STOCKHOLM ENVIRONMENT INSTITUTE

iied

An Adaptation Research Workshop
Research/Issue Brief

Enhancing Capacity for Adaptation to Climate Change in Developing Countries

9-12 November 2003

Scientific and Technical Capacity Building in Support of Adaptation

(Draft: 7 July 2003)

Neil Leary, Saleem Huq and Suruchi Bhadwal

What is the Policy Issue?

> *The most vulnerable regions and communities are those that are highly exposed to hazardous climatic change effects and have limited adaptive capacity. Countries with limited economic resources, low levels of technology, poor information and skills, poor infrastructure, unstable or weak institutions, and inequitable empowerment and access to resources have little capacity to adapt and are highly vulnerable. (Smit et al., 2001, pg 905)*
>
> *Enhancement of adaptive capacity is necessary to reduce vulnerability, particularly for the most vulnerable regions, nations and socioeconomic groups. (Smit et al., 2001, pg 905)*
>
> *Current knowledge of adaptation and adaptive capacity is insufficient for reliable prediction of adaptations; it also is insufficient for rigorous evaluation of planned adaptation options, measures, and policies of governments. (Smit et al., 2001, pg 906)*
>
> *Further research is required, however, to strengthen future assessments and to reduce uncertainties in order to assure that sufficient information is available for policymaking about responses to possible consequences of climate change, including research in and by developing countries.(IPCC, 2001, pg 17)*

With these findings, the IPCC highlighted the vulnerability of countries with limited capacity to adapt to climate change and the importance of building up this capacity to reduce vulnerability. Vulnerabilities from climate change include risks to food security, water resources, human health and environmental systems that support human livelihoods. The importance of building capacity to lessen vulnerabilities to climate change has also been recognized in the UNFCCC process, as exemplified in the Delhi Declaration at COP 8 in 2002. But while vulnerability to climate change has typically been studied in isolation from other stressors, increasingly it has been recognized that multiple environmental and social stresses (e.g. climate change, land-use change, desertification, biodiversity loss, and economic globalization) act on people and the environment. Consequently, integrated approaches that cut across these multiple stresses are needed to build capacity, manage vulnerabilities and adapt (see, for example, Watson et al., 2001, pp 123-24 and GEF Council, 2003, pp 6-7).

Capacity of many types and at many levels is required to withstand, cope with, adapt to, or recover from the shocks of stresses including climate change. Some of these confer general capacity to deal with all manner of stresses, for example economic wealth, well functioning governance and other institutions, a literate and healthy workforce, and equitable access to resources and decision making authority. Others confer specific capacity to deal with particular stresses such as climatic variation and change. These include, for example, infrastructure, institutions and technically trained professionals to manage water supply and demand, knowledge of existing mechanisms for coping with climatic variability, observational data and skills to make and deliver seasonal weather forecasts, and experts skilled in the assessment of climatic vulnerabilities and adaptations.

The findings of the IPCC quoted above highlight the dependence of adaptive capacity on information, knowledge, and skills, the present insufficiency of these to reliably guide policy, and the need for further research to support adaptation. These findings point to the critical role of scientific and technical capacity. But developing countries, which are generally the most vulnerable to climate change and other environmental stresses, have the least capacity to conduct the scientific investigations to assess the risks and develop meaningful adaptation strategies. Developing countries contain 80% of the world's population but only 25% of the world's scientists. According to UNESCO, only 4% of total world research is conducted in developing countries. Developing countries especially lack scientists trained in emerging cross-disciplinary and integrative approaches that are required for the study of global change vulnerabilities and adaptation responses. (START et al).

In this paper we focus on scientific and technical capacity building needs, with an emphasis on capacity that is specific to climatic stresses, and highlight some capacity building efforts already underway or planned. We also consider how these might be integrated into a broader approach that builds scientific and technical capacity for responding to multiple stresses.

What kinds of scientific and technical capacity are needed?

Lack of appropriate scientific and technical knowledge has the potential to seriously impede a nation's ability to implement adaptation options (IPCC WGII, 2001). In order to build adaptive capacity to deal with climate change there are four main domains of scientific and technical knowledge and capacity that need to be built-up in vulnerable countries. They are (i) the ability to construct credible scenarios of future changes, such as climate change, that would result in exposures of people and the environment to stresses, (ii) the ability to assess vulnerabilities that would arise from the exposures and adaptations to limit or recover from harm, (iii) the ability to effectively communicate information about exposures, vulnerabilities and adaptations to technically trained managers, and their ability to understand and use the information, and (iv) the ability to communicate information to the wider public, and their ability to understand and use the information. We will address the first two domains. The other two, though important, we leave for others to address.

Capacity to construct credible scenarios

The ability to construct credible scenarios of future changes and exposures to stresses are needed at a range of time and spatial scales. For example, in the case of climatic stresses, seasonal forecasts at local to regional scales can be used to limit harm from near term climate variability, a capacity that may also lessen vulnerability to changes in variability and extremes that are expected to characterize longer-term climate change. Capacities to predict or simulate climate changes over decades or more can be used to explore the range of stresses to which a society may need to adapt and be resilient.

While the capacity to run the global scale general circulation models (GCMs) is based almost exclusively in the developed countries, capacities to construct regional scale scenarios of future climate already exist in some developing countries and can well be transferred to others. For example, there are several modelling groups in developing countries that presently use regional climate models for seasonal forecasting. There are also research centers in developing countries that are modelling longer-term climate change using regional climate models to downscale the large-scale changes projected by GCMs. More widespread and accessible is the ability to downscale GCM projections of climate change using statistical techniques. Yet more ubiquitous is the ability to manipulate the outputs of GCMs to derive regional scenarios that are consistent with the GCM projections.

The type of climate scenario capacity to be built in a country should be appropriate to its existing institutional, human, computing and data resources and the needs of impacts researchers in the country. Regional climate modelling is technically and computationally demanding and two or more years experience with these techniques would be required before proficiency could be achieved by someone with masters-level training in an appropriate field. Also, individual high-resolution model runs can take months to execute, placing practical limits on the ability to explore the implications of the many uncertainties that arise in climate modelling using this technique. Consequently, it would not be appropriate to develop regional modelling capacities initially in each and every developing country.

But there is a requirement to generate this technical expertise within major regions. Such capacity can certainly be developed in key regional institutions that could then function as centers to serve high-resolution climate modelling needs of countries and researchers within a region. It should also be recognized that there is still much that can and needs to be learned about the sensitivities and vulnerabilities of systems to climate variations that can be adequately studied using climate scenarios constructed with simpler techniques. Building capacity in these simpler techniques can serve the present needs of impacts researchers while also developing a base upon which more sophisticated climate modelling techniques might be erected in the future.

Capacity to assess vulnerabilities and adaptations

The ability to assess vulnerabilities and adaptations has many facets. It can and needs to draw upon country-specific knowledge of current vulnerabilities to climatic and other hazards, the processes that have shaped these vulnerabilities, the historical means of coping with and adapting to hazards, and the factors that have facilitated and obstructed successful coping and adaptation. Mechanistic understanding of system processes and behaviours is needed to develop and apply models of human and environmental systems that are exposed to stresses. Observational data of system responses to stresses such as climate variation and extremes, and the skills to analyze the data, are needed to develop an understanding of the sensitivity of these systems to stresses and to calibrate and validate models. Coupling of models, whether conceptually or directly, is needed to integrate the analysis of multiple and interacting human and environmental systems. Decision analysis and multi-criteria evaluation techniques are useful for comparing the outcomes of different adaptation decisions and investigating the implications of different sources of uncertainty. The list could go on.

The investigation of vulnerabilities and adaptation clearly requires skilled individuals from multiple disciplinary and technical backgrounds and institutions to bring them together and support the work. It also requires persons skilled in cross-disciplinary and integrative approaches. Persons with appropriate disciplinary and technical backgrounds are present within research institutes, universities, government departments and NGOs in developing countries, even the poorest. But the ability of these persons to undertake the scientific and technical investigations to support adaptation policy is limited by a number of factors including (i) general scarcity of scientists, science infrastructure (computers, equipment, data etc.), and science funding in developing countries relative to the many scientific demands, (ii) limited research experience of many of the scientists, particularly in multi- or interdisciplinary research, (iii) lack of familiarity with climate change and the particular methods and models used in climate change impact, adaptation and vulnerability analysis, and (iv) the difficulty in a environment characterized by the previous four points of establishing and continuing needed working relationships among scientists from multiple disciplines to conduct this type of research.

Despite the above obstacles, human and institutional capacities to investigate vulnerabilities and adaptation already exist, especially relating to climate hazards, in most developing countries. While presently limited and rudimentary in many developing countries, these scientific and technical capacities are critically important aspects of overall adaptive capacity and building upon and enhancing them needs to be part of our approach to lessening vulnerability in the developing world.

What has been/is being done already?

There are a number of international organizations that work to build scientific capacity in developing countries. For example, START was established over a decade ago under the aegis of the International Council for Science (ICSU) to address capacity building needs for global environmental change research in developing regions. Toward this goal, START has developed a system of regional research networks, provided small research grants, organized research workshops and institutes, and awarded fellowships to developing country scientists and graduate students. The Inter-American Institute and the Asia-Pacific Network are two other organizations that build scientific capacity for global change research through research projects, workshops and other activities.

Over the last decade most of the developing countries have carried out their first National Communication to the UN Framework Convention on Climate Change. The National Communications included assessment by in-country teams of experts of climate change impacts, vulnerabilities and adaptation in their respective countries. These used the common IPCC assessment methodology and were supported by different agencies including the United Sates (under the US Country Studies Programme), The Netherlands, and the GEF. Most of these first round assessments were able to carry out reasonably standard impact and vulnerability assessments and were successful in building some scientific and technical capacity to carry out such assessments in most of the developing countries. However they tended to be weak on the adaptation analysis and one of the feedbacks from the work was the need to have both better methodologies for carrying out the adaptation analysis and to also build capacity in each country to do so.

There are also a few more recent projects to build scientific and technical capacity. A global enabling activity project funded by the Global Environment Facility (GEF), Assessments of Impacts and Adaptations to Climate Change (AIACC), involves more than 200 scientists and 60 students from over 40 developing countries in Asia, Africa and Latin America. The project aims to build scientific and technical capacity by involving developing country scientists in multidisciplinary research on climate change vulnerabilities and adaptation options in their regions. Juried research grants were awarded to 24 teams of developing country scientists to carry out 3-year research projects in areas that include water, agriculture and food security, human health, rural livelihoods, urban flood risks, tourism, and biodiversity conservation. A variety of training activities, mentoring, technical support and cross-project collaborations have been implemented to complement and add to the capacity being gained through participation in the research.

A notable development in the AIACC project is that several of the developing country project teams have begun to act as nodes for spreading capacity through their region by providing technical support and even training to other researchers. A group at the University of Cape Town, which is a leading center for research with regional climate models and statistical downscaling methods, is working actively to extend this capacity to researchers in other countries of Africa. They are doing this through workshops and collaborative research, assisted by the AIACC project. The Hadley Centre is also participating in these efforts and is looking to work with other groups in the developing world to provide training with their regional climate model.

Another effort launched after the seventh conference of parties (COP7) held in Marrakech in 2001 is the National Adaptation Programmes of Action (NAPAs) for the least developed countries (LDCs) which are about to be started in over 40 of the poorest countries, mostly in sub-Saharan Africa and South Asia with funding from the GEF. In addition the United Nation Development Programme (UNDP) has also developed the Adaptation Policy Framework (APF), which is being used in 8 countries in Central America and will probably be used in many of the non-LDC developing countries very soon.

The Special Climate Change Fund (SCCF) will support a number of activities including adaptation, mitigation and technology transfer through voluntary contributions. While these projects were initially planned to begin in the year 2005, a decision was made at the eighteenth session of SBSTA to start a pilot phase in 2003 and to give adaptation actions top priority. Activities supported by the SCCF might conceivably help to advance scientific and technical capacity.

What more needs to be done?

There is wide and growing acceptance internationally of the need to build capacity for adaptation to climate change, particularly in the more vulnerable parts of the world. It is also clear that the capacity to be built must include scientific and technical capacity so as to better understand the risks and evaluate options for responding. Whatever action is taken to mitigate the emissions that drive climate change, the climate will be changing continuously in uncertain ways and with uncertain consequences for decades to come. Given that prognosis, enhancing scientific and technical capacity may be the ultimate adaptation.

Previously we identified a number of factors that limit capacity in developing countries for scientific investigations of climate change vulnerabilities and adaptations. These limitations will need to be targeted if scientific and technical capacity is to be built and sustained. We repeat them here in shortened form:

- (i) scarcity of scientists, science infrastructure and science funding
- (ii) limited research experience of scientists
- (iii) lack of familiarity with relevant methods and models
- (iv) difficulty of establishing and continuing collaborations among scientists from multiple disciplines needed for climate change research

Regarding the first limitation, funding science and science infrastructure in developing countries is notoriously difficult. And low funding of science and inadequate infrastructure exacerbates the problem of too few scientists as scientists leave the developing world to seek better opportunities elsewhere. National governments in developing countries are hard pressed to increase budget allocations for science given other pressing concerns. There are a number of bilateral and international programs that fund science in developing countries, including science relevant to managing climate change risks. But the resources available have been meagre compared to the needs.

The growing recognition that enhancing scientific and technical capacity is important for lessening vulnerabilities to climate change and other stresses in the developing world should be used to press for increased funding for science in these vulnerable regions. In the current environment, some success should be possible. But any increments are likely to be modest, and it is important to pay attention to ways of using all resources as effectively as possible.

Experience in programs such as the US Country Studies Program, the Dutch program, and AIACC indicates that capacity building is best done through programs that support multidisciplinary research projects that are designed, led and implemented by developing country scientists. Such programs are most effective when project teams are provided technical support to help assure their success. Technical support that can contribute to successful capacity building include guidance in project design, mentoring to assist with problems encountered during project implementation, intensive training workshops on advanced methods, hands-on assistance with selected techniques or models, and coaching in the writing of papers for submission to peer-review journals. Forums for participants from multiple projects to share their work are important for establishing regional networks of scientists for collaboration on common research problems.

There is a need for new funding for programs of this type to build upon the scientific and technical capacity created by earlier efforts. That these earlier efforts have been successful is evidenced by the degree to which South-South collaborations are now becoming common for transfer of capacity from one developing country to another.

Because the intent of building scientific and technical capacity is to provide information that will enable better adaptation decisions to be made, strong encouragement should be given for engaging stakeholders in these projects. Engaging stakeholders in different phases of a research project can improve the utility of the work to potential users of the information, introduce information and knowledge not otherwise available to researchers, and increase users understanding and confidence in the credibility of the results. But engaging stakeholders to successfully achieve these results requires a set of skills and capacities that also must be developed.

In addition to programs that support multidisciplinary research projects, there is also need for stronger centers of research and for increasing the number of scientists working on global change in the developing world. Grants to strengthen existing institutions to create centers of excellence for global change research, doctoral fellowships for young scientists working on global change, small grants to assist them in their research, and visiting scientist programs are needed.

The basic philosophy of the approach outlined above is one of learning by doing. The approach would attack limitation (i) above by building up a cadre of scientists who have overcome limitations (ii) and (iii), and would make a good start on limitation (iv)..

References

GEF Council, 2003. A proposed GEF approach to adaptation to climate change. Global Environment Facility, Washington, DC, USA. GEF/C.21/Inf.10.

IPCC, 2001. Summary for Policymakers, in J.J. McCarthy, O.F. Canziani, N.A. Leary, D.J. Dokken and K.S. White, editors, *Climate Change 2001: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, USA.

Smit, B. et al., 2001. "Adaptation to climate change in the context of sustainable development and equity," in J.J. McCarthy, O.F. Canziani, N.A. Leary, D.J. Dokken and K.S. White, editors, *Climate Change 2001: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK and New York, USA.

Smith, J.B., S. Huq, S. Lenhart, L.J. Mata, I. Nemesova, and S. Toure, editors, 1996. *Vulnerability and Adaptation to Climate Change; Interim Results from the U.S. Country Studies Program*. Kluwer Academic Publishers, Dordrecht, The Netherlands.

START, International Foundation for Science, and Third World Academy of Sciences. *Capacity Building for Global Change Science, a Decadal Plan.* International START Secretariat, Washington, DC, USA.

Watson, R.T. and the Core Writing Team. 2001. *Climate Change 2001: Synthesis Report*. Contributions of Working Groups I, II and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York, NY, USA.