Preamble

Adaptation planning for climate change is constrained by, among other factors, inadequate knowledge about current and future impacts and vulnerability, under-resourced institutions, insufficient human capacity and financial resources, and a lack of awareness about potential threats from climate change. While these constraints manifest in rich and poor countries alike, their effect is most acute in the developing world where knowledge generation and communication systems to support climate change science and planning are generally weak or sometimes nonexistent and yet where the potential risks from climate change are great. The lack of robust science-based knowledge systems in the developing world hinders not only national- and regional-level adaptation planning but also the ability of the global scientific community to effectively investigate and assess climatic and other global environmental change processes, teleconnections and feedbacks that occur across regions.

Concern over the existence of substantial knowledge and capacity gaps in the developing world spurred the climate change science community, led by the IPCC during its Third Assessment period, to recommend the development of a wide-ranging programme of assessments that would address knowledge gaps in key sectors, enhance scientific capacity in developing countries, and inform and support effective adaptation planning. This effort culminated in the Assessments of Impacts and Adaptation to Climate Change (AIACC) project, which supported sub-regional assessments in Africa, Asia and Latin America. The AIACC project was jointly executed by the global change SyStem for Analysis, Research and Training (START) and the Academy of Sciences for the Developing World (TWAS) on behalf of UNEP.

The insights and lessons gained from the AIACC project, described in Section 1 below, enabled START, a Nairobi Work Programme Focal Point, to contribute to several of the NWP's Areas of Work. Relevant pledges under these work areas included:

- To develop and disseminate diverse methods and tools for conducting integrated assessments of impacts, adaptation and vulnerability.

- To develop climate change scenarios and downscaled climate projections for regions where this information is generally lacking.

- To advance the use of integrated research assessments that further understanding of impacts of and vulnerability to current and future climate change.

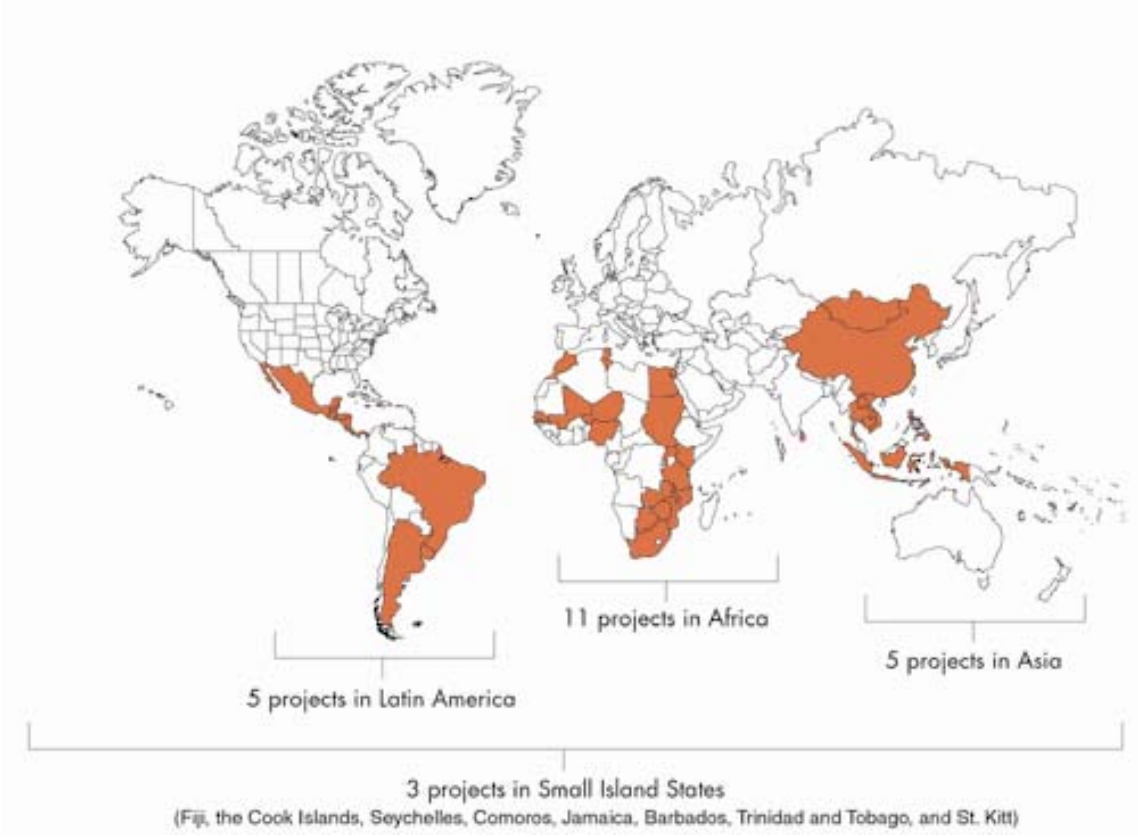
- To promote informed adaptation planning based on knowledge generated through integrated research and assessments.

This paper describes the various tools and methods used by the assessment teams and best practices that emerged from the assessments, and discusses how the assessment process assisted Parties to address adaptation needs. This paper also examines the underlying importance of assessments to adaptation planning, where opportunities exist to enhance positive outcomes from assessments, and the challenges and opportunities for sustaining this effort.

1. Outcomes and impacts

The assessments carried out under the AIACC project represented the largest organized effort of its kind. Over a 5-year period (2002-2007), the AIACC conducted 24 sub-regional climate change assessments in Africa, Asia, Latin America, and small island states (Figure 1), involving over 300 scientists, experts, and students from more than 50 developing countries. The project produced more than 200 publications by developing country scientists, and providing critical inputs to the 4th Assessment Report of the IPCC, which contained more than 100 citations of AIACC publications. The assessments investigated a wide range of topics, including biodiversity conservation and ecosystem resiliency, water resources, agriculture, food security and rural livelihoods, human health, and tourism.

Figure 1. Locations of AIACC regional studies



Several common insights emerged from the assessments that have enhanced understanding of vulnerability and adaptation dynamics in the developing world. These include:

- Systems with similar exposures to climate stimuli can vary considerably in their vulnerability to damage from exposure to extreme events, depending on the strength of institutions, resilience of livelihoods to extreme events, and overall levels of socio-economic development.

- Non-climate drivers exert a strong influence on vulnerability where natural systems are severely degraded and human systems prone to failure. Addressing these non-climate drivers is an important means for reducing the adaptation deficit with respect to current climate variability and extreme events while also advancing broad development goals.

- Development can either enable or hinder adaptive capacity depending on how the benefits of development are distributed and how development outcomes influence interactions between climate and non-climate drivers of vulnerability.

- Understanding and addressing obstacles to adaptation is essential for creating the conditions that enable adaptation to proceed. Obstacles found to be common across the assessments included competing priorities in resource-scarce settings, entrenched poverty, lack of knowledge and information, lack of financial resources, weak institutions, degraded natural resources, inadequate infrastructure, insufficient financial resources, distorted incentives and poor governance.

Assistance to the Parties: The AIACC produced a rich body of knowledge that has directly assisted adaptation planning at the national level, through strengthening the scientific basis for National Communications to the UNFCCC and through informing national delegations to the UNFCCC COP about key issues. All of the Assessment Teams established contacts and shared scientific outputs with entities responsible for National Communications and National Adaptation Programs of Action (NAPA), and many of these teams were asked to formally contribute to National Communications and NAPAs, as shown in Table 1.

Table 1. Examples of AIACC outputs that supported national-level adaptation planning

Country/Region	**Key assessment findings or products**	**AIACC Team inputs to adaptation policy and decision-making processes**
South Africa	Biodiversity study in which new methodologies were developed that has improved understanding of individual species' dispersal response to climate change and their potential persistence.	• Assessment team members prepared briefings to the South Africa delegations to the UNFCCC COP. • Training workshop provided to conservation professionals from throughout Africa.
SubSaharan Africa	Downscaled regional climate change scenarios for SubSaharan Africa, developed for the AIACC assessment teams in Africa.	The scenarios were used by other adaptation projects to assess impacts on agriculture and water resources; in some instances, this information was used for National Communications.
Sudan	A framework for sustainable management of natural resources was developed to bolster understanding of livelihood security and human coping capacity in drought-prone areas.	• Project outputs were used in the development of Sudan's NAPA and in planning of Sudan's Second National Communication. • Sustainable livelihoods approach for enhanced drought resilience now used as a model for similar efforts.

Nigeria	Key climate change risks and shifts in agroecological zones identified; Needs assessment for extended-range weather forecasts conducted.	Assessment results incorporated into Nigeria's First National Communication, and in planning for the Second National Communication.
Miombo region (Southern Africa)	Vulnerability framework for LDCs developed that addresses key climate risks, livelihood facets and ecosystem services.	Participatory V&A assessment tools being made available to LDCs to assist in the development of NAPAs.
Mongolia	Climate change impacts on land and water resources and pastoral livelihoods identified; and adaptation options for pasture and herd management developed.	• Assessment results have fed into subsequent adaptation projects. • Findings to be incorporated into the Second National Communications.
Lower Mekong Delta	Sensitivity of rice production to climate change evaluated; Socioeconomic analysis identified differential risks and vulnerabilities for rice-growing communities in the Mekong Delta.	• Principal Investigator in his role as member of Thailand's National Climate Change Committee has used AIACC findings to influence its national climate change strategy. • The lead institution held regional trainings on V&A assessment.
Philippines	Climate change impacts on surface water flow and risks to lowland farmers estimated. Forest management practices to reduce climate change-related risks identified.	• Findings incorporated into the Second National Communications. • The lead institution held regional trainings on V&A assessment.
Pampas region (South America)	Regional climate change projections used as the basis to estimate impacts on agriculture and to develop adaptation recommendations.	• Assessment findings incorporated into Argentina's Environmental Agenda and its Second National Communication.
Mexico	Climate change risks to coffee production, and social vulnerability and adaptation options at the farm level identified.	• Findings to be incorporated into Mexico's Third National Communication. • Media outreach widely disseminated assessment findings.
Jamaica	Climate and epidemiology databases for dengue fever developed. Current and future risks and adaptation strategies identified.	• The Second National Communication to include results of the dengue assessment. • Inputs to planning for a dengue early warning system.
Seychelles	Climate change risks (coral bleaching, coastal ecosystem degradation) and impacts of these risks on tourism estimated.	Assessment Team involved in Second National Communication.

In addition, several investigators, drawing on their AIACC experiences, co-authored technical papers for UNDP's Adaptation Policy Framework, and participated in numerous international, regional, and national conferences on climate change, during and subsequent to the AIACC.

Methodological approaches: The assessment teams developed a number of different methodological approaches and tools, reflecting the particular environmental and sectoral issues under investigation, the scientific and institutional strengths and capacities of the assessment teams, and the socio-economic and policy landscape in which the assessment

were being conducted. Most of the assessment teams used case studies as a means of developing and testing their respective assessment approaches, and they drew from multiple and diverse sources of information, (e.g., biophysical and socio-economic datasets and models, climate change scenarios and projections based on data from downscaled GCMs, household surveys, and stakeholder workshops) in developing and executing the assessments. Table 2 provides a sample of the different types of assessment approaches used by the teams.

Table 2. Examples of assessment methods and tools used by assessment teams

Country/region	Assessment topic	Assessment approach
Southern Africa	Biodiversity conservation	Dynamic niche modeling for capturing transient climate change, integration of non-climate drivers into a vulnerability assessment; and use of an economic framework to assess adaptation costs for options identified through multiple case studies.
Sudan	Rural livelihoods	Integrated (local and external) knowledge frameworks on sustainable livelihoods and natural resources management supported by case studies to assess drought vulnerability.
Nigeria	Agriculture and food security	Data from climate change projections, current climatic conditions, land use, socio-economic and population data aggregated and applied to case studies of different cropping systems in West Africa
Miombo Region (Southern Africa)	Ecosystems and rural livelihoods	Participatory rapid integrated assessment tool developed, supported by the project's collation of climatic and other regional datasets and local level assessments. National level stakeholder workshops conducted to raise awareness.
West African Sahel	Rural livelihoods	Rapid rural appraisal, questionnaire surveys, literature survey, and focus group discussions were combined with climatic, socio-economic and environmental data.
Mongolia	Grasslands sustainability and pastoral livelihoods	Analysis of long-term plant and animal dynamics, use of animal production models, remote sensing, climate and biophysical datasets and climate projections combined with field and participatory surveys.
Lower Mekong Delta	Water resources and rainfed rice production	Regional climate, crop, and hydrologic models combined with household surveys, focus group meetings, and local stakeholder meetings.
Philippines and Indonesia	Watershed resiliency	Climate change scenarios, land use and cover change and current vulnerability assessment through stakeholder interviews and surveys used to assess future vulnerability and adaptation.
Argentina and Uruguay	Coastal flooding	Hydrodynamic models and climate models used to estimate mean sea level and storm surge level; social vulnerability estimated through integrated physical and social data.
South American Pampas region	Agriculture	Crop and pasture simulation models integrated with climate change scenarios to assess impacts of climate variability and change on farmers' income
Mexico and Argentina	Agriculture and rural livelihoods	Observed impacts of El Nino –driven climate variability on agriculture documented and projections of climate variability within climate change estimated. Socioeconomic determinants of social vulnerability determined.

Capacity building: Building or enhancing the capacity of developing country scientists to undertake multidisciplinary, multi-sectoral research and assessment was a driving motivator behind the AIACC project. The project deployed a multipronged approach to engender capacity development that combined learning-by-doing with targeted technical assistance and training, and that engaged the assessment teams in research networks designed to facilitate multidisciplinary, inter-institutional and cross-border cooperation. By collaborating with others from diverse backgrounds and areas of expertise in a learning-by-doing process, the participants gained essential skills for conducting integrated assessments that included recognizing and accounting for cross-system interactions and feedbacks, integrating results across multiple sectors and scales, and synthesizing findings in a manner relevant to the needs of societal stakeholder groups engaged in adaptation planning.

Training activities were carried out at multiple, reinforcing levels. The activities included global training workshops organized by START and TWAS and training activities organized by the assessment teams themselves, which included south-south training events in which assessment teams provided training to other teams in the AIACC network. For example, the climate analysis group at the University of Cape Town convened a workshop on regional climate modeling for researchers from other AIACC assessment teams in Africa, and AIACC teams in Thailand and the Philippines provided training to other AIACC teams in Southeast Asia on assessments methodology.

2. Emerging good practices and lessons learned

AIACC was structured in such a way as to encourage interactions across research disciplines, institutions, and political boundaries, and enable more effective south-south exchange of information, knowledge and capacity. This approach, replicated across such a large number of assessments and in contrasting research environments, has generated a number of key insights that can inform "good practice" recommendations for future global change assessment efforts in the developing world. These include:

1. *Consider broad criteria in selecting assessment teams.* The peer-review process of selecting proposals for the AIACC project considered the need for representation of countries with low capacity as a co-criteria to scientific merit. This inclusive selection approach helped to broaden the reach of the climate change assessments to LDC countries where there are substantial knowledge and capacity gaps. The presence of a strong technical support team within the project and the project's emphasis on capacity building helped to support the needs of teams from low capacity countries.

2. *Coordinate assessments*. Execution of multiple climate change assessments under the umbrella of a larger project produced synergistic benefits. The AIACC project provided numerous opportunities for the different assessment teams to interact with each other through regional workshops, synthesis activities, joint training activities, peer-review of each others work, and electronic communication. Moreover, executing a group of assessments together also made it possible for investigator from multiple

projects of similar design to compare results from across the projects and to identify and synthesize common lessons.

3. *Provide for flexible, bottom-up management.* The assessment teams were given wide latitude to set their specific objectives, focus on sectors and issues of their choosing and select the methods and tools to be applied. This allowed for a high degree of innovation and matching of the focus and design of each assessment to the priorities, capabilities and interests of the teams, and it allowed for flexibility in adapted to shifting priorities within the assessment. The flexible and 'bottom-up' approach to project management created good working relationships and respect among the participating institutions and was a key factor in the overall performance of the project.

4. *Promote multiple, reinforcing activities for capacity building*. A comprehensive program of learning-by-doing, technical assistance, group training, self-designed training and networking was demonstrated to be effective at building capacity. Efforts were made to utilize the expertise of developing country participants to assist with training and capacity transfers to their colleagues. This worked well and even led to a number of training workshops organized by some of the teams for colleagues in other projects. A substantial portion of the capacity building resulted from the cross-project learning and sharing of methods, expertise, data and experiences. The central role assumed by regionally based capacity building and regional research networks helped to ensure greater sustainability and achieve a wider impact than is generally the case with north-south transfers of expertise and capacity development.

5. *Engage stakeholders early and often*. Active engagement of stakeholders, such as those from vulnerable communities, the private sector, resource management groups, and the policy making community, can help to inform the assessment process as to where multiple and interacting determinants of vulnerability exist, how manifold risks are perceived and managed, and where opportunities and obstacles to adaptation exist. An important result of active stakeholder engagement is that assessment outputs tend to be more demand-driven and are thus perceived as relevant to national development priorities. Examples of stakeholder engagement in the AIACC project included focus group meetings, household surveys, participatory workshops, and science-policy dialogues. Stakeholder engagement in the AIACC was not always optimal and some project teams felt that greater outreach to vulnerable communities would have furtherstrengthened the outcome.

3. Emerging opportunities, challenges, and further needs

The assessments conducted under the AIACC project, and the plethora of recent assessments, projects, and programs undertaken by the global change community, have made important progress towards advancing knowledge, enhancing human and institutional capacity and improving links between science, policy, and stakeholder communities. However, substantial knowledge and capacity gaps remain, providing both challenges as well as opportunities.

Challenges and further needs: The extent to which knowledge generated through the assessment process ultimately yields tangible progress towards adaptation depends on the extent to which (i) gains in capacity development can be sustained post-assessment, (ii) there are viable pathways for new knowledge to be "translated" into salient and actionable information to guide decision making, and (iii) access to resources is adequate to allow stakeholders to act on recommendations produced through the assessment. Given these wide-ranging needs, efforts to support assessments and related capacity building must be embedded within a larger objective of building capacity across society to better enable communication and knowledge exchange between scientists and policy/decision makers, including vulnerable communities, so that new knowledge can be more readily integrated into development planning. Actions that are needed include:

- Support for on-going training of developing country scientists, especially young scientists, in order to build a critical mass of expertise on climate change risks to key sectors. A targeted process of scientific capacity building is in itself an adaptation response, given the current knowledge gaps in understanding impacts, vulnerability and adaptation, particularly in regions such as Sub-Saharan Africa. However, current donor priorities for adaptation tend to be focused on policy outcomes rather than on building scientific capacity to support the kinds of robust knowledge systems that are needed to address climate change threats.

- Continued development and improvement of regional and subregional scale models, along with developing the necessary skill set of researchers to use the models for problem solving rather than to simply run existing models as "black boxes".

- Development of knowledge exchange mechanisms between assessment teams and relevant stakeholder groups that promote greater understanding of various decision-making contexts for managing climate risks and the integration of local and traditional knowledge, and community-based adaptation needs, into scientific assessments. Efforts to integrate the science and research community with policymakers and other stakeholder communities in a more participatory framework help to engender trust in the assessment process and a broader stake in the outcome, and opens up new avenues for communication of findings.

- Build technical capacity to plan and implement adaptation measures, including proposal development, project management, and monitoring and evaluation.

Opportunities: Significant knowledge gaps about global change processes will continue to persist for a very long time, theoretically providing ample opportunity for research and assessment. Currently, key knowledge gaps for which assessments are needed include:

- Characterization of the range of future exposures to climate hazards at regional and finer spatial scales that are important for adaptation decisions;

- Identification and prioritization of climate hazards that are of highest concern for different sectors, systems, places and groups and investigation of how these hazards will change with human-caused climate change;

- Understanding of "upstream-downstream" interactions and feedbacks at regional scales, and regional resource allocation and governance, under global change;

- Measurement of vulnerability of different groups, empirical validation of the measurements, and attribution of differences in vulnerability to proximate and underlying causes;

- Evaluation of potential opportunities, constraints, synergies, and pitfalls of integrating mitigation and adaptation at national and regional scales;

- The role of institutions (rules, processes and organizations) in facilitating or limiting adaptation to climate hazards;

- Identification of effective strategies for enabling adaptation and lessons about how strategies that are successful in one context can be expanded in use or transferred to other contexts; and

- The benefits and costs of adaptation and mitigation.

Some Opportunities:
The recent emergence of global or quasi-global networks, such as UNEP's Global Climate Change Adaptation Network and the Ecosystems and Livelihoods Adaptation Network administered by WWF and IUCN, could potentially create opportunities for conducting novel assessment activities, such as cross-regional comparisons and evaluation of climate analogues. These kinds of networks could also potentially provide support for the assessment process through mobilizing the resources of relevant regional centers and ground networks, and acting as a conduit for disseminating knowledge and capacity building tools. This may be particularly true for UNEP's Adaptation Network, which aims to support implementation of the NWP. However, these networks are still at a nascent stage in their development and their ability to provide added value remains unproven.

Lastly, recently developed web-based knowledge portals, such as weAdapt and the Africa DIVA, which is being developed by START and the UNFCCC, could aid the assessment process by providing an on-line collaborative platform for scientists, managers and policy makers to interact. For example, the Africa DIVA is intended to link very strongly with the needs of the science community in Africa for access to data sets and regionally appropriate modeling tools.