



Arctic • Small Island Developing States • Action on Climate Change

Many Strong Voices

Outline for an assessment project design

CICERO in partnership with UNEP/GRID-Arendal

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Abstract:

This document defines, guides, and supports the development and implementation of a full assessment of vulnerability and adaptation to climate change in Small Island Developing States (SIDS), under the Many Strong Voices (MSV) programme. A summary of impacts of climate change on SIDS is provided along with a literature review and analysis of vulnerability and adaptation to climate change in SIDS, supplemented by consultations with SIDS partners, to indicate data availability and quality along with how to fill in data gaps. Then, an initial structure for the assessment is detailed with recommendations for implementing a SIDS assessment of climate change vulnerability and adaptation. Recommendations describe the need for the work, the scientific methods to adopt, the focus on case studies, and the emphasis on a problem-driven and action research approach involving local consultations. Research, policy, and practice outcomes of the assessment are also described.

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Contents

- 1 Introduction 3
 - 1.1 BACKGROUND AND PURPOSE..... 3
 - 1.2 RATIONALE 4
 - 1.3 STRUCTURE OF THIS DOCUMENT 5
 - 1.4 DEFINITIONS: SIDS AND CLIMATE CHANGE 5
 - 1.5 METHOD..... 6
- 2 Past and ongoing work: impacts, vulnerability, and adaptation 7
 - 2.1 DEFINITIONS: IMPACTS, VULNERABILITY, ADAPTATION, AND RESILIENCE..... 8
 - 2.1.1 *Impacts*..... 8
 - 2.1.2 *Vulnerability*..... 8
 - 2.1.3 *Adaptation*..... 8
 - 2.1.4 *Resilience* 9
 - 2.2 PUBLISHED LITERATURE AND PROJECTS 10
 - 2.2.1 *Impacts overview*..... 10
 - 2.2.2 *Vulnerability overview* 16
 - 2.2.3 *Caribbean overview* 17
 - 2.2.4 *Pacific overview*..... 18
 - 2.2.5 *Africa and Indian Ocean overview*..... 20
 - 2.2.6 *National Adaptation Plans of Action*..... 21
 - 2.3 SIDS CONSULTATIONS 22
 - 2.3.1 *Summary of findings related to consultations* 23
 - 2.3.2 *Gaps and deficiencies in approach* 25
 - 2.3.3 *Gaps in knowledge* 27
 - 2.3.4 *Advice for the assessment*..... 27
- 3 Discussion and recommendations 28
 - 3.1 THE NEED FOR AN ASSESSMENT..... 28
 - 3.2 DATA NEEDS, AVAILABILITY, AND GAPS..... 29
 - 3.3 IMPORTANCE OF CASE STUDIES 32
 - 3.4 METHODOLOGICAL CONSIDERATIONS 32
- 4 Conclusions and next steps..... 34
- 5 References cited 36
- 6 Annexes 39
 - 6.1 LIST OF SIDS 39
 - 6.2 SIDS CONTACTS AND PROGRAMMES IDENTIFIED THROUGH CONSULTATIONS 41
 - 6.3 BELIZE WORKSHOP SUMMARY 44
 - 6.4 SIDS SPATIAL DATA REVIEW..... 45
 - 6.5 CARIBBEAN SIDS CLIMATE CHANGE PROJECTS 48

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Executive Summary

This document has been produced in order to guide and support the development and implementation of a full assessment of vulnerability and adaptation to climate change in Small Island Developing States (SIDS), under the Many Strong Voices (MSV) programme. MSV is a collaborative programme designed to ensure the well-being, security, and sustainability of coastal communities in the Arctic and SIDS in the face of climate change. The programme brings together local, national, and regional stakeholders in the Arctic and SIDS to exchange knowledge about the climate change challenges facing them.

A core objective of the MSV programme is research into the consequences of climate change for vulnerable groups and how to deal with those consequences. Participants at an initial stakeholder meeting held in Belize in May 2007 discussed the need for and relevance of a SIDS-wide assessment of vulnerability and adaptation to climate change, and agreed that this assessment should contain strong links to the Arctic and that it should lead to concrete, community-relevant adaptation strategies, strengthen national adaptation planning, and support vulnerable regions in their call for strong action globally. Moreover, the Belize participants noted that a SIDS assessment should go beyond providing a “snapshot” of impacts and vulnerability in these regions, to produce results that can guide concrete adaptation actions and appropriate policy measures over time.

This document follows the format agreed to at the Belize Workshop, with participants deciding that a scoping document should include:

1. A summary of impacts of climate change on SIDS, describing the context for developing an assessment project design in this document.
2. A literature review and analysis of vulnerability and adaptation to climate change in SIDS, supplemented by consultations with SIDS partners.
3. An analysis of data availability, balancing a review of data, studies, publications, and projects which are publicly available with interactions with SIDS representatives in research and policy to provide detail on local initiatives and perspectives.
4. Recommendations from the above analyses for the method for carrying out a full assessment.

Based on the material reviewed, a number of overarching themes relevant to the implementation of a SIDS assessment emerge. The first is that climate change is not a potential threat or theory, but is a reality for residents in the Arctic and SIDS. Second, islanders and coastal residents in the Arctic are continually adapting to climate change in their daily lives, in addition to dealing with other immediate and pressing needs such as economic development, poverty elimination, education, and health. Third, adaptation is not only about what the future holds, but is also about reducing vulnerability to current exposure and risks. Fourth, there is a need to develop comprehensive and integrative approaches, tools, capacities, and methodologies for studying and applying information on climate change vulnerability and adaptation in vulnerable regions, including the Arctic and SIDS. Fifth, and a crucial contention upon which the design of this document and a SIDS assessment rests, is that while a major regional scientific undertaking has documented the potential impacts of climate change on Arctic people, environments, and economies (resulting in the Arctic Climate Impact Assessment) a similar regional effort has yet to be undertaken for the SIDS. Although some impact and vulnerability assessments have been conducted for some SIDS regions and communities, no comprehensive review of present and projected climate change impacts, vulnerability, or adaptation is available for the SIDS region as a whole.

This document aims to address this gap by providing an initial structure and recommendations for implementing a SIDS assessment of climate change vulnerability and adaptation. The recommendations for carrying out the SIDS assessment, as identified in the literature and through consultations with SIDS stakeholders are:

1. An assessment is needed and should be completed as a scientific research project focusing on scientific methods but incorporating other relevant bodies of knowledge, such as traditional, local, and indigenous knowledge, especially with local partners.
2. The assessment should be designed to make full use of available data but should also collect new data to fill in gaps.
3. The assessment should be built on the understanding that vulnerability and adaptation to climate change are dynamic processes that occur and change over time. Therefore, the assessment should itself be dynamic and aim to avoid static descriptions of these processes at a given point.
4. The assessment should learn from and draw upon, but also improve on, other regional assessment efforts, in particular, the Arctic Climate Impact Assessment.
5. Case studies should be a crucial aspect of the assessment. They should be chosen to reflect a realistic and appropriate diversity of SIDS contexts, for the purposes of comparability, and, where possible, provide scope for comparison with case studies in the Arctic and other vulnerable regions.
6. The assessment should adopt a problem-driven and action research approach, which includes local consultations as well as desk-based literature searches and analyses, and which links to policy makers as well as to MSV's communications and outreach strategies.

In particular, the assessment will lead to:

1. Capacity built and developed in the participating institutions and among individuals to understand and tackle climate change.
2. Networks developed and solidified across the SIDS and between SIDS, Arctic partners, and non-SIDS institutions regarding climate change impacts, vulnerability, and adaptation.
3. Cutting-edge scientific publications in international peer-reviewed journals written in cooperation with local and community partners.
4. Communication of the scientific work being done and the results achieved to the general public, policy makers, and other researchers—especially those in SIDS.
5. Timely and relevant policy recommendations and policy briefs for interested parties, including governments, which are based on sound science.

The assessment builds on a recognition that research into vulnerability and adaptation to climate change must include elements and approaches that ensure practical and policy relevance, and that address questions relating to the needs and priorities of SIDS regions. The SIDS assessment will provide a robust scientific foundation for MSV partners in the Arctic, SIDS, and other vulnerable regions as they seek to adapt to climate change, to make their voices heard, and to lobby effectively in international climate change fora. It will also lay the foundation for the design of appropriate capacity building and communication efforts under the MSV programme.

1 Introduction

1.1 *Background and purpose*

The Many Strong Voices Programme (MSV; <http://www.manystrongvoices.org>) brings together local, national, and regional stakeholders in the Arctic and Small Island Developing States (SIDS; <http://www.sidsnet.org>) to exchange knowledge about, and to devise strategic solutions to, the climate change challenges facing them and to raise the voices of peoples in the two regions such that they may be heard in international fora on climate change adaptation and mitigation. The programme was launched in December 2005 by the United Nations Environment Programme (UNEP), and is coordinated by UNEP/GRID-Arendal and CICERO.

Programme participants include international organisations, government agencies, non-governmental organisations, Indigenous Peoples' organisations, research institutes, communities, and individuals from across the Arctic and SIDS, which are two of the regions of the world that are particularly vulnerable to climate change.

The MSV programme has three inter-connected and mutually reinforcing objectives:

1. **Research:** Development of dynamic assessment of vulnerability and adaptation to climate change in SIDS that leads to concrete, community-relevant adaptation strategies, strengthens national adaptation planning, and supports SIDS in their call for strong action globally.
2. **Capacity-building:** Development of new climate change networks to facilitate sharing of knowledge and communication of good practices between vulnerable regions and groups, and within the regions themselves.
3. **Communication:** Development of communications tools that will ensure that people's voices in the two regions are heard in international negotiations and fora, as well as informing and supporting communication.

This document describes the development of the research and assessment component of MSV. The assessment will document research and methods for understanding and acting on vulnerability and adaptation to climate change for SIDS, with lessons for other vulnerable regions, including the Arctic. Completing such an assessment will not only engage local SIDS partners but will also add to the scientific and local knowledge foundations that support MSV information provision, education, outreach, and advocacy.

Some similar work has been completed for the Arctic, through the Arctic Climate Impact Assessment (ACIA, 2005; <http://www.acia.uaf.edu>). ACIA (2005) focused on climate impacts and that experience is applied in this document for SIDS by:

- Helping to scope and articulate the approach for the assessment.
- Demonstrating how the assessment method and structure could be improved without reinventing processes and without repeating any errors made.
- Building on the strengths and successes, while drawing on experiences from research and assessment work carried out on Arctic islands.

ACIA (2005) is instructive especially regarding the important role played by Indigenous Peoples in its development. The assessment incorporated indigenous knowledge into its analysis in innovative ways (ACIA, 2005):

Indigenous observations and perspectives are...of special value in understanding the processes and impacts of arctic climate change. There is a rich body of knowledge

based on their careful observations of and interactions with their environment. Holders of this knowledge use it to make decisions and set priorities. The ACIA has attempted to combine knowledge and insights from indigenous people with data from scientific research, bringing together these complementary perspectives on arctic climate change.

ACIA (2005) also provided a storehouse of information for Indigenous Peoples and others to begin lobbying to have the world pay attention to climate change effects in the Arctic. In the same way, the MSV assessment for SIDS will help to catalyse action at the local, regional, and international levels, but will go beyond ACIA (2005) by detailing vulnerability and adaptation, not just impacts.

1.2 Rationale

Even though SIDS are recognized as some of the most vulnerable places to climate change (e.g. IPCC, 2007; Kelman, 2006a; Lewis, 1990; Lewis, 1999; Pelling and Uitto, 2001; UN, 1994; UN, 2005), so far no assessment comprehensively brings together knowledge, experiences, data, data gaps, and future needs for all SIDS. Some similar assessments have been undertaken for some SIDS, but they tend to address one SIDS country (e.g. Taveuni et al., 2000), a few specific SIDS countries (e.g. USCSP, 1999), a specific SIDS region (e.g. IPCC, 2007), all islands generally without going into much detail (also IPCC, 2007), particular communities (e.g. Mataka et al., 2006), or climate change within the context of other sectors (e.g. UNEP, 2004). Dealing with all SIDS simultaneously in one forum would yield strong advantages in cross-region and cross-country comparisons along with pooling data to avoid repetition and to facilitate learning from each other's experiences.

Ultimately, an assessment will help to reduce the vulnerability and improve the adaptation of SIDS to climate change, through:

- Increasing the understanding of ongoing and future climate change impacts, reinforcing the need for measures to deal with climate change.
- Demonstrating the constraints and opportunities for adaptation within SIDS—and how adaptation leads to constraints and opportunities for communities and countries—in areas including, but not limited to, knowledge, culture, institutions, governance, natural resources, and livelihoods.
- Identifying the gaps in resources for adaptation and laying the foundation for developing, implementing, and monitoring adaptation strategies.

This assessment will be SIDS-based and participatory. A major focus of the MSV programme and of the assessment proposed is to produce robust scientific information combined with local knowledge and experiences that will catalyse local action by SIDS, and that can be shared, contrasted and replicated in other regions that are vulnerable to climate change, including the Arctic. Experience suggests that the most effective manner of reducing vulnerability and bringing about successful adaptation is through community-based work (e.g. Lewis, 1999; Mileti et al., 1999; Wisner et al., 2004). That can be supported by programmes such as MSV and by preparing the assessment proposed here in collaboration with SIDS communities and institutions, taking into account experiences from other vulnerable regions.

Throughout the assessment process, recognising that climate change is one challenge and opportunity amongst many others will be important. SIDS face many other ongoing concerns with examples being rapid rural-to-urban migration, the potential loss of languages and cultures through emigration, gender inequities, exposure to environmental changes at all time scales, pollution, manipulation by richer governments or corporations, and illegal resource extraction. These challenges are in addition to inherent SIDS characteristics of isolation, restricted land area, and limited domestic land-based resources which bring about their own

significant environmental and social challenges. Yet some characteristics of islands and islanders also yield advantages and opportunities for addressing the challenges faced, including the challenge of climate change. SIDS advantages include tight kinship networks, unique heritage, a strong sense of identity and community, creativity for sustainable livelihoods, remittances from islander diasporas supporting island life, and local knowledge and experience of dealing with environmental and social changes (Kelman, 2007).

Such background, knowledge, and experience, along with local knowledge and ideas, forms the basis for this assessment proposal, and will form the basis for the assessment, in order to help SIDS reduce vulnerability and implement adaptation to climate change.

1.3 Structure of this document

This document follows the format agreed at the MSV Belize Stakeholder Workshop held in May 2007. The workshop confirmed the need for and scoped the assessment outlined here, with participants deciding that this document should include:

- A summary of impacts of climate change on SIDS, describing the context for developing an assessment project design in this document.
- A literature review and analysis on vulnerability and adaptation to climate change in SIDS plus extensive consultations with SIDS partners. An important point was that some assessments have been conducted, but no comprehensive review of lessons for all SIDS is yet available, despite a strong need for a SIDS-wide approach.
- An analysis of data availability, balancing a review of data, studies, publications, and projects which are publicly available with interactions with SIDS representatives in research and policy to provide detail on local initiatives and perspectives.
- Recommendations from the above analyses for the method for carrying out a full assessment.

The MSV Belize Stakeholder Workshop also framed this document to integrate the elements of research, communication, and advocacy. Workshop attendees wanted MSV, including the assessment, to produce new and original science built on a foundation of what has already been accomplished, to help communicate the issues to various audiences, and to produce lobbying tools to seek support for and to implement adaptation.

1.4 Definitions: SIDS and climate change

This section defines SIDS and climate change. Impacts, vulnerability, and adaptation are defined in section 2.1.

Climate change has various meanings for those addressing the topic. The Intergovernmental Panel on Climate Change (IPCC), defines climate change to be “any change in climate over time, whether due to natural variability or as a result of human activity” (IPCC, 2007). In contrast, the United Nations Framework Convention on Climate Change (UN, 1992), defines climate change to be “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods” (Article 1, Paragraph 2). Therefore, scientific studies consider all climate trends irrespective of their origin whereas UNFCCC policy measures, most notably the Kyoto Protocol for climate change mitigation, factor in only human-induced climate change due to greenhouse gas emissions. Since UNFCCC’s definition is encompassed by IPCC’s definition, this document accepts IPCC’s broader approach.

However, significant challenges exist in decoupling long-term climate trends from ongoing climate variability and climate cycles (e.g. Glantz, 2003a). Climate variability and cycles can occur annually, producing seasons, as well as decadal, producing phenomena such as the El Niño-Southern Oscillation (ENSO), the North Atlantic Oscillation (NAO), and the Pacific Decadal Oscillation (PDO). Climate also cycles on the order of centuries and millennia. The latter cycles are linked to connections amongst for example, ice ages and the Earth's position in space relative to the sun, the most prominent changes of which are referred to as Milankovitch Cycles. Human-caused climate change will affect many of these climate cycles, climate variations, climate trends, and climate extremes.

Climatic variability and trends are also influenced by single events such as meteorite strikes and volcanic eruptions. While this study focuses on impacts, vulnerability, and adaptation for climate change only, the wider context of climate variability, both natural and human-caused and including extreme events, cannot be ignored for SIDS. Indeed, it is SIDS' experience with and understanding of past and current climate variabilities that help to frame discussions of adaptation to future climate change.

For example, Nunn (2000), Nunn and Britton (2001), and Nunn et al. (2007) describe sea-level fall and regional changes in the Pacific climate approximately seven hundred years ago which altered the environment of Pacific islands and the culture of Pacific island communities. Lessons from this work related to islander migration in response to the changes assist in understanding the options and challenges brought by contemporary climate change impacts, vulnerability, and adaptation (Kelman, 2006a).

SIDS became a group in April 1994 at the first Global Conference on Sustainable Development of SIDS which was held in Barbados and which adopted the Barbados Programme of Action (UN, 1994, updated in the Mauritius Strategy (UN, 2005)) outlining national, regional, and international actions to support SIDS' sustainable development. SIDS now comprises 51 small, low-lying, coastal countries, both sovereign and non-sovereign, that display similar characteristics related to sustainable development and which have generally been considered to be developing or less affluent countries. The few which are not in the tropics are in the low-latitude sub-tropics. Their physical and human geographies vary immensely. Although not all are literal islands, by the definition of a small piece of land surrounded by water, all of them share the island characteristics, challenges, and opportunities described in section 1.1, as further noted in UN (1994, 2005). Annex 6.1 lists all the SIDS and provides basic data on them.

1.5 Method

This document was developed by CICERO and UNEP/GRID-Arendal in close collaboration with MSV partners including SIDS representatives. The work took place from March 2007 to March 2008 through gathering, assessing, and summarising available information about climate change impacts, vulnerability, and adaptation in the SIDS. This process was supplemented by consultations and meetings with SIDS stakeholders and representatives. The aims of these consultations were to identify additional background material, to gain insights about the status of climate change research in the SIDS, to build a network of people interested in contributing to the assessment, and to elicit opinions about the appropriate focus and content of the research. The main activities were:

1. Consultation with SIDS representatives

Consultations occurred via formal and informal meetings, discussions, side-events and break-out sessions with individuals and groups at the following venues:

- MSV Stakeholder Workshop in Belize from 27-30 May 2007.

- High-level meeting of Norwegian and SIDS diplomats and researchers at the United Nations Commission for Sustainable Development (CSD-15) in New York from 30 April to 11 May 2007.
- The United Nations Framework Convention on Climate Change 13th Conference of Parties (UNFCCC COP 13) in Bali in 3-14 December 2007.

In addition to these fora, input from SIDS to the design of the assessment was elicited via:

- Formal invitation letters sent electronically to SIDS colleagues.
- Individual e-mails.
- Conference calls.
- A short questionnaire circulated at COP 13 (Annex 6.6).
- Phone calls and emails to SIDS contacts whom we did not previously know.
- Following up with further information and people suggested by our SIDS contacts.
- Informal discussions with SIDS diplomats.
- Findings and outcomes from the consultations are presented and discussed in section 2.3.

2. A literature search for:

- Formally published scientific literature including in books, journals, and conferences.
- Not formally published scientific material (“grey literature”) including degree theses and dissertations, reports, websites, assessments, and presentations. Sources covered the academic, private, government, and non-profit sectors.
- Non-scientific material, including documents used for advocacy, publicity, education, outreach, awareness, and training. The audience for such material included fishers, farmers, diplomats, politicians, policy developers, teachers, trainers, sustainable development campaigners, scientists, newspapers, and donors. All ages were considered. The main limitation was a high bias towards material in English.
- Ongoing projects, work, and publications.

This document provides an overview of the material available with numerous examples. For brevity and to ensure that the best material is presented, this report does not try to be comprehensive.

2 Past and ongoing work: impacts, vulnerability, and adaptation

This section has two main tasks:

- Defining the terms “impacts”, “vulnerability”, “adaptation”, and “resilience” along with the relevant SIDS issues with respect to climate change. Standard IPCC (2007) definitions are compared with definitions from the United Nations International Strategy for Disaster Reduction (UNISDR) and other relevant definitions to provide depth and history to the discussion.
- Summarising existing material on the topic, published and unpublished, including information and views from the SIDS.

2.1 Definitions: impacts, vulnerability, adaptation, and resilience

2.1.1 Impacts

IPCC (2007) defines climate change impacts to be:

The effects of climate change on natural and human systems. Depending on the consideration of adaptation, one can distinguish between potential impacts and residual impacts:

Potential impacts: all impacts that may occur given a projected change in climate, without considering adaptation.

Residual impacts: the impacts of climate change that would occur after adaptation.

The first part of the definition is clear and straightforward, especially in that it does not assume that impacts must be negative. The MSV assessment should explicitly examine both positive and negative climate change impacts. However, the differentiation between potential and residual impacts is less useful because it is inconsistent with IPCC's (2007) own definition of "adaptation" (see section 2.1.3) in implying that (i) adaptation will occur and then stop even though adaptation is an ongoing process and (ii) adaptation should be done only to stop climate change impacts rather than to enhance the positive impacts.

2.1.2 Vulnerability

For vulnerability, UNISDR (2008) defines "vulnerability" to be "The conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards." IPCC (2007) defines vulnerability to be "the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity." Whereas IPCC's (2007) definition focuses almost exclusively on climate change and requires definitions of other phrases such as "adaptive capacity", UNISDR's (2008) definition is more generic and easier to understand.

The most important difference is IPCC (2007) implying that a specific measure can be taken of vulnerability ("the degree to which") in contrast to UNISDR (2008) including "factors and processes". That latter phrase suggests that "vulnerability" is more than a snapshot in space and time. This focus on longer-term factors and processes, while noting that climate change is considered to be a "hazard" within UNISDR's (2008) definition, connects better with the detailed and comprehensive scientific literature on vulnerability (Hewitt, 1983; Lewis, 1999; Mileti et al., 1999; Oliver-Smith, 1986; Wisner et al., 2004).

2.1.3 Adaptation

"Adaptation", according to IPCC (2007), is:

Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation:

Anticipatory adaptation – Adaptation that takes place before impacts of climate change are observed. Also referred to as proactive adaptation.

Autonomous adaptation – Adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. Also referred to as spontaneous adaptation.

Planned adaptation – Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.

Several limitations to this definition are evident, three of which are presented here. First, the explicit separation of “natural or human systems” is unhelpful for many SIDS and Arctic contexts where indigenous cultures live in close connection to the environment, shaping each other in a continual adaptation or adjustment process termed “co-evolution” (Wilches-Chaux, 2008). Second, the narrowing of “autonomous adaptation” to consider only “ecological changes in natural systems and by market or welfare changes in human systems” eliminates the wide variety of other spontaneous adaptation measures, such as natural responses to human conservation and preservation efforts related to climate change along with societal changes due to human rights, health concerns, or risk perceptions rather than market or welfare changes. Third, the definitions do not “distinguish” anticipatory adaptation and planned adaptation as claimed in IPCC (2007) because those two definitions clearly overlap.

The key word in IPCC’s (2007) definition is “adjustment”, which emerges from White’s (1942/1945) investigation of different ways in which people adjust to floods, not always viewing floods as a threat or hazard. Here, IPCC’s (2007) definition is accepted, but more in the context of straightforward “adjustment” without the unnecessary complexities and pitfalls that occur through the other adaptation terms.

2.1.4 Resilience

Due to its connection with impacts, vulnerability, and adaptation, it is appropriate to consider the definition of “resilience” too. For resilience, IPCC’s (2007) definition is “The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change”. One principal difficulty with this definition is defining the terms in it including “self-organisation” and “stress and change”. Another principal difficulty is the separation of “social or ecological system” because, for climate change, little separation occurs between society and the environment.

UNISDR’s (2008) definition of “resilience / resilient” is:

The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.

This definition is much more straightforward than IPCC’s (2007) definition while containing similar elements. As well, by suggesting an “acceptable level”, it appropriately accepts that the term is always subjective and contextual. Manyena (2006) notes the many inherent challenges and misunderstandings in using “resilience” which potentially suggests that this term causes more problems than it solves.

2.2 Published literature and projects

Projects, information, and literature reviewed for this paper fall into three geographic categories:

1. Focused on islands, coastal zones, or SIDS in general.
2. Regional, which is usually either Caribbean or Pacific; however, the Indian Ocean Islands and the African SIDS also form SIDS regions while some studies address other regional groupings such as the South Pacific, the Eastern Caribbean, or the Lesser Antilles.
3. Case studies of specific locations which are sometimes specific islands or countries.

Following an overview of the material on expected climate change impacts for SIDS and the material on SIDS climate change vulnerabilities, literature and projects combining impacts, vulnerability, and adaptation are provided on a regional basis. This structure emerges directly from the material available. Some is focused on impacts only and some is focused on vulnerability only, but almost all adaptation material inevitably includes a significant component of impacts and vulnerability and is generally provided by region.

In discussing the material available, this report is not comprehensive, providing instead illustrative examples mainly from the best material available. Occasionally, sources are critiqued to demonstrate the necessity of improving some approaches.

2.2.1 Impacts overview

Table 1 summarises the dominant climate change impacts for SIDS identified in the literature, compiled with a strong but not exclusive reliance on IPCC (2007) and UNEP (2007).

Table 1: Dominant climate change impacts for SIDS

Sphere of impact	Specific parameter or area of impact	Specific impacts
Atmosphere	Air temperature	-Increasing globally with widely varying regional and local increases, affecting ecosystems, species, and weather.
	Cycles (e.g. ENSO, NAO, PDO)	-Intensities, frequencies, and durations of these cycles.
	Droughts	-Changes to intensities, frequencies, and durations. -Changes to terrestrial species and ecosystems affected. -Could local knowledge and experience become less useful for farming? Or will it adjust and incorporate new knowledge?
	Humidity	-Changes to baseline values at a given location. -Changes to soil. -Terrestrial species and ecosystems affected. -Could local knowledge and experience become less useful for farming? Or will it adjust and incorporate new knowledge?
	Extreme temperatures	-Likely increase in heat waves. -Likely decrease in cold waves.

Sphere of impact	Specific parameter or area of impact	Specific impacts
	Precipitation	-Changes to baseline volume and type at a given location. -Soil changes. -Terrestrial species and ecosystems affected. -Could local knowledge and experience become less useful for farming? Or will it adjust and incorporate new knowledge?
	Storms	-Changes to intensities, frequencies, and durations in terms of wind, freshwater flooding, coastal flooding, and ocean waves affecting fishing and coastal zones. -Terrestrial species and ecosystems affected. -Near-shore species and ecosystems could be affected by freshwater and sediment runoff changes. -Could local knowledge and experience become less useful for farming? Or will it adjust and incorporate new knowledge?
	Wind patterns	-Changes to baseline speeds and direction at a given location. -Terrestrial species and ecosystems affected. -Could local knowledge and experience become less useful for navigation and settlements? Or will it adjust and incorporate new knowledge?
Land	Coastal zone exposure to ocean	-Likely to experience more wave power and near-shore species and ecosystems changes if surrounding coral reefs and coastal vegetation changes. -Erosion and retreat of coastal zones. -Could local knowledge and experience become less useful for navigation and settlements? Or will it adjust and incorporate new knowledge?
	Salt water intrusion	-Salinisation of fresh groundwater.
	Terrestrial ecosystems	-Biome shifts. -Species composition changes, including invasive alien species. -Could local knowledge become less useful for terrestrial resources based livelihoods? Or will it adjust and incorporate new knowledge?
	Terrestrial species	-Increased disease susceptibility. -Extinctions. -Migrations. -Prey switching, changing ecosystem balance. -Could local knowledge become less useful for terrestrial resources based livelihoods? Or will it adjust and incorporate new knowledge?
Ocean	Acidification	-Affects ecosystems and species. -Possible geomorphological changes, especially to coral islands.

Sphere of impact	Specific parameter or area of impact	Specific impacts
	Current changes	<ul style="list-style-type: none"> -Affects ecosystems and species. -Could local knowledge and experience become less useful for navigation? Or will it adjust and incorporate new knowledge?
	Marine ecosystems	<ul style="list-style-type: none"> -Biome shifts. -Coral bleaching. -Species composition changes, including invasive alien species. -Could local knowledge become less useful for marine resources based livelihoods? Or will it adjust and incorporate new knowledge?
	Marine species	<ul style="list-style-type: none"> -Increased disease susceptibility. -Extinctions. -Migrations. -Prey switching, changing ecosystem balance. -Could local knowledge less useful for marine resources based livelihoods? Or will it adjust and incorporate new knowledge?
	Sea level	<ul style="list-style-type: none"> -A global mean rise of 0.1-0.9 m by 2100 which could lead to local rises of over 1.0 m. -Possible extreme scenarios leading to an eventual global rise of over 5.0 m. -King Tides many cm higher than normal. -Wave regimes with higher power and deeper inland penetration. -Could local knowledge and experience become less useful for navigation? Or will it adjust and incorporate new knowledge?
	Sea surface temperature	<ul style="list-style-type: none"> -Increasing globally, affecting ecosystems, species, and weather.
Settlements	Agriculture	<ul style="list-style-type: none"> -Affected by atmospheric, water, ecosystem, and species changes which also affect soil and pests. -Both land and water based agriculture.
	Buildings	<ul style="list-style-type: none"> -Might be less comfortable or less safe if constructed for a specific climate.
	Extreme events	<ul style="list-style-type: none"> -Changes to intensities, frequencies, and durations of atmospheric-based extreme events (storms and droughts) affect settlement safety and design. -Consequent impacts on other extreme events, such as landslides, avalanches, epidemics, earthquakes (e.g. through soil changes), and volcanic events (e.g. tephra dispersion and explosivity intensity).

Sphere of impact	Specific parameter or area of impact	Specific impacts
	Health	-Diseases might migrate into new locations and change their virulence, frequency, and mutation rates. -Heat, humidity, and dehydration related illnesses and productivity losses are likely. -Extreme event casualties will vary according to extreme event frequencies, intensities, locations, and durations.
	Migration	-Some islands evacuated. -Some settlements moved inland. -Some inland peoples moving towards the coasts, especially cities, as they are affected.
Direct policy links	Aid	-Development aid might be affected as donors deal with their own impacts.
	Heritage sites	-Lost such as through inundation, forced migration away from or onto sites, and the changing environment affecting natural heritage.
	Livelihoods	-Natural resource based livelihoods will need to change with those natural resources. -Tourism based livelihoods could increase or decrease.
	Local knowledge	-Could it become less useful for understanding the local environment if changes are rapid or unusual enough? Or can local knowledge adjust at the same speed as the changes?
	Resource conflict	-Terrestrial and marine resources of evacuated islands. -Fresh water, due to precipitation changes. -Marine living resources, especially fisheries, as ecosystems and species change. -Timber, as ecosystems and species change. -Mineral resources, especially fossil fuels, as accessibility of deposits changes. -Exclusive economic zones change with coastlines.

Some notes for Table 1:

- Marine and terrestrial ecosystems and species frequently overlap with or are connected to the coastal zone.
- Changes to glaciers, frozen precipitation, first snowfall day, timing of the spring ice breakup, and days below freezing are extremely important climate change impacts for the Arctic, but few SIDS locations experience these phenomena.
- Although global increases in adverse heat-related health effects might be balanced by decreases in adverse cold-related health effects, most SIDS experience limited cold-related effects, so the focus in Table 1 is heat-related health effects.

Sea-level rise details

For SIDS, sea level rise is arguably the most certain and potentially devastating climate change impact. According to IPCC (2007), observed sea-level rise is 1.8 ± 0.5 mm/y from 1961-2003 and 3.1 ± 0.7 mm/y from 1993-2003. There is a significant controversy regarding the discrepancy between the two figures. IPCC (2007) notes that projected sea-level average from 2090-2099 will have seen a rise of between 1.8 and 5.9 mm/y from 1980-1999 levels. That is, during the 21st century, sea level will rise at least 0.18 m and perhaps as much as 0.59 m; however, IPCC (2007) explicitly does not provide a real upper bound to the maximum possible sea level rise, stating that the final maximum rise by 2100 might exceed these projections, partly because of inputs from ice sheet break up in Greenland and Antarctica.

Sea level rise exhibits a non-uniform geographical distribution and some regions appear to show nearly 10 times the global average rise, as is the case in some parts of the Indian and Pacific Oceans (Cazenave and Nerem 2004). In the small likelihood that the West Antarctic Ice Sheet collapses raising global mean sea level by approximately five meters (Vaughan and Spooe, 2002), the coastal zones of all SIDS would be completely inundated, covering many entire SIDS and a significant proportion of most SIDS capital cities and ports.

Even without this extreme scenario, some SIDS might lose significant proportions of their land due to sea level rise. Tuvalu, with its highest point approximately five meters above sea level, comprises nine inhabited coral atolls supporting approximately 11,000 people (Connell, 2001; Parks and Roberts, 2006; Ralston et al., 2004). Other SIDS with similar concerns include Tonga (Lewis, 1990) with a population of 115,000, Kiribati with a population of 105,000, Marshall Islands with a population of 60,000, Tokelau, population 1,400, and the Maldives, population 360,000. Tonga, the only island group of these six which is not mainly coral atolls, and Kiribati have some hilly islands, but the majority of the population lives in low-lying coastal areas. Many other island groups, including Antigua and Barbuda, could also have their habitability severely restricted. Even larger islands with much land area well above potential sea level rise—such as Cuba, Fiji's largest island Viti Levu, Puerto Rico, and Samoa's main islands—could have problems since most settlements and infrastructure are in the coastal zone while the hilly, inland regions would require severe ecological changes to settle all the migrants.

Care must be taken in assuming island destruction because the expected physical changes to low-lying islands under sea-level rise scenarios have not been well-studied. Significant geomorphological changes are likely, but complete inundation and loss of all land is not inevitable (e.g. Harvey and Mitchell, 2003; Kench and Cowell, 2002). Yet that does not necessarily imply that these islands will remain habitable in the long term.

An example of a significant event-based geomorphological change occurred on Tuvalu, then the Ellice Islands, during Cyclone Bebe on 21 October 1972. The storm surge which inundated Funafuti Atoll created a coral rubble wall 18-19 km long and 30-40 m wide with a mean height of 3.5 m—larger than some of the atoll's islets (Baines and McLean, 1976; Maragos et al., 1973). Continual similar events might increase island area but reduce island habitability.

Additional details on other impacts

Chemical, rather than geomorphological changes, could also reduce low-lying islands' habitability. Oceanic absorption of atmospheric carbon dioxide has led to ocean acidification (Caldeira and Wickett, 2003; Royal Society, 2005) which is likely to harm coral reefs and to have detrimental effects on coral islands, including shingle beaches.

Freshwater changes, through precipitation changes and sea water intrusion into freshwater lenses and aquifers, will affect SIDS that are dependent on these supplies. Examples are Antigua and Barbuda, Aruba, the Bahamas, Barbados, Kiribati, the Maldives, Tokelau, Tonga, and Tuvalu. Over the long-term, some SIDS receive up to 25% of their annual freshwater supply during tropical cyclones. If the cyclone regimes change to decrease the precipitation which SIDS receive during tropical cyclones, then SIDS such as Puerto Rico and Jamaica might also experience freshwater shortages.

Air temperatures are projected to increase for all SIDS regions but with the lowest increase in the Pacific (Table 2). An increase in mean temperature would likely be accompanied by an increase in the frequency of extreme high temperatures.

Table 2 (from Mimura et al., 2007): Projected increase in air temperature (°C) by region, relative to the 1961–1990 period.

Region	2010–2039	2040–2069	2070–2100
Caribbean	0.48 to 1.06	0.79 to 2.45	0.94 to 4.18
Indian Ocean	0.51 to 0.98	0.84 to 2.10	1.05 to 3.77
Northern Pacific	0.49 to 1.13	0.81 to 2.48	1.00 to 4.17
Southern Pacific	0.45 to 0.82	0.80 to 1.79	0.99 to 3.11

While data are more limited for sea surface temperatures, they also appear to be increasing but varying by region (IPCC, 2007). The Caribbean Sea, for example, has warmed by 1.5°C in the last 100 years (Clarke, 2004). Warming oceans have severely depleted zooplankton and have resulted in considerable coral bleaching in some SIDS regions (UNFCCC, 2005, 2007). Coral bleaching occurs if coral cannot adapt fast enough to increasing sea surface temperatures. These events have the capacity to eliminate more than 90% of the corals on a reef, destroying the ecosystem, leaving islands exposed to ocean waves and storms, and eliminating many islander livelihoods.

Projections regarding tropical cyclones are subject to intense debate across all SIDS regions, including their frequencies, tracks (including durations), and intensities. In January 2008, at the American Meteorological Society's Annual Meeting, the bitter exchanges continued between scientists contending that the Atlantic/Caribbean hurricane season is worsening due to climate change and those who state that the evidence is inconclusive. For the South Pacific, NZCCO (2001) explains that "The intensity of wind and rainfall of tropical cyclones is expected to increase with global warming, but there is little agreement between current climate models about whether the intensity or frequency of mid-latitude storms is likely to increase".

In both regions, increased sea surface temperatures appear to be leading to more intense storms once the storms form, although storm formation might be less likely due to wind changes at the tropopause. As well, storm tracks might change, potentially leading to more northerly South Pacific SIDS such as Tuvalu and Tokelau experiencing more storms along with more southerly Caribbean SIDS such as Aruba, Barbados, and Trinidad and Tobago. Because the SIDS closer to the equator have limited experience in dealing with cyclones, the

consequent disasters are liable to be much greater than on more experienced SIDS until the newly-hit islands can adjust to the changing storm regime.

Precipitation changes over SIDS regions are subject to large relative uncertainties and even the direction of the change is not certain (Table 3). Downscaling such projections to a country level would not yield much confidence. It is likely that wet seasons will become wetter while dry seasons will become drier across SIDS regions. Definitive conclusions on precipitation related to climate change are challenging to reach due to data reaching insufficiently back in time to make adequate comparisons.

Table 3 (from Mimura et al., 2007): Projected change in precipitation (%) by region, relative to the 1961–1990 period.

Region	2010–2039	2040–2069	2070–2100
Caribbean	-14.2 to +13.7	-36.3 to +34.2	-49.3 to +28.9
Indian Ocean	-5.4 to +6.0	-6.9 to +12.4	-9.8 to +14.7
Northern Pacific	-6.3 to +9.1	-19.2 to +21.3	-2.7 to +25.8
Southern Pacific	-3.9 to +3.4	-8.23 to +6.7	-14.0 to +14.6

2.2.2 Vulnerability overview

Vulnerability information for SIDS is relatively extensive, often provided in the form of databases, data lists, and annual sector reports (Box 1). The main caution with all such reports is that data are not always disaggregated by country. SIDS are small compared to other countries, so reported trends and analyses can be unreflective of SIDS's experience. For conducting a thorough and accurate assessment of climate change vulnerability, it would be important to seek country-by-country data which could entail contacting the publishers directly to obtain these data or visiting first-hand sources such as government ministries.

Other studies of specific SIDS or SIDS locations would need to be compiled for an assessment to extract the information relevant to climate change. Older studies, before climate change was identified as an important issue, would be relevant in order to compare overall vulnerabilities with those deemed to be most relevant to climate change. For example, Lewis (1984) compiled a hazard history of Antigua while Lewis (1982) discussed disaster issues for Tonga. Even focusing on climate change, historical retrospectives would need to be part of an assessment, such as comparing Lewis (1989) with Ralston et al. (2004) regarding Tuvalu's vulnerabilities to sea level rise.

One summary of island vulnerabilities to climate change is Mimura et al. (2007), which is Chapter 16 from Working Group 2 of IPCC (2007). Vulnerabilities and impacts are combined into the sectors which are identified as being key: water resources; coastal systems and resources; agriculture, fisheries and food security; biodiversity; human settlements and well-being; economic, financial and socio-cultural impacts; and infrastructure and transportation. The vulnerabilities to climate change are placed within the context of multiple stressors.

The concentration on a few industries/sectors in SIDS contributes to their vulnerability to climate change. For example, on islands such as St. Eustatius in the Netherlands Antilles, the main industry is scuba diving, and on Grenada nutmeg is the only important export (Leonard Nurse, personal communication).

Box 1: Vulnerability data and analyses available for SIDS.

Vulnerability profiles of countries include SIDS and always incorporate climate change related material. Some examples of public databases are:

- United Nations International Strategy for Disaster Reduction (UNISDR):
<http://www.unisdr.org/eng/country-inform/introduction.htm> with an example of Cuba at
<http://www.unisdr.org/eng/country-inform/cuba-hazard.htm>
- UNEP/GRID-Arendal <http://www.grid.unep.ch/activities/earlywarning/preview/data/index.php>.
Often, more hazard information than vulnerability information is available.

For deeper vulnerability profiles which can and should be applied to understanding climate change vulnerability, the following indices need to be included:

- Country Health Profiles for the Caribbean SIDS <http://www.paho.org/english/country.htm>
- Environmental Vulnerability Index <http://www.vulnerabilityindex.net>
- Happy Planet Index <http://www.happyplanetindex.org>
- Human Development Report <http://hdr.undp.org/en/statistics>
- WorldMapper <http://www.worldmapper.org>

Additionally, useful profiles for specific climate change relevant sectors can be gleaned from annual world reports, some of which are:

- *CIA World Fact Book* published by the American Central Intelligence Agency which is useful for tracking basic human and physical geography data.
- *State of the World* published by the WorldWatch Institute which tracks sustainability and environment data and initiatives.
- *State of the World's Children* published by the United Nations Children's Fund.
- *State of World Population* published by the United Nations Population Fund.
- *State of the World's Cities* published by the UN-HABITAT, the United Nations Human Settlements Programme.
- *State of the World's Refugees* published by the United Nations High Commission for Refugees which is useful for tracking forced migrants.
- *World Disasters Report* published by the International Federation of Red Cross and Red Crescent Societies.
- *World Health Report* published by the United Nations World Health Organization.

Similar reports exist for more environmental data, such as for birds, coral reefs, endangered species, forests, and sea turtles, all of which are important to SIDS and which are vulnerable to climate change.

2.2.3 Caribbean overview

With general impacts and vulnerabilities covered in previous sections, adaptation efforts and projects combining impacts, vulnerabilities, and adaptation are now covered on a regional basis. The Caribbean is examined in this section.

The Barbados Programme of Action (UN, 1994) indicated that climate change was a high priority for the Caribbean, thus governments initiated a series of regional projects addressing climate change adaptation. Four major climate change adaptation projects have been undertaken across the Caribbean SIDS within the context of and linked to the development of the CCCCC (Appendix 6.5). Governments also agreed to a permanent centre for climate

change, the **Caribbean Community Climate Change Center (CCCCC)**. The centre was established in 2004 and is based in Belmopan, Belize. Other examples of Caribbean climate change projects, taking one example per sector, are given in Box 2.

Box 2: Examples of Caribbean SIDS climate change projects.

Regional organisation: The **Caribbean Disaster Emergency Response Agency (CDERA)** explicitly incorporates climate change adaptation as part of their Comprehensive Disaster Risk Management programme. CDERA has been involved in the above three projects. An example of a specific CDERA project is “Adaptation for Climate Change and Disaster Mitigation: Township Planning Strategies For Storm Surge in the Caribbean” funded by the Netherlands and Inter-American Development Bank Partnership Program in Environment.

National initiative: Country initiatives such as *St. Lucia’s National Climate Change Policy and Adaptation Plan*.

Consortium: The Caribbean Adaptation to Climate Change and Sea Level Rise running from January 2003 until December 2013 and involving more than two dozen partners.

Scientific study: Lewsey et al. (2004) assessed climate change impacts on coastal infrastructure in the Eastern Caribbean.

Private sector: Caribbean insurance industry representatives examining how to deal with extreme weather events in the context of climate change (UNDP, 2003).

Non-profit: The Island Resources Foundation has been involved in producing several Environmental Outlook and Environmental Profile reports for Caribbean SIDS.

Also in the Caribbean, an example of using local perspectives and preparing useable material for climate change adaptation on Caribbean SIDS is the guidebook *Surviving climate change in small islands* (Tompkins et al., 2005). This guidebook illustrates the challenges inherent in producing such material and the care which is necessary to ensure conceptual and scientific rigour. Three significant examples in this guidebook which would require improvement to ensure its relevance and applicability are:

- The definition of “risk” in the guidebook is not consistent with commonly-used definitions and is not supported by the body of research on this subject (e.g. Crichton, 1999; UNISDR, 2008 which was available in the same form before 2005).
- Invasive alien species are not mentioned in the guidebook, despite this issue being well documented and being continually raised as a major issue for SIDS with respect to climate change.
- Early warning systems are labelled as “technical fixes” which not only discourages the development and implementation of warning systems but which also neglects the long history of warning system science and practice demonstrating the need and effectiveness of warning systems as social processes embedded in day-to-day life (e.g. Glantz, 2003b; Glantz, 2004; Lewis, 1999; Wisner et al., 2004).

Repeating the useful elements of such initiatives while avoiding repetition of the limitations would be important for continuing work in SIDS climate change adaptation.

2.2.4 Pacific overview

Projects, organisations, and institutions relevant to impacts, vulnerability, and adaptation are covered for the Pacific SIDS in this section.

For Pacific SIDS, the **Pacific Regional Environment Programme** (SPREP) is the focal point for climate change, focusing on strengthening meteorological services; understanding climate change, variability and sea level rise; understanding vulnerability, adaptation and mitigation; and supporting policy development on climate change. SPREP's projects for climate change adaptation include:

- Pacific Islands Global Climate Observing System (PI-GCOS).
- Capacity Building for the Development of Adaptation Measures in Pacific Island Countries, empowering local actors to define adaptation solutions in the Cook Islands, Fiji, Samoa, and Vanuatu. Community Vulnerability & Adaptation assessments were conducted along with training for doing the assessments. The assessments were conducted using a bottom-up approach, similar to the International Polar Year's CAVIAR project.¹
- Pacific Islands Renewable Energy Programme (PIREP). Although energy projects are generally more related to climate change mitigation, they have clear adaptation links.
- Co-ordination of climate change policy and climate change science.
- Pacific Climate Change Framework 2006-2015.

Two other SPREP projects are worth detailing. The Pacific Islands Climate Change Assistance Programme (PICCAP) ran from 1997-2000, funded by the Global Environment Facility (GEF). Ten Pacific island countries that signed and ratified UNFCCC were assisted with their reporting, training, and capacity building under the convention. Climate Change Country Teams were created and a Climate Change Country Co-ordinator was appointed to: (i) inventory sources and sinks of greenhouse gases; (ii) identify and evaluate mitigation options to reduce greenhouse gas emissions; (iii) assess vulnerability to climate change; (iv) develop adaptation options; and (v) develop a national implementation strategy for mitigating and adapting to climate change over the long term. GEF has also funded climate change programmes in Niue and PNG which are not in PICCAP.

The South Pacific Sea Level and Climate Monitoring Project, funded by the Australian Agency for International Development (AusAID) set up high resolution monitoring stations in eleven Pacific island countries to measure the relative motions of land and sea at each station. The project also assists with information exchange and holds training courses on using oceanographic, atmospheric and climate data in social and economic decision making.

The **Pacific Islands Applied Geoscience Commission** (SOPAC) is contributing towards climate change knowledge. SOPAC's GeoNetwork "allows the sharing of geographically referenced thematic information between different organizations", providing maps, supporting decision making, improving data access, and encouraging interdisciplinary approaches. Maps for sea level rise have been produced for several Pacific SIDS.

The Community Lifelines Programme at SOPAC also links to climate change through the three areas of Energy, Information and Communication Technology, and Water, Sanitation and Hygiene. That includes the Pacific Resource Centre on Water and Climate along with many international links to climate, water, and weather centres, all of which contribute

¹ CAVIAR is co-led by Grete Hovelsrud at CICERO in Oslo, Norway, and Barry Smit at the University of Guelph in Canada. The project aims to fully integrate scientific and local knowledge. It takes a bottom-up and interdisciplinary approach in order to fully understand the problems identified by local communities. Local involvement in the research design and local consultation on choice of indicators is very important. Assessments and socioeconomic scenarios are designed to be comparable across the entire Arctic region.

directly to dealing with climate change impacts, vulnerability, and adaptation. The Community Risk Programme at SOPAC is similarly involved by including climate change in the three areas of Strengthening Resilience to Disasters, Mitigating the Effects of Hazards, and Mainstreaming Disaster Risk Management.

The **East-West Center** based in Honolulu Hawai'i has long been involved in all aspects of Pacific SIDS and climate change. Some examples of their work are:

- Living with a Climate in Transition: Pacific Communities Plan for Today and Tomorrow.
- Preparing for a Changing Climate: The Potential Consequences of Climate Variability and Change.
- Symposium on Climate and Extreme Events in Asia Pacific: Enhancing Resilience and Improving Decision Making.
- Pacific Islands Regional Assessment of the Consequences of Climate Variability and Change.
- Pacific Climate Information System (PaCIS).
- Pacific Island Training Institute on Climate and Extreme Events.
- Pacific Islands Integrated Ocean Observing System (PacIOOS).
- Workshops on Climate Variability and Change in Pacific SIDS.

Examples of projects involving the **International Global Change Institute (IGCI)** in Hamilton, New Zealand are:

- Climate Change Impacts and Adaptation in Viti Levu, Fiji.
- Adaptation Guidelines for Pacific Island Countries.
- Asian Development Banks Climate Change Adaptation for the Pacific Islands.
- Climate Change Impact Assessment: Republic of Kiribati.

Other examples of Pacific climate change projects, one example per sector, are in Box 3.

2.2.5 Africa and Indian Ocean overview

Projects and material relevant to impacts, vulnerability, and adaptation are covered for the African and Indian Ocean SIDS in this section.

Mauritius and Seychelles were the first and second countries respectively to ratify UNFCCC—in fact, out of the first twenty ratifying countries, ten are SIDS. Nevertheless, there has been limited work done on climate change adaptation for the African and Indian Ocean SIDS at a country or sub-country level.

The most prolific work has been in two categories. First, impacts and vulnerability with the most prominent material being for Seychelles coral bleaching (e.g. Walter et al., 2002), Seychelles tourism impacts (Maddison, 2001), and Maldives sea-level rise vulnerability (e.g. Ghina, 2003). Second, regional or global overviews of climate change issues which include the African and Indian Ocean SIDS amongst all other countries, so the material on each country is extremely limited. IPCC (2007) is an example.

Box 3: Examples of Pacific SIDS climate change projects.

Regional organisation: The Secretariat of the Pacific Community held a workshop 14-17 January 2008 in Nadi, Fiji with national forestry services from thirteen Pacific SIDS to raise awareness and increase understanding of using the Kyoto Protocol's Clean Development Mechanism for forestry projects.

National initiative: Fiji working towards adaptation to climate change in the tourism sector (Fiji Ministry of Tourism, 2006).

Consortium: *Integrated Methods and Models for Assessing Coastal Vulnerability and Adaptation to Climate Change in Pacific Island Countries* through the Assessments of Impacts and Adaptations to Climate Change in Multiple Regions and Sectors (AIACC) programme (Koshy, 2003).

Scientific study: How Pacific islands mangroves will be affected by climate change and actions to reduce these affects (Gilman et al., 2006).

Private sector: A tender to be fulfilled in 2008 for investigating the feasibility of a Pacific island catastrophe insurance pool.

Non-profit: Ben Namakin of the Environmental Education & Awareness Program Conservation Society of Pohnpei (Federated States of Micronesia) producing a pamphlet entitled "Climate Change is Real".

As well, many development projects link to or incorporate aspects of climate change adaptation, but that is far from the main focus. For example, Mauritius and Guinea-Bissau have received African Development Bank loans for projects on agricultural and economic development. The Asian Development Bank has funded an energy and water project in the Maldives, but climate change is not mentioned (ADB, 2007, although see also ADB, 2003a and 2003b).

A few relevant projects were found. As part of the project "Assessments of Impacts and Adaptations to Climate Change" (AIACC), Payet (2003) completed an "Assessment of Impacts of Climate Change on Tourism in Small Island States Based Upon Field Studies in Seychelles and Comoros". For the Seychelles (Mahe & Praslin islands) and Comoros (Grand Comore, Anjouan & Moehli islands), this project developed and tested "a quantitative and stakeholder-driven vulnerability assessment process, with emphasis on developing an adaptation decision framework to address the impacts of climate change on tourism-dependent coastal resources".

In the Maldives, IGCI (mentioned in section 2.2.5) is involved in several climate change projects, including the Climate Change Enabling Activity of Maldives which is funded by GEF, vulnerability and adaptation assessments, and capacity building and training for dealing with climate change. As well, in an attempt to adapt to sea level rise, Japan paid for a sea wall to surround the capital Male which is its own island and the Maldives has built a new settlement on an artificially raised island (Hamilton, 2008).

2.2.6 National Adaptation Plans of Action

One common adaptation document across all SIDS that have produced one is a National Adaptation Plan of Action (NAPA). NAPAs provide a process for certain countries party to UNFCCC to identify priorities for addressing the most urgent needs for climate change adaptation. Those countries are identified by their limited ability to adapt to adverse climate change impacts and are termed “Least Developed Countries”, as defined by UNFCCC.

Any NAPA must factor in existing strategies and build on those, rather than conducting new research, considering long-term scenario modelling, or working on long-term national climate change policies. The NAPA process is particularly relevant due to their focus on community-based activities, knowledge, and inputs; their need to be action-oriented and flexible; and their requirement to use only existing information to present suggestions in an easily-understood format and language. Table 4 shows the SIDS with NAPAs, noting how recent they are.

Table 4: SIDS with NAPAs as of December 2007 downloadable from http://unfccc.int/national_reports/napa/items/2719.php

SIDS	Date of NAPA submission
Cape Verde	December 2007
Comoros	November 2006
Haïti	December 2006
Kiribati	January 2007
Samoa	December 2005
Sao Tome and Principe	November 2007
Tuvalu	May 2007
Vanuatu	December 2007

2.3 SIDS consultations

Published material, as covered in the literature review, does not provide the complete picture for SIDS and climate change. Consultations with people from SIDS are necessary to ensure that unpublished material and projects on the ground are covered. Several such consultations were undertaken via phone and email, in addition to specific venues, as detailed in this section.

MSV Stakeholder Workshop, May 2007, Belize

The meeting was coordinated by UNEP/GRID-Arendal and CICERO, hosted by CCCCC, and held in Belize from 27-30 May 2007. Stakeholders from the Arctic and SIDS that participated in the original MSV planning meeting in Ottawa in 2006, as well as additional stakeholders identified after the Ottawa meeting, were invited to attend and share their experiences. The discussion on the research assessment led to this document, including its format and structure.

UNFCCC COP13, December 2007, Bali

The UNFCCC COP 13 was an excellent venue for profiling MSV, gaining information about projects, people, and programmes that are relevant to this document, and for networking with

and meeting SIDS representatives. An MSV meeting with SIDS stakeholders was held on 6 December 2007 along with informal meetings on the mornings of 4-7 December. As well, a short questionnaire (Appendix 6.6) was developed and distributed to MSV partners and others who were interested, but unfortunately no responses were received.

UN Commission for Sustainable Development (CSD-15), April/May 2007, New York

A meeting between the Norwegian delegation and SIDS representatives was held at the Commission on Sustainable Development (CSD-15) in New York in May 2007. The Norwegian Minister for Development Co-operation (Erik Solheim) chaired the meeting, the MSV programme was presented, and a discussion ensued in which SIDS representatives and high-level officials discussed concerns about climate change in different SIDS regions.

Informal consultations with SIDS diplomats

Informal discussions with environmental diplomats—diplomats tasked with representing their governments at international environmental fora—from St. Lucia, Guyana, and Samoa whose speciality is climate change.

2.3.1 Summary of findings related to consultations

Some general and consistent themes identified through the consultations were that:

- Arctic and SIDS representatives noted the practical and political utility of conducting assessments of vulnerability and adaptation to climate change in their respective regions as a tool for helping them to lobby for strong action globally and to implement and replicate successful adaptation practices locally.
- Climate change is not a potential threat or theory, but is a reality for the Arctic and SIDS.
- Islanders are continually adapting to climate variability and change in their daily lives, in addition to dealing with other immediate and pressing needs such as economic development, poverty elimination, education, and health. For this reason, climate change needs to be set into appropriate contexts that recognise that climate change is one of many factors to which people adjust.
- Adaptation is not only about the future, but also about current exposure and risks. Although knowledge of the “science” behind climate change tends to be low at the community and individual levels, for many islanders, experiences with extreme events—including hurricanes, droughts, and floods—provides a practical and tangible entry point for understanding climate change impacts, vulnerability, and adaptation.
- There is a need to develop comprehensive and integrative approaches, tools, capacities, and methodologies for studying and applying information on climate change vulnerability and adaptation in SIDS. At the moment, many piecemeal projects on climate change impacts and vulnerability exist or have been undertaken in different SIDS regions, but there is no comprehensive assessment for SIDS as a region.

Approaches and guiding principles suggested for a SIDS assessment are summarised in Table 5.

Table 5: Summary of approaches and guiding principles suggested for a SIDS assessment

Approach emphasised	Guiding principle suggested
A community-focused, people-centred approach focused on sustainable livelihoods.	Bring communities and community organisations into the assessment at the design stage (as MSV has done for this document) so that their realities, needs, and priorities are fully reflected in the assessment.
Recognise the synergies and trade-offs between climate change, sustainable development, poverty reduction, and disaster risk reduction activities and priorities at local national and regional levels.	Assessment objectives should factor in the Barbados Programme of Action (UN, 1994) updated in the Mauritius Strategy (UN, 2005) along with poverty reduction, sustainability, and disaster risk reduction priorities, mandates and activities at national and regional levels.
The assessment should recognise and learn from the experiences that people have in dealing with climate variability and risks.	Consider the impacts of extreme weather events such as hurricanes, droughts, and floods on SIDS.
The assessment should provide new information, avoiding replications of what has already been completed.	Identify knowledge gaps, and build on and learn from what is already known.
Include traditional, indigenous, and local experiences and knowledge of climate change vulnerability and adaptation, identifying both the strengths and weaknesses of different knowledge for dealing with climate change.	Make specific efforts to seek and incorporate non-scientific knowledge in the assessment.
Research should be action-oriented and should incorporate aspects of capacity building, training, education, and raising awareness.	Include SIDS capacity building and training needs in the design of research activities and pursue applied research where possible.
Building partnerships and collaborations, and engaging multiple stakeholders, throughout the assessment are essential.	Invest in the creation and maintenance of partnerships throughout the assessment, and produce results that are policy relevant.
More emphasis on collection and representation of social data.	Consider the effects of climate change on traditional culture.
There should be an emphasis on local interests and solutions without neglecting wider scales.	Include applied case studies that emphasise the formulation, identification, and implementation of local solutions and analyse these for their relevance elsewhere and within wider contexts.
Recognise and treat vulnerability reduction and adaptation as processes, rather than as outcomes.	The assessment should be dynamic, avoiding static descriptions of vulnerability and adaptation at one point in space or time.

Several specific research approaches and projects were identified as having specific elements, information, or methods that could be applied and built upon for the SIDS assessment (Box 4).

Box 4: Research approaches and projects identified by SIDS partners

SPREP's project Community Vulnerability and Adaptation Assessment and Action (see section 2.2.4). Lesson: Engaging communities at the outset of any development process that affects them will ensure appropriate input and ownership.

Assessments of Impacts and Adaptations to Climate Change (AIACC) programme, a multilateral project funded by GEF and implemented by UNEP. Twenty-four assessments of climate change vulnerability and adaptation were completed in Africa, Asia, Latin America, and SIDS.

WWF Climate Witness and South Pacific Programmes: shows the importance of engaging communities at the beginning of projects, that local observations of environmental change concur with the science, and that training and dissemination of climate change information is invaluable.

Work of local environmental NGOs, including the Cook Islands Association of NGOs (contact David Ngatae), and Environmental Education & Awareness Program of the Conservation Society of Pohnpei (contact Ben Namakin). Both contacts were keen to cooperate in MSV, and to provide input from and to their local initiatives and contacts.

French project on enhancing regional and national capacity building for the Indian Ocean Commission, in which Comoros, France (Réunion), Madagascar, Mauritius and the Seychelles are involved. The project, supported by the French Global Environment Facility, aims at building capacity on climate observation, assessing and analysing climate change impacts, extreme event warning and risk reduction, strengthening adaptation policies and measures, and creating regional structures for cooperation and coordination.

2.3.2 Gaps and deficiencies in approach

The section summarises gaps and deficiencies in current assessment approaches as articulated during the SIDS consultations.

1. Top-down approaches with a heavy emphasis on physical data acquisition

During consultations, several SIDS researchers pointed out that care should be taken to balance the production of time and resource-demanding datasets with the actual needs of local residents for that information. One example that illustrates these trade-offs is the Climate Adaptation in the Pacific (CLIMAP) project, which was funded by the Government of Canada and implemented through the Asian Development Bank. The project required local climate data, including data on bathymetry and sea-level rise. These datasets did not exist, and had to be painstakingly produced to meet the demands of the project. Moreover, contrary to intention, the risk mapping efforts that resulted from these efforts were not necessarily useful at a local scale, since local people were already able to identify the actions that were needed to reduce vulnerability and adapt to climate risks, but they faced other challenges to doing so, such as social, institutional and economic constraints.

Suggested solution: A strong need identified was for more and better integration of top-down and bottom-up research approaches and involvement of communities from an early stage. For example, the "Guideline for Community Vulnerability and Adaptation Assessment and Action" developed and piloted by SPREP points out that although adaptation to climate change is a difficult and costly exercise, people's inability to adapt adequately does not lessen the knowledge that they have of their own situations. The solution is to fully involve local communities in analysing their own situations and in identifying appropriate solutions to their vulnerabilities, recognising the need to exchange the latest information and knowledge on the effects of climate change on local communities. Mercer et al. (2007, 2008) further describe this approach for disaster risk reduction including climate-related events in PNG.

2. IPCC assessments

The IPCC assessment process is based on published, peer-reviewed literature. There is currently no systematic way for the IPCC to track other kinds of literature, including grey literature and reports undertaken in the SIDS. As a result, there is much adaptation work around the world that does not yet qualify for inclusion in the IPCC reports.

Suggested solution: Review and include SIDS grey literature and reports in MSV. MSV's originality is thus enhanced plus it provides another service to the SIDS by going beyond the IPCC and making available the material collected; for example, by scanning the material and placing it online and on a CD for distribution (subject to copyright).

3. Vulnerability and adaptation assessments

At an expert meeting on adaptation for SIDS in 2007, participants at the UNFCCC Subsidiary Body for Implementation² asserted that vulnerability and adaptation assessments are essential tools for SIDS to evaluate and implement responses to climate change. However, they explained that international financing to support the customisation and application of these tools to SIDS contexts is decreasing. They noted that there is a need to better integrate socio-economic information into vulnerability and adaptation assessments, including linking climate vulnerability to socio-economic studies, long-term periodic and socio-economic assessments, studies on coping strategies, and gender specific vulnerability assessments. The need to link top-down (scenario-driven) and bottom-up (based on analyses of current vulnerability) approaches and to consider community-based and participatory approaches was described. Also discussed was the fact that sustainable high-quality and long-term observational monitoring of climate, agricultural, and sea level data is vital for SIDS.

Solutions: Link top-down and bottom-up approaches in order to reduce costs and build capacity to implement vulnerability and adaptation assessments and methods that are suited to SIDS contexts. Provide financial support for building data inventories and accessing and utilising high-resolution downscaling models.

4. Combining traditional, local, indigenous, and scientific knowledge bases for climate change.

A clear need identified through consultations, and just starting to emerge in the scientific literature (e.g. Mercer, 2007, 2008), is the need to include the voices, experiences, needs, priorities, and knowledge of indigenous peoples in assessments of vulnerability and adaptation to climate change. The Arctic and SIDS are both home to diverse indigenous groups, but Arctic indigenous groups and academics have been relatively more successful at demonstrating the detrimental impacts of climate change on traditional livelihoods compared to their SIDS counterparts. Two recent publications on indigenous peoples and climate change (Minority Rights Group International, 2008 and IUCN, 2008) highlight that although climate change is disproportionately affecting indigenous groups around the world, their capacities and demonstrated resilience for dealing with past climate variability and change are resources that should be built upon.

Informal consultations with SIDS environmental diplomats focused more on "local knowledge" and climate change than on "traditional" or "indigenous" knowledge per se. The consensus was that there is little awareness of climate change at the local or community

² Comprising 38 SIDS parties to UNFCCC, 10 representatives of Annex II Parties that provide support to adaptation-related activities in the SIDS, and 23 representatives of relevant international organisations, intergovernmental organisations, and NGOs that are active in the region.

levels. Local strategies for dealing with climate change were seen as either not being particularly effective due to a lack of relevant knowledge from which to work, or else hampered by a lack of supportive institutions and financial resources to implement adaptation activities. Although local knowledge might have elements that could contribute to climate change adaptation, social changes are in some cases rendering that knowledge less valuable. In some cases, it was suggested that traditional knowledge may be “obsolete” because the people who know their community and know their environment developed that knowledge in a very different climatic regime than is currently being witnessed.

Solutions: Include methods for integrating and enhancing indigenous, traditional, and local knowledge and perspectives into the assessment alongside scientific perspectives on climate change vulnerability and adaptation.

2.3.3 Gaps in knowledge

The main gaps in knowledge which were identified through the SIDS consultations are:

- Lack of local climate and environmental data, in particular historic data, for sea-level rise.
- Lack of knowledge and awareness of climate change, its causes, its drivers, and its practical implications at the local level in many SIDS.
- Few studies of impacts, adaptation, and vulnerability exist for African and Indian Ocean SIDS.
- Documentation of indigenous, traditional, and local knowledge of climate variability in the SIDS is relatively lacking compared to other regions such as the Arctic—even though the knowledge exists to be documented.
- Ocean temperature changes, and the link to ocean acidification, plus the implications for SIDS is an under-researched area.

2.3.4 Advice for the assessment

The SIDS consultations provided helpful advice for conducting the assessment, especially in identifying needs to ensure that the assessment would be successful and in the components to be included in the assessment.

Needs identified were:

- Link experiences and research information across SIDS, and between Arctic, SIDS, and other vulnerable regions.
- Include African and Indian Ocean SIDS representatives in all elements of the MSV programme, including research and assessments.
- Pursue community-based approaches and methods that integrate top-down and bottom-up assessment approaches.
- Engage stakeholders at a variety of levels throughout the assessment.
- Create a steering group to guide the development and implementation of the assessment.

Suggested components for the assessment are:

- Social, cultural, environmental, and livelihood aspects of vulnerability (including adaptive capacity) and adaptation should be comprehensively assessed for all SIDS.
- Comparative case studies are needed to illustrate the diversity of SIDS and SIDS contexts.
- Funding the analysis by SIDS experts on sea level data would be helpful, as this is currently lacking.

- The research should include some quantitative assessments of impacts and vulnerabilities, as this would help in seeking assistance towards adaptation.
- Links should be made to similar assessment work in the Arctic, such as ACIA (2005), but the SIDS assessment should go beyond that.

The assessment should be placed in a global perspective, especially in terms of implications and policy relevance of findings on regional climate change vulnerability and adaptation for sustainable development, poverty reduction, and disaster risk reduction globally. Examples of global assessments to consider are UNEP's GEO4 in 2007, the Millennium Ecosystem Assessment in 2005, and IPCC (2007). Examples of policy documents including climate change but covering wider issues are:

- The Mauritius Strategy for SIDS (UN, 2005).
- The Johannesburg Plan of Implementation from the World Summit on Sustainable Development held in August and September 2002 in South Africa (see Chapter VII for SIDS).
- The Hyogo Framework for Action agreed at the World Conference on Disaster Reduction in January 2005 in Japan (e.g. paragraphs 13g and 25 for SIDS).

3 Discussion and recommendations

This section analyses the data and material found, as reported in Section 2, in order to provide recommendations for conducting a full assessment of SIDS impacts, vulnerabilities, and adaptations to climate change. The discussion and recommendations significantly reflect the comments from SIDS partners, to articulate their desires and wishes which emerged during the consultations.

3.1 *The need for an assessment*

The consultations, especially the Belize Workshop, discussed the need and relevance for a SIDS-wide assessment of impacts, vulnerability, adaptation, recommending the importance of going ahead with it. A strict impacts assessment, similar to ACIA (2005), was not wanted. Rather, it was recognised that vulnerability and adaptation are dynamic processes (e.g. Lewis, 1999). A SIDS assessment should go beyond providing a "snapshot" of impacts and vulnerability in these regions, to produce results that can guide concrete adaptation actions and appropriate policy measures over all time scales. The recommendation was for an impacts, vulnerability, and adaptation assessment for SIDS.

This approach to the assessment would provide a basis for learning in the Arctic and other vulnerable regions. The links to assessments and research in the Arctic strengthens MSV and ensures that the Arctic-SIDS links established under MSV continue, and that the opportunities for learning from one another are multiplied—and are applied beyond the Arctic and SIDS.

Important elements for the assessment, as confirmed by the literature and stakeholder consultations, are:

- Filling in identified gaps in knowledge and data (section 3.2).
- Case studies as an integrative element (section 3.3).
- Applying appropriate methods and combinations of methods to use (3.4).

Additionally, different areas of research along with different framings of the vulnerability and adaptation knowledge should be considered. For example, analyses by individual SIDS might yield a different emphasis than analyses by sector, such as water, agriculture, tourism, energy, and transportation. Studying vulnerability and adaptation from the perspectives of a particular group, such as indigenous people, would again yield a different perspective. Policies at different governance levels must also be matched with practices which occur at those governance levels.

The assessment should involve a component of scenario building, particularly related to different climate scenarios. Scenarios to consider would be the speed of changes, the balance between advantageous and deleterious effects, the role which extreme events such as storms play compared to long-term trends such as sea-level rise, and different inputs from natural variability and natural shifts in the baseline compared to anthropogenic climate change. A variety of possibilities would be needed, ranging from the most extreme scenarios such as a collapse of the West Antarctic Ice Sheet (Vaughan and Spooce, 2002), a supervolcanic eruption, or a meteorite strike negating much of the temperature rise, all the way through to much milder scenarios such as negative feedbacks countering the greenhouse effect.

Recommendation:

An assessment is needed and should be completed as a scientific research project focusing on scientific methods but incorporating other relevant bodies of knowledge, such as traditional, local, and indigenous knowledge, especially with local partners.

As a scientific project, the assessment would be based in CICERO in conjunction with UNEP GRID-Arendal, but the process would be conducted with ownership by the SIDS with links to MSV Arctic partners. To enact this recommendation, the MSV steering committee comprising representatives from SIDS and non-SIDS collaborators would advise and guide the overall assessment process, a process which would then be pursued on the scientific basis which CICERO brings. SIDS research partners would carry out much of the research in their own SIDS.

3.2 Data needs, availability, and gaps

The material in section 2 helped to identify data needs, data availability, and data gaps for the assessment. To some degree, the availability or lack of availability of data will determine the design, method, and success of the assessment. In particular, case studies should be selected which balance those with different data available (section 3.3). Case studies for which there are plenty of data available are useful because in-depth analyses can be completed. Case studies for which less data are available are useful because data can be generated according to needs, rather than using only available data. Both yield original research with needed policy and practice outcomes.

Data are available in many forms. Table 6 presents samples of free, online, robust data which are relevant to SIDS and climate change. The challenge with these data sets is often the resolution. For example, ½ degree scale would dwarf many SIDS. As well, where data are aggregated by region, that can cover many SIDS or else the SIDS characteristics are buried by the characteristics of non-SIDS areas. Another common concern is that SIDS data are sometimes of less quality than other locations because data collection and storage infrastructure is sometimes less adequate. Finally, differences across islands of a SIDS can be

vast, such as amongst the different islands of Tonga and of St. Vincent and the Grenadines, but data might be focused on the capital city or main island.

Table 6: Examples of free, online, robust data which are relevant to SIDS and climate change

Topic	Database	Source	Link
Biogeochemical data	LOICZ environmental database (½ degree scale, global coverage except for polar regions).	LOICZ	http://hercules.kgs.ku.edu/hexacoral/envirodata/main.htm
Climate and moisture availability	Includes monthly and annual summaries for precipitation, temperature, humidity, hours of sunshine, evaporation estimates, wind speed, total number of days with and without rainfall, days without frost, and Penman-Montieth reference evapotranspiration rates.	IWMI World Water and Climate Atlas	http://www.iwmi.cgiar.org/WAtlas
Dams, lakes and reservoirs database	Dams and reservoirs (point attributes) Lake density (% of grid cell area) Lake volume (km ³ per grid cell)	UNH Global Data Sets	http://wwdrii.sr.unh.edu
Energy and energy Products	Energy projects under the Kyoto Protocol.	UNFCCC	http://cdmpipeline.org http://cdm.unfccc.int/Projects/projsearch.html
Environmental flows for freshwater ecosystems	Eco-hydrological Databases for the functioning, requirements, and management of freshwater ecosystems.	International Water Management Institute	http://dw.iwmi.org/ehdb/wetland/index.asp
Marine species	Where and when marine species have been recorded.	IOBIS -- Ocean Biogeographic Information	http://www.iobis.org
Water balance components	Annual precipitation (mm/yr per grid cell) Annual evapotranspiration (mm/yr per grid cell) Annual runoff (mm/yr per grid cell) Annual river discharge (blended, km ³ /yr per grid cell)	UNH Global Data Sets	http://wwdrii.sr.unh.edu/

Annex 6.4 provides a review of SIDS spatial data from UNEP/GRID-Arendal. UNEP/GRID-Arendal also identified a sampling of data sources to illustrate relevant material for the assessment. These data—including 99 digital sources, 55 hard copy sources, and 82 sources available through UNEP/GRID-Arendal—are provided as a separate file in conjunction with this report.

This document suggests that the main data available for SIDS are:

- Climate scenario information on a regional basis, but with limited downscaling. Care should be taken to balance the production of time and resource-demanding datasets with the actual needs of local residents and their capacity to use that information.
- Enough information at various resolutions to develop reasonably in-depth vulnerability profiles and in-depth impacts assessments, with time. Sometimes, availability varies widely amongst SIDS. For example, Belize has much more information than Tokelau. The Caribbean and Pacific SIDS also tend to have much more information than the African and Indian Ocean SIDS, so the assessment should be used to bolster available data for the African and Indian Ocean SIDS.
- Adaptation information is more difficult to generalise. This is because adaptation has to do with people and their behaviour and responses. It occurs at a local scale and the particular contexts will vary. A strong need identified through the SIDS consultations was for more and better integration of top-down and bottom-up research approaches and involvement of communities from an early stage. Mercer et al. (2007 and 2008) illustrate how that could be achieved.
- Climate change information is often not placed in the context of multiple stressors. In conducting the assessment, it will be important to disaggregate climate change from other stressors where feasible, to identify where disaggregation is not useful, and to avoid attributing to climate change those concerns that are due to other factors.
- Links across different space and time scales need to be explicit in the assessment. If vulnerabilities are expected to create severe impacts over the next few years, then long-term adaptation strategies might not be as important as shorter-term measures; however, shorter-term measures should not be implemented without factoring in long-term considerations. That is, time scales need to be linked. As with time scales, all space scales must be considered simultaneously. Local case studies should consider national policies (e.g. NAPAs) and trends while national policies should be influenced by local inputs. Both will need to interact with the regional and international scales, such as for migration issues and for using non-local approaches and knowledge in combination with local approaches and knowledge.

Several areas were particularly prominent regarding data gaps, parts of which could potentially be filled during an assessment. As noted above, the most prominent data gaps are with respect to adaptation. This statement should not imply that all information is available for vulnerability and impacts, because that is not the case, especially regarding baseline data for most of the smaller SIDS. Instead, this statement means that, overall, considering data across all SIDS, the largest gaps are seen in certain aspects of adaptation.

Recommendation:

The assessment should be designed to make full use of available data but should also collect new data to fill in gaps.

3.3 Importance of case studies

Case studies must be integrated into the assessment because they inform and test the theoretical approaches used while illuminating local concerns and insights which would not become apparent through a desk-based study. Section 2.3 demonstrates the importance and value of field work based on case studies.

All 51 SIDS will not be done in equal detail, but a balance will be selected covering different locations, data availabilities, interests, community types, impacts, vulnerabilities, and adaptation possibilities. An important selection criterion will also be comparability, in terms of highlighting similarities and differences. Comparisons will be needed amongst different communities in the same SIDS, amongst different SIDS, and between Arctic and SIDS locations. The latter are to be highlighted as being core to MSV's foundation, values, and vision; as being a highly innovative aspect of the assessment work; and as being an essential part of pushing the SIDS assessment beyond ACIA (2005) in order to demonstrate what could be achieved through an assessment and how much the SIDS and Arctic regions have to offer each other.

The case studies must demonstrate solidly the meaning of vulnerability as a process (e.g. Lewis, 1999; see also section 2.1.2) and how adaptation can reduce that vulnerability. The theory, definitions, and methods must be shown to be relevant on the ground, for the people and for the communities who will be affected by climate change and who must act to avoid detrimental effects. The case studies therefore not only provide important knowledge but also serve as corroboration for the desk-based approaches which are frequently found in the scientific literature.

Recommendation:

For the assessment, select a variety of case studies factoring in comparability.

3.4 Methodological considerations

The overall approach adopted for the assessment is recommended as being problem-driven research and action research. Problem-driven research means that, rather than choosing a disciplinary-based method or a disciplinary perspective for research, a practical problem is identified and research is used for tackling that problem, irrespective of the academic origins of those approaches. The problem has been defined earlier as climate change impacting the Arctic and SIDS.

Action research means that the problem-driven approach helps to initiate and support action—and that the research is conducted with this purpose in mind, rather than being an academic exercise. This reflects MSV's objective to "Increase understanding of needs and solutions, and take practical measures on adaptation" by "developing community-driven comparative and integrated research on the socio-economic and natural conditions that shape vulnerability and capacity to adapt to climate change".

For example, warning systems for extreme events or climate trends are often seen as a telecommunications engineering concern. Research and practice illustrates that they are more effective for appropriate and timely decision-making when they are viewed as a social process which is part of day-to-day living, using telecommunications as one possible approach amongst many (e.g. Glantz, 2003b; Glantz, 2004; Kelman, 2006b). The problem is to develop effective social warning systems through research while the action is to implement and evaluate those systems. That approach creates dialogue across disciplines, bringing together

people from diverse backgrounds and ensuring that the best work is combined and applied to the problem in order to create action.

A wide variety of possible methods, tools, and techniques exist for the assessment task. Examples are GIS, role-playing games, participatory processes (e.g. future visioning, participatory rural appraisal), inventorying and surveying techniques (for physical, biological, and social processes), expert elicitation, model coupling techniques, and methods for visualizing observations and model results. None are either necessary or to be avoided. Each might have a role. The local context, in consultation with SIDS partners, must dictate the set which is chosen for a specific case study site.

Given the relatively short time for field work in each case study site, short-term “guided discovery” might be an appropriate approach to adopt when dealing with communities. It uses participatory techniques by working with the community to choose tasks such as mapping, timelines, matrices, one-on-one structured and semi-structured interviews, surveys, focus groups, participatory mapping, three-dimensional models, and location walk-throughs. This approach parallels the participatory action research methods commonly used across the Arctic and in SIDS (e.g. Chambers, 2002; Wilcox, 1994).

As above, the specific methods must be decided with the local partners in each case study (e.g. Chambers, 2002; Wilcox, 1994) factoring in the need to draw generalisations and to aggregate lessons across sites. For example, if maps are presented or if participants are asked to draw maps, the map form should account for local approaches to visualising their landscape (e.g. Haynes et al., 2007 for Montserrat). Otherwise, a risk exists of imposing values and ideas through the techniques before consultation has started or of falling into the trap of the “tyranny of participation” (Cooke and Kothari, 2001).

Working with local populations should complement literature searches, especially in the libraries and offices of institutions in the case study sites. Regional organisations whose libraries should be explored include CCCCC, CDERA, SOPAC, and SPREP. Local and national governments and non-profits will also have a wealth of material, usually uncatalogued, while regional non-governmental organisations such as the Caribbean Conservation Association and the Island Resources Foundation have important libraries. National climate change and disaster officers should be directly engaged for information and for building capacity through the assessment; that is, the assessment work will not be one way by only extracting information, but will give back the assessment’s knowledge to the SIDS.

As well, given the amount of material continually published online and in the scientific literature—both new material and historical documents—web-based and journal-based searches should continue. A project officer conducting the assessment should set up email alerts and RSS feeds based on MSV-related keywords. Steps for communicating MSV’s purpose and goals, as well as soliciting participation and information, are part of MSV’s broader communications and outreach strategy. Publicizing the assessment may be done through a combination of press releases, email lists, websites, and newsletter articles along with announcements and networking at meetings, workshops, and conferences.

Recommendation:

The assessment should adopt a problem-driven and action research approach, which includes local consultations as well as desk-based literature searches and analyses, and which links to policy makers as well as to MSV’s communications and outreach strategies.

4 Conclusions and next steps

To conclude, the following section summarizes the contents of this paper and discusses next steps.

The May 2007 MSV Stakeholder Workshop in Belize recommended the development of an assessment of climate change impacts, vulnerabilities, and adaptation prospects for SIDS. This report has detailed the form, method, and content of such an assessment by providing an overview of available material on the topic, supplemented by and placed in the context of the views of people from SIDS. This document is not comprehensive, instead highlighting the work deemed to be most appropriate and most useful while indicating some limitations of other material as well as describing what is not available.

From the material throughout this document, the recommendations for carrying out the assessment were:

1. An assessment is needed and should be completed as a scientific research project focusing on scientific methods but incorporating other relevant bodies of knowledge, such as traditional, local and indigenous knowledge, especially with local partners.
2. The assessment should be designed to make full use of available data but should also collect new data to fill in gaps.
3. The assessment should be built on the understanding that vulnerability and adaptation to climate change are dynamic processes that occur and change over time. Therefore, the assessment should itself be dynamic and aim to avoid static descriptions of these processes at a given point.
4. The assessment should learn from and draw upon, but also improve on, other regional assessment efforts, in particular, the Arctic Climate Impact Assessment.
5. Case studies should be a crucial aspect of the assessment. They should be chosen to reflect a realistic and appropriate diversity of SIDS contexts, for the purposes of comparability, and, where possible, provide scope for comparison with case studies in the Arctic and other vulnerable regions.
6. The assessment should adopt a problem-driven and action research approach, which includes local consultations as well as desk-based literature searches and analyses, and which links to policy makers as well as to MSV's communications and outreach strategies.

Many Strong Voices is a powerful and highly innovative project which contributes significantly to understanding and acting on climate change in some of the most highly impacted and most vulnerable locations. The assessment outlined in this document would play a small but important role in ensuring that adaptation takes place in a manner directed by and assisting those who stand to suffer the most.

In moving forward with the assessment, all three elements of the Many Strong Voices programme—research, communication, and advocacy—must be integrated. It is particularly important to highlight the need to produce useful material for SIDS, not only for the partners in MSV but also for the people and communities who will have contributed to the assessment during the case study visits and analyses. That will fulfil the fundamental MSV purpose of involving and helping the people who will most have to adapt to climate change.

In particular, the assessment will lead to:

1. Capacity built and developed in the participating institutions and among individuals to understand and tackle climate change.
2. Networks developed and solidified across the SIDS and between SIDS, Arctic partners, and non-SIDS institutions regarding climate change impacts, vulnerability, and adaptation.

3. Cutting-edge scientific publications in international peer-reviewed journals written in cooperation with local and community partners.
4. Communication of the scientific work being done and the results achieved to the general public, policy makers, and other researchers—especially those in SIDS.
5. Timely and relevant policy recommendations and policy briefs for interested parties, including governments, which are based on sound science.

Both SIDS and the Arctic are already experiencing the impacts of climate change, making their vulnerabilities and their need to adapt more apparent. While communities in both regions have proven adept at adapting to changing conditions in the past, climate change will pose new and unprecedented challenges.

There is a sense of urgency in both regions and a recognition that action must happen now before choices no longer exist. At the same time, people understand that inappropriate actions can cause more harm than good, so the right choices have to be made. The assessment outlined in this document is designed to help communities make and implement those choices for themselves. In parallel, they recognize that they have more chance of succeeding by collaborating. MSV and the proposed assessment are designed to facilitate that process.

The Arctic and SIDS are barometers of global change and are considered critical testing grounds for applied processes and programmes to strengthen the ability of communities to deal with climate change. Lessons learned through Many Strong Voices, and particularly through this assessment, will support policy processes at local, national, regional, and international levels, and will provide decision-makers with the knowledge to proactively safeguard and strengthen vulnerable communities and societies. These lessons will also assist the people living in these regions, who are on the front lines of climate change, to participate in and guide the decisions that will affect their lives, their livelihoods, and their future generations.

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6 Annexes

6.1 List of SIDS

From the official United Nations list at <http://www.un.org/esa/sustdev/sids/sidslist.htm>

American Samoa 1/ 4/
Anguilla 1/ 2/ 4/
Antigua and Barbuda
Aruba 1/ 2/ 4/
Bahrain 2/
Barbados
Belize
British Virgin Islands 1/ 2/ 4/
Cape Verde
Commonwealth of the Northern Marianas 1/ 2/
Comoros
Cook Islands 1/ 3/
Cuba
Dominica
Dominican Republic 2/

Federated State of Micronesia
Fiji
French Polynesia 1/ 2/ 4/
Grenada
Guam 1/ 4/
Guinea-Bissau
Guyana
Haiti
Jamaica
Kiribati
Maldives
Marshall Islands
Mauritius
Montserrat 1/ 2/ 4/
Nauru
Netherlands Antilles 1/ 4/
New Caledonia 1/ 2/ 4/
Niue 1/ 3/
Palau
Papua New Guinea
Puerto Rico 1/ 4/
Saint Kitts and Nevis
Saint Lucia
Saint Vincent & the Grenadines
Samoa
Sao Tome and Principe
Seychelles
Solomon Islands
Suriname
The Bahamas
Timor-Leste
Tonga
Trinidad & Tobago
Tuvalu
U.S. Virgin Islands 1/ 4/
Vanuatu

1/ Associate Member of a UN Regional Commission

2/ Not a Member or Observer of the Alliance of Small Island States (AOSIS)

3/ States non-Members of the United Nations

4/ Territories non-Members of the United Nations

For basic data on SIDS, see:

<http://www.sidsnet.org/2.html>

http://www.sidsnet.org/docshare/other/20040219161354_sids_statistics.pdf

<http://www.un.org/esa/sustdev/sids/sidslist.htm>

<https://www.cia.gov/library/publications/the-world-factbook/index.html>

6.2 SIDS contacts and programmes identified through consultations

This appendix provides a list of many of the SIDS and contacts identified through consultations. The list does not include friends, partners, and steering group members of MSV before this phase began.

Name	Organisation	Contact details (Focused on email)	Venue met or Suggested by
Annett Moehner	UNFCCC Associate Programme Officer, Adaptation, Science and Technology Programme	amoechner@unfccc.int	UNFCCC COP 13
Ben M. Namakin	Program Manager, Environmental Education & Awareness Program Conservation Society of Pohnpei (CSP)	bnamakin@yahoo.com and csp@mail.fm Website: www.serehd.org PO Box 2461 Pohnpei, FM 96941 phone +691-320-5409 fax +691-320-5063	UNFCCC COP 13
Carlos Fuller	CCCCC	cfuller@caribbeanclimate.bz	Cletus Springer
Claire Anterea	Pacific Calling Partnership	goodsams@tskl.net.ki phone 68621490	UNFCCC COP 13
David Ngatae	Cook Islands Association of NGOs	ciango@oyster.net.ck cookislandsfilmcompany@gmail.com	UNFCCC COP 13
Domingos Ferreira	Sao Tome and Principe	domingosferreira74@hotmail.com	CSD15
Geraldine Kearney	Sisters of the Good Samaritan, Pacific Calling Partnership	gkearney@goodsams.org.au	UNFCCC COP 13
Habiba Gitay		phone +81 318 378 249 (mobile, Bali)	Ian Noble
Ian Noble	World Bank	inoble@worldbank.org phone +1-202-473-1329 fax +1-202-522-0367	UNFCCC COP 13
Idelia Ferdinand	St. Vincent and the Grenadines	ideliaf@hotmail.com	Personal contact
Isabelle Meyer	Université de la Réunion	isamayus@yahoo.fr	Personal contact
Jaime Royo Olid	Cape Verde	jaime@cantab.net	Personal contact

Name	Organisation	Contact details (Focused on email)	Venue met or Suggested by
Jay Roop	Asian Development Bank	jroop@adb.org +63-2-632-5631	UNFCCC COP 13
Jennifer Erosa	Pacific Calling Partnership, Torres Straight Islands, Australia	jen@tsima4mw.org.au	UNFCCC COP 13
Julie Morin	Université de la Réunion	julieapi@yahoo.fr	Personal contact
Kairo Taubuli	Pacific Calling Partnership,	kanouak@yahoo.com	UNFCCC COP 13
Kanayathu Koshy	University of the South Pacific, Fiji	koshy_k@usp.ac.fj	Taito Nakalevu (SPREP); Neil Leary (START)
Ken Bryant	Pacific Calling Partnership, Catholic Diocese of Wollongong	ken.bryant@sjv.woll.catholic.ed.au	UNFCCC COP 13
Latai Taumoepeau	Pacific Calling Partnership	sistapasifika@yahoo.com	UNFCCC COP 13
Melanie Speight	DFID Team Leader Climate Change Adaptation Team	m-speight@dfid.gov.uk	<i>Simon Andersen (IIED)</i>
Nirmal Shah	Nature Seychelles	nirmalshah@natureseychelles.org	Personal contact
Penehuro Lefale	SPREP and University of Waikato, NZ	pfi2@waikato.ac.nz	Personal contact
Pepetua Latasi	Climate Change Coordinator Department of Environment, Ministry of Natural Resources and Lands, Tuvalu	enviro@tuvalu.tv	UNFCCC COP 13
Ambassador Robert Aisi	Permanent Representative of Papua New Guinea to the United Nations	raisi@un.int png@un.int phone +1-212-557-5001 ext. 17	COP 13
Rawleston Moore	GEF, Washington	rmoore1@thegef.org	Cletus Springer
Rufina Moi Tulele	SIDS	rufina@oxfam.org	UNFCCC COP 13
Saleem ul Huq	IIED Group Head, Climate Change	saleemul.huq@iied.org	UNFCCC COP 13

Name	Organisation	Contact details (Focused on email)	Venue met or Suggested by
Shuuichi Endou	NGO Tuvalu Overview	shuuichi@tuvalu-overview.tv	UNFCCC COP 13
Simon Andersen	IIED Climate Change Group	simon.andersen@iied.org siAndersen@aol.com phone +44-20-73882117 fax +44-20-7388-2826	Saleem ul Huq (IIED)
Tangaroa Arobati	Pacific Calling Partnership	tangaroa_arobati@yahoo.com	UNFCCC COP 13
Terei Fred	Pacific Calling Partnership	goodsams@tskl.net.ki	UNFCCC COP 13
Tony Chen	Jamaica	anthony.chen@uwimona.edu.jm	Neil Leary (START)
Tony Tologina	SIDS	ursular@online.net.pg	UNFCCC COP 13
Ursula Rakova	Papua New Guinea	ursular@online.net.pg	UNFCCC COP 13
Winston Bennet	CCCCC Project Coordinator	wbennett@caribbeanclimate.bz phone +501-822-1094/1104 fax +501-822-1365	UNFCCC COP 13
Yvan Biot	DFID	Y-Biot@dfid.gov.uk phone +44-20-7023-1138 fax +44-20-7023-0291	Simon Andersen (IIED)

Without providing details, a sample of MSV-relevant programmes identified through consultations is:

- AIACC programme.
- GEF Pacific Alliance for Sustainability programme.
- Nairobi Programme of Action activities.
- Kiribati adaptation project.
- SPREP's project Community Vulnerability and Adaptation Assessment and Action.
- WWF Climate Witness and South Pacific Programmes.
- Work of local environmental NGOs, including the Cook Islands Association of NGOs (contact David Ngatae), and Environmental Education & Awareness Program of the Conservation Society of Pohnpei (contact Ben Namakin).
- French Global Environment Facility project on enhancing regional and national capacity building for the Indian Ocean Commission.

6.3 Belize workshop summary

Summary Report from the Many Strong Voices Stakeholders' Workshop
Belize City, 27-30 May 2007
Prepared by UNEP/GRID-Arendal and edited for this document.

“Action Today, Not Tomorrow”

The Many Strong Voices programme is a unique alliance between the Arctic and Small Island Developing States (SIDS) that aims to ensure the well-being of these regions in the face of climate change. It is driven by the need to protect the cultures, economies and environments of Arctic communities and SIDS from the Caribbean, Pacific and other regions – two groups which are among those most affected by climate change.

The workshop was coordinated by UNEP/GRID-Arendal, based in Norway, and the Center for International Climate and Environmental Research – Oslo (CICERO), and was hosted by the CARICOM Climate Change Centre, based in Belmopan, Belize. The participants represented communities and organizations in the Arctic and SIDS and came from 16 countries and regions, including Alaska, the Caribbean, Norway, Fiji, the Canadian Arctic, Micronesia, Greenland and French Polynesia.

The goals of the stakeholder workshop were 1) to discuss the latest research and assessments on climate change vulnerability and adaptation in the Arctic and SIDS and 2) to begin developing a five-year Action Plan for the Many Strong Voices programme. The Action Plan will include an assessment of the ability of SIDS to adapt to climate change and a communications and outreach strategy, and will enable the collective voices of these regions to be heard at the international policy level.

Workshop participants highlighted similar climate change effects, including the relocation of communities away from coastal areas due to sea level rise and frequent storm surges, and the human and economic impacts of changes to the marine resources upon which Arctic and SIDS communities depend. This new alliance will press for significant reductions in greenhouse gas emissions globally while working to ensure that resources are allocated regionally to assist those that need to adapt now to climate change.

Influencing Policy Makers – Participants identified the United Nations Framework Convention on Climate Change (UNFCCC) as an important vehicle for their activities. The upcoming 13th Conference of the Parties to the UNFCCC in Bali, Indonesia in December was identified as a key opportunity to further strengthen the alliance of Arctic and SIDS. There are also a number of regional and international meetings participants at which indicated their voices must be heard.

Communications and Outreach – An outline for a communications and outreach plan was developed. Besides using conventional media, the internet and other vehicles, emphasis will be placed on engaging groups such as youth, religious, health and education organizations, and socially responsible companies.

Research and Assessments – This group recommended developing an assessment of the vulnerability and adaptive capacity of the SIDS. The project design will include links to the Arctic, which will be instrumental for developing a similar assessment in the Arctic.

The workshop attracted international and regional media attention, including several stories that ran on the Reuters wire service, in regional and local newspapers, on radio and television, and on environmental web sites and blogs.

6.4 SIDS spatial data review

Prepared by Shannon Mallory, UNEP/GRID-Arendal

A. SUMMARY OF THE DATA SURVEY For Small Island Developing States

There is sufficient GIS data to view all of the Small Island Developing States spatially at a coarse scale. Such data are available for free or by CD ROM order, and have been developed primarily by Digital Chart of the World (DCW), ESRI and the U.S Geological Survey. Additional data sets can be found through the Secretariat of the Pacific Islands Applied Geoscience Commission (SOPAC) and FAO (UN Food and Agricultural Organisation) GeoNetwork. These data sets have been created by national governments or by the FAO. A number of hardcopy maps have been made available by the UN Office for the Coordination of Humanitarian Affairs (OCHA) - Regional Office for Asia and the Pacific and FAO GeoNetwork. These maps provide disaster data, interpretation of natural occurrences for planning purposes and topographical features. Various other websites have been created to provide up-to-date information on weather and potential natural hazards.

B. MAIN DATA SOURCES

There are three main data aggregators and sources for many of the Small Island Developing States. These data sources are primarily global in coverage and are widely accessible by internet download, or by CD ROM order. Digital Chart of the World (DCW) is a comprehensive digital map of the world and is freely available. The database is 1:1,000,000 in scale and covers transportation, hydrography, physiography, vegetation, utilities, populated places, political boundaries and land cover. It was developed in 1991\1992 by ESRI and is the most comprehensive global GIS data set available. However DCW layers on their own may not be the best solution in visualising Small Island Developing States.

The U.S. Geological Survey provides GTOPO5 and GTOPO30 data sets, which provide global coverage of Digital Elevation Models (DEM). GTOPO5 is created at 5 arc-second scale and GTOPO30 at 30 arc-second scale. U.S Geological Survey also provides land cover raster images and Hydro1k data sets (global coverage of drainage systems and streams). The Hydro1k data has been derived from the GTOPO30 coverage.

The Secretariat of the Pacific Islands Applied Geoscience Commission (SOPAC) and FAO GeoNetwork provides an aggregation of many data sources for many of the Small Island Developing States. Many of the data sets come from either DCW or from the U.S. Geological Survey, but are specifically for the country specified by a search from the SOPAC or FAO GeoNetwork website. Instead of having to download a global coverage, masks are created for the country in question to allow the user to access to data for the specified region. The SOPAC website also provides downloads of data provided by other sources with specific themes, for example: soil surveys, geologic mapping and hazard mapping.

Data source links:

DCW <http://www.lib.ncsu.edu/gis/dcw.html>

USGS <http://edc2.usgs.gov/geodata/index.php>

SOPAC <http://iprc.sopac.org.fj/geonetwork/srv/en/main.home>

FAO GeoNetwork website <http://www.fao.org/geonetwork/srv/en/main.home>

C. SPATIAL DATA GAPS

The primary type of spatial data that is available for the SID States is global, small scale data sets which may not give the user a detailed view of the area in question. However, from the main data sources above, data sets can be found for demographics, climatic data, environmental and biological features. These data sets that provide larger scale information are not global in coverage and are primarily developed by national or regional authorities and therefore will not be available for all SID states.

D. INTERNET APPLICATIONS

A few of the SID States have their own Internet Map Server, such as Papua New Guinea, Fiji, Vanuatu, Tuvalu, Tonga, Haiti and British Virgin Islands. These map servers and internet sources don't necessarily provide an interactive map, but do provide hardcopy maps of the island and other relevant resources and links.

Map server links:

Fiji Mapserver <http://map.mrd.gov.fj/tiki/tiki-index.php>

Vanuatu Mapserver <http://map.lands.gov.vu/tiki/tiki-index.php>

Tonga Mapserver <http://maps.gov.to/maps/tiki-index.php>

Tuvalu Mapserver <http://map.tuvalu.tv/tiki-index.php>

E. CATALOGUE OF AVAILABLE DATA – Data Review excel spreadsheet

An excel spreadsheet has been compiled that identifies and describes data available for Small Island Developing States. The spreadsheet provides information and sources and is intended to help the user to formulate some idea of the scale, coverage and type of main datasets. Worksheets within the spreadsheet are: Digital data, Hardcopy maps, Internet information, Main digital sources, Data available through the GRID-Arendal server, and Countries and Capitals of SID States.

Worksheet 1 – Digital sources

The digital sources worksheet catalogues various sources of digital spatial data for SID States. A web link to download the data and view metadata is available from the DOWNLOAD LINK and METADATA LINK columns of the worksheet.

Fields of the Digital Sources worksheet:

ORGANISATION *Name of Organisation supplying the data*

ORIG_NAME *Original name of the download file*

SCALE *Scale of the data*

FILE TYPE *Raster (Image) or vector (Points, lines or polygons) data*

LOCATION *Location of data coverage*

DATA_DESC *Description of the data*

CURRENCY *Currency of data creation by year*

DOWNLOAD LINK *Link for downloading the data set*

METADATA LINK *Link for downloading metadata*

Worksheet 2 – Hard Copy information

Hard copy information of specific regions was also catalogued in the Data Review excel spreadsheet. Such data sets were primarily hard copy map products and were available by download or by ordering through the organisation.

Fields of the Hard Copy Information worksheet:

ORGANISATION *Name of Organisation supplying the data*

ORIG_NAME *Original name of the download file*

SCALE *Scale of the data*

FILE TYPE *Hardcopy map or other type of file*

LOCATION *Location of data coverage*

DATA_DESC *Description of the product*

CURRENCY *Currency of data creation by year*

CONTACT_EMAIL_DOWNLOAD *Link for downloading the product or email of organisation*

METADATA LINK *Link for downloading metadata*

Worksheet 3 – Internet information

In addition to digital data and hard copy maps, internet resources were found for many of the SID States. The internet information worksheet provides a description and link to these sources.

Fields of the Internet Information worksheet:

ORGANISATION *Name of Organisation supplying the data*

TITLE *Title of the online product*

RESOURCES *Describes resources available on the site*

ONLINE LINK *Link to the Internet source or product*

DESCRIPTION *Description of the information*

TOPIC *Topic of the website*

Worksheet 4 – Countries

The Countries worksheet provides, for reference, a list of all the Small Island developing States and their capitals.

Fields of the Countries worksheet:

LIST OF SIDS BY REGION *A list of SIDS countries grouped into Africa, Latin America and the Caribbean and Asia and the Pacific*

LIST OF SIDS ALPHABETICAL *A list of SIDS countries provided alphabetically*

CAPITALS *Capitals of SIDS countries corresponding to the LIST OF SIDS ALPHABETICAL column*

Worksheet 5 – GRID-A Data

UNEP/GRID-Arendal hosts many global data sets on their GIS servers. This data is viewed by internet mapping products such as the Shelf Data Map, Arctic Environmental Atlas and the Baltic Environmental Atlas. These products can be viewed through this link

<http://maps.grida.no>. It is appropriate to catalogue this data as it is a quick source of some of the main global data sets described in the summary of this document.

Fields of the GRID-A worksheet:

ORGANISATION *Name of Organisation supplying the data*

ORIG_NAME *Original name of the download file*

NAME *Name of data set theme*

FILE TYPE *Raster or vector data*

SCALE *Scale of the data*

CURRENCY *Currency of data creation by year*

WEBSITE *Link to the organisations website*

6.5 Caribbean SIDS climate change projects

This Appendix supplements Section 2.2.3 and the material is from CCCCC's website (<http://www.caribbeanclimate.bz>), complemented by information presented at the MSV Belize Stakeholder Workshop.

1. Caribbean Planning for Adaptation to Climate Change Project (CPACC) (1997-2001)

Achievements of the project:

- Establishment of a sea level and climate monitoring system – A total of 18 monitoring systems, along with the related data management and information networks, were installed in 12 countries.
- Improved access and availability of data – An integrated database for the monitoring of climate change effects was established through the Inventory for Coastal Resources and the institutionalization of coral reef monitoring.
- Increased appreciation of climate change issues at the policy-making level – CPACC enabled more unification among regional parties and better articulation of regional positions for negotiations under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol.
- Meeting country needs for expanded vulnerability assessment – Pilot vulnerability studies were carried out in Grenada, Guyana, and Barbados.
- Establishment of coral reef monitoring protocols – This resulted in a significant increase in monitoring and early warning capabilities.
- Articulation of national climate change adaptation policies and implementation plans – Such policies and plans were formulated in 11 participating countries.
- Creation of a network for regional harmonization – CPACC developed initial collaborative efforts with a number of existing regional agencies. Partners include PetroTrin of Trinidad and Tobago, as well as key players in the insurance and banking sectors

During CPACC, National Adaptation Policies were developed under which adaptation options were identified for different sectors, for example water and tourism.

2. Adaptation to Climate Change in the Caribbean (ACCC) (2001-2004)

Outcomes of the project:

- Development and distribution of risk management guidelines for climate change adaptation decision making; Political endorsement (by CARICOM) of the business plan and establishment of the basis of financial self-sustainability for the Caribbean Community Climate Change Centre (CCCCC);

- Development of a guide to assist environmental impact assessment (EIA) practitioners in CARICOM countries to integrate climate change in the EIA process;
- A draft regional public education and outreach (PEO) strategy;
- Development and handover to MACC (see below) of the organization's website;
- Successful launch of a Master's Programme in climate change (the first set of graduates, in 2003, included eight students);
- Statistically downscaled climate scenarios development for Jamaica, Trinidad and Tobago, and Barbados;
- Staff training and development at the Caribbean Institute for Meteorology and Hydrology (CIMH) in climate trend analysis in order to strengthen climate change capacity;
- Dialogue established with the Pacific Regional Environment Programme (SPREP) and the Pacific Islands Climate Change Assistance Programme (PICCAP) for collaboration on issues related to climate change; and
- Implementation of pilot projects on adaptation studies in the water health and agricultural sectors.

3. Mainstreaming Adaptation to Climate Project (MACC) (2004-2007)

The five major components were:

1. Building capacity to identify climate change risks – Among other things, this will include strengthening networks to monitor impacts on regional climate, downscaling global climate models, and developing impact scenarios;
2. Building capacity to reduce vulnerability to climate change;
3. Building capacity to effectively access and utilize resources to minimize the costs of climate change;
4. Public education and outreach; and
5. Project management.

In addition, the project seeks to build capacity in a cost effective way.

Neville Trotz (personal communication) wrote that “MACC uses vigorous modelling to give more site-specific projections and regional climate models. It makes use of sectoral vulnerability assessments – particularly for agriculture and water. For vulnerability assessments, earlier guidelines from UNEP and the IPCC focusing on physical vulnerability were first used. We then crafted a new vulnerability assessment now used in studies. There is a need for more realistic models to use in work. The project also used sectoral impact models. In agriculture, there hasn't been wide use of sectoral models – this must be taught. In Belize, there was a focus on water impacts, in Barbados a focus on tourism”.

4. Special Program on Adaptation to Climate Change (SPACC) (2007-2010)

In the upcoming project, SPACC programme, the first component will be to design adaptation options that address biodiversity and land-use change. Component 2 will involve actually implementing adaptation. Component 3 will develop a framework to use the “ecosystem approach” (Neville Trotz, personal communication).