems that all of these angles are important for build-

ing resilience to global climate change and sustaining Indigenous values and ways of life.

There is a natural order to many of these adaptation strategies, depending on location and context. In the Arctic, where climate changes are already significant, much assessment, monitoring, adaptation, co-management, and planning are underway. Arctic peoples are collaborating more actively than many Indigenous peoples closer to the equator or on continents, where changes are less noticeable or defined. In the Pacific, low-lying islands threatened by rising sea levels are under pressure to build buffers and other defensive infrastructure, so the emphasis seems to be on gaining international donor support and less on collecting traditional knowledge. Because each place has its own conditions and impacts, it is very important that Indigenous peoples, science, policy makers and the international community begin their approach to responding to climate change from local concerns, data, knowledge and perspectives.

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# Potential Paths for Native Nations

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*"We, the Indigenous Peoples, walk to the future in the footsteps of our ancestors."*

Kari-oca Declaration, Brazil (1992)

Indigenous peoples share significant similarities in their colonial and postcolonial experiences, such as loss of land, natural resources and subsistence, abrogation of treaties, and the imposition of psychologically and socially destructive assimilation policies. The collective understanding is that non-Indigenous societies typically do not relate to the land, sea and sky in the same manner, extracting natural resources and demanding control of nature itself.

Over the decades, Indigenous peoples of the Pacific Rim have observed changes in the environment, due to regional or local impacts from changing land management practices, and/or more from a global shift – bird migration and water levels either rising or falling are some examples. Tribal histories note that the times indeed, “are a’ changing.” Historically when environmental shifts occurred, the Indigenous people shifted habitation to another location, later returning if the climate permitted.

*"Images of eel have appeared on Maori artifacts and throughout oral histories. According to the oral histories, never has the eel migration been so erratic. Eel migrations correspond with changes in local water temperature and rainfall. But New Zealand's weather has been increasingly volatile, throwing the eel off."*

“Early Signs,” LivingOnEarth.org

With the encroachment of colonization and consumerism exploding in a global manner, there simply is no longer a place “to go” – and most likely no longer a place “to return.” Aotearoa (New Zealand), Australia and other countries in the Pacific Rim are faced with limited land mass. In Indigenous terms, "Nature" is viewed as a garden, distinct from cultivated fields and yards but not a "wilderness" as in Western thinking. The Native garden (known in anthropology as "hunter-gatherer territory") requires tending with prescribed burns,

tree and brush thinning, weeding, out-planting in the wild of preferred cultural plants, and management of culturally important animals. In short, sustainability.

*"After the garden is gone*

*What will people do?*

*After the garden is gone*

*What will people say?*

*After the garden is gone..."*

Neil Young,

“After the Garden is Gone” (2006)

*Native science's view on sustainability has begun to take effect. The survival of Planet Earth may be contingent on Western science, governments and private industry to relinquish their monopoly on accepted "knowledge", and listen to the voices of the indigenous cultures.*

(Gregory Cajete, *Native Science*, p. 269)

“Think globally, act locally.” This phrase from the 1970s is now more imperative than ever. Perhaps this is the true vision of “homeland security,” developing strategies in Indigenous communities to change the course for planet Earth. To limit the effects of human-induced global warming, the international Indigenous movement must work closely with the national and local tribes. Communication and education are key initiatives. Global warming awareness is relatively low throughout developed countries and the general understanding of the phenomenon is quite poor. Issues of global warming are so complex that many people feel helpless or frustrated. For some Indigenous people and tribes, the terms “global warming” and “climate change” might not be in their vernacular.

The local context is most important to consider: what locally is affecting them? Chemical changes due to global warming may result in warmer waters, which may lead tuna or anchovy, instead of sockeye salmon to traditional fishing areas. In the words of Terry Williams, the Fisheries and Natural Resources Commissioner of the Tulalip Tribes, the “People of the Salmon” may become the “Mahi-Mahi People.”

If you were to ask most Northwest tribal members about the effects of climate change on the environment of the Pacific Rim, they would likely not know how to respond. However, if the question was related to the natural resource management process, chances are they would be quick to relate it to the environmental impact in their local area. This connection is evident with regard to the sockeye diversion, and the devastating effects of the increasingly intense El Niño and La Niña cycles—to name just a few.

Since time immemorial, tribes have historically depended on natural resources for their cultural, spiritual and economic necessities. It is not coincidental that the tribes have been situated in each major watershed in the region and have been able to adapt quickly to respond to the changes of the ecosystems. Tribes hold thousands of years of knowledge and experience to share with other organizations that are willing to work with them.

There is power in Treaty Indian tribes to successfully preserve, protect and restore their natural resources. The Northwest Indian Fisheries Commission (NWIFC) has a membership of 20 tribes within Washington state. NWIFC has recognized the need for a comprehensive assessment of water resources in western Washington as the starting point for informed management of these resources. Climate changes and urban development have extremely affected water resources and aquatic ecosystems.

NWIFC recognizes the importance of a management plan for water resources while protecting tribal rights. This assessment plan involves information about the quantity and quality of water that is obtainable in western Washington. It can produce the scientific information useful to sustain a diversity of tribal resource management, administrative and legal activities.

The Lummi Tribe in Bellingham, Washington, has implemented a Water Resources Division to promote the protection of treaty rights to water, and develop and implement a comprehensive water resource management program. The program has several on-going projects—from water quality monitoring to flood damage reduction plan, to on-reservation water rights negotiation and litigation. These programs support the development of reservation water and land resources safeguarded against water degradation.

As water quality monitoring has been ongoing since 1993, the Lummi Nation Water Resources Division functions will include the documentation of a baseline

for the conditions of Lummi Nation waters. This information is important in order to protect groundwater, tribal tidelands, and sensitive shellfish growing areas. Protecting groundwater is necessary because almost all of the water consumed on the reservation comes from groundwater, and a sufficient supply of quality water is important to fulfill the purpose of the reservation for future generations.

The Northwest tribal response to the tsunami threat can serve as a precedent for their response to climate change. Tsunami emergency planning has been an afterthought to most non-Native communities (Washington coastal tribes evacuated their communities more quickly and effectively after a June 2005 earthquake alert). The Lummi Nation has acquired a Washington State Emergency Management Program grant for two tsunami warning towers to be placed within the reservation boundaries. One has already been pursued by Whatcom County and Cherry Point industries. The additional two towers would bring the total of three towers to be housed within Lummi reservation boundaries. This proactive response to the threat of earthquakes can help guide the response to destructive climate change.

International and national indigenous groups need the support of local tribes or local indigenous groups (*Iwi* in Aotearoa), which can create a feeling of empowerment by educating people about how they can 'make a difference' within their community. Currently, numerous organizations are bringing together elders, youth, tribal leaders, environmentalists and concerned citizens to address environmental concerns. Other Indigenous groups are focused in the legal international arena for human rights, land and treaty issues.

An example of an organization working toward indigenous support is the Inuit Circumpolar Conference (ICC), a leading organization supporting 150,000 Inuit of Alaska, Canada, Greenland, and Russia. The organization retains Consultative Status II in the United Nations. ICC holds a General Assembly every four years, which is the driving force for the organization. The Assembly offers the opportunity for sharing information, discussing common concerns, debating issues, and reinforcing the bonds linking all Inuit. Delegates of the Inuit Circumpolar Youth Council and the International Elders Council are present, which develops communication and working together.

The basis for ICC was developed to promote the protection of human rights of all Inuit people. In order to thrive in their circumpolar motherland, the Inuit had the

vision to find a united voice on issues of common concern, and to unite their forces and abilities toward the protection and support for their way of life.

The ICC has taken firm action on climate change by submitting a petition to the Washington, D.C.-based Inter-American Commission on Human Rights, seeking relief from infringements of Inuit human rights by global warming caused by greenhouse gas emissions. ICC Chair Sheila Watt-Cloutier states in her annual report: “During the past year, ICC has marked out a bold new step on this road. We have alerted the world that we will not become a footnote to the onslaught of globalization by finalizing and filing a complaint at the Inter-American Commission on Human Rights to defend our human rights against the impacts of climate change...”

The ICC petition asks the Commission to recommend that the United States implement mandatory limits to its emissions of greenhouse gases, and cooperate with the

global community of nations to “prevent dangerous anthropogenic interference with the climate system,” which is the intention of the U.N. Framework Convention on Climate Change (UNFCCC).

The petition also appeals for the Commission to affirm that the U.S. has a responsibility to work in collaboration with the Inuit to implement a plan to help them adjust to the inevitable impacts of climate change, and to consider the impact of its emissions on the Arctic before endorsing any key government actions.

Ms. Watt-Cloutier said, “This petition is not about money, it is about encouraging the United States of America to join the world community to agree to deep cuts in greenhouse gas emissions needed to protect the Arctic environment and Inuit culture and, ultimately, the world. We submit this petition not in a spirit of confrontation—that is not the Inuit way—but as a means of inviting and promoting dialogue with the United States



Program students and faculty meeting with Tulalip Tribes Natural Resources staff (Terry Williams, Daryl Williams, and Preston Hardison) on the Tulalip Reservation on July 17, 2006. *From left:* Alan Parker, Brett Stephenson (Maori environmental scientist from Awanuiarangi University), Renée Klosterman, Laural Ballew and Jill Bushnell. Photo by Zoltán Grossman.

of America within the context of the climate change convention. Our purpose is to educate not criticize, and to inform not condemn. I invite the United States of America to respond positively to our petition. As well, I invite governments and non-governmental organizations worldwide to support our petition and to never forget that, ultimately, climate change is a matter of human rights.” (*Indian Country Today*, January 5, 2006)

“We need an impassioned “*mistica*” – mission, passionate desire and empowered need – to strive for “ecological personhood. Our very survival as a species depends on our ability to make such a transformation.”

Gregory Cajete, *Native Science*, pg. 266)

Creating an action agenda, a “*mistica*,” is what international indigenous organizations can develop. The following model is one approach in creating this agenda, described by Terry Williams, the Fisheries and Natural Resources Commissioner of the Tulalip Tribes:

Local/Regional	Data-Info	The goal is:
National	Organizational	Cultural sustainability
Global	Declaration	Action plan

Questions in developing this agenda must include:

- How do we sustain our people at home?
- Are the extremes beyond the traditional limits?
- What is the role of tribal government?
- What is the role of media – getting out the story, what can be changed, what is possible, not always focusing on just the negative.

**Communication**

"Community begins with communications," said Dalton of Earth Cycles Radio Project by the same name in Calpella, California (Norrell 2006). Films such as *An Inconvenient Truth* and the recent Discovery project, “Global Warming, What you Need to Know,” portray global warming and climate change not as “theories,” but as realities.

International Indigenous groups have access now more than ever. Moises Naim, in his article, “An Indigenous World, How Native Peoples can Turn Globalization to their Advantage” argues that without discounting the atrocities and damage that globalization has done world-

wide to Indigenous people, there has been a powerful benefit – the ability to communicate and share information globally. The increased reach of the global environmental movement, which brings the experience of organizing politically and the ability to mobilize international media and governments, has pushed Indigenous issues to a larger audience than before.

“...a louder voice that can be heard internationally, and increased political influence at home. More fundamentally, globalization's positive impact on indigenous peoples is also a surprising and welcome rejoinder to its role as a homogenizer of cultures and habits. When members of the Igorot indigenous tribe in northern Philippines and the Brunca tribe from Costa Rica gather in Geneva, their collaboration helps to extend the survival of their respective ways of life—even if they choose to compare notes over a Quarter Pounder in one of that city's many McDonalds. In short, globalization's complexity is such that its results are less preordained and obvious than what is usually assumed. As the Maori, the Mayagnas, and the Tlicho know, it can also be a force that empowers the poor, the different, and the local” (Naim 2003).

*The media has enormous power to determine what issues are important and to set the public agenda. It has enormous power to shape the meaning of these issues and as a result strongly influence people's ideas and values, including their ideas about Indigenous peoples. Native Americans, Maori, First Nations peoples and the Aboriginal peoples of Australia are now in a position to provide information about environmental concerns to indigenous and non-indigenous people through the use of radio, television, print, Internet and film. “Every generation must develop and add a social ecological imperative to perennial truths; these are the foundations of life we pass down to subsequent generations.” (Cajete, p. 267)*

**Education**

The power and energy of youth, combined with the knowledge and experience of elders, is a powerful tool in expanding the mission to combat global climate change. Increasing the scope of organizations at all scales will educate young and old alike. “It’s Getting Hot in Here” is a website devoted to “dispatches from the Global Youth Climate Movement.” The Maori see the world through food resources, *Tangata Whenua* or people of the land. Maori environmental knowledge encompasses historical knowledge that is located within oral testimony *purakau*, *waiata* and *whakapapa* that

identify previous experiences of a type that will assist in the reconstruction of long term climate trends. (Brett Stephenson, Maori Environmentalist Scientist, July 28,2006). Aleut elders are identifying and educating youth in their culture, to prepare for climate change in southwestern Alaska.

Numerous Canadian First Nations youth groups are involved in the environmental movement. At the World Youth Forum in Vancouver B.C. on June 23, 2006, the “Ayateway Declaration” was created by the attendees. The preamble states: “The “Ayateway Declaration” is a living document. These words are not set in stone, they have been planted and fed by many minds and will continue to grow as we share them with our communities. We hope that this declaration will allow for the gathering of thoughts, beliefs and concerns of the Indigenous youth globally.” (Ayateway Declaration 2006).

Supporting youth participation is now a prominent goal of international organizations as they work toward solutions to issues that have a bearing on children's experiences in the future, such as environmental care. (Blanchet-Cohen, et al. 2003) Researchers and policy-makers have recently begun to pay more attention to the implications of carrying out research with children and youth, and to the variety of ways to meaningfully involve them in matters that affect their lives. It is now commonly recognized that working with children requires adapting conventional research methods and creating new ones. This call for creativity has encouraged researchers to explore different approaches and mediums, such as action research and other participatory methods (Christensen and James 2000; Greig and Taylor 1999; Punch 2002).

*“The accumulated knowledge of the remaining Indigenous groups around the world represents an ancient body of thought, experience and action that if honored and preserved as a vital storehouse of environmental wisdom, can form the basis for evolving the kind of cosmological reorientation so desperately needed.”*  
(Cajete, p. 281)

In order for Northwest tribes to take a serious look at the climate change and how this affects their region, the message needs to be brought out on a continual basis. This would include frequent visits to conferences, gatherings and include in these visits the tribal schools and colleges which cater to tribal members. If the message is to be carried on into the future, it is important to include the youth. They may be more willing to hear this message and carry on with ideas of how to combat the climate

change crisis. They can also bring in fresh ideas which could be beneficial to this cause.

Housed on the Lummi reservation is Northwest Indian College (NWIC) which is the only accredited tribal college for Washington, Oregon, and Idaho region. It was designed to provide post-secondary education to people living in the Pacific Northwest.

NWIC has collaborated with faculty from Huxley College of Environmental Studies at Western Washington University to offer an exclusive program of study for students. The Tribal Environmental and Natural Resources Management program is devised to promote tribal managers who know the land and its resources first hand. This has been structured in a thoroughly Native way. This would present the best opportunity for organizations to tap into this resource in order to bring awareness to Native students about the effects of global warming. Communication is key for the global organizations to enlighten the public, there could not be a better forum than within the tribal colleges. Not only would this message reach out to young, but older non-traditional students as well. Starting in one school can fuel the fire to envelope other colleges as they gather for annual conferences for all tribal colleges throughout the nation.

At the same time it is important to include the elders of this region. The elders are highly respected among their communities and with their support they can bring more leverage with regard to tribal officials. It would be just as important to include the elders along with the youth groups to carry out the message on climate change crisis in Indian Country.

### **Legal strategies**

From an environmental and spiritual perspective, Maori see the world as a unified whole, where all elements, including *tangate whenua* are connected. Emphasis is placed on maintaining the balance of cultural and spiritual values in the environment when using resources for social and commercial purposes. Maori may demand that the New Zealand government maintain and develop policies against global warming as part of the “active protection” under the Waitangi Treaty of 1840.

Legal precedent in terms of the environment and U.S. tribes include the U.S. Supreme Court decision in the *South Florida Water Management District v. Miccosukee Tribe of Indians*. The Court reaffirmed the federal trust

responsibility (*Seminole Nation v. U.S.*) by stating, “The interests being threatened here, including the threat to the Miccosukee Tribe’s homeland, sovereignty, economic integrity, resources, and its right to conduct its religious and cultural practices, are precisely the interests the United States is duty bound to protect.” (*Oneida Nation v. County of Oneida*, *Mescalero Apache Tribe v. Jones*, etc.) This ruling was based on the Clean Water Act. Further research on Reserved Right and Trust Obligations, and how federal laws and policies interplay with tribal jurisdiction surrounding climate change issues, needs to be conducted.

”International Indigenism” is a global phenomenon and a growing activist movement, according to researcher Ronald Niezen. In his 2003 book *The Origins of Indigenism – Human Rights and the Politics of Identity*, Niezen examines how the relatively recent emergence of an internationally recognized identity of "Indigenous peoples" merges with the development of universal human rights laws and principles. Together, their focus is on human rights laws, policies and the international

organizations of states to resist and change the political, cultural, and economic sanctions of individual nations, such as the Inuit petition to the Inter-American Commission on Human Rights. Niezen argues that from a new position of legitimacy and influence, these Indigenous groups are striving for greater recognition of collective rights, in particular their rights to self-determination in international law. These efforts are influencing local politics in turn and encouraging more ambitious goals of autonomy in Indigenous communities worldwide.

*“From the smallest unit of society to the largest unit of government, we can protect, enhance, and restore the inheritance of the Seventh Generation to come.*

*Consider becoming a Guardian in your community”*

The Bemidji Statement on Seventh Generation Guardianship (July 6, 2006, at the Protecting Mother Earth Conference)

### TEACH US, AND SHOW US THE WAY (CHINOOK BLESSING LITANY)

*We call upon the earth, our planet home, with its beautiful depths and soaring heights, its vitality and abundance of life, and together we ask that it Teach us, and show us the Way.*

*We call upon the mountains, the Cascades and the Olympics, the high green valleys and meadows filled with wild flowers, the snows that never melt, the summits of intense silence, and we ask that they Teach us, and show us the Way.*

*We call upon the waters that rim the earth, horizon to horizon, that flow in our rivers and streams, that fall upon our gardens and fields and we ask that they Teach us, and show us the Way.*

*We call upon the land which grows our food, the nurturing soil, the fertile fields the abundant gardens and orchards, and we ask that they Teach us, and show us the Way.*

*We call upon the forests, the great trees reaching strongly to the sky with the earth in their roots and the heavens in their branches, the fir and the pine and the cedar, and we ask them to Teach us, and show us the Way.*

*We call upon the creatures of the fields and forests and the seas, our brothers and sisters the wolves and deer, the eagle and dove, the great whales and dolphin, the beautiful Orca and salmon who share our Northwest home, and we ask them to Teach us, and show us the Way.*

*We call upon all those who have lived on this earth, our ancestors and our friends, who dreamed the best for future generations, and upon whose lives our lives are built, and with thanksgiving, we call upon them to Teach us, and show us the Way.*

*And lastly, we call upon all that we hold most sacred, the presence and power of the Great Spirit of love and truth which flows through all the Universe, to be with us to Teach us, and show us the Way.*

## Organizations

National Indigenous organizations are leading the clarification call to develop policy about global warming/climate change. At the July 2006 Assembly of First Nations meeting in Vancouver, the Environmental Stewardship Unit developed a flyer to further educate tribal leaders at the Assembly. National Chief Phil Fontaine states that First Nations support the Kyoto Protocol, and “recognize enormous impacts of climate change on the land and people.” Almost 80% of the First Nations citizens reside in the northern boreal forest, the place where climate change will have enormous impact. The paper encourages finding ways of reducing greenhouse gas emissions through carbon sinks and new clean energy projects.

*Only by truly touching the Earth can we honor and enable the vision and action necessary to recapture the feeling and understanding that we have always been a part of the living and “conscious” Earth.*

(Cajete, p. 267)

## CONCLUSIONS

- The Treaty of Indigenous Nations - Support providing information to tribes:
  - Assembly of First Nations (AFN)
  - Affiliated Tribes of Northwest Indians (ATNI)
  - National Congress of American Indians (NCAI)
  - National Tribal Environmental Council (NTEC)
  - Northwest Indian Fisheries Commission (NWIFC)
  - Water Summit (annual gathering)
  - Aboriginal Fisheries Commission in Canada
  - Maatua Awa led Maori meetings in Aotearoa
- International organizations develop a partnership to promote communication about climate change issues, using print, television, film, radio, Internet and other media formats.
- Further research into how national laws protecting tribal rights can be used as making changes at local and national levels.
- Tribes can sign the Kyoto Protocol Agreement (HonorEarth.org). However, it should be noted that portions of the Kyoto agreement, relating to “carbon sinks” have been deemed unacceptable to Indigenous groups. Under the proposal “land” or “forests” could become carbon “credits” that can be traded between participat-

ing countries. Further research and consultation on the Kyoto Agreement socio-economic and cultural context is necessary prior to acceptance by Indigenous governments.

- Development on a local, national and international level youth/elder coalitions that educate Indigenous people, and encourage youth/elders to collaborate in preparing their communities for climate change and joining together to reduce the threat.
- Traditionally, Indigenous cultures have the capacity to adapt or mitigate climate change. Indigenous governments will need to determine:
  - Many Indigenous communities can redeploy and re-establish forms of resource management for climate change derived from their traditional knowledge base.
  - Local indicators – what is a locally appropriate indicator (will vary by region)
  - When/if the extremes are beyond traditional limits?On-going mitigation through research and collaboration on prevention strategies in order to reduce extremes is paramount.
- Valuable environmental information, disseminated from oral history/traditions from Indigenous communities will assist the understanding of the long-term weather changes for both Native and non-Native. Indigenous groups collaborating with “Western science” may lead to mitigation of climate change.
- Work collaboratively with state and federal government agencies to ensure proper funding is available.
- Develop one voice in the numerous international organizations– perhaps through U.N. or other large scale organization.
- Think Globally, Act Locally.

The intricate web of international Indigenous organizations has the ability to work toward weaving a future for the generations to come, sustaining the current generation, and respecting the ancestors. It is clear that actions are necessary to change policies, laws, and education.

*“Human beings consist of seventy percent salt water and thirty percent minerals of the earth. We are the earth and her waters made more animate. Our understanding of this essential natural connection is one of understanding our relationships to all things of the Earth.”* (Cajete, p. 279)

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# Recommendations

**Dr. Alan Parker**

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## **Recommendations for Indigenous leadership regarding climate change impacts and tribal communities**

This section of the report is addressed primarily to the leadership of U.S. tribal nations and to First Nations, Maori, and other Pacific Rim Indigenous nation community leaders. Through our research and consultations with tribal officials we have determined that climate change impacts Indigenous peoples in distinctive ways that demand distinctive responses.

Climate change brought about by human activity has already resulted in irreversible global warming. It is impacting Native peoples in the Arctic and Sub-Arctic by permanently disrupting their lifestyles centered on subsistence hunting and fishing. Over many thousands of years the Inuit, the Iñupiat and the Yup'ik have lived in Arctic climates by adapting to frigid weather conditions and seasonal changes, based on long winter nights and long summer days. In a matter of a few short years these conditions have been disastrously altered.

Global warming changes are much more intense in the Arctic. Whereas globally we have seen average mean temperature increases of 1%, Arctic peoples have experienced an 8% increase. In many areas the permafrost has melted and ice packs have retreated at a rate that is beyond the adaptation abilities of wildlife and ocean life. ***For Indigenous people who live on the land and the water, climate change is already a disaster.***

In the temperate zones where the great majority of Pacific Rim tribal peoples live, evidence of disastrous climate change has already been documented, although it has escaped the attention of the U.S. public (who depend on commercial media for information).

In the Pacific Northwest, glacier-fed rivers and streams have permanently warmed due to the decline in winter snow pack and the retreat of high mountain glaciers. Global warming means that these glaciers will not reappear and the fish and wildlife that depend on clear cold water are disappearing. These fish and wildlife are necessary supplements to the diet of Northwest tribes and

essential to the practice of their tribal cultures.

## **The critical importance of community**

When we contemplate the urgent need to plan for climate change impacts, an important advantage that Indigenous peoples have in contrast to the non-Indigenous population is that *we still have community!* Our tribal communities are comprised of extended families who care for each other, who keep track of each other, and, who insist that the collective family, the tribe, does everything possible to take care of the tribal community.

Our colleague from the Maori Nation points out that the foundation of Maori community is the "*marae*". As we understand it, a marae may be thought of as a building and is comparable to Native American communities that are organized around a longhouse. But the marae is not simply a building, or a structure that serves as a meeting place for those families that belong to a particular marae. It is also a sacred space that serves as the center of community ceremonial life. We were informed that the members of a marae, historically a tribe or sub-tribe, assume a responsibility for community members who experience family losses or tragedy as well as to extend hospitality to insure that guests to the marae are feed and housed.

In this respect, Maori custom is typical of Indigenous people worldwide, who place great value on maintaining community as the focal point for cultural and social values and practices. As we contemplate the potential disastrous consequences of climate change impacts upon our communities, it seems clear that we must look to the structures and institutions of community as the means to prepare for and deal with these consequences.

As one contemplates acceleration of climate change in the next 5-10 years, our tribal communities must adapt to these changing conditions at a pace that will stress their social, economic and cultural fabrics. But, we cannot afford to join our fellow Americans in massive denial. *The time to plan and adapt is now.*



The Tribal Canoe Journey arrives at Lake Washington in Seattle on July 31, 2006. Pacific Rim Indigenous nations have a long history of traveling to meet and trade with each other, to work together, and to bind together their peoples. Photo by Zoltán Grossman.

## RECOMMENDATIONS

**1. Gather information** on the impacts of climate change in your region and *make it available to your tribal community!* As tribal people who have survived against all odds in the past, we will survive the changes associated with global warming—if we prepare. We cannot even begin to prepare if we are uninformed or unaware of the facts as they pertain to our own regions and localities. Moreover, this information must be shared within the entire community if leadership is to have the support and understanding to allocate tribal resources to the different steps discussed below. This report is intended to assist tribal leadership begin the process of informing their respective communities, but it must be supplemented by information specific to the different regions and locales that comprise Indian Country in the U.S., and Indigenous communities in the Pacific Rim region.

**2. Secure sources of water** (fresh water/drinking water) for drought-impacted regions. In North America we have many reports of global warming resulting in severe weather change, taking the form of extended droughts. In the near future we could face situations where drinking water supplies for metropolitan areas (derived from reservoirs and other storage facilities, and underground aquifers), literally dry up. For those tribal communities living adjacent to such localities, prior planning could be extremely crucial.

Even in rural areas there may be demand for agricultural or industrial water use that far exceeds supply, and tribal communities may be forced to pay exorbitant rates unless they have already secured water sources. Under existing federal law there is a Winters right (based on the U.S.v. Winters case) that recognizes tribal rights to sufficient water to fulfill the purposes of the federal reservation. Not all tribes are in a position to assert such a federal right and even for those that have already



The Tsyunhehkwa farm has reintroduced traditional foods such as white flint corn to the Oneida Nation of Wisconsin, providing a connection to the culture and building community cooperation. Photo by Michele Shaw.

established such rights they may be overridden in time of extreme shortage.

**3. Secure sources of food stocks** that will continue to be available in disaster or emergency conditions:

- Plan for food storage facilities, both perishable and non-perishable;
- Negotiate agricultural production capabilities for food crops that will be able to adapt to changing climate conditions, through agreements among tribes.

This recommendation contemplates that tribes will need to develop a level of self-sufficiency due to a climate-change-induced breakdown in the commercial food production and supply infrastructure. Even if such an extreme situation may be avoided in the future, prices will no doubt increase in relation to constraints on supply. Having a supplementary food production and storage capability could be crucial to maintaining a healthy diet for the community. For example, different root crops may be more adaptable to drought conditions or might produce much more volume from the same amount of land that is in production.

Many small land-based tribes do not have food production resources, while some large land-based tribes have excessive production capabilities. If the smaller tribes are planning ahead, they may consider proposing joint agreements that involve the investment of capital resources into food production systems with tribes possessing a larger land base.

**4. Prepare for impacts on plant and animal species;** determine whether species adaptation will provide alternative sources of culturally important plant and animal species. As climate change impacts our landscapes, inevitably we will see the disappearance of fish runs and entire fisheries. Perhaps in some cases such fisheries will be replaced by other runs as species adapt by shifting north or south.

Drought conditions will also influence plant and animal species that have sustained Indigenous peoples as subsistence food sources or as essential to their ceremonial life. To the extent that they can, tribes should be studying these phenomena in order to adapt as the plants and animals adapt.

**5. Develop relationships with neighboring governments and communities** regarding emergency plans for the more disastrous impacts of climate change.

It is predictable that local governments will be more responsive to climate change than state or national governments. They are by definition closer to the people, who will no doubt demand that government take whatever action is possible, and their smaller size makes them more flexible. Although the residents in jurisdictions under local governments are not in communities as close-knit as tribal communities, they still possess the ability to work together as neighbors, having common interests in local impacts on their homes and neighborhoods. It is recommended that tribal leadership look to these municipal and county governments to search for common ground in addressing climate change impacts.

**6. Consider political alliances with municipal, county and other local governments to build a renewable energy policy** on local, regional and national levels:

- To develop carbon emission reduction and control measures;
- To develop renewable energy policies and practices;
- To advocate for response and proactive positions by national governments.

In light of the refusal of the Bush Administration and the current congressional leadership to adopt the Kyoto Protocol, or even to acknowledge that human-caused global warming is occurring, many local government leaders have taken initiative. Seattle Mayor Greg Nickels had asserted leadership among U.S. urban leadership to adopt carbon emission control measures that would apply to the city government, and over 140 other towns and cities have followed suit. The California Assembly recently adopted stringent carbon emission standards that would apply to the world's third-largest

economy, the State of California.

Tribal governments should consider joining these efforts with municipal governments, as discussed at the 2005 Native Renewable Energy Summit. The value of such local initiative with respect to carbon emission controls is not that they could impact global warming directly, but that they will have a cumulative effect and they keep the issue on the public agenda until such time as our federal government is forced to respond.

In contrast to their relative inability to affect carbon emission levels, U.S. tribes are in a position to participate meaningfully in programs of renewable energy. Indigenous nations can begin convert from dependence on fossil fuels and the centralized electrical grid to cleaner and more locally controlled renewable energies, and select the energy systems most appropriate for their natural region, whether it is wind, solar, biomass, wave, tidal, *etc.* These energy sources can also provide a source of income and trade, and provide an example to non-Indigenous communities.

The Tulalip Tribes in Washington state have embarked on a biomass energy development project involving a number of large dairy farmers. The project will benefit both parties. Through making use of dairy farm waste to produce methane (burned to generate electricity), the Tribes not only are acquiring a source of renewable energy but are also providing for disposal of dairy farm waste that would otherwise add to the pollution of the Snohomish River, a major salmon fishery for the tribe. The dairy farmers acquire a non-cost means of waste disposal to relieve them of potential liability, and can thereby expand to meet increased demand for their dairy products. Other tribes have embarked on windmill projects, small hydroelectric, thermal and biomass projects.

Native American communities through their tribal governments are uniquely positioned to become influential and credible advocates for public education and much needed government initiative on global warming. This is an opportunity to address a real issue that has already began to impact their vital interests in distinctive manner,s and by taking leadership tribes will gain public support and even admiration.

**7. Consider strategies to unite tribes around habitat protection** needed to defend treaty rights to fish and game, and to seek enforcement of U.S. trust responsibilities to protect tribal homelands through U.S. adoption of global warming control and mitigation. Treaty signatory tribes, particularly those in the Pacific Northwest,

have been engaged in many ways and on many levels asserting their rights, guaranteed under treaty, that fish and game habitat be protected. As we have already seen, climate change impacts habitat in devastating ways.

By creating a national program to unite tribes around treaty-defined habitat protection issues, and by combining the treaty rights protection claims with claims that the U.S. is breaching its trust duty to protect tribal homelands, tribes may strengthen their voice in a unique way. Through the strategy of placing such tribal advocacy in the context of climate change and the lack of U.S. response to evidence of climate change, U.S. tribes raise a new argument that only tribes are entitled to make thereby generating yet another level of public pressure and public education.

**8. Consider active involvement as sovereign Indigenous governments in global climate change negotiations**, including formal Indigenous government representation at the annual “Conference of the Parties” of the United Nations Framework Convention on Climate Change (UNFCCC). This UN forum has only seen representation of the special and unique concerns of Indigenous nations through Non-Governmental Organizations (NGOs).

It is recommended that U.S. tribal governments, First



The Asia-Pacific Economic Cooperation (APEC) Forum has brought together states around the Pacific Rim to improve economic and political ties. APEC members include some of the national governments that have been most resistant both to Indigenous sovereignty and to carbon emission reductions.

Nations based in Canada, Maori tribal nations and other Indigenous nations in the Pacific Rim consider a joint, coordinated strategy, perhaps through the structure of the NCAI-sponsored Treaty of Indigenous Nations, to have a voice and presence at the international level. The UN Convention on Climate Change is the most appropriate venue for such advocacy, but certainly not the only one.

If a Pacific Rim coalition of Indigenous nations is created, the alliance should also consider directing its attention to put pressure on Asia-Pacific Economic Cooperation (APEC) Forum states to reduce carbon emissions.

**9. Get youth involved in cultural education, and defending the future of their nation from harmful climate change.** By making the youth of Indigenous communities more aware of climate change issues, tribal leaders can energize and inspire a level of activism and involvement will benefit future generations.

Young people are often more idealistic than their parents' generation, and willing to commit to a cause

However, they need the elders' traditional ecological knowledge, including awareness of climatic cycles and species. Support youth who want to set up groups of secondary school and college-age Indigenous youth around these issues.

**10. Work with other Indigenous nations across imposed colonial boundaries,** on the basis of being part of the same natural region (such as the Pacific Rim). Share skills and knowledge about animal and plant species, as their habitats shift due to climate change. Exchange ideas and training about community adaptation, climate change mitigation, and renewable energies.

Pacific Rim Indigenous nations can use the Treaty of Indigenous Nations process as a way to build political alliances and practical programs that are based on cooperation and joint responds to climate change impacts. As the Pacific Rim states have cooperated historically in order to colonize Indigenous lands and increase industrial growth, Indigenous nations need to cooperate to decolonize ancestral territories and protect our common property (the air and water) for future generations.



The future of our children is at stake. These young tribal members at Makah Days 2005 in Washington are learning the ways of their people, which will help them face future challenges. Photo by Zoltán Grossman.

# Contributors

**Laural Balley** is a member of the Swinomish Tribe in LaConner, Washington, and has lived on the Lummi Reservation for 31 years. Her professional experience has been in the financial field. She has worked most recently in the capacity of Grant Manager, Clinic Business Office Manager, and Budget Officer for the Lummi Nation. She received a Bachelor of Arts Degree in American Cultural Studies from Western Washington University in 2002, and a Master's of Public Administration-Tribal Governance degree from The Evergreen State College in Olympia, Wash., in 2006—with a capstone (thesis) project on "Strategies for Communicating Tribal Sovereignty."

**Bradley Burnham** is a Master's student in Public Administration at The Evergreen State College in Olympia, Wash., and an Educational Specialist with Evergreen's Gaining Early Awareness and Readiness for Undergraduate Programs (GEAR UP). He earned a Bachelor's degree at Connecticut College, with a major in zoology, and earned a Master's degree in biology at City College of New York. He has also worked as an instructor at museums, nature centers and aquariums, and has written science books for children.

**Jill Bushnell** is a policy analyst for the State of Washington. She received a Bachelor of Arts from the University of Washington in Comparative History of Ideas. She is currently working on Master's degrees in Public Administration and Environmental Science at The Evergreen State College in Olympia.

**Zoltán Grossman** is a Member of the Faculty in Geography and Native American & World Indigenous Peoples Studies at The Evergreen State College, in Olympia, Washington. Dr. Grossman earned a Ph.D. in Geography with a minor in American Indian Studies in 2002, as a Udall Fellow at the University of Wisconsin-Madison. His doctoral dissertation studied "Unlikely Alliances: Treaty Conflicts and Environmental Cooperation between Native American and Rural White Communities." Zoltán taught human geography at the University of Wisconsin-Eau Claire in 2002-05, focusing on interethnic relations. He was a co-founder of the Midwest Treaty Network, which coordinated the Witness for Nonviolence program monitoring the Wisconsin Ojibwe spearfishing conflict, and later brought together Native Americans with their former adversaries in sportfishing groups, to protect the fish

from metallic mining projects. He is a co-author of *Wisconsin's Past and Present: A Historical Atlas*.

**Preston Hardison** is a watershed Policy Analyst for the Tulalip Tribes in Marysville, Washington, and has coordinated the Chinook Salmon Recovery Plan, programmed databases for the Cultural Stories Project, developed data policy and supported natural resources negotiations. Since 1996, he has helped negotiate terms in the Convention on Biological Diversity (CBD) relating to Indigenous knowledge, and has provided expert testimony to the World Intellectual Property Organization (WIPO). He serves on several international biodiversity information network committees and promotes the development of information exchange standards and protocols.

**Renée Klosterman** is the Multimedia Production Manager for the State of Washington Department of Information Services (DIS), and has been involved in video production for 25 years—mainly in projects focusing on social issues. She was nominated for an Emmy Award for her production of the video *Journey to the Healing Circle*, which explored Fetal Alcohol Syndrome. She is a graduate of the Edward R. Murrow School of Communications at Washington State University, and earned a Master's of Public Administration-Tribal Governance degree at The Evergreen State College in Olympia, in 2006—with a capstone (thesis) project on "Strategies for Communicating Tribal Sovereignty."

**Alan Parker** is the Director of the Northwest Indian Applied Research Institute (NIARI) at The Evergreen State College, in Olympia, Washington, where he has been a faculty member since 1997, and co-founded the nation's first graduate school program in tribal public administration. He is a citizen of the Chippewa Cree Nation, on the Rocky Boy's Reservation in northern Montana. He graduated from the UCLA School of Law in 1972 and practiced law for over 20 years in Washington D.C., where he directed research on tribal governments for the American Indian Policy Review Commission, and was the first Native American to serve as Chief Counsel to the U.S. Senate Committee on Indian Affairs, in 1977-81 and 1987-91. He was instrumental in securing passage of the Indian Child Welfare Act, the American Indian Religious Freedom Act, the Native American Graves Protection and Repatriation Act, the Tribal Self-governance Act, American Indian Development Finance Corporation Act, and numerous

tribal land and water claims settlements. He served as President of the American Indian National Bank in 1982-87. He later organized the National Indian Policy Center at George Washington University, and was appointed as the first Native American attorney on the Washington State Gambling Commission.

**Brett Stephenson** is a Senior Lecturer in Environmental Sciences and honorary research fellow at the Maori University Te Whare Wananga o Awanuiarangi, in Whakatane, Aotearoa (New Zealand). He has developed a culturally informed program in environmental science that has its foundation in Maori philosophy and is infused with Indigenous knowledge. His innovations have presented students with more meaningful alternatives that speaks both to their experience and cultural survival and have resulted in significant success in both academic terms and community needs and expectations.

**Terry Williams** has served since 1982 as a Fisheries and Natural Resources Commissioner for the Tulalip Tribes, in Marysville, Washington. Since 1985, he has served on the Northwest Indian Fisheries Commission.(NWIFC) and the Pacific Fisheries Management Council, and since 1997 has served on the Pacific Salmon Commission. He served as the director of the U.S. Environmental Protection Agency (EPA) American Indian Environmental Office in 1995-96, and as Chair of the Tribal Committee of the National Environmental Justice Advisory Committee in 2003-04.

In 1997, the Secretary for Policy and International Affairs Office of the U.S. Department of the Interior appointed Williams to represent Indigenous peoples on the U.S. delegation to the United Nations Conference on Biodiversity. He served in 1985-95 on the Puget Sound Water Quality Authority, aWilliams has received the Washington State Environmental Award and Seventh Generation Legacy Award for his work, and was a finalist for the Buffett Award for Indigenous Leadership in 2004.

**Edward Whitesell** is the Director of the Graduate Program on the Environment at The Evergreen State College, where he has been a member of the faculty since 1998. Ted earned a Bachelor of Arts degree in environmental biology from the University of Colorado, Boulder. He earned a Master's and a Ph.D. in geography at the University of California-Berkeley, specializing in cultural geography and political ecology. His graduate research was conducted in Brazilian Amazonia, where he studied the livelihood and conservation strategies of riverine populations dependent upon small-scale agriculture and extraction of rainforest commodities such as rubber and fish. Ted has been active in conservation advocacy since 1970 in Colorado, Alaska, and Washington. He is currently president of the board of directors of the Washington Wilderness Coalition In 2004, The Mountaineers Books published a book on that was written by his Evergreen undergraduate students: *Defending Wild Washington: A Citizen's Action Guide*.



The Salmon Homecoming on Lake Washington in Seattle, on September 11, 2005. Photo by Zoltán Grossman.

# Resources, Links & Contacts

## PROJECT LINKS

Climate Change and Pacific Rim Indigenous Nations project  
<http://academic.evergreen.edu/g/grossmaz/climate.html>

Table of Pacific Rim countries  
<http://academic.evergreen.edu/g/grossmaz/pacificrim.html>

Indigenous Nations Treaty (Powerpoint & notes presented by Alan Parker at NCAI conference)  
<http://academic.evergreen.edu/g/grossmaz/IndigenousNationsTreaty.ppt>

Proposed treaty could protect nations  
(*Indian Country Today*, 3/21/05) [www.indiancountry.com/content.cfm?id=1096410573](http://www.indiancountry.com/content.cfm?id=1096410573)

Video on proposed Indigenous Nations Treaty (6:30)  
<http://academic.evergreen.edu/g/grossmaz/indigenous2.mov>

Global climate change--implications for indigenous practices (Lecture notes by Maori environmental scientist Brett Stephenson)  
<http://academic.evergreen.edu/g/grossmaz/Ata.ppt>

Climate change--some insights for indigenous peoples (Powerpoint by Maori environmental scientist Brett Stephenson)  
<http://academic.evergreen.edu/g/grossmaz/Ata.doc>

Global Warming (Powerpoint by Zoltan Grossman with charts, photos, maps, etc.)  
<http://academic.evergreen.edu/g/grossmaz/GlobalWarming.ppt>

Ethnoclimate bibliography (Excel spreadsheet compiled by Preston Hardison, Tulalip Tribes)  
<http://academic.evergreen.edu/g/grossmaz/Ethnoclimate.xls>

## GLOBAL LINKS

United Nations Framework Convention on Climate Change (UNFCCC) <http://unfccc.int/2860.php>

Demystifying Climate Change Negotiations (by Raymond de Chavez) [www.tebtebba.org/tebtebba\\_files/susdev/cc\\_energy/climate.htm](http://www.tebtebba.org/tebtebba_files/susdev/cc_energy/climate.htm)

Statement Regarding Water, Climate Change...and POPs (UN Permanent Forum on Indigenous Issues, 2005) [www.treaty-council.org/PDFs/PF3\\_Agenda4\\_b\\_Environment\\_English.pdf](http://www.treaty-council.org/PDFs/PF3_Agenda4_b_Environment_English.pdf)

Native Climate Commons (United Nations and Tulalip Tribes)  
<http://climate.nativecommons.net>

Be Worried, Very Worried (*Time* special report, 4/3/06)  
[www.time.com/time/archive/preview/0%2C10987%2C1176980%2C00.html](http://www.time.com/time/archive/preview/0%2C10987%2C1176980%2C00.html)

Dialogue Paper by Indigenous Peoples to World Summit on Sustainable Development (Johannesburg 2002)  
[www.ifg.org/wssd/indigenous.htm](http://www.ifg.org/wssd/indigenous.htm)

Indigenous peoples voice urgency on global warming (*Indian Country Today*, 1/5/06)  
[www.indiancountry.com/content.cfm?id=1096412233](http://www.indiancountry.com/content.cfm?id=1096412233)

Climate Alliance of European cities and indigenous peoples  
[www.climatealliance.org/english/indigenous/frameset.htm](http://www.climatealliance.org/english/indigenous/frameset.htm)

It's Getting Hot in Here: Dispatches from the Global Youth Climate Movement [www.itsgettinghotinhere.org](http://www.itsgettinghotinhere.org)

The Canary Project (photos of changing landscapes)  
[www.canary-project.org](http://www.canary-project.org)

Climate Change in a Nutshell  
[www.henryconsulting.biz/Doc/CCNut-26Apr06b-R.pdf](http://www.henryconsulting.biz/Doc/CCNut-26Apr06b-R.pdf)

Globalization: Affects on Indigenous Peoples (world map pdf)  
[www.ifg.org/programs/indig/IFGmap.pdf](http://www.ifg.org/programs/indig/IFGmap.pdf)

State of the Salmon (maps)  
[www.stateofthesalmon.org/page.php?pgID=17](http://www.stateofthesalmon.org/page.php?pgID=17)

## NORTH AMERICA LINKS

National Congress of American Indians (NCAI) [www.ncai.org](http://www.ncai.org)

National Tribal Environmental Council (NTEC) [www.ntec.org](http://www.ntec.org)

Tribal Lands Climate Conference [www.tribalclimate.org](http://www.tribalclimate.org)

Assembly of First Nations (AFN) [www.afn.ca](http://www.afn.ca)

First Nations Summit (B.C.) [www.fns.bc.ca](http://www.fns.bc.ca)

The Evergreen State College (Wash.) [www.evergreen.edu](http://www.evergreen.edu)

Northwest Indian Applied Research Institute (NIARI)  
[www.evergreen.edu/nwindian](http://www.evergreen.edu/nwindian)

University of British Columbia [www.ubc.ca](http://www.ubc.ca)

University of Alaska-Fairbanks [www.uaf.edu](http://www.uaf.edu)

Indigenous Environmental Network (IEN) Climate Justice Campaign [www.ienearth.org/climate\\_campaign.html](http://www.ienearth.org/climate_campaign.html)

Circles of Wisdom: Native Peoples -  
Native Homelands Climate Change Workshop  
(U.S. Global Change Program, 1998)  
[www.usgcrp.gov/usgcrp/Library/nationalassessment/native.pdf](http://www.usgcrp.gov/usgcrp/Library/nationalassessment/native.pdf)

Climate Change and Inuit Human Rights (ICC resolution,  
2003) [www.inuit.org/index.asp?lang=eng&num=244](http://www.inuit.org/index.asp?lang=eng&num=244)

Arctic Indigenous Peoples Unveil Statement on  
Climate Change (6/12/05) [www.arcticpeoples.org/Newsletter/  
Documents/ArcticDayNews.doc](http://www.arcticpeoples.org/Newsletter/Documents/ArcticDayNews.doc)

Inuit Circumpolar Conference (ICC) climate change petition to  
Inter-American Commission on Human Rights (12/7/05)  
[www.inuitcircumpolar.com/index.php?ID=318&Lang=En](http://www.inuitcircumpolar.com/index.php?ID=318&Lang=En)  
*Description:* [www.inuitcircumpolar.com/index.php?  
ID=318&Lang=En](http://www.inuitcircumpolar.com/index.php?ID=318&Lang=En)  
*Summary:* [www.inuitcircumpolar.com/files/downloads/  
FINALPetitionSummary.pdf](http://www.inuitcircumpolar.com/files/downloads/FINALPetitionSummary.pdf)  
*Full text:* [www.inuitcircumpolar.com/files/downloads/  
FINALPetitionICC.pdf](http://www.inuitcircumpolar.com/files/downloads/FINALPetitionICC.pdf)

Native Energy (fighting climate change through Native renew-  
able energy) [www.nativenenergy.org](http://www.nativenenergy.org)

Native Wind (reservation wind energy) [www.nativewind.org](http://www.nativewind.org)

Bering Sea Climate is Shifting (*Los Angeles Times*, 3/10/06)  
[www.latimes.com/news/printedition/asection/la-sci-  
beringsea10mar10%2C1%2C902918.story](http://www.latimes.com/news/printedition/asection/la-sci-beringsea10mar10%2C1%2C902918.story)

Environmental Justice and Climate Change (EJCC) Initiative  
[www.ejcc.org](http://www.ejcc.org)

Native Americas Special Issue on Global Warming, Climate  
Change & Native Lands (Fall/Winter 1999).[www.news.corn-  
nell.edu/Chronicle/00/1.20.00/Native\\_Americas.html](http://www.news.cornell.edu/Chronicle/00/1.20.00/Native_Americas.html)

Energy Justice Network [www.energyjustice.net](http://www.energyjustice.net)

## PACIFIC LINKS

South Pacific Forum (SPF)  
<http://www2.hawaii.edu/~ogden/piir/pacific/spf-info.html>

Asia-Pacific Network on Climate Change (APNet)  
[www.ap-net.org](http://www.ap-net.org)

Te Whare Wananga o Awanuiarangi (Maori University)  
[www.wananga.ac.nz](http://www.wananga.ac.nz)

University of Hawai'i [www.hawaii.edu](http://www.hawaii.edu)

South Pacific Organizations Coordinating Committee (SPOCC)  
[www2.hawaii.edu/~ogden/piir/pacific/SPOCC-members.html](http://www2.hawaii.edu/~ogden/piir/pacific/SPOCC-members.html)

Alliance of Small Island States (AOSIS) [www.sidsnet.org/aosis](http://www.sidsnet.org/aosis)

Climate Change and the Pacific Islands (Ministerial  
Conference on Environmental & Development in Asia & the  
Pacific, 2000) [www.unescap.org/mced2000/pacific/  
background/climate.htm](http://www.unescap.org/mced2000/pacific/background/climate.htm)

Republic of the Marshall Islands [http://unfccc.int/resource/  
ccsites/marshall/activity/seaframe.htm](http://unfccc.int/resource/ccsites/marshall/activity/seaframe.htm)

Sinking Feeling (*Time*, 8/01)  
[www.time.com/time/pacific/magazine/20010820/climate.html](http://www.time.com/time/pacific/magazine/20010820/climate.html)

Climate Convention (1999) [www.sidsnet.org/pacific/sprep/  
PressRelease/COP5/COP5-7\\_.htm](http://www.sidsnet.org/pacific/sprep/PressRelease/COP5/COP5-7_.htm)

Pacific Worlds (Indigenous regional geographies)  
[www.pacificworlds.com](http://www.pacificworlds.com)

Oceania map  
[www.lib.utexas.edu/maps/australia/oceania\\_pol01.jpg](http://www.lib.utexas.edu/maps/australia/oceania_pol01.jpg)

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*Web:* <http://academic.evergreen.edu/w/whiteset>  
*Tel.:* (360) 867-6768

### Climate Change and Pacific Rim Indigenous Nations

<http://academic.evergreen.edu/g/grossmaz/climate.html>

*Powerpoint:*

<http://academic.evergreen.edu/g/grossmaz/IndigClimate.ppt>

*Report:*

<http://academic.evergreen.edu/g/grossmaz/IndigClimate.pdf>