Many Strong Voices

Backgrounder

This report is intended to provide background information on the issues underlying the Many Strong Voices programme. It was developed by Lauren Haney, partially based on materials previously prepared by UNEP/GRID-Arendal, March 2006, as support material for the initial planning meeting for this programme. Support for this project was provided by the Government of Canada and the Inuit Circumpolar Conference (Canada).

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1. INTRODUCTION

If anyone has any doubt that climate change is underway they need only listen to the many small voices from this region— the early warning system of the globe. The Arctic is comparable to other vulnerable places like the small island developing states of the Caribbean, Indian Ocean and the Pacific. Here too indigenous people are also struggling for their livelihoods, their cultural identity.

Klaus Toepfer
UNEP Executive Director
High Level Plenary Address to COP XI/MOP I
7 December 2005

Research has demonstrated that the Arctic and the Small Island Developing States (SIDS) are feeling the effects of climate change more rapidly than the rest of the world. People in these regions are working through a number of institutions to address these effects by developing adaptation strategies and influencing global processes that will reduce the levels of greenhouse gases.

Critical testing grounds
In many ways the Arctic and SIDS are harbingers of what may be in store for the rest of the planet. For that reason, the rest of the world has an interest in the solutions being generated in both regions. The Arctic and Small Island Developing States are critical testing grounds for the processes and programs that will strengthen adaptive capacities of human societies and help decision-makers act responsibly to protect fragile ecosystems. The Arctic and SIDS share many characteristics which impose constraints, but which also offer unique opportunities for sustainable development.

Broader context
Many of the current efforts to develop new mitigation and adaptation strategies in the Arctic and SIDS are regional and have not reached a wide audience. An important opportunity exists to include efforts in these areas under the broader umbrella of Article 6 of the UNFCCC, which focuses on education, training and public awareness. Building alliances between the Arctic and SIDS, developing common approaches to problem solving, and ensuring that information reaches both decision-makers from developed countries and the people most directly affected by climate change will aid in the broader goals outlined in Article 6.

UNEP/GRID-Arendal works with other sections of the United Nations Environment Programme (UNEP) in implementing Article 6 of the UNFCCC. A number of UNEP-sponsored regional initiatives under Article 6 have taken place in Europe, Russia/CIS, Africa, Latin America and the Caribbean. At the 2005 COP XI meeting in Montréal, Canada, the UNFCCC Secretariat was asked to organize a workshop on Article 6 and the particular needs of SIDS. As well as falling under Article 6, the Many Strong Voices project will support the further development of the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA) Programme of Work on Adaptation, the framework for which was decided upon at COP XI in 2005.

2. CLIMATE CHANGE IMPACTS

The Arctic and SIDS are experiencing impacts of climate change. In this way, they act as "early-warning systems" of the potential effects of climate change in the rest of the world.

Small Island Developing States

Challenges in data collection

Ninety per cent of the SIDS, which include the island states of the Pacific Ocean, the Atlantic and Indian Oceans and the Caribbean and Mediterranean Sea, are in the tropics (UNFCCC CC SIDS 2005). Climate variability, droughts and flooding are features of their weather patterns. Many are also seasonally affected by extreme weather events – tropical storms, cyclones, and hurricanes. In addition, El Niño Southern Oscillation (ENSO) events produce dramatic changes in rainfall, rising seas and other weather-related phenomena.

ENSO events have become more frequent, persistent and intense during the last 20 years compared to the previous 100 (Tompkin and others 2005 – pocket book). The ENSO influences are difficult to separate from the influences of climate change, thereby adding to the challenge of accurately reporting on the current state of the climate in these regions and projections for future environmental change. As well, although climate data information systems are improving for SIDS, accurate figures and comprehensive reporting on the current state of SIDS sectors experiencing change is somewhat limited and scattered.

Impact: sea level rise

Among SIDS, sea level rise is arguably the most well-documented and potentially devastating consequence of climate change. Over the last century, global sea levels rose ~1.0-2.0 mm per year and over the last decade the rate increased by ~3.1 mm annually (Alley and other 2005, Cazenave and Nerem 2004). Research confirms that current rising sea levels can be attributed to the impacts of CO_2-induced climate warming, primarily resulting from thermal expansion caused by warming oceans and freshwater input from melting land ice (Alley and other 2005).

Sea level rise exhibits a non-uniform geographical distribution and some regions show nearly 10 times the global average rise, as is the case in parts of the Indian and Pacific Oceans (Cazenave and Nerem 2004). The rate of sea level rise is expected to continue to increase over the next 100 years and by the end of the 21st century, sea levels are projected to have risen by 0.5 ± 0.4 m in response to additional global warming (IPCC 2001). The polar ice sheets are the largest freshwater contributors to sea level rise and their dynamic responses to warming dominate the uncertainty of this figure.

Sea level rise leads to land and habitat loss, coastal erosion resulting from increased wave intensity and abnormal tide ranges (UNEP AIO SIDS 2005). These effects can cause displacement of communities, salt-water intrusion within freshwater aquifers, impeded drainage, damage to coastal infrastructure, degradation of coral reefs, mangroves, seagrasses, and loss of wetlands. Countries such as the Bahamas and Barbados, which are almost entirely dependent on groundwater supplies, are among the SIDS most severely affected by sea level rise. In the Maldives, as a result of sea level rise, a large proportion of the landmass could disappear over the next 30 years. Some islands could be completely submerged by the end of the 21st century.

Impact: temperature rise

Temperatures are projected to increase in all SIDS, for both seasons (UNFCCC CC SIDS 2005). An area-averaged annual mean warming of at least 2ºC for the 2050s and at least 3ºC for the 2080s is projected for SIDS, as a result of anthropogenic warming (Lal 2002). Surface temperatures are likely to increase least for the Pacific Ocean islands and most for the Mediterranean Sea islands. An increase in mean temperature would likely be accompanied by an increase in the frequency of extreme high temperatures.

While data are limited, it seems that recent surface warming in SIDS regions has resulted in warming of the ocean. The Caribbean Sea, for example, has warmed by 1.5°C in the last 100 years (Clarke 2004). Warming of the oceans has severely depleted zooplankton and resulted in considerable coral bleaching in some SIDS regions (UNFCCC CC SIDS 2005). Coral bleaching occurs if coral cannot adapt fast enough to increasing ocean surface temperatures (Wong 2003). Coral bleaching has the capacity to eliminate more than 90% of the corals on a reef.

Impact: changes in precipitation patterns

Much of the variability in the rainfall patterns of the Caribbean and Pacific Oceans can be attributed to the onset of ENSO and other natural phenomena. However, changes in precipitation have been observed in the 20th century that are consistent with patterns related to anthropogenic climate change (Dore 2005). Under the IPCC (2001c) climate change scenario, the mean rainfall intensity is projected to increase by 20-30% over much of the tropical oceans; other models simulate only a marginal change (<10%) in annual rainfall over most of the SIDS. The 2001 IPCC assessment generally projects that wet seasons will become wetter and dry seasons will become drier. Fiji, for example, has experienced two droughts and severe flooding in the past decade. Observations have shown a decrease in rainfall in the Caribbean and over the last few decades there have been prolonged dry spells (Clarke 2004).

Impact: changes in extreme weather events

Other likely consequences of climate change for SIDS are changes in patterns of extreme weather events / natural disasters, soil moisture budgets, prevailing winds (speed and direction), and patterns of wave action. Natural disasters appear to be on the increase in some SIDS regions (UNEP Car. EO 2005, AIO EO 2005). Projections indicate that although the frequency of tropical cyclones in some SIDS regions is not projected to increase dramatically, storm intensity is expected to increase by 10-20% (Jones and others 1999).

Summary of impacts

There are many consequences of these and other impacts of climate change in the SIDS and they are difficult to accurately predict. Expected consequences are reduction or loss of natural habitats, biodiversity and fisheries, erosion of coastal zones and loss of human settlements, diminishing agricultural and water resources, poor human health (including increases of vector- and water-borne diseases) and increased natural disasters and insurance costs. Impacts of climate change will also compromise traditional ways of life, which in many cases are closely connected to the environment.

Box 1: Climate change impacts on SIDS listed in the Barbados Programme of Action (BPoA)

Small island developing States are particularly vulnerable to global climate change, climate variability and sea level rise. As their population, agricultural land and infrastructure tend to be concentrated in the coastal zone, any rise in sea level will have significant and profound effects on their economies and living conditions; the very survival of certain low-lying countries will be threatened. Inundation of outlying islands and loss of land above the high-tide mark may result in loss of exclusive economic rights over extensive areas and in the destruction of existing economic infrastructure as well as of existing human settlements. Global climate change may damage coral reefs, alter the distribution of zones of upwelling and affect both subsistence and commercial fisheries production. Furthermore, it may affect vegetation and saline intrusion may adversely affect freshwater resources. The increased frequency and intensity of the storm events that may result from climate change will also have profound effects on both the economies and the environments of small island developing States. Small island developing States require all available information concerning those aspects of climate change, as it may affect their ability to enable appropriate response strategies to be developed and implemented.

Source: BPoA 1994

The Arctic

Climate change "drivers"

The picture of climate change in the Arctic is very different from that in SIDS. The Arctic also demonstrates the impacts of climate change to the world, but additionally, the Arctic environment contains important climate change "drivers" that can exacerbate warming and impact the entire globe. Dramatic regional changes experienced by Arctic ecosystems and the 4 million Arctic inhabitants have recently gained global attention.

Impact: temperature rise

Global warming, due at least in part to anthropogenic increases in greenhouse gas emissions, is augmented in the polar regions in a process termed *polar amplification*. The Arctic is warming as much as seven times faster than the rest of the globe (Christy and Spencer 2005). Impacts of the current warming trend are already apparent in the Arctic environment and its people. In addition, many realms of the Arctic environment that are affected by climate warming contribute to feedback loops that exacerbate warming. For example, decreased sea ice extent, melting permafrost, and northward expansion of vegetation all act as climate change "drivers".

Impact: reduction in sea ice

Sea ice is considered to be a key indicator of climate change. The extent of Arctic summer sea ice has declined by almost 30% in the past 50 years and coverage reached record lows in 2005 (ACIA 2005). Sea ice thickness has also decreased considerably in the past two decades. At the current rate of decline in sea ice coverage, the Arctic would be ice-free in September by 2060. If the positive feedbacks of decreased sea ice coverage- namely, increased absorption of solar radiation and increased ocean heat transport to the Arctic- are taken into account, even more drastic predictions are possible. One climate simulation performed as a contribution to the IPCC-AR4 predicts near ice-free September conditions in the Arctic by 2040 (Holland et al. 2006).

By opening up Arctic sea routes, reduction in sea ice indirectly contributes to an increase in natural resource exploration and transport in the Arctic. Not only will Arctic oceanic and terrestrial ecosystems be impacted considerably by sea ice reduction, but further global implications are expected (GEO 2006). The Arctic's store of sea ice, glaciers and ice sheets holds a considerable proportion of the world's freshwater reserve and regulates global temperatures. Reduction in Arctic sea ice could affect surface energy and moisture budgets and impact atmospheric and oceanic circulation.

Impact: land ice reduction

The extent of melting on the Greenland Ice Sheet reached record highs in 2005 and its ice mass loss has nearly doubled in the past decade (Rignot and Kanagaratnam 2006, Hanna *et al.* 2005). Studies point to climate change as a common cause of the recent acceleration and retraction of some of the Ice Sheet's glaciers. If greenhouse gas emissions rise at current projected rates, it is expected that by the year 2100, greenhouse gases will raise average temperatures enough to melt the Ice Sheet entirely (Gregory and others 2004).

The impacts of the melting Ice Sheet are vast. Increased freshwater runoff into the oceans could lead to significant sea level rise and affect the stability of the North Atlantic Conveyor Belt, with serious global implications. Recent findings suggest that if current trends continue, the Greenland Ice Sheet will contribute to sea level rise faster and more than predicted by today's climate models (Rignot and Kanagaratnam 2006, Luckman *et al.* 2006). If the Ice Sheet were to melt entirely, the meltwater could raise the global average sea level by 7 m over 1000 years, catastrophically impacting coastal regions around the world and influencing the global climate (Chylek and Lohmann 2005). Furthermore, the decreased surface albedo that results from melting of the Greenland Ice Sheet can act as a climate change "driver", further warming the climate globally.

Impact: permafrost melt

Presently, permafrost covers 10.5 million km^2 of northern and Arctic land. By 2100, as little as 1.0 million km^2 could remain (Lawrence and Slater 2005). This melting will dramatically impact surrounding ecosystems and is expected to cause a ~4.2% increase in freshwater discharge to the ocean. Additionally, release of methane stored by permafrost has the potential to amplify climate warming considerably. In western Siberia, for example, a massive peat bog has begun to melt (GEO 2006). Estimates put the amount of methane stored in the peat bog at around 70 billion tones, which equates to one quarter of all land-stored methane globally (Pearce 2005).

Impact: sea level rise

Sea level rise has consequences for the Arctic as well as for the rest of the world. Sea levels in the Arctic Ocean have risen considerably in the past 50 years or so (Proshutinsky and others 2001). This is expected to impact Arctic coastlines; at least one indigenous community has already relocated inland due to coastal erosion.

Summary of impacts

The impacts of a changing Arctic climate are extensive. Numerous plant and animal species are shifting northward in response to warming conditions, leading to changes in ecosystem structure and composition. Reduction in sea ice coverage compromises the survival of polar bears; this species is not expected to survive if the predicted complete loss of summer sea ice transpires. Changes in precipitation patterns and melting permafrost affect the migration routes and breeding grounds of caribou and reindeer. The advancement of trees and shrubs into the tundra depletes food sources and breeding grounds for migratory birds.

All environmental changes in turn impact the lives of Arctic residents, especially indigenous peoples, most of whom inhabit coastal areas (ACIA 2005) (Table 1). Indigenous peoples of the Arctic are intimately tied to the land and sea and to the resources that land and sea provide. When the plants, animals, physical environments and weather patterns that Arctic indigenous peoples rely on for survival are impacted by climate change, livelihoods and traditional ways of life are compromised as well. For example, regional changes have reduced the food security of indigenous populations; one reason for this is that reduced sea ice affects the ability of Arctic indigenous peoples to traditionally harvest marine animals such as seals and whales.

Table 1: Examples of environmental changes experienced by Arctic indigenous peoples

	European Arctic	Canada and Greenland	Alaska
Atmosphere/ weather/winds	Weather patterns are changing so fast that traditional methods of prediction are no longer applicable. Winters are warmer. Seasonal patterns have changed.	Weather patterns are changing so fast that traditional methods of prediction are no longer applicable. Winters are warmer. There has been cooling in Hudson Strait/Baffin Island area, but greater variability.	Weather patterns are changing so fast that traditional methods of prediction are no longer applicable. There are more storms and fewer calm days. Winters are shorter and warmer, summers longer and hotter.
Rain/snow	Rain is more frequent in winter than before. There are more freeze–thaw cycles, thus more trouble for reindeer grazing in winter.	Snow is melting earlier and some permanent snow patches disappear. There is less snow and more wind, producing snow conditions that do not allow igloo building.	There is less snow.
Ocean/sea ice		Later freeze-up and earlier breakup of sea ice. Shore-fast ice is melting faster, creating large areas of open water earlier in summer.	Sea ice is thinner and is forming later. There is increased coastal erosion due to storms and lack of ice to protect the shoreline from waves.
Lakes/rivers/ permafrost	Ice on lakes and rivers is thinner.	Water levels in lakes and rivers are falling on the Canadian mainland. Thinner river ice affects caribou on migration (they fall through). Permafrost is thawing, slumping soil into rivers and draining lakes.	Lakes and wetlands are drying out. Permafrost thawing is affecting village water supply, sewage systems, and infrastructure.
Plants and animals	New species are moving into the region.	Caribou suffer from more insects; body condition has declined. Caribou migration routes have changed.	Trees and shrubs are advancing into tundra. There are die-offs of seabirds and marine mammals due to poor body condition. New species of insects are observed.

Source: ACIA 2005

3. VULNERABILITIES TO CLIMATE CHANGE

The Arctic and SIDS combined produce less than 5% of global GHG emissions, yet they are arguably the regions of the world most adversely affected by resulting climate change. Why are such strong impacts of climate change being felt in these regions?

Background on vulnerability
The IPCC defines climate change vulnerability as "…the degree to which a system is susceptible to damaging or adverse impacts from climate change" (Schneider and Sarukhan 2001). According to Tompkins and others (2005), vulnerability incorporates:

- Exposure: the degree to which you are exposed to the impacts of climate change;
- Sensitivity: how much you are affected, adversely or beneficially, by these impacts; and
- Adaptive capacity: your potential to cope with the impacts, recover and adjust.

The components of vulnerability can be seen in Figure 1. Changes in human dimensions, driven by factors such as population growth and economic, social, and cultural trends, and in biophysical dimensions, driven by factors such as greenhouse gases, come together to determine vulnerability to climate change impacts. Biophysical and socioeconomic impacts of climate change then occur, and are usually assessed in sectors such as agriculture, coastal, and forestry. The sensitivity of each sector to climate change impacts is determined by its resilience or ability to withstand change. Adaptation occurs as feedback to the system, to reduce adverse impacts or enhance beneficial ones (Warrick 2000).

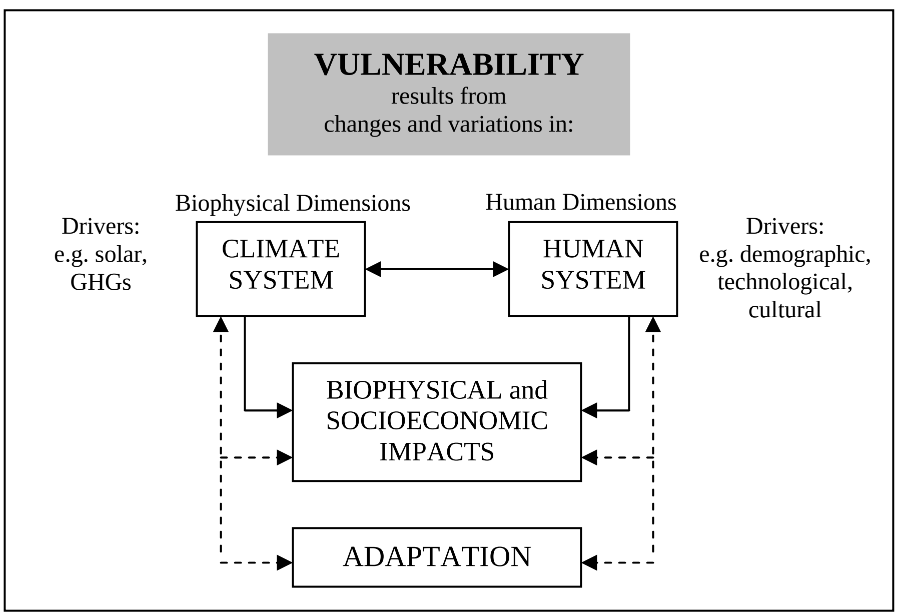

Figure 1: A conceptual framework for climate change vulnerability and adaptation
Source: adapted from Warrick 2000

Vulnerability assessments
As a result of the climate change impacts already experienced in the Arctic and SIDS, there is a demand for accurate assessment of regional vulnerabilities to climate change and

confident projection of future regional changes. In this way, appropriate adaptation strategies involving long-term planning of infrastructure, biodiversity conservation, and economic resources can be developed to respond to climate change impacts. In both regions, vulnerability assessments have been performed to assess the risk to sectors potentially affected by climate change.

In the Arctic, large-scale assessments like the Arctic Climate Impact Assessment 2004/5 (Box 2) and the Arctic Human Development Report provide broad overviews of the impacts of climate change on all sectors. Additionally, numerous smaller-scale impact and vulnerability assessments, conducted through research sponsored by governments, NGOs, universities, and private organizations, look in depth at specific sectors. Recent vulnerability assessments of the Arctic have incorporated the unique dimensions of indigenous peoples and their traditional ways of life as well as consideration of the gap between Arctic societies and their southern counterparts.

Box 2: The Arctic Climate Impact Assessment (ACIA)
This major scientific assessment was requested by the Arctic Council and produced through an international collaboration of over 300 authors. The ACIA is "the world's most comprehensive and detailed regional climatic and ultraviolet radiation assessment to date and documents impacts that are already felt throughout the Arctic region". The ACIA includes:

- Comprehensive reviews of the record of past climate variability and the current state of climate parameters across the circumpolar North;
- Chapters on climate-related anomalies and vulnerabilities of the Arctic tundra and boreal forest regions and the agricultural sector;
- Coverage of climate effects on infrastructure, ice and snow;
- Application of five climate scenarios consistently across all subjects and chapters;
- Incorporation of perspectives based on local ecological knowledge and traditional knowledge; and
- Identification of priorities for research and monitoring and policy recommendations.

Sources: ACIA 2004, ACIA 2005

SIDS generally possess less capacity than the Arctic to themselves monitor climate change and assess its impacts; much work on SIDS vulnerabilities has been conducted through international bodies. Unfortunately, such work is dispersed among institutions that tend to use different means of assessment. Nevertheless, publications such as UNEP's Pacific, Atlantic and Indian Oceans and Caribbean Environment Outlook reports (2005) and the UNFCCC's report, Climate Change Small Island Developing States (2005), provide comprehensive syntheses of regional vulnerabilities and impacts.

Common vulnerability characteristics
The Arctic and SIDS are highly vulnerable to the effects of climate change by virtue of the characteristics that define these regions. One of the reasons for their high vulnerability is that these two regions possess low adaptive capacities to cope with climate change impacts. Common characteristics of their vulnerability include:

- Geography and location which directly exposure them to climate change impacts
- Coastal societies and infrastructure concentrated along coastlines

- Reliance on marine and coastal resources
- Relative isolation
- Inadequately developed social systems; compromised socioeconomic status
- Narrow economic bases sensitive to external forces
- Inadequately developed infrastructure, weak institutional and human resources capacity
- Compromised health status
- Traditional societies and ways of life intricately linked with their environments

Additionally, anthropogenic factors such as pollution, resource exploitation, unsustainable development, and current impacts of climate change reduce human and biophysical resilience and further increase the vulnerability of these regions to future climate change.

SIDS vulnerabilities

The Mauritius Strategy, which built upon the Barbados Programme of Action concerning sustainable development in SIDS, concluded that SIDS are on the "front-line" when it comes to experiencing the effects of climate change and inadequate development strategies (GEO YB 2006). Vulnerability of SIDS to climate change has gained global attention.

Biophysical dimensions (inherent environmental characteristics) of SIDS vulnerability to climate change:

- Geographic isolation
- Low-lying, small landmasses surrounded by large ocean expanses
- Sensitivity and proneness to natural disasters
- Complex, sensitive and specialized ecosystems with high biodiversity, which can occupy only a relatively narrow geographical range
- Interannual variability in temperature, rainfall and sea level related to the ENSO phenomenon (degrades ecological integrity and human infrastructure)
- Operation of climate change directly on these regions due to geography and location
- Limited availability of freshwater

Human dimensions of SIDS vulnerability to climate change:

- High human population growth rates and densities
- Limited natural resources and fragile resource base
- Indigenous societies with traditional ways of life that include subsistence agriculture and fishing methods
- Critical infrastructure and socioeconomic activities concentrated along coastlines
- High dependence on marine and coastal resources
- Intra- and inter-island migration and rapid changes in social structure
- Small economies with little diversification
- Extreme economic openness that is sensitive to external shock
- Inadequate infrastructure, limited funds, weak institutional and human resources capacity
- Compromised human health

Anthropogenic influences that contribute to SIDS vulnerability by decreasing biophysical and human resilience:

- Pollution— through waste, transboundary pollution, island industry, point and non-point source marine pollutants, etc.
- Over-exploitation of resources— e.g. forestry, agriculture, aquaculture, fisheries
- Coastal erosion— through coral and sand mining and coastal development
- Urbanization
- Unsustainable tourism development
- Warfare
- Current climate change impacts including rising sea levels, increased instances of drought, increased frequencies of cyclones and storms, and coral bleaching

Sources: WMO 2006, Tompkins 2005, Lal 2002, PIRACCC 2001, IPCC 2001c

Due to these vulnerabilities, climate change is expected to have a disproportionately large impact on the economic and social development of many SIDS. For example, SIDS are arguably the parts of the world most vulnerable to sea level rise (UNFCCC CC SIDS 2005). It is argued that land loss from sea level rise, especially on low-lying atolls (e.g. those in the Pacific and Indian Oceans) and low limestone islands (e.g. those in the Caribbean), is likely to be so large that it will disrupt virtually all socioeconomic sectors in these countries (Lal 2002).

Table 2: Major vulnerable sectors in SIDS

Climate change impact	Vulnerable Sectors
Sea level rise	Water resources, marine biodiversity, aquaculture, human settlements and infrastructure, tourism, fisheries
Temperature rise	Water resources, marine biodiversity, aquaculture, health, forestry, agriculture
Precipitation changes	Water resources, terrestrial biodiversity, health, forestry, agriculture, food security
Increase in frequency/intensity of natural disasters	Water resources, marine and terrestrial biodiversity, aquaculture, human settlements and infrastructure, tourism, health, forestry, agriculture, food security

Arctic vulnerabilities

The Arctic is an enormous land; with an area of more than 30 million km^2, it makes up over one sixth of the earth's landmass (AC 2006). As discussed in Section 2, environmental changes in the Arctic are affecting ecosystems and the numerous indigenous societies that rely upon them. Much of the Arctic's vulnerability to climate change lies in the intrinsic qualities of the Arctic environment and indigenous peoples.

The Arctic is a special case of climate vulnerability in that most of its populations are citizens of well-developed, often prosperous nations (ACIA 2004). However, wide disparities in the level of social and economic development generally exist between Arctic indigenous peoples and their southern counterparts. Standards of living in the Arctic are considerably lower than in the rest of each respective country (VAG 2005). Economic prosperity and its benefits often do not reach Arctic populations. The promotion of equitable and sustainable nation-wide development is a critical concern for Arctic indigenous peoples— particularly at present when faced with the challenges of coping with climate change.

Biophysical dimensions (inherent environmental characteristics) of Arctic vulnerability to climate change:

- Presence of climate change "drivers" in ecosystems
- Operation of climate change directly on Arctic physical systems (polar amplification)— including glaciers, sea ice, permafrost and tundra
- Complex, highly climate sensitive and specialized ecosystems and community structure, which can occupy only a narrow geographical range
- Long coastline and many low-lying areas
- Extreme annual climate fluctuations
- Low biodiversity, highly specialized and sensitive organisms

Human dimensions of Arctic vulnerability to climate change:

- Indigenous societies with traditional ways of life that include subsistence harvesting methods; tied to climate, vegetation and wildlife
- High reliance on natural resources
- Predominantly coastal societies; high dependence on marine and coastal resources
- Inadequate infrastructure, weak institutional and human resources capacity (in some regions)
- Compromised human health— changes in traditional diet, exposure to contaminants
- Isolated, rural communities concentrated along coastlines
- Relatively small populations
- Compromised socioeconomic status of many indigenous people— low incomes, economic insecurity
- Narrowly based economies highly sensitive to outside forces, including market fluctuations and political interventions
- Loss of cultural values, community cohesion, and traditional ecological knowledge (in some regions)
- Social transformations associated with self-determination and indigenous rights, technological innovation, global trade and urbanization
- Inadequate devolution of political authority to regional and local governments
- Human population that is sparse, unevenly distributed, and skewed in terms of both age structure and gender balance

Anthropogenic influences that contribute to Arctic vulnerability by decreasing biophysical and human resilience:

- Increased commercial exploration— mining, oil and gas
- Natural resource exploitation— mining, oil and gas, fisheries, hunting
- Ozone depletion
- Pollution— through industry, persistent organic pollutants (POPs), etc.
- Piecemeal development
- Tourism pressures

- Current climate change impacts including melting sea ice, glaciers and permafrost, changing ecosystem structure and animal migration patterns, and changing precipitation patterns

Sources: ACIA 2004, AHDR 2004, IPCC 2001

Table 3: Major vulnerable sectors in the Arctic

Climate change impact	Vulnerable Sectors
Sea level rise	Water resources, marine biodiversity, human settlements and infrastructure, tourism
Sea-ice reduction	Marine and terrestrial resources, culture, health
Temperature rise	Water resources, terrestrial biodiversity, health, agriculture
Precipitation changes	Water resources, terrestrial biodiversity, health, forestry, agriculture
Permafrost melt	Water resources, marine and terrestrial biodiversity, human settlements and infrastructure, health, agriculture, culture

Table 4: Summary of adaptive capacity, vulnerability and key concerns

Arctic (polar)	• Natural systems in polar regions are highly vulnerable to climate change and current ecosystems have low adaptive capacity; technologically developed communities are likely to adapt readily to climate change, but some traditional indigenous communities have little capacity and few options for adaptation. • Climate change in polar regions is expected to be among the most rapid of any region on Earth and will cause major physical, ecological, sociological and economic impacts, especially in the Arctic, Antarctic and Southern Ocean. • Changes in climate that have already taken place are manifested in the decrease in extent and thickness of Arctic sea ice, permafrost thawing, coastal erosion, changes in ice sheets and ice shelves and altered distribution and abundance of species in polar regions. • Some polar ecosystems may adapt through eventual replacement of species by migration and changing of species composition, and possibly eventually increase in overall productivity; ice edge systems that provide habitat for some species would be threatened. • Polar regions contain important drivers of climate change. Once triggered, they may continue for centuries, long after greenhouse gas emissions are stabilized. This would cause irreversible impacts on ice sheets, global ocean circulation and sea levels.
SIDS	• Adaptive capacity of human systems is generally low in small island states and vulnerability high; small island states are likely to be among the countries most seriously impacted by climate change. • The projected sea level rise of 5 mm per year for the next 100 years would cause enhanced coastal erosion, loss of land and property, dislocation of people, increased risk from storm surges, reduced resilience of coastal ecosystems, saltwater intrusion into freshwater resources. The cost of resources to respond and adapt to these changes would be high. • Islands with very limited water supplies are highly vulnerable to the impacts of climate change on the water balance. • Coral reefs would be negatively affected by bleaching and by reduced calcification rates due to higher oceanic CO_2 levels; mangroves, sea grass beds and other coastal ecosystems and the associated biodiversity would be adversely affected by rising ocean temperatures and accelerated sea level rise. • Declines in coastal ecosystems would negatively impact reef fish, those who earn their livelihoods from reef fish, and those who rely on the fisheries as a significant food source. • Limited arable land and soil salinization makes agriculture of small island states, both for domestic food production and cash crop exports, highly vulnerable to climate change. • Tourism, an important source of income and foreign exchange for many islands, would face severe disruption from climate change and sea level rise.

Source: adapted from IPCC 2001 Synthesis Report

4. A SPECIAL CASE OF RESILIENCE

Resilience refers to the innate ability of biophysical and human systems to maintain their integrity when subjected to climatic disturbance (IPCC synthesis, 2001). Characteristics of Arctic and SIDS cultures, such as a close relationship with the environment, can be a source of vulnerability. However, these characteristics are also a source of coping mechanisms which increase the resilience of these populations.

SIDS resilience

"The survival of Small Island developing States is firmly rooted in their human resources and cultural heritage, which are their most significant assets; those assets are under severe stress and all efforts must be taken to ensure the central position of people in the process of sustainable development" (BPoA 1994).

The residents of Small Island States have faced hazards in the past; extreme events and environmental variability are not new phenomena to these populations. Experience adapting to these conditions can be drawn upon to develop appropriate adaptation strategies for future climate change. Thus, adaptation to short-term climatic variability and extreme events can serve as a starting point for reducing vulnerability to climate change (UNDP 2005b).

Furthermore, many traditional SIDS cultures incorporate strong social and kinship ties that serve to strengthen their resilience at a community level. Many SIDS inhabitants have developed capacity to manage change by using traditional coping skills and mechanisms. Such strategies include the application of traditional knowledge or locally appropriate technology, the use of indigenous materials, and other customary practices (IPCC 2001c) (see Box 3).

Box 3: UNFCCC Local Coping Strategies

Mulching and zero tillage in American Samoa

Vulnerability/Hazard: Floods
Impact: Soil erosion
Strategy: Soil conservation
Resources required: mulch and labour, legumes
Potential maladaptation: none
Non-climate benefits: less labour requirement as compared to tillage type land-preparation

Taro, an edible aroid, is the most important staple crop in American Samoa. It is inherently tied in to the tradition, customs and culture of the Samoans. Soil erosion is a constant threat in Samoa. When preparing land for taro, only the tops of grasses and shrubs are cut, leaving the roots intact along with the larger trees, so that disturbance to the soil and plants is minimized, and perennials continue their growth. Leaving the larger perennials and trees intact incorporates long-term sustainability into the overall agro-ecosystem management. To minimize the risk of erosion, farmers cut weeds to use as mulch and use a planting stick, the oso, in the no-till cultivation of taro. The weed mulch and no-till practice could be combined with other practices such as contour hedgerows, strip cropping along the contour etc. to

further aid in reducing soil erosion from fields.
Source: UNFCCC Local Coping Strategies Database 2006

Arctic resilience
"Arctic societies have a well-deserved reputation for resilience in the face of change. But today they are facing an unprecedented combination of rapid and stressful changes involving environmental processes, cultural developments, economic changes, industrial developments, and political changes" (AHDR 2004).

Historically, Arctic indigenous groups have demonstrated innate resilience and adaptability (AHDR 2004). They are highly adapted to extreme environmental conditions and have adjusted to environmental variability in the past (ACIA 2004). They cope continually with changes in resource availability due to changes in weather and migration patterns. They employ traditional coping strategies learned through strong community ties, transmission of useful skills, values and traditional ecological knowledge through experiential learning. In response to decades of climate change, Inuit in Canada have already changed the species they hunt, timing and methods of harvesting, and altered food sharing networks and intercommunity trade (Thomas and Twyman 2005).

New challenges
Despite the innate ability of the Arctic and SIDS to cope with some degree of environmental change, in many cases, these systems are already at or near their tolerance limits (ACIA 2005). Furthermore, coping with climate change in addition to the multitude of other stresses that face these regions will be considerably more challenging than the changes dealt with thus far (Box 4).

Box 4: Natural resilience in Arctic Indigenous People: new challenges
Indigenous Peoples have interacted with their environment over generations through careful observations and skillful adjustments in traditional food-harvesting activities and lifestyles. Through ways of life closely linked to their surroundings, these peoples have developed uniquely insightful ways of observing, interpreting and responding to the impacts of environmental change…

…Flexibility and adaptability have been key to the way Arctic Indigenous Peoples have accommodated environmental changes over many generations. Current social, economic, political and institutional changes play a part in enabling or constraining the capacity of peoples to adapt. The rapid climate change of recent decades, combined with other ongoing alterations in the world around them, presents new challenges.
Source: ACIA 2004

5. ADAPTATION & MITIGATION

There are two ways to respond to climate change: mitigation (responses that prevent further climate change) and adaptation (responses that lessen adverse impacts or enhance beneficial impacts). It is the dynamic, evolving nature of the overall vulnerability system (human and climate systems and biophysical and socioeconomic impacts, Figure 1) that presents opportunities for adaptation and mitigation (Lal 2002). As the impacts of climate change continue to accumulate, efforts to address these impacts through adaptation and to prevent further impacts through mitigation are required at local, national, regional and global levels.

Both adaptation and mitigation require extensive communication and education about climate change and its impacts. Further research, monitoring and modeling is thus needed to refine and extend the findings of regional impact and vulnerability assessments. Synergies among SIDS and Arctic nations, which exhibit common vulnerability and resilience characteristics, in the development of mitigation and adaptation strategies will be highly beneficial for both regions.

Background on adaptation

Adaptation is an adjustment in ecological, social or economic systems in response to observed or projected climate change and its effects (IPCC CH 18 2001). There are three cornerstones to adaptation, which can be related back to the three elements of vulnerability. The three cornerstones are: 1) alter the exposure of the system to climate change; 2) reduce the sensitivity of the system to climate change; and 3) increase the resilience of the system to cope with the changes (Adger and others 2005). Figure 2 shows the elements of an adaptation strategy, while Box 5 shows an example of an adaptation strategy that incorporates some of these elements.

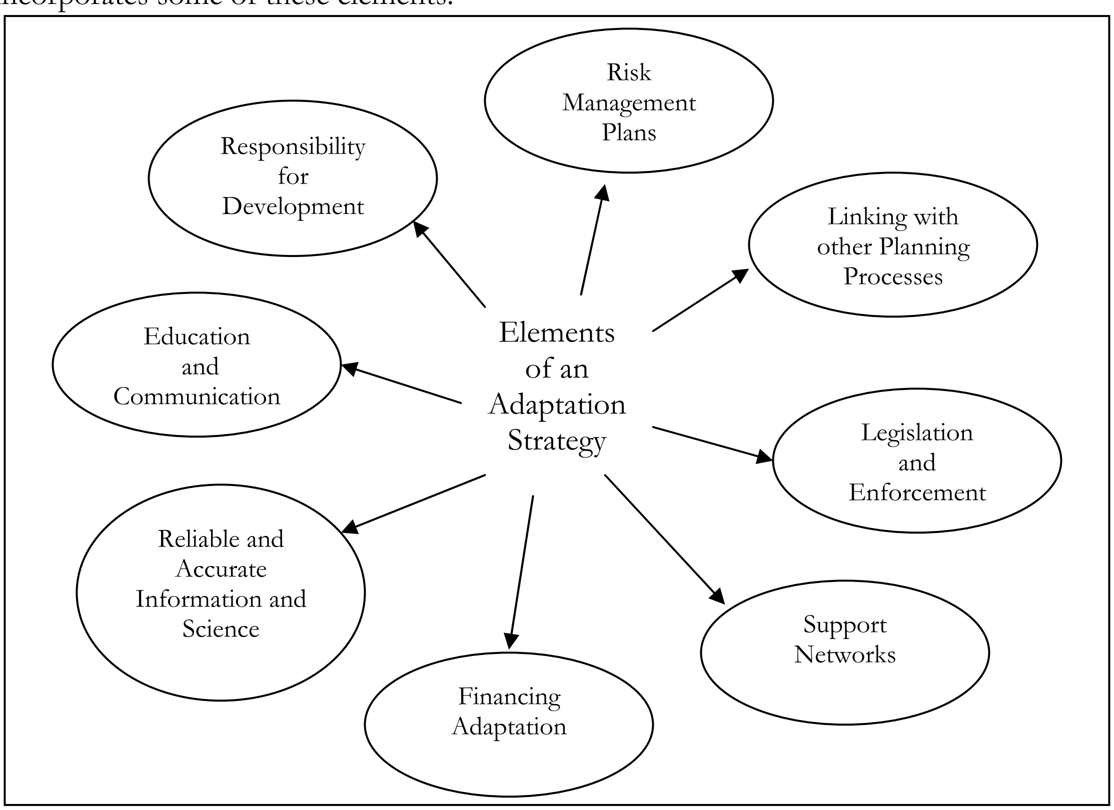

Figure 2: Elements of an adaptation strategy
Source: adapted from Tompkins and others 2005

Box 5: The Caribbean Planning for Adaptation to Climate Change (CPACC) programme
Description
The CPACC project is a United Nations sponsored Global Environment Facility (GEF) funded effort designed to assist developing countries in coping with the adverse effects of global climate change. Funds are implemented through the World Bank and the project is managed by the Organization of American States (OAS). CPACC consists of 8 components:

1. Design and establish a sea level/meteorological monitoring network.
2. Establish a database and information system.
3. Inventory of coastal resources and use.
4. Coral reef monitoring.
5. Coastal vulnerability and risk assessment.
6. Formulation of policy for coastal and marine management.
7. Economic valuation of coastal and marine resources.
8. Economic and regulatory proposals for adaptation to climate change.

Issues Addressed

- Climate change and sea level rise
- Regional institutions and technical cooperation

Results Achieved

- Climate and sea level monitoring station was established. Temperature change, sea level rise, barometric pressure, wind speed and wind direction are being measured.
- Technological training— in data collection, the use of the Internet, GIS, conversion and automation and metadata creation
- Awareness raising and capacity building
    - Local consultants prepared the issues paper for national consultation, that involved non-governmental and public and private sector organizations
    - Brochures on the project and the impacts of global climate change to Saint Lucia have been disseminated to the general public
- Work was undertaken to develop an integrated management and planning framework for cost-effective responses and adaptation to climate change in coastal and marine areas, to provide training and institutional strengthening that could enhance regional and national capacities, and to identify and assess policy options
- Based on the success of these initial activities, the Caribbean SIDS went on to create a sub-regional institution that will be dedicated to supporting action in the region on climate change

Lessons Learned

- Regional projects can be very beneficial at a national level as long as local participants are involved in the process

- The annual regional and national focal point meetings enhance the understanding local participants have of the process
- Multidisciplinary or multi-sectoral teams are vital to the success of the project locally
- Training should always be targeted at the non-governmental, private and public sectors
- The training sessions can be used as a means of public sensitization of the regional project.

Sources: UNFCCC CC SIDS 2005, CPACC 2006

Adaptation can involve: 1) building adaptive capacity and resilience, thereby increasing the ability of individuals, groups or organizations to cope with changes; and/or 2) implementing actual adaptation decisions, i.e. transforming that capacity into action (Adger and others 2005). Actual adaptations can be spontaneous/autonomous, taking place in reaction to climatic stimuli without intervention of a public agency, or planned, requiring informed and strategic action. Planned adaptations can be either anticipatory or reactive (Wong 2003; IPCC II).

Enhancing adaptive capacity

Adaptive capacity is the potential or ability of a system, region, or community to adapt to the impacts of climate change (IPCC 2001). The ability of human systems to cope with climate change depends on features such as wealth, technology, education, information, skills, infrastructure, access to resources and management capabilities. Adaptive capacity is also often associated largely with governance, civil and political rights and literacy (Brooks and others 2005). In general, those states with the least resources have the least capacity to adapt and are therefore the most vulnerable.

The sets of conditions that shape vulnerability in the Arctic and SIDS, outlined in Section 3, depict the limited adaptive capacities of these regions. Both regions are constrained by factors such as technical, institutional and human resources capability, as well as the political and legal frameworks of each nation, through which adaptation plans are implemented (Ashe 1999). Adaptation to climate change impacts in the Arctic and SIDS must take into account the limited adaptive capacity and vulnerability of these regions. The successful implementation of adaptation strategies requires vulnerability assessments based on current, reliable information about the state of the environment. While there is considerable information of this type available for the Arctic, such baseline, broad-ranging information for SIDS is still limited.

It is critical for these regions to enhance their adaptive capacity if they are to meet the challenges of present and projected climate change (UNFCCC CC SIDS 2005). Actions to build adaptive capacity include communicating climate change information and building awareness of potential impacts, as well as maintaining well-being, building community cohesiveness, protecting property or land, maintaining economic growth, or exploiting new opportunities (IPCC 2001).

Global policy responses

In 1992, most countries joined an international treaty called the United Nations Framework Convention on Climate Change (UNFCCC), concerning means of mitigation and adaptation to climate change (Boxes 6 and 7). However, the guidelines of the UNFCCC were difficult if not impossible to implement, and the effectiveness of this treaty was limited. In 1997, the Kyoto Protocol, a multilateral agreement which includes more powerful and legally-binding measures to reduce GHG emissions, was adopted as an addition to the UNFCCC (UN 1997). Article 10 of the Kyoto Protocol also commits parties to promote and facilitate adaptation and deploy adaptation technologies to address climate change. All 8 Arctic nations are Parties to the UNFCCC and 7 have ratified the Kyoto Protocol. Among SIDS, 41 states are Parties to the UNFCCC and 29 have ratified the Kyoto Protocol.

Box 6: The UNFCCC and mitigation
The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic 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, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.
Source: UNFCCC 1992 Article 2

Box 7: The UNFCCC and adaptation
UNFCCC Article 4.1(b): All Parties shall "Formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and measures to facilitate adequate adaptation to climate change."
Article 4.1(e): All Parties shall "Cooperate in preparing for adaptation to the impacts of climate change; develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods."

Article 4.1(f): All Parties shall "Take climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions, and employ appropriate methods, for example impact assessments, formulated and determined nationally, with a view to minimizing adverse effects on the economy, on public health and on the quality of the environment, of projects or measures undertaken by them to mitigate or adapt to climate change."

Article 4.4: "The developed country Parties and other developed Parties included in Annex II shall also assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects."
Source: UNFCCC 1992

Importance of adaptation measures
While the UNFCCC and its Kyoto Protocol incorporate both voluntary and legally-binding agreements between governments to progressively reduce GHG emissions, there will continue to be an increase in atmospheric concentrations of GHGs for several more decades (IPCC 2001). This means that impacts of climate change will continue to accumulate. Thus,

mitigation efforts must be coupled with adaptation measures to effectively manage climate change—particularly in highly vulnerable regions like the Arctic and SIDS. The failure thus far by industrialized nations, which contribute most to GHG emissions, to even implement the far-reaching mitigation measures outlined by the UNFCCC and its Kyoto Protocol further underscores the need for adaptation measures (Ashe 1999).

The UNFCCC states as its objective the "…stabilization of greenhouse gas concentrations … achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change…" (Box 5). However, particularly in the Arctic and among SIDS, many sectors are at or beyond their natural coping thresholds (ACIA 2004, UNFCCC CC SIDS). Planned adaptation is thus necessary at all scales to complement mitigation efforts. While adaptation has the potential to reduce adverse impacts of climate change and to capitalize on beneficial impacts, it is important to remember that adaptation measures will incur costs and cannot prevent all damages.

Funding adaptation strategies
Adaptation strategies will incur costs and their benefits may not be immediately realized (IPCC 2001). At present, most international funding is directed towards mitigation efforts (Huq and Reid 2004). The increasing international awareness of the role of adaptation in climate change management has not been accompanied with increases in funding—particularly for developing countries.

SIDS funding
One of the principle channels of support for climate change issues related to SIDS is the Strategic Priority on Adaptation (SPA) under the Global Environment Facility (GEF) Trust Fund (UNFCCC CC SIDS 2005). In addition, in 2001, three funds to be managed by the GEF were established to support adaptation and related activities in developing countries (Huq and Reid 2004):

1) The Least Developed Countries Fund (LDCF) – enables LDCs (12 SIDS are listed as LDCs) to conduct National Adaptation Programmes of Action (NAPAs) to identify priority adaptation actions for further funding.
2) The Special Climate Change Fund (SCCF) – supports adaptation as well as other actions such as technology transfer in developing countries.
3) The Adaptation Fund (AF) – will finance adaptation projects and programmes in developing countries that are Parties to the Kyoto Protocol.

The LDCF and SCCF are established under the UNFCCC and based on voluntary contributions from donor countries. To date, the majority of LDCs have received funds to prepare their NAPAs under the LDCF and many are now close to completion (Box 8). The LDCF will now support implementation of the NAPAs as soon as possible after their completion (GEF 2005). At the end of 2004, the SCCF became operational and pledges of USD 34.7 million had been received; the fund is now accepting project proposals (UNFCCC CC SIDS 2005, GEF 2005).

The AF is to be based on contributions from the "Adaptation levy" placed on all transactions under the Clean Development Mechanism (CDM) of the Protocol, as well as other funding sources. With Kyoto's entry into force in 2005, the AF and CDM have become available to SIDS. At the second meeting of the Parties to the Kyoto Protocol in

November 2006 (COP/MOP 2), further guidance on the management of the AF was adopted.

Box 8: Somoa's National Adaptation Programme of Action
Somoa is currently the only SIDS Least Developed Country that has a National Adaptation Programme of Action (NAPA). Samoa was one of the first countries to receive GEF funding under the LDCF to develop its NAPA. The main objectives of Samoa's NAPA are:

1. To develop and implement immediate and urgent project based activities to adapt to climate change and climate variability;
2. To protect life and livelihoods of the people, infrastructure and environment;
3. To incorporate adaptation measures and goals into national and sectoral policies, and development goals; and
4. To increase awareness of climate change impacts and adaptation activities in communities, civil society and government.

Source: UNDP 2005a

Arctic funding
Most Arctic nations have mobilized national funding for adaptation and climate change activities (Box 9). The exception to this is the Russian Federation, which only ratified the Kyoto Protocol in November 2004. Although some work has been done to assess vulnerability to climate change in this region, most of this work was implemented through other countries. Regional climate change activities in the Russian Federation are scarce at present.

Box 9: Adaptation activities funded through the Canadian government
Between 1998 and 2001, the Impacts and Adaptation component of the Government of Canada's Climate Change Action Fund supported over 75 projects to examine the impacts of climate change on Canadians and potential adaptation processes. One such project is described below:

Climate Change, Permafrost Degradation and Infrastructure Adaptation: Community Case Studies in the Mackenzie Valley

In many northern communities much of the infrastructure, including roads, foundations and utilities, relies on the strength of permafrost for stability. As such, the effects of climate warming on permafrost represent a key concern in the north. To help the towns of Norman Wells and Tuktoyaktuk prepare for potential changes, researchers conducted in-depth assessments of current and future permafrost conditions and infrastructure sensitivity through the use of literature reviews and thermal modeling. Community members were involved throughout all stages of the project, and results were presented and made available to community officials, planners and engineers for use in their decision-making. The researchers also provided each town with ideas and tools for developing adaptation strategies to deal with the projected changes in permafrost.
Source: C-CIARN 2006

Mainstreaming adaptation
The Arctic and SIDS both face other pressures related to issues such as socioeconomic

development which are often more immediately critical than climate change (IPCC 2001). Many of the activities that need to be undertaken to reduce vulnerability and increase adaptive capacity to climate change relate closely to these ongoing mainstream development activities at local, sectoral and national levels (Huq and Reid 2004). It is increasingly realized that in order to be most effective, adaptation activities should be incorporated into larger planning initiatives related to sustainable development, such as integrated coastal management, disaster management, and health care and education planning.

Integrating climate change adaptation into existing policies and programmes greatly expands the range of opportunities for enhancing adaptive capacity and builds adaptation considerations into the system (OECD 2004). Integration also allows climate change adaptation to be addressed in a more economically efficiently way (OECD 2004). As well, with the addition of climate change considerations, development can become more sustainable and equity can be enhanced (Box 10).

Box 10: Advantages of mainstreaming adaptation
Policies that lessen pressures on resources, improve management of environmental risks and increase the welfare of the poorest members of society can simultaneously advance sustainable development and equity, enhance adaptive capacity and reduce vulnerability to climate and other stresses.
Source: IPCC 2001

Current sustainable development policies
Efforts toward achieving sustainable development are currently underway in both the Arctic and SIDS. In the Arctic, national governments and multilateral agencies are responsible for sustainable development initiatives. The exception is again the Russian Federation, which lacks agencies specifically devoted to such initiatives.

The 1994 Barbados Programme of Action (BPoA) highlights SIDS as deserving special consideration and assistance with sustainable development initiatives (Box 11). SIDS have begun to recognize and develop effective institutions and administrative capacity to promote sustainable development (Huq and Reid 2004). Most SIDS have established high-level policy-making bodies to coordinate sustainable development policies. Others have established specialized bodies and entrusted them with responsibilities for specific sectors such as coastal zone management. Some states have introduced environmental impact and vulnerability assessments as an important environmental management tool or are using economic instruments to promote behavioural changes towards sustainable development.

Box 11: Barbados Programme of Action for Small Island Developing States
The 1994 Barbados Programme of Action for Small Island Developing States (BPoA) provides a framework for specific actions and measures to be taken at the national, regional and international levels in support of the sustainable development in SIDS. This includes steps to reduce the adverse impacts of climate change and environmental disasters. "Climate change and sea level rise" is the first item on the BPoA. The BPoA, however, has received little funding or recognition in development arenas and has no specific funding mechanisms under the UN. Although some resources have been leveraged for specific actions through the Global Environment Facility (GEF), most of the implementation to date has been fully

funded by individual SIDS. Efforts have been focused on building technical skill capacity, developing policy and plans, coordinating national and regional actions, undertaking sub-national environmental assessments, with substantial efforts undertaken in international negotiations.

In January 2005, the International Meeting to Review the Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States, adopted both the Mauritius Strategy to further implement the Programme of Action, and also a political declaration, the Mauritius Declaration. The Strategy emphasizes that SIDS "are located among the most vulnerable regions in the world in relation to the intensity and frequency of natural and environmental disasters and their increasing impact, and face disproportionately high economic, social and environmental consequences".
Sources: UNESD, DSD 2006, UNEP PEO SIDS 2005

Incorporating local knowledge
In addition to mainstreaming adaptation, emphasis should be placed on incorporating local perspectives into adaptation plans in the Arctic and SIDS. The cultures of both the Arctic and SIDS are founded in their intimate relationship to the environment. This unique perspective, in addition to their traditional coping mechanisms, can greatly enrich adaptation strategies and ensure their feasibility "on-the-ground".

While it is the responsibility of governments and other high-level bodies to facilitate adaptation processes, most actual adaptation activities are carried out by individual stakeholders and communities (IPCC 2001). This further reinforces the importance of including local Arctic and SIDS residents in the development of adaptation strategies. Incorporation of local knowledge will also assist in promoting viable sustainable development practices. A consultative framework that is wide-ranging and underpins the culture and economy of these regions is necessary to properly include local knowledge in adaptation and sustainable development strategies. These ideas encompass the recommendations of the Arctic Climate Impact Assessment (Box 12), which can be easily extended to SIDS.

Box 12: Adaptation recommendations from the ACIA
Adaptation to climate change and its impacts in the Arctic must take into account the especially sensitive and vulnerable natural and human systems of the region. Special attention needs to be paid to strengthening the adaptive capacities of Arctic residents. Recognizing that not all impacts of climate change can be properly addressed through adaptation, the Senior Arctic Officials recommend:

- *Work* closely with Arctic residents, including indigenous and local communities, to help them to adapt to and manage the environmental, economic and social impacts of climate change and ultraviolet radiation change. Adaptation needs will vary. Arctic residents may need *inter alia* enhanced access to information, decision makers, and institutional capacity building to safeguard their health, culture and well-being.
- *Recognize* that opportunities related to climate change, such as increased navigability of sea routes and access to resources, should be developed and managed in a sustainable manner, including through the consideration of environmental and social impacts and taking appropriate measures to protect the environment, local residents

and communities.
- *Implement,* as appropriate, adaptive management strategies for Arctic ecosystems, making use of local and indigenous knowledge and participation, review nature conservation and land and resource use policies and programmes, and to the extent possible reduce risks related to infrastructure damage, permafrost degradation, floods and coastal erosion, taking into account costs and benefits.

Source: ACIA 2004

Sharing adaptation experiences

The Arctic and SIDS share many characteristics, within their respective regions as well as between the two regions. The sharing of adaptation stories between nations in each region has the potential to benefit both regions tremendously. However, the limited adaptive capacities of the Arctic and SIDS not only impede them from effectively implementing adaptation strategies within each country, but also impede the process of sharing adaptation experiences regionally. High-level intergovernmental organizations in both regions can provide a means of bridging this gap between nations (Boxes 13 and 14).

Box 13: Arctic governance framework

The Arctic consists of eight nations: Canada, Finland, Denmark (including Greenland and the Faroe Islands), Iceland, Norway, the Russian Federation, Sweden and the United States of America. The Arctic is officially governed at a national, rather than regional level. An institutional complex, created by a variety of actors and intended to address a range of distinct issues and inform and influence the Arctic's national governments, has emerged in the realm of Arctic governance, in contrast to a coherent and integrated institutional system. An alliance among local, sub-national, and national constituencies in the Arctic region has emerged in order to maximize the effectiveness of the voice of the Arctic in global forums. The Arctic Council (www.arctic-council.org) is a high-level intergovernmental forum that provides a mechanism to address the common concerns and challenges faced by the Arctic governments and the people of the Arctic. The Council is a unique forum for co-operation between national governments and indigenous peoples. Six international organizations representing many Arctic indigenous communities have the status of Permanent Participants of the Arctic Council and are involved in the work of the Council in full consultation with governments. The Council also has five Working Groups that address critical issues affecting the Arctic at a regional level; in particular, important environmental issues. The Northern Forum (www.northernforum.org/) provides another means for Arctic nations to converge and communicate on issues of importance to the region.

Source: Young 2002

Box 14: SIDS governance frameworks

There are 51 SIDS countries, each governed at a national level. The Alliance of Small Island States (AOSIS, www.sidsnet.org/aosis/) is the most prominent coalition of SIDS and low-lying coastal countries that share similar development challenges and concerns about the environment. AOSIS functions primarily as an ad hoc lobby and negotiating voice for SIDS within the UN system. SIDS are often further divided sub-regionally into Pacific Ocean, Atlantic and Indian Oceans, Caribbean Sea and Mediterranean Sea islands. The work of the Secretariat of the Regional Environment Programme of the South Pacific (SPREP, www.sprep.org.ws) is guided by a 4-5-yearly Action Plan, organized under 5 key areas:

natural resources management, pollution prevention, climate change and variability, economic development and process. The South Pacific Applied Geoscience Commission (SOPAC, www.sopac.org/tiki/tiki-index.php) also includes numerous Pacific SIDS. The Indian Ocean Commission (IOC) Regional Environmental Programme (www.coi-info.org/) represents Comoros, Mauritius, Reunion and Seychelles. The Caribbean Environment Programme (CEP www.cep.unep.org) is managed by and for Caribbean nations under the Caribbean Action Plan.

Sources: AOSIS 2004, SPREP 2003, SOPAC 2006, CEP 2006

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